Digital Empowerment in Rural Villages: Unraveling MSEs' Path to Technological Readiness and Sustainability

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Abstract

This study examines the digital readiness of micro and small enterprises (MSEs) in rural Indonesia, aiming to evaluate their readiness and develop a specialized model tailored to rural challenges. Using a mixed-method approach, insights were drawn from 12 articles and 24 business participants across 11 villages, combining systematic literature reviews and in-depth interviews. The methodology focused on analyzing digital readiness dimensions such as strategy, organization, technology, finance, and market integration. Interviews with MSE owners and managers explored factors influencing digital readiness, including the macro environment, technology perceptions, motivation for adoption, social capital, and knowledge-based capabilities. Findings revealed that many rural MSEs possess a basic level of digital readiness, with some lagging due to limited technology use and owner disinterest. Addressing these challenges requires collaboration among governments, educational institutions, local communities, and the MSEs themselves. The study underscores the importance of digital readiness in enhancing the competitiveness and sustainability of rural MSEs. By developing a tailored model and addressing key challenges, rural MSEs can better leverage digital technologies to drive growth and economic development in rural areas.

Keywords: Digital readiness, digital maturity, digital village transformation, MSEs, rural areas.

INTRODUCTION

Micro, small, and medium enterprises (SMEs) are widely recognized as the backbone of economies, playing a pivotal role in the economic development of both developed and developing countries (Yezhebay et al., 2021). Beyond their economic functions, micro and small enterprises (MSEs) in developing countries hold social significance, contributing to workforce assimilation, fostering rural development, promoting entrepreneurship, and enhancing rural residents' standard of living.

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However, developing MSEs in rural areas hinges on crucial factors, necessitating financial and technical support from governmental and local authorities. In rural settings, many businesses still face challenges in adopting modern technology due to various issues, including poor telecommunications infrastructure, limited business premises, transportation infrastructure, small local markets, characteristics of the rural labor market, restricted access to information and finance, management incompetence, and insufficient entrepreneurial knowledge (Lekhanya, 2018). Digital connectivity issues, such as internet access, digital inclusion, and gaps in high-speed internet usage, further hinder the implementation of digital business practices in villages (Richmond, Rader, & Lanier, 2017).

The same holds true for conditions in Indonesia. Micro, small, and medium enterprises in Indonesia significantly contribute to achieving the country's Gross Domestic Product, influencing the economy in terms of the number of companies, gross added value, and employment (Okfalisa et al., 2022). In 2022, MSEs in Indonesia initially demonstrated impressive performance with a positive growth rate trend, but later faced contraction. Approximately 81.95 percent of MSEs encountered operational difficulties. MSEs struggled to capitalize on the opportunities presented by shifts in consumer shopping patterns, especially the increasing trend towards online transactions. In 2021, only a small fraction of MSEs (22.89 percent) utilized the internet for various online business needs (Central Bureau of Statistics, 2023).

SMEs encounter numerous challenges in their journey towards digital transformation, and despite these limitations, they must strive to achieve digital transformation. Digital transformation represents the highest level following digitization and digitalization. It involves the innovative use of digital technologies, accompanied by the strategic utilization of key resources and capabilities, aiming to enhance profits, radically improve enterprises, and redefine the value proposition for stakeholders (Silva et al., 2022; Williams et al., 2022). Digital readiness and digital maturity are crucial components ensuring SMEs are prepared for digital transformation (Yezhebay et al., 2021; Sándor & Gubán, 2022).

There is limited research regarding the digital readiness of MSEs in rural areas. Research opportunities exist to determine the factors that encourage small businesses in rural areas to adopt internet-based practices (Richmond et al., 2017). Little literature discusses how small and medium-sized businesses in rural areas can use better broadband connections to overcome

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the digital divide. Previous research regarding the digital readiness of MSMEs in Indonesia focused more generally, not specifically assessing digital readiness in rural areas. It is known that 43.86% of MSMEs in West Java Province, Indonesia, are at digital readiness level 2 or the digital novice category. Other research results show that MSMEs in Sumedang Regency, Indonesia, are still at the lowest level of digitalization. Many MSMEs are still unprepared to face the digitalization era (Sari et al., 2023). Both previous studies in Indonesia used the same digital readiness index from Pirola et al. (2020), with the dimensions of people, strategy, process, technology, and integration. Future research is expected to carry out more in-depth analyses to improve the digital readiness of MSMEs, considering other variables or dimensions in measuring readiness (Sari et al., 2023).

Based on the limitations of previous research, this study focuses on MSEs in rural Sumedang Regency, with business owners being native rural residents. This was done to carry out a deeper analysis to better understand the relationship between variables that influence the digital readiness of MSEs in rural areas. According to Pirola et al. (2020), future research directions are needed to highlight groups with similar profiles and behavior to better understand the relationship between variables and dimensions that influence a company's digital readiness. Additionally, there is a need to assess the government's role in SMEs digitalization (Yezhebay et al., 2021) and to measure SMEs with a digital maturity model that reflects reality or empirical conditions (Sándor & Gubán, 2022).

Sumedang Regency is on the island of Java, Indonesia. The distribution of MSEs locations in Indonesia is centered on Java, which hosts around 60.38 percent of total MSEs in the country. The largest number of businesses using the internet is on Java, at 68.31 percent (Central Bureau of Statistics, 2023). Sumedang Regency is noted for its implementation of Electronic-Based Government Systems. However, there are still problems with MSEs in villages in Sumedang Regency, such as a decline in economic growth and low adaptation to ICT among trading businesses (Sumedang Regency Medium-Term Regional Development Plan 2018-2023). The Sumedang Regency Government has a digital transformation strategy for MSEs, aiming to increase their economic capacity through digitalization and intergenerational collaboration.

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Based on empirical conditions and the limitations of previous research, the novelty of this study lies in its focus on MSEs in a rural context, using different dimensions to assess digital readiness. The research questions are:

1. What are the dimensions in assessing MSEs' digital readiness?
2. What is the condition of digital readiness of MSEs in rural areas in Indonesia?
3. How can a digital readiness model for MSEs in rural areas be developed?

The ultimate objective of this study is to formulate a digital readiness model specifically tailored for MSEs in a rural context, contributing to the limited research on the digital readiness of MSEs in rural areas (Richmond, 2017). This study aims to enhance existing digital readiness models by gaining a deeper understanding of the relationships between variables and dimensions that influence digital readiness (Pirola et al., 2020; Yezhebay et al., 2021).

LITERATURE REVIEW

Digital Readiness and Digital Maturity

Digital readiness is about being prepared and capable of using digital technology effectively, while digital maturity is the level of organization and formality in achieving digital goals. Readiness assessment precedes the maturity assessment, focusing on readiness for transformation, whereas maturity assessment captures the current state during the maturing process. Despite some nuances, the terms are often used interchangeably to represent similar concepts. Combining them, readiness can be seen as organizational digital maturity, with maturity models aiding in evaluating readiness and setting improvement goals. They provide objective evaluations and guide companies on what to measure and how to progress through stages of digital transformation. In this study, we utilize both digital readiness and digital maturity concepts to assess the digital readiness of MSEs (Pirola et al., 2020; Sándor & Gubán, 2022; Yezhebay et al., 2021).

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## Level of Digital Readiness and Digital Maturity

Various authors put forward levels of digital readiness and digital maturity. This model is described as a ladder, and each level has a description and requirements for moving to the next level. Below in the table 1 is a summary from several authors regarding the level of digital readiness and digital maturity of SMEs.

Table 1. Level of digital readiness and digital maturity of SMEs

Author	Level of Digital Readiness or Digital Maturity of SMEs
Choirunnisa et al. (2022)	The digital transformation readiness was classified into three stages: Level 1: SMEs have low readiness in all dimensions Level 2: SMEs have started to have good readiness of people but still need improvement in the strategy, technology, financial, and rapidity. Level 3: SMEs already have a well-thought-out future planning strategy.
Sándor & Gubán (2022)	Classification of digital maturity levels: Level 1: Initial. Businesses that have not focused enough on digital development. Level 2: Pathfinder. Businesses have demonstrated a need for digital development but still do not have a mature concept of change methods. Level 3: Advanced. A business with an acceptable level of digital development, with some variation in the market environment and competitors performing well. Level 4: Managed. With a good level of digital maturity, the system is superior to some of its competitors, and the system internally detects deficiencies and attempts to correct them. Level 5: Optimized and providing feedback. Being the highest level, it is very important to monitor, analyze and develop changes through feedback to avoid falling into lower maturity levels.
Yezhebay et al. (2021)	Digital maturity model: Level 0: outsiders. Not yet implemented any digitalization practices. Level 1: Beginners, who have tried digital transformation Level 2: Intermediate is a middle-phase company with a smart technology operating infrastructure. Level 3: Experienced is an experienced company with vertical integration and manufacturing system networks. Level 4: Expert. Experts with horizontal integration through value networks that have applied big data analysis and machine learning. Level 5: Top performers are the best performers who display digital maturity features and have continuous self-adaptation and optimization.
Blatz, Bulander, & Dietel (2018)	Digital maturity level: Level 1 Digitization steps in the company are taken, but no mature approach has been defined so far. The impact on the company and processes is minimal. Level 2 Some digitization steps are described formally and are executed accordingly. Level 3 Quantitative objectives and their evaluation are set. Reflection and adaption of actions of digitization.

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RESEARCH METHODS

We used systematic literature reviews (SLR) and interviews. The results of the interviews were used to validate the SLR results (Williams et al., 2022). The SLR aims to answer the first research question (RQ1). The dimensions resulting from RQ1 are used as guidelines in conducting interviews to answer RQ2. Next, through coding, we developed dimensions from existing literature to obtain a model to answer RQ3. Figure 1 below illustrates the research approach.
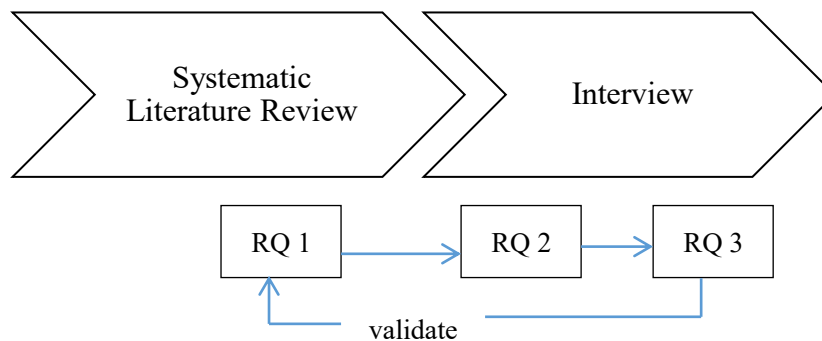
Figure 1: Research Approach

Source: modified according to research purposes, from Williams et al. (2022).

Systematic Literature Review

A systematic literature review using PRISMA was conducted to address RQ1. Initially, keywords like "digital readiness" AND MSEs AND (rural OR village) yielded no results in the Scopus database. Adapting the search to "digital readiness" AND SMEs led to 21 articles. To broaden the scope, "digital maturity" was included as a synonym, but no relevant articles were found. Finally, using ("digital readiness" OR "digital maturity") AND SMEs yielded 65 articles. Screening for duplicates and relevance narrowed down to 29 articles based on eligibility criteria including English full-text, relevant dimensions, and focusing on MSMