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DRIVING DIGITAL INNOVATION: THE ROLE OF ENTREPRENEURIAL TRAITS AND CAPABILITIES IN GENDER-BASED SMALL MEDIUM ENTREPRISES

Lela Nurlaela Wati[1*], Momon[2], Heri Ispriyahadi[1], Rita Yuni Mulyanti[1], Saiful Simanullang[1]

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[1] Universitas Teknologi Muhammadiyah Jakarta, Post Graduate School, Indonesia

[2] Universitas Teknologi Muhammadiyah Jakarta, Faculty of Economics and Business, Indonesia

[*]**Corresponding Author:**
Lela Nurlaela Wati

Email:
lela@utmj.ac.id;
lela_nwm@yahoo.com

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ABSTRACT

Despite the growing significance of digital innovation, research on its determinants and effects on SMEs, especially those led by women, is limited. This study examined the role of digital innovation in mediating the impact of entrepreneurial characteristics, digital orientation, and digital capabilities on the competitive advantage of SMEs managed by males and females. The research sample comprised 325 SME owners and managers in Indonesia. This study employed a structural equation model and multi-group sample testing to evaluate the hypothesis. The determinants of digital innovation in SMEs managed by males are entrepreneurial characteristics, digital orientation, and capability. Digital capabilities are distinct from those of SMEs managed by females. Digital orientation does not directly affect competitive advantage but has an indirect effect on digital innovation. The different test results for the digital capabilities of males and females indicate that there is a gender gap in digital technology. This study corroborates the resource-based view (RBV) and expands the RBV Theory in the realm of digital innovation by empirically identifying the factors that drive digital innovation, which enhances the competitive advantage of SMEs. Thus, the government needs to conduct a digital literacy program and accept a technology pact to encourage more female students in science, technology, engineering, and mathematics (STEM) to narrow the gender gap in digital literacy. Research examining different models of digital innovation and competitive advantage to prove the gender gap between females and males in the use of digital technology has not yet been conducted.

Keywords: *Characteristics, digital orientation, digital capabilities, digital innovation, competitive advantage*

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) are salient in achieving Sustainable Development Goals (SDGs), particularly in terms of stimulating innovation, creativity, and job creation. The number of SMEs in Indonesia has been increasing annually. In 2015, the number of SMEs was 59 million, rising to over 64 million by 2024, contributing 60% to the national Gross Domestic Product (GDP) and employing approximately 97% of Indonesia's workforce (Kemenko Perekonomian Press Release, 2025). Nonetheless, hardly 16.64 million (26 %) of the 64 million SMEs have transitioned to digital platforms, despite the fact that SME digitalization is essential

for enhancing their contribution to the national economy (Kemkominfo Press Release, 2024). The role of information technology is one of the determining factors for SMEs' growth and development, and it has been proven that these businesses can survive several crises (Ntwoku et al., 2017). The COVID-19 pandemic that hit the world in 2020 shifted consumer behavior toward online shopping, especially in Indonesia. Therefore, they are encouraged to adapt to technology and innovate to seize these opportunities. Digital technology provides new opportunities for SMEs, such as greater ease of market access, better access to skills and talent, more comprehensive access to financing, better communication and collaboration, greater access to technological applications, broader product development, and reduced bureaucracy (OECD, 2017). Consequently, digital technology helps SMEs compete healthily and grow faster because of ease of access to these services. Additionally, it provides a robust foundation for SMEs in digital technology applications and adopts digital innovation as a fundamental concept for managing SMEs with high competitiveness (Adeniran & Johnston, 2015). Digital innovation is a solution that needs to increase competitive advantage by minimizing costs, increasing efficiency, increasing business model innovation, elevating customer profits and satisfaction, and enhancing internationalization (Bala & Feng, 2019; Erlany et al., 2023; Scuotto et al., 2021; Shehadeh et al., 2024; Susanti et al., 2023; Neffati & Imen, 2025)

According to Ramdani et al. (2022), the entrepreneurial characteristics of SME owners are one of the determining factors of digital innovation. These characteristics describe the individuals responsible for using digital technology. SME owners' characteristics include knowledge and experience, education, attitudes, motivation, age, gender, and entrepreneurial orientation (AlBar & Hoque, 2019). Meanwhile, Khin & Ho (2019) attested that digital innovation is influenced by digital orientation and capabilities. Digital orientation is regarded as an entrepreneur's commitment to technological applications and the quick response of business actors to technological change. Digital SMEs can adopt and apply technology in everyday business. SME are anticipated to possess digital capabilities to effectively manage and utilize appropriate digital technology and orientation. Digital capability refers to the management and use of digital technology by integrating and mobilizing human and technological resources (Khin & Ho, 2019). Digital capabilities determine their ability of SMEs in producing technology-based innovations. Digital capabilities include digital knowledge and the use of devices, applications, and online media. The literature on the relationship between entrepreneurial characteristics, digital orientation, digital capability, and digital innovation still needs to be explored (Bolatbek et al., 2025). The positive effect of digital capabilities and digital orientation on digital innovation has been documented by (Hudayah et al., 2024; Khin & Ho, 2019; Ranjan, 2024; Rupeika-Apoga et al., 2022).

The development of digital products and services depends significantly on an organization's ability to manage digital technologies. Karina & Astuti (2022) provided empirical evidence that digital capabilities and digital orientation positively affect digital innovation. Digital innovation is the determining factor for competitive advantage. The ability of SME players to innovate in digital data utilization is useful for creating a competitive advantage for SME entrepreneurs. Digitalization has created a new way for firms to create business value. Modernizing a company's business by incorporating physical resources, digital technology, and personal creativity is a salient step in transforming innovative businesses that can lead to competitive advantage. Numerous studies have revealed a significant correlation between digital technology use and business growth in creating innovative business models (Adeniran & Johnston, 2015; Erlany et al., 2023; Karina & Astuti, 2022; Shehadeh et al., 2024; Susanti et al., 2023). Creating new products and services through digital innovation generates more benefits for companies (Berawi et al., 2020).

The active participation of females in the economic sector has significantly increased state revenues. In Indonesia, 64% of all SMEs are operated by females and 36% are operated by

males (Kemenko PMK, 2023). However, female managers often face more challenges in business development than male managers do, such as access to financing and digital ecosystems, resulting in inequality. Digital inequality refers to inequality in the utilization of information and communication technologies. In a regional context, digital equality provides considerable opportunities to encourage digital innovation and competitive advantage in SMEs managed by females (Susanti et al., 2023).

Gender equality in the digital world is part of the global ideal for formulating Sustainable Development Goals (SDGs) by 2030. The gender-based digital divide is a common challenge for all parties: educational inequality is perceived as the cause of a low understanding of digital security, and females are often victims of the digital world. The lack of female representation in STEM (science, technology, engineering, and mathematics) exacerbates the gender gap in the digital domain. According to data from the United Nations Development Programme (UNDP), Indonesia's Gender Inequality Index (GII) is the highest among ASEAN countries. Indonesia has the highest GII score in ASEAN, at 0.48 points, indicating that it has no optimal gender development achievements compared to other ASEAN countries. Based on this elaboration, the authors test the effects of entrepreneurial characteristics, digital orientation, and digital capabilities on the digital innovation and competitive advantage of female and male SMEs, both directly and indirectly. This study differs from previous research in that it examines various models of digital innovation and competitive advantage in female and male SMEs, and considers gender equality in digital technology utilization.

This study is expected to expand the application of the Resource-Based View and Dynamic Capabilities theories within the realm of digital entrepreneurship, specifically through a gender lens. The findings of this study are expected to provide a foundation for governments, SME support organizations, and business stakeholders to devise digital capacity development strategies that are more inclusive and attuned to gender-specific characteristics and requirements through training, mentoring initiatives, and policies that foster digital innovation as a means of sustainable competitive advantage for SMEs in developing nations, especially Indonesia.

2. LITERATURE REVIEW

Porter (1985) states that competitive advantage is a company's ability to perform better than others in the same industry or market, through its characteristics and resources. Business players require competitive advantage as a fundamental source to attain better performance than their competitors. A competitive advantage is that every aspect enables an organization to perform better and produce better products than its competitors by having something that others do not have (Barney, 1991). This advantage can be achieved by utilizing resources to make products or services more effective and efficient. Companies can exhibit better selling points and advantages than their competitors, reflecting their competitive advantage (Torres et al., 2018). Furthermore, some indicators measure competitive advantage, such as minimizing production costs, market exploration ability, and the ability to outperform competitors. These aspects have been established as indicators of competitive advantage (Barney, 1991).

This study refers to resource-based view (RBV) theory as a combination of strategically valuable, expensive resources, difficulty in replicating a company exhibits, and capabilities that lead to sustainable competitive advantage (Barney, 1991). An SME's ability to incorporate, build, and configure capabilities in digital technology, and to incorporate them with broader managerial skills and capabilities, will support the creation of products or services with unique, rare features; thus, it is difficult for competitors to replicate. This study uses the RBV to conceptualize entrepreneurial characteristics, digital orientation, and digital capabilities toward digital innovation as essential assets for SMEs to gain competitive advantage.

2. 1. THE EFFECT OF ENTREPRENEURIAL CHARACTERISTICS ON DIGITAL INNOVATION

Digital innovation involves the development of new products, services, and solutions using digital technology. Digital innovation emphasizes the novelty of creating services, solutions, or new products through digital technology applications (Khin & Ho, 2019). Entrepreneurial characteristics that support digital innovation are necessary. The characteristics of an entrepreneur or owner describe the individual responsible for using digital technology. Entrepreneurial characteristics consist of knowledge and experience, the educational level of the owner or manager, attitude towards digital innovation, motivation for involvement in digital innovation, age of owner or manager, owner or manager gender, and entrepreneurial orientation (AlBar & Hoque, 2019; Eggers et al., 2017; Newby et al., 2014; Ntwoku et al., 2017). Empirical evidence shows that SME owners and managers are more likely to engage in digital innovation if they are aware of its potential benefits. SMEs with larger sizes, factories, and business owners with higher education are more likely to adopt digital technology early (Ntwoku et al., 2017). Newby et al. (2014) showed that management characteristics significantly affect a company's perception of CRM technology, especially innovation. This study used indicators of age, education, and experience to measure the characteristics of entrepreneurs. Empirical evidence has shown that entrepreneurial characteristics influence digital innovation (AlBar & Hoque, 2019; Eggers et al., 2017; Hossain et al., 2024; Newby et al., 2014; Ntwoku et al., 2017). Therefore, the following hypothesis is formulated:

H_1: Entrepreneurial characteristics positively influence digital innovation.

2. 2. THE EFFECT OF DIGITAL ORIENTATION ON DIGITAL INNOVATION

Digital orientation refers to a company's commitment to adopting new technologies and responding to technological changes. Entrepreneurs should embrace digital technologies and translate them into innovative digital solutions. Entrepreneurs or managers can achieve digital innovation with serious commitment to responding to emerging technologies (Khin & Ho, 2019). Based on resource-based theory, the literature reveals that companies with an exceptional orientation toward technology attain higher levels of innovation because they are more committed and have a vision of applying new technologies to develop more innovative products. SMEs with a solid technological orientation can develop superior digital innovations to gain an advantage over their competitors.

Digital innovation is an important research agenda in the current digital era owing to the increasing need for new digital solutions, particularly for SMEs. Khin & Ho (2019) provided empirical evidence that digital orientation influences digital innovation in Malaysia. Companies with a vision and commitment to digitization, enthusiasm, and trust in the organization provide technological applications for the organization's functioning. This empirical evidence is supported by Karina & Astuti (2022), who proved that digital orientation is a determining factor for digital innovation in small and medium enterprises in Indonesia. Ardito et al. (2021) explained that the transformation condition of SMEs is associated with the efficiency that results from digital orientation. SMEs committed to digitalization applications with enthusiasm and trust between organizations demonstrate a clear vision of technological implementation in an organization's functioning. Applying the latest digital technology can support SMEs' innovation performance. Other studies have shown that digital orientation is a determining factor in the success of digital innovation in small and medium-sized companies (Hudayah et al., 2024; Karina & Astuti, 2022; Ranjan, 2024; Rupeika-Apoga et al., 2022). Therefore, we hypothesize the following:

H_2: Digital orientation influences digital innovation

2. 3. THE INFLUENCE OF DIGITAL CAPABILITIES ON DIGITAL INNOVATION

Digital capability is the technological capability of a company in formulating and developing products and process-related aspects (Khin & Ho, 2019). Digital competence closely pertains to skills in communication with ICT; skills in information, knowledge, and specific attitudes concerning the ethical, legal, and privacy aspects of security; understanding ICT's role in communities; and a balanced technological attitude (Hunady et al., 2025). Digital capabilities are required to incorporate digital technology into potential professional talents. Technological capability is defined as a company's ability to develop new products and services by aligning innovative processes with its strategy (Fernández-Mesa et al., 2014). These abilities incorporate skills and knowledge to acquire, use, absorb, adapt, improve, and produce new technologies (Khin & Ho, 2019).

According to the theory of dynamic capability, digital capability refers to an organization's ability to create new processes or products in response to changes in market conditions (Khin & Ho, 2019). Moreover, digital competence enhances a firm's digital orientation and entrepreneurial attributes because the effective management of new technologies is essential for a company to adopt them and commit to the technological transformation of new goods (Pavithra & Sundari, 2025). Digital capabilities can be assessed using various indicators, including proficiency in acquiring digital technologies; capacity to recognize emerging digital opportunities; expertise in mastering new digital technologies; ability to innovate products, services, and processes through digital technology utilization; and competence in integrating within the digital ecosystem (Karina & Astuti, 2022; Khin & Ho, 2019). Digital capabilities are a salient requirement for achieving digital innovation because success in developing digital products greatly depends on a company's capability to manage digital technology. This statement is supported by the literature that shows that digital capabilities are the determining factor for the digital success of SMEs (Fernández-Mesa et al., 2014; Hudayah et al., 2024; Karina & Astuti, 2022; Khin & Ho, 2019; Ranjan, 2024; Rupeika-Apoga et al., 2022; Yasa et al., 2019). The higher the digital capabilities of SMEs, the more digital innovation they can achieve. Therefore, we hypothesize the following:

H_3: Digital capabilities positively affect digital innovation.

2. 4. THE EFFECT OF DIGITAL ORIENTATION ON COMPETITIVE ADVANTAGE

In response to shifting economic conditions, commitment to technology can improve resource development and utilization, achieving a persistent competitive advantage through increased innovation potential (Ardito et al., 2021). Internal and external strategic components must be incorporated when conceptualizing digital orientation. The close connection between the suits of an organization's technologies, procedures, and routines is crucial as digital technology utilization constantly advances. Therefore, an organization's digital orientation is defined as a strategic posture intended to gain the advantage of the potential delivered by digital technology. This attitude and behavior encourage the creation and application of proactive innovation, market insights, and receptivity to novel concepts (Quinton et al., 2018).

Corporations have no control over the changes brought about by contemporary digital environments. Entrepreneurs must modify their digital strategies in response to evolving market conditions. Entrepreneurs can pinpoint essential strategic areas that need focus by examining the company's comprehensive plan and addressing resource or skill deficiencies instead of merely enhancing core strengths. This analysis can assist in developing a business's competitive advantage (Quinton et al., 2018). However, Karina & Astuti (2022) provided empirical evidence that digital orientation has no significant effect on the competitive advantage of Indonesian

SMEs. Commitment to technology in response to changes in economic conditions might lead to the improvement of development and utilization of resources, in which there is a sustainable competitive advantage through the improvement of innovation potential. Rupeika-Apoga et al. (2022) provide empirical evidence that digital orientation can increase the revenue and business of small and medium enterprises in Latvia. Based on the above discussion, the following hypothesis is formulated:

H_4: Digital orientation positively affects SMEs' competitive advantage

2. 5. THE EFFECT OF DIGITAL CAPABILITY ON COMPETITIVE ADVANTAGE

Technology has improved business capabilities by employing innovative business processes to launch new products and services (Fernández-Mesa et al., 2014). Digital capability is a digital system that develops novel outcomes and structures devoid of the planning of system designers or uncoordinated involvement of outside players. Understanding the processes that influence digital technology adoption is crucial for improving business performance. Digital capability has led organizations to improve their competitive edge in the marketplace (Erlany et al., 2023; Heredia et al., 2022). Digital capabilities offer SMEs competitive advantages beyond the necessary hardware, software, or functionalities. Adeniran & Johnston (2015) provided empirical evidence that digital capability exhibits a positive influence on competitive advantage. The ability of digital technology to provide a competitive advantage for SMEs lies not only in its use of ICT tools, applications, or functions. Their digital capabilities can also help SMEs generate long-term returns on their applications, functions, and digital technology tools used by SMEs. Rupeika-Apoga et al. (2022) suggested that digital capabilities can increase the revenue and business of small and medium enterprises in Latvia. However, Karina & Astuti (2022) provided empirical evidence that digital capability does not significantly influence SMEs' competitive advantage. This elaboration leads to the following hypothesis:

H_5: Digital capabilities positively influence competitive advantages.

2. 6. THE EFFECT OF DIGITAL INNOVATION ON COMPETITIVE ADVANTAGE

Digital technology must be deployed to manage the integration of product life cycles and enhance effective, dependable, and sustainable corporate operations. A company's workflow can be improved using intelligent production and supply chains, which provide a competitive advantage. Through digitalization, businesses can now operate in new value-added ways. To transform an innovative company into a competitive advantage, business enterprises must be modernized by incorporating physical resources, digital technology, and individual creativity. Utilizing digital technologies links people, systems, and products and enhances the effectiveness and efficiency of their services. Businesses must transform their processes to increase consumer satisfaction (Berawi et al., 2020).

Digital innovation is defined as the creation of new digital products, productive process improvement, and organizational and business model transformation by integrating computing, information technology, communication, and connectivity into the innovation process (Fichman et al., 2014). Research has shown that digital innovation positively affects competitive advantage (Adeniran & Johnston, 2015; Erlany et al., 2023; Karina & Astuti, 2022; Shehadeh et al., 2024; Susanti et al., 2023). The ability of a business to innovate by adopting new procedures, items, or concepts within the company is directly associated with innovation. Karina & Astuti (2022) demonstrated the critical role of the innovation process in supporting SMEs in le-

veraging their digital capabilities as a competitive advantage. The innovative methods used by SMEs are expected to generate products with evident and advantageous community values. The rapid advancement of digital innovation has transformed the entrepreneurial landscape in China (Sahibzada et al., 2024). Digital innovation is crucial for all stakeholders because it significantly influences the sustainability performance of SMEs and promotes sustainable development (SDGs). Based on this description, the following hypothesis was formulated:

H_6: Digital innovation positively affects competitive advantage.

2. 7. THE MEDIATION ROLE OF DIGITAL INNOVATION

Digital innovation is a critical strategic tool for companies to improve performance and competitiveness. Empirical evidence regarding the positive influence of digital innovation on competitive advantage has been found in the literature (Adeniran & Johnston, 2015; Karina & Astuti, 2022). However, based on a literature search, no study has examined the mediating effect of innovation on the relationship between digital orientation and digital capability for competitive advantage in a gender context. Rupeika-Apoga et al. (2022) offer empirical data concerning the function of digital transformation in moderating the impact of digital orientation and competencies on SME income and operations, excluding gender inequalities. Therefore, there is limited empirical evidence of the mediating effect of digital innovation on the influence of digital orientation and capabilities on competitive advantage. The reason for the mediating impact of innovation is that companies with high digital orientation and better digital capabilities can provide innovative offerings with higher-quality products, efficient costs, punctuality in serving consumers for their ultimate satisfaction, and improve the competitiveness of SMEs. Based on this rationale, we suggest that digital innovation acts as a mediator by transforming entrepreneurial characteristics, digital orientation, and digital capabilities into SMEs' competitive advantages. Therefore, we hypothesize the following:

H_7: Digital innovation mediates the effect of digital orientation on competitive advantage.

H_8: Digital innovation mediates the effect of digital capabilities on a competitive advantage.

2. 8. DIFFERENT MODELS OF DIGITAL INNOVATION AND THE COMPETITIVE ADVANTAGE OF GENDER-BASED SMES

Based on the results of a literature search, research has not yet examined the differences in the effects of entrepreneurial characteristics, orientation, and capabilities on digital innovation and competitive advantage in a gender-based digital context. Therefore, there is limited empirical evidence to test this gender-based digital innovation and competitive advantage model. However, an abundance of literature addresses the gender gap in digital technology (Abu-Shanab & Al-Jamal, 2015; Alam et al., 2022; Awa et al., 2015; Belas et al., 2025; Expósito et al., 2023; Hull et al., 2023; Lin & Wang, 2020; Lopez-Nicolas et al., 2020; Rosenbaum, 2017). The degree of digitization in firms is a paramount factor influencing the sustainable commercial growth of SMEs, regardless of whether they are led by males or females, in the Visegrád group of countries: the Czech Republic, Slovakia, Poland, and Hungary (Belas et al., 2025).

The theory of planned behavior (TPB) is based on hypothesis testing on gender equality. The TPB captures information on social and behavioral factors that are critical to understanding gender inequality in digital technology use. The digital gender gap (GDD) refers to unequal opportunities for males and females to use digital technology in social, political, economic, and cultural spheres (Abu-Shanab & Al-Jamal, 2015). Several factors, including culture, education, work, environmental factors, and media, contribute to the gender gap in digital technology. A culture that considers

females inferior to males limits access to digital technology. GDD is also influenced by educational and occupational differences between males and females, with males having higher levels of education. GDD is also affected by environmental factors, such as childhood social orientation and the media and schools' roles in treating girls and boys (Abu-Shanab & Al-Jamal, 2015).

Several studies have confirmed that the gender of SME owners or managers determines digital innovation, with male owners or managers having more influence on the adoption of digital e-commerce technology than female business owners or managers (Awa et al., 2015). Research in the field of information systems also provides empirical evidence that females and males differ in their use of information technology (Lin & Wang, 2020). According to Hull et al. (2023), the prevalence of digital entrepreneurship is greater among females than males. Rosenbaum (2017) stated that only a few female entrepreneurs use networks to expand into new foreign markets. This is because female entrepreneurs need to help with the start-up and sustainability of the business, such as barriers to access to capital, barriers to achieving the objectives of business establishment, and poor entrepreneurial knowledge (Abu-Shanab & Al-Jamal, 2015).

Female entrepreneurship and management are essential because they can become role models for the younger female generation, encouraging them to pursue entrepreneurial careers or top management positions, thereby contributing to economic growth. Lopez-Nicolas et al. (2020) showed that females in top management positions are a unique resource with specific capacities for innovation and experimental behavior, with females being more involved in innovation than their male counterparts. Other empirical evidence explains the significant differences between female and male-managed SMEs in their perceptions of digital transformation (Alam et al., 2022; Expósito et al., 2023). Furthermore, the utilization of social networking platforms, innovation processes, workplace culture, and communication technology determines the perception of digital transformation. Some researchers argue that digital transformation is a form of digital innovation. The debate on the gender gap in digital technology led the authors to develop the following hypothesis:

H_9: There is a difference in the effect of entrepreneurial characteristics on digital innovation between female and male-managed SMEs.

H_{10}: The effect of digital orientation on digital innovation differs between female and male-managed SMEs.

H_{11}: The effect of digital capabilities on digital innovation differs between female and male-managed SMEs.

H_{12}: Digital orientation has different effects on the competitive advantage of female and male-owned SMEs.

H_{13}: Digital capabilities affect the competitive advantage of female and male-managed SMEs differently.

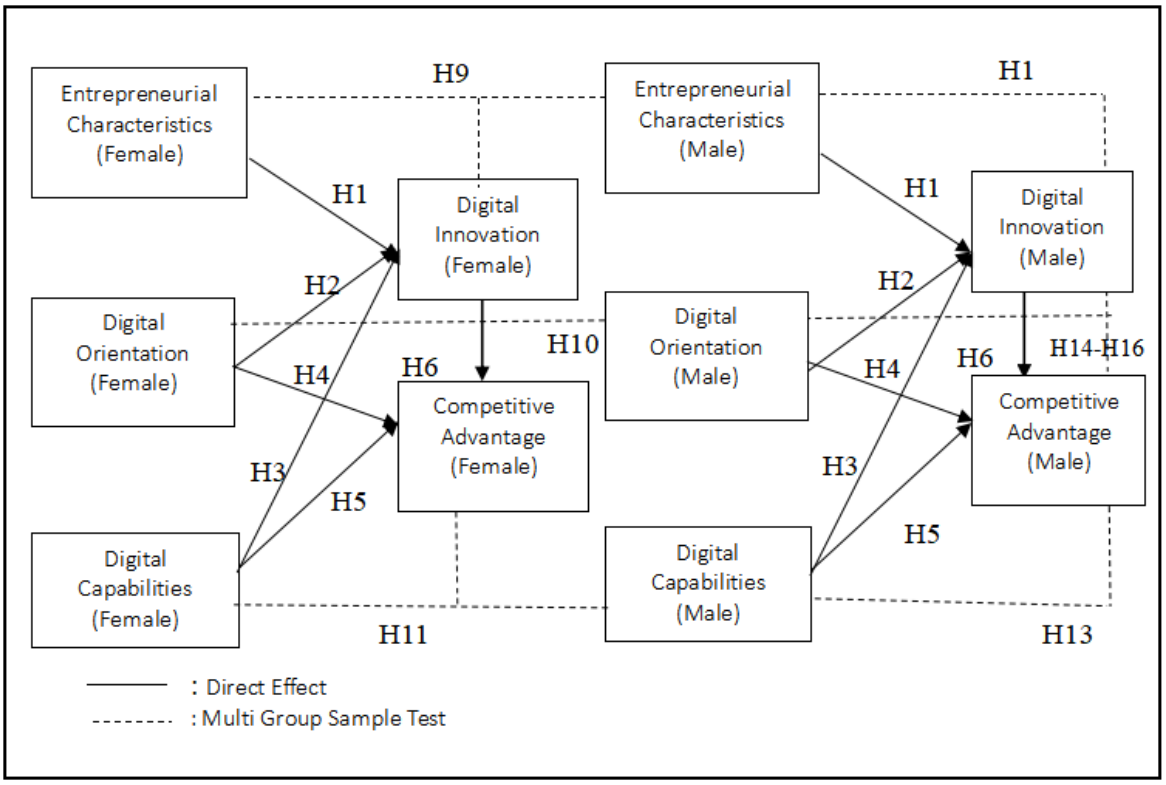
H_{14}: Digital innovation has different effects on competitive advantage between female and male-managed SMEs.

H_{15}: There are differences in the mediation effect of digital innovation on the effect of digital orientation on competitive advantage between female and male-managed SMEs.

H_{16}: There are differences in the mediation of digital innovation on the effect of digital capabilities on competitive advantage between female and male-managed SMEs.

Figure 1 delineates the conceptual framework through the interrelations between the variables and research hypothess.

Figure 1. Conceptual Framework



Source: Author's elaboration (2025)

3. RESEARCH METHOD

This study used a quantitative approach with a causal design to test the hypothesis. The sample comprised 325 respondents: 211 female SME entrepreneurs and 114 male SME entrepreneurs. The participants were trained to improve their digital skills, which Universitas Teknologi Muhammadiyah Jakarta organized in collaboration with PT Telkom Tbk. Purposive sampling was used, with the criterion that SMEs use digital platforms to run their businesses. The data were analyzed using Structural Equation Modeling (SEM) with a multi-group analysis approach, differentiating the groups into female-owned and male-owned SMEs. Data analysis using Smart-PLS 4.1.1.4. This study used a first-order confirmatory approach using Smart-PLS. Latent entrepreneurial characteristics and digital innovation constructs were measured using formative indicators. In contrast, the latent constructs of digital orientation, digital capabilities, and competitive advantage were measured using reflective indicators.

Table 1 presents a description of the indicators used to measure the research variables and the references used.

Table 1. Variable operational

Variables and indicators	Reference
Entrepreneurial Characteristics (EC) 1. Age of MSME owner 2. MSME owner educational background 3. MSME owners experience	(AlBar & Hoque, 2019; Newby et al., 2014; Ntwoku et al., 2017)
Digital orientation (DO) 1. Commitment to use digital technology for marketing 2. Desire to have a website with full features 3. Looking for new digital technology opportunities to facilitate job monitoring 4. Digital technology speeds up decision making 5. Digital technology improves quality in business management	(Karina & Astuti, 2022; Khin & Ho, 2019a; Yunis et al., 2017)
Digital capabilities (DC) 1. Digital technology capabilities 2. New digital opportunity capabilities 3. Ability to master digital updates 4. Technological-based financial records 5. Integrated with digital ecosystem 6. Ability to use digital technology to develop products/service	(AlBar & Hoque, 2019; Karina & Astuti, 2022; Khin & Ho, 2019)
Digital innovation (DI) 1. The digital platform used by SMEs 2. Digital quality solution with cost efficient operation 3. Digital features according to customer expectation and requirements 4. Digital applications offer higher quality products or services than competitors 5. Ability of digital applications to accelerate the delivery of products/services compared to competitors 6. Increase in the speed of work by digital solutions 7. Digital solutions flexibility	(AlBar & Hoque, 2019; Eggers et al., 2017; Khin & Ho, 2019b; Kohli & Melville, 2019; Mulyanti et al., 2025; Newby et al., 2014; Susanti et al, 2023)
Competitive advantage (CA) 1. A new product or service is instantly recognizable by consumers 2. Using innovation in marketing the products/services offered 3. The products/services have different designs from competing products 4. Production cost lower than budget 5. The company's operational data stored in the information system 6. Having an organizational structure that facilitates communication 7. Wider market share	(Adeniran & Johnston, 2015; Hendayana et al., 2019; Oyedijo, 2012; Prakash, 2014; Susanti et al, 2023)

Source: Author's elaboration (2025)

Based on Figure 1, the following equations were obtained:

$$DI = \beta_1 CE + \beta_2 DO + \beta_3 DC + \varepsilon_1 \quad (1)$$

$$CA = \beta_4 DO + \beta_5 DC + \beta_6 DI + \beta_7 DO + \beta_8 DC_{DI} + \varepsilon_2 \ldots \quad (2)$$

To calculate the t-value of the statistical differences in the effects of each model, we used multi-group analysis (MGA). The stages of MGA analysis in PLS SEM are preparing data, determining data groups in PLS, testing Measurement Invariance (MICOM), and testing PLS MGA (Cheah et al., 2020).

4. FINDING AND DISCUSSION

4. 1. ANALYSIS OF RESPONDENTS' CHARACTERISTICS

Table 2 presents the respondents' characteristics, including type of business, online media used, sales turnover, number of workers, and marital status. The respondents accounted for 325 samples, comprising 211 SMEs managed by females and 114 SMEs managed by males. The types of business for female entrepreneurs were culinary (68.7%) and male entrepreneurs (53.5%). This is possible because culinary businesses are relatively more accessible and cheaper and culinary skills are always necessary.

Table 2. Respondents' characteristics

Characteristics	Female		Male		Total	
	F	%	F	%	F	%
Type of business						
Culinary	145	68.7	61	53.5	206	63.4
Fashion	32	15.2	17	14.9	49	15.1
Automotive	2	0.9	2	1.8	4	1.2
Agribusiness	6	2.8	6	5.3	12	3.7
Beauty	5	2.4	0	0.0	5	1.5
Fishery	0	0.0	4	3.5	4	1.2
Craft	10	4.7	7	6.1	17	5.2
Industry	1	0.5	3	2.6	4	1.2
Other	10	4.7	14	12.3	24	10
Total	211	100	114	100	325	100
Media online used						
Facebook	78	37.0	44	38.6	122	37.5
Instagram	47	22.3	16	14.0	63	19.4
Tik tok	23	10.9	14	12.3	37	11.4
Whatsapp	36	17.1	20	17.5	56	17.2
Twitter	2	0.9	2	1.8	4	1.2
Website	25	11.8	18	15.8	43	13.2
Total	211	100	114	100	325	100
Revenue						
< 5	105	49.8	34	29.8	139	42.8
5- 10 million	31	14.7	20	17.5	51	15.7
10 - 20 million	35	16.6	14	12.3	49	15.1
20 – 50 million	27	12.8	29	25.4	56	17.2
50 - 100 million	8	3.8	7	6.1	15	4.6
>100 million	5	2.4	10	8.8	15	4.6
Total	211	100	114	100	325	100
No. of workers						
Not applicable	52	24.6	23	20.2	75	23.1
1-2 workers	102	48.3	35	30.7	137	42.2
3-5 workers	37	17.5	22	19.3	59	18.2
>5 workers	20	9.5	34	29.8	54	16.6
	211	100	114	100	325	100
Status						
Married	185	87.7	105	92.1	290	89.2
Single	26	12.3	9	7.9	35	10.8
Total	211	100	114	100	325	100

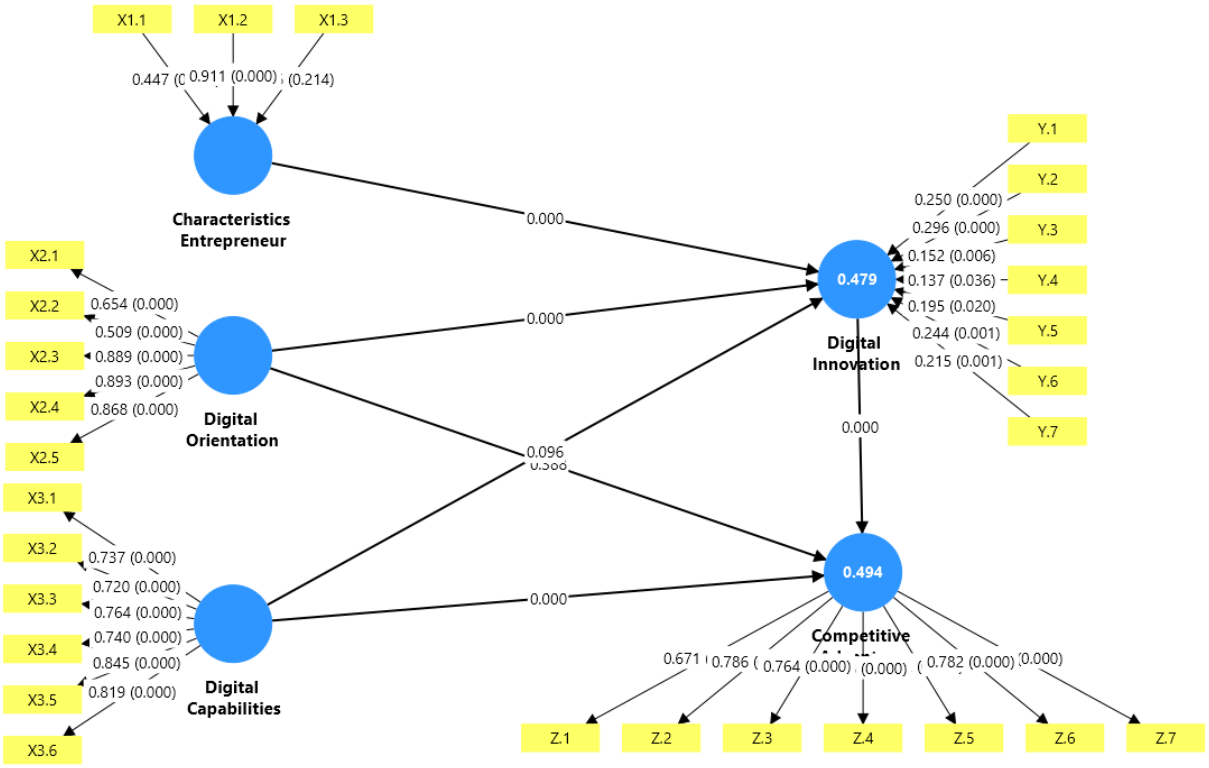
Source: Author's calculation (2025)

The online media most commonly used by female SMEs were Facebook (37 %), Instagram (22.3 %), and WhatsApp (17.1 %). Most online media owned by male SMEs were Facebook (38.6 %), WhatsApp (17.5 %), and Instagram (14 %). The average monthly turnover of female and male SME entrepreneurs is < 5 million, followed by 20 – 50 million. The data analysis results show that male-managed SMEs earn a more significant average monthly turnover than female-managed SMEs. On average, SMEs have 1–2 workers, of which 42.2% have 1–2 workers, 18.2% have 3–5 workers, and 16.6% have more than five workers. The data analysis results show that male-managed SMEs have more workers than female-managed SMEs. In this study, status is considered necessary as a distinguishing factor, considering the dual role of females as business actors who are simultaneously responsible for household duties. The questionnaire results showed that 87.7% of the respondents were married female entrepreneurs and 92.1% were married male entrepreneurs. The dominance of business actors, particularly married females, is possible because they support the family economy.

4. 2. MEASUREMENT (OUTER) MODEL EVALUATION

The outer loading value in this study used a standard of 0.5. If the outer loading value is above 0.5, the research indicator can be considered valid (Hair et al., 2019).

Figure 2. Measurement (Outer) Research Model



Source: Author's calculation (2025)

The validity test results in Figure 2 and Table 3 indicate that all outer loading values are above 0.5, while the outer weight value for the entrepreneurial characteristic X1.3 is insignificant (a formative indicator).

Table 3. Measurement (Outer) Model

Variable	Indicator	Outer	Result	Cronbach Alpa	Composite Reliability	AVE	VIF
Enterpreneurial characteristics (EC) Outer weight	X1.1	0.447	Sig***	Formative 1.009 1.052			1.053
	X1.2	0.911	Sig***				
	X1.3	0.156	Non				
Digital orientation (DO) Outer loading	X2.1	0.654	Valid	0.826	0.869	0.605	1.340
	X2.2	0.509	Valid				1.183
	X2.3	0.889	Valid				2.981
	X2.4	0.893	Valid				3.441
	X2.5	0.868	Valid				2.665
Digital capability Outer loading	X3.1	0.737	Valid	0.863	0.867	0.596	1.812
	X3.2	0.720	Valid				1.719
	X3.3	0.764	Valid				1.860
	X3.4	0.740	Valid				1.970
	X3.5	0.845	Valid				2.814
	X3.6	0.819	Valid				2.378
Digital innovation (DI) Outer weight	Y1	0.250	Sig***	Formative			1.039
	Y2	0.296	Sig***				1.650
	Y3	0.152	Sig***				1.559
	Y4	0.137	Sig***				1.930
	Y5	0.195	Sig***				1.935
	Y6	0.244	Sig***				1.816
	Y7	0.215	Sig***				1.431
Competitive advantage (CA) Outer loading	Z1	0.671	Valid	0.850	0.859	0.529	1.466
	Z2	0.786	Valid				1.892
	Z3	0.764	Valid				1.779
	Z4	0.578	Valid				1.351
	Z5	0.772	Valid				1.970
	Z6	0.782	Valid				2.050
	Z7	0.714	Valid				1.593

Source: Author's calculation (2025)

Based on the results of the reliability test, we conclude that the digital orientation, digital capability, and competitive advantage variables have composite reliabilities above 0.7. Thus, the indicators used in each variable have good reliability; that is, they can measure the structure of the variables. Likewise, with the value of Average Variance Extracted (AVE), digital orientation variables, digital capabilities, and competitive advantage have values above 0.5; thus, we are confident that the constructs of digital orientation, digital capability, and competitive advantage have high discriminant validity in both female and male SME groups, as well as total respondents. The Heterotrait-Monotrait ratio (HTMT) of the research variable is <0.90, and all measurement items are strongly correlated with other variables, thus meeting the discriminant validity evaluation. Meanwhile, the outer Variance Inflated Factor (VIF) value is <5, indicating the absence of multicollinearity (Hair et al., 2021).

4. 3. STRUCTURAL MODEL (INNER) EVALUATION

The goodness of fit model evaluation of research is measured using the PLS Predict (Q^2 Predict), SRMR and NFI value (Hair et al., 2019). PLSpredict assesses the predictive power of the research model. Hair et al. (2019) stated that Q^2 Predict > 0 indicates that the model has predictive relevance. Q square (0 is low, 0.25 is medium, 0.50 is high). The PLSpredict value for both the digital innovation and competitive advantage models has a moderate value (0.439 and 0.385). The SRMR value of the research model is 0.062 < 0.08 and the NFI is 0.8, indicating that the model fits (closely) with the empirical data. Table 4 present the results of hypothesis testing and analysis of the coefficients of determination for the research variables, direct and indirect effect.

Table 4. Structural Model (Inner) Evaluation

Hypothesis Coeff		Female SME's			Male SME's			Total SME's		
		t-stat	f^2	Coeff	t-stat	f^2	Coeff	t-stat	f^2	
Digital Innovation Model										
H1	E.Characteristics	0.173	2.563***	0.038	0.226	3.092***	0.135	0.193	4.120***	0.068
H2	D. Orientation	0.534	4.608***	0.222	0.486	3.862***	0.112	0.526	5.874***	0.189
H3	D. Capabilities	0.070	0.639	0.007	0.224	1.767**	0.035	0.110	1.313*	0.008
R^2		0.429 (42.9%)			0.574 (57.4%)			0.479 (47.9%)		
Adjusted R^2		0.421 (42.1%)			0.562 (56.2%)			0.474 (47.4%)		
PLSpredict (Q^2)		0.439 (43.9%)								
Competitive Advantage Model										
H4	D. Orientation	0.042	0.354	0.001	0.031	0.059	0.001	0.028	0.320	0.001
H5	D. Capabilities	0.371	3.084***	0.128	0.360	3.319***	0.076	0.389	4.403***	0.103
H6	D. Innovation	0.367	4.149***	0.171	0.475	3.884***	0.238	0.415	6.407***	0.158
The Indirect Effect of Digital Innovation on Competitive Advantage										
H7	D. Orientation	0.196	2.612***	0.0014	0.216	2.610***	0.001	0.218	3.781***	0,001
H8	D. Capabilities	0.026	0.607	0.000001	0.100	1.538*	0.0007	0.046	1.306*	0.00001
R^2		0.469 (46.9%)			0.596 (59.6%)			0.494 (49.4%)		
Adjusted R^2		0.459 (45.9%)			0.581 (58.1%)			0.489 (48.9%)		
PLSpredict (Q^2)		0.385 (38.5%)								
SRMR		0.062								
NFI		0.800								

Notes: Significant level, *p < 0.1. **p < 0.05. ***p < 0.01

Source: Author's calculation (2025)

Digital innovation in female and male-managed SMEs has R^2 values of 0.429 and 0.574, respectively, indicating that SME digital innovation can be explained by the constructs of entrepreneurial characteristics, digital orientation, and digital capabilities by 42.9% for female SMEs and 57.4% for male SMEs. In contrast, the remaining 57.1% and 42.6% were influenced by other variables excluded from the research model. The competitive advantage models for female and male SMEs have R^2 values of 0.469 and 0.596, respectively. Thus, the innovation model and competitive advantage of male SMEs are better than those of female SMEs because of their higher R^2 values (see Table 4).

The effect size or f-squared value was used to observe the magnitude of the effect between the research variables. The f^2 value of 0.35 is considered a considerable measure, while a value of 0.15 is regarded as a medium effect, and 0.02 is considered a small effect (Cheah et al., 2018). The mediation effect size is measured using the upsilon statistic (v) using the Lachowicz et al. (2018) approach. The effect of entrepreneurial characteristics on the digital innovation of

SMEs, both female and male, has small f^2 value (0.04 and 0.14, respectively). The effect of digital orientation on digital innovation in female SMEs has a medium effect size (0.222), whereas male SMEs have a negligible effect size (0.11). The effect of digital capabilities on digital innovation, for both females and males, has a negligible effect size (0.007 and 0.04, respectively). Similarly, digital orientation and competitive advantage capabilities have negligible effect sizes. By contrast, digital innovation moderately affects the competitive advantage of female and male SMEs (see Table 4). The results indicate that the variable that contributes the most to the digital innovation model is digital orientation, and the variable that contributes the most to competitive advantage is digital innovation.

Robustness check in this study uses linearity test with Quadratic effect analysis and endogeneity using Gaussian Copula (Hair et al., 2019). The results of the p-value test of the quadratic effect and Gaussian copula in both the digital innovation and competitive advantage models show a p-value > 0.05 (not significant), which indicates that the influence of entrepreneurial orientation, digital orientation, and digital capabilities on digital innovation and competitive advantage of SMEs is linear and there is no endogeneity problem.

Table 5 presents the results of testing the differences hypothesis that the effects of entrepreneurial characteristics, digital orientation, and digital capabilities on digital innovation and competitive advantage between female and male-managed SMEs.

Table 5. Difference hypothesis testing results (difference SME's model)

Hypothesis		Coef. Path		p-value		Difference (Female - Male)	p-value Difference Effect	Result
		Female	Male	Female	Male			
H9	EC --> DI	0.173	0.226	0.005	0.001	-0.053	0.291	Not different
H10	DO --> DI	0.534	0.486	0.000	0.000	0.048	0.387	Not different
H11	DC --> DI	0.070	0.224	0.261	0.039	-0.154	0.174	Not different
H12	DO --> CA	0.042	0.031	0.362	0.477	0.034	0.422	Not different
H13	DC --> CA	0.371	0.360	0.001	0.000	-0.012	0.476	Not different
H14	DI --> CA	0.367	0.475	0.000	0.000	-0.078	0.290	Not different
H15	DO --> DI --> CA	0.196	0.216	0.005	0.005	-0.021	0.426	Not different
H16	DC --> DI --> CA	0.026	0.100	0.272	0.062	-0.074	0.160	Not different

Notes: Significant level, *p < 0.1. **p < 0.05. ***p < 0.01

Source: Author's calculation (2025)

Based on Table 5, there are no significant difference in the effect of entrepreneurial characteristics, digital orientation, and digital capabilities on digital innovation between female and male-managed SMEs. Digital orientation and capabilities have no different effects on the competitive advantage of female and male-owned SMEs. Similarly, regarding the mediation effect, there are no differences in the mediation of digital innovation on the effect of digital orientation and capabilities on competitive advantage between female and male-managed SMEs.

4. 4. DISCUSSION

Based on the path coefficients and hypothesis testing in Table 4-5, the entrepreneurial characteristics, digital orientation, and digital capabilities of male-managed SMEs affect digital innovation positively and significantly. However, for female-managed SMEs, only entrepreneurial characteristics and digital orientation have a significant effect, whereas digital capabilities have no significant impact on digital innovation. The results of this study support the theory of RBV and dynamic capabilities in male-managed SMEs and support previous research (AlBar & Ho-

que, 2019; Eggers et al., 2017; Newby et al., 2014; Ntwoku et al., 2017), which proves that entrepreneurial characteristics, as measured by age, education, and experience, have a significant effect on digital innovation. Business owners with higher education have a greater tendency to adopt digital technology; however, SME entrepreneurs with low educational backgrounds tend to be less interested in adopting digital technology in developing their businesses (Ntwoku et al., 2017). Another interesting empirical evidence is that the age of entrepreneurs contradicts previous research (Palvia & Palvia, 1999), where the more mature the age of the SME owners, the greater their desire to be involved in digital innovation; the difference in this study results could be because the majority of respondents (75%) were over 35 years old. Male entrepreneurs' experiences significantly shape their characteristics and positively affect their digital innovation. The results support Hossain et al. (2024) finding that entrepreneurs with more experience tend to be involved in digital innovation. However, the experience variable did not significantly influence the characteristics of female entrepreneurs. The results of testing the difference hypothesis indicate a difference in the effect of entrepreneurial characteristics on digital innovation between female and male. However, this difference is insignificant, and lies in the experiences that shape the characteristics of male and female SMEs. This study corroborates the findings of Expósito et al. (2023) that male CEOs in Spain implement digital innovations more frequently than their female counterparts; nevertheless, this disparity is not statistically significant.

Empirical evidence of the effect of digital orientation on digital innovation in both female and male-managed SMEs supports the results of previous research (Ardito et al., 2021; Hudayah et al., 2024; Karina & Astuti, 2022; Khin & Ho, 2019; Ranjan, 2024; Rupeika-Apoga et al., 2022), which shows that digital orientation positively affects digital innovation. Within the RBV framework, digital orientation serves as a strategic resource that empowers SMEs to proficiently develop digital innovation capabilities, irrespective of the manager's gender. These results indicate that the higher the commitment of SME entrepreneurs to digital technology applications, the higher the digital innovation they are likely to carry out, regardless of gender, in running their businesses. Commitment and desire to have digital technology, as well as looking for new digital technology opportunities to improve quality, can increase digital innovation to develop new products and services with SME digital technology solutions. Other empirical evidence shows no difference in the effect of digital orientation on digital innovation between female and male-managed SMEs. The digital orientation of female and male-owned SMEs has the same technological orientation towards increasing digital innovation. These results imply that digital orientation emphasizes that SMEs embrace digital technology because digital orientation assists SME entrepreneurs in providing new connections to compete more broadly, not limited to previously explored markets (Khin & Ho, 2019). The lack of gender-based disparities in the impact of digital orientation substantiates that strategic factor like digital orientation are universally applicable in fostering digital innovation, hence broadening the scope of gender literature in entrepreneurship. The findings of this study align with those of Astuti et al. (2024), indicating that individual entrepreneurial orientation affects SME innovation and performance irrespective of gender variations among entrepreneurs. Consequently, digital orientation as a strategy methodology transcends gender prejudices and distinctions, demonstrating inclusive efficacy.

The results of hypothesis testing show that digital capabilities affect digital innovation only in male entrepreneurs. The results of this study support (Fernández-Mesa et al., 2014; Hudayah et al., 2024; Karina & Astuti, 2022; Khin & Ho, 2019; Ranjan, 2024; Rupeika-Apoga et al., 2022; Yasa et al., 2019) which shows that digital capability has a positive effect on digital innovation. These results prove that the digital skills of male entrepreneurs determine the success of digital innovation in SMEs. Digital capability is a fundamental building block that can change customer experiences, operational processes, and SME business models (Karina & Astuti, 2022;

Khin & Ho, 2019). Digital utilization can be powerful in exploring and learning about various potential and new opportunities in the market. By conducting a market analysis through digital incorporation, diligent SMEs can map the market; thus, they can provide and fulfil products/services according to the community's needs in their area with better quality, leading to high growth potential. Digital financial platforms used by SMEs can increase customer payment flexibility and facilitate bookkeeping automation to achieve cost efficiency. The capability of digital technology achievement determines digital capability, the capability in new digital opportunities optimization, the ability in digital updates mastery, digital financial capabilities, the ability in a proven digital ecosystem integration, and the ability of digital technology utilization in developing products/services are all proven to increase digital innovation in male-managed SMEs. However, this does not improve digital innovation among female-managed SMEs. The results support the hypothesis that there is a difference in the effect of digital capabilities on digital innovation between male- and female-managed SMEs despite not being significant. This empirical evidence supports the gender gap in the application of digital technology (Fernández-Mesa et al., 2014; Karina & Astuti, 2022; Khin & Ho, 2019; Yasa et al., 2019). This shows inequality in digital technology utilization between males and females in the economic domain. Liberal feminist theory posits that there are no intrinsic differences in innovation capacities between men and women when resources are equitably distributed, however the social constructionist perspective asserts that perceptions, social structures, and prejudices shape innovative behaviour according to gender (Expósito et al., 2023). These differences may be attributed to differences in education and experience. The educational background and experience of male entrepreneurs are better than those of females, as is apparent from the average educational background of men at 4.04, while that of female is 3.66. On the other hand, the average experience of male was 3.84, while that of female was 3.8.

The results vary according to competitive advantage model testing, where digital orientation does not directly affect competitive advantage in female and male-managed SMEs. The hypothesis testing results also show no difference between female and male-managed SMEs. However, the impact of digital orientation on competitive advantage must be reflected in the research results (Quinton et al., 2018). However, according to Karina & Astuti (2022), digital orientation has no significant effect on competitive advantage built through low cost, product differentiation, and focus. This empirical evidence indicates that other factors mediate the influence of this variable. In addition, it has been proven that digital innovation can mediate the effect of digital orientation on competitive advantage in both female and male-managed SMEs. These results indicate that with a strong commitment and vision related to the response and desire to adopt high digital technology, they can provide digital-based innovative offerings with higher-quality products, efficient costs, and accuracy. Eventually, they serve customers better, have advantages, and increase SMEs' competitiveness.

The influence of digital capabilities and innovation significantly positively affects competitive advantage in female and male-managed SMEs. No statistical difference was observed between the two groups. The increasing digital capabilities of SME owners or managers, as measured by the ability to obtain digital technology, optimize new digital opportunities, master digital updates and digital financial capabilities, integrate the digital ecosystem, and use digital technology in developing products/services, can improve product and service quality, expand market share, and enhance cost efficiency. Thus, they have an advantage over their competitors. The results of this study support previous research (Adeniran & Johnston, 2015; Erlany et al., 2023; Fernández-Mesa et al., 2014; Heredia et al., 2022; Rupeika-Apoga et al., 2022), which shows that digital capabilities can increase a company's competitive advantage. Digital capabilities enable SMEs to differentiate products from competitors' prices and establish a proper product

distribution and merchandise inventory strategy; thus, they can focus on the right approach to gain a competitive advantage.

The results of other studies also support the hypothesis that digital innovation significantly and positively affects SMEs' competitive advantage, both of which are managed by female and male. The study results support those conducted by (Adeniran & Johnston, 2015; Berawi et al., 2020; Erlany et al., 2023; Karina & Astuti, 2022; Shehadeh et al., 2024; Susanti et al., 2023), which reveals that digital innovation will lead to an increase in the competitive advantage. With more quality digital platforms used by customer needs and providing digital solutions that can accelerate work and flexibility, SMEs can expand their market reach, produce products different from competitors, and achieve cost efficiency to gain advantages and improve competitiveness. Digital technology enables SME to invent new ways of integrating customer needs into service delivery or product development throughout the process chain, thereby creating a competitive advantage (Berawi et al., 2020). This study's findings affirm that digital competencies and digital innovation function as potent strategic resources for SMEs, irrespective of the manager's gender. These findings expand the theoretical framework with significant consequences, as RBV and DC theories on digital innovation must underscore gender neutrality, suggesting that strategic digital capabilities and innovation function successfully irrespective of the manager's gender. This facilitates the formulation of an inclusive digital entrepreneurship theory, wherein digital competencies and innovation are regarded as universal strategic resources accessible and utilizable by all entrepreneurs, regardless of gender.

Digital innovation can mediate digital capabilities to a competitive advantage among male-managed SMEs only. Despite being insignificant, there is a difference in the effect of digital capabilities on competitive advantage through innovation between female and male-managed SMEs. This difference can be attributed to the negligible effect of females' digital abilities on digital innovation. This empirical evidence supports the existence of gender inequality between male and female in digital technology. The result of this study supports the findings of Alam et al. (2022) that there are significant differences between female-managed and male-managed SMEs regarding their perceptions of digital technology adoption and digital transformation. This gender gap in digital technology could be caused by the cultural consideration that men are superior to female, thereby limiting their access to digital technology. These differences may also be caused by poor knowledge, educational background, experience, and environmental factors (Abu-Shanab & Al-Jamal, 2015). This study's findings correspond with Expósito et al. (2023), which indicated that male entrepreneurs are more inclined to achieve superior performance advantages from innovation, especially digital innovation, compared to female entrepreneurs. This underscores the necessity of acknowledging structural impediments that obstruct the mediation pathways of digital innovation in female-led SMEs, despite the aggregate difference lacking statistical significance. Another fact based on the study results is that most female managing SMEs are married (87.7%), indicating that they have more tasks. In addition to managing their businesses, they must also care for their families. However, these findings do not explain the social, cultural, or environmental contextual effects of female-led SMEs in Indonesia. Further research is required to conduct a more comprehensive study on gender inequality, including the social, cultural, and economic realities of female-led businesses in Indonesia.

5. CONCLUSION

This study examines the factors that determine SME owners/managers' perceptions of digital innovation and competitive advantage, in the context of gender equality. We find that entrepreneurial characteristics and digital orientation contribute positively and significantly to digital innovation in female and male-managed SMEs. In contrast, digital capability significantly and

positively affects digital innovation only in male-managed SMEs. Digital orientation did not directly affect competitive advantage, but had an indirect impact on digital innovation. Both digital capability and innovation significantly increased competitive advantage for both female and male-managed SMEs; however, innovation could not mediate the impact of digital capabilities on the competitive advantage of female-managed SMEs. The difference in the results of testing the digital capabilities of male and female indicates a gender gap in digital technology use. This study supports resource-based view (RBV) theory. It requires RBV theory in the digital innovation context to empirically demonstrate the determinants of digital innovation that contribute to SMEs' competitive advantage.

This study's findings have several implications. First, the government, through the Ministry of Communication and Information in collaboration with academics, should carry out a digital literacy movement incorporating four pillars: digital skills, culture, ethics, and safety in SMEs, especially for SMEs managed by females. The number of Internet users was dominated by female (56.6 percent) rather than male (43.4 percent). However, empirical evidence indicates that there is a gender gap in the use of digital technology. Second, the government collaborates with stakeholders to agree on a technology pact that encourages females and girls in science, technology, engineering, and mathematics (STEM) to narrow the gender gap in the digital world. Third, cyber security and privacy are crucial factors; thus, the government must immediately regulate the Personal Data Protection Act (PDP) to protect female from data breaches and other cybercrimes. Fourth, the government must carefully consider the opportunities and threats resulting from digital disruption, mainly because of digital innovation, facilitating the provision of technological items and enhancing the reach of Internet networks in rural regions, particularly in interior and border areas.

This study has several limitations, such as the small sample size of SMEs and the need for further differentiation between SMEs in urban and rural areas. The study results were not confirmed through in-depth interviews with respondents, and the output of digital innovation only tested competitive advantage, even though there were many other outputs such as financial performance, business performance, and the internationalization of SMEs. Thus, further research is needed to differentiate samples by region (rural and urban) to avoid biased results. Research also adds financial or business performance variables to quantitatively forecast the impact of digital innovation; studies gender gaps, including the social, cultural, and economic realities of businesses led by females in Indonesia; and uses mixed-methods research to obtain more optimal and comprehensive research results.

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Credit Authorship Contribution Statement

Lela Nurlaela Wati: Writing, Conceptualization, Methodology, Data Analysis, Writing Article; Momon: Writing, Validation, Methodology, Data Curation; Heri Ispriyahadi: Data Analysis, Visualization; Rita Yuni Mulyanti: Methodology and Review; Saiful Simanulang: Discussion and Review.

Declaration of Competing Interest

The Authors declare that they have no conflicts of interest.

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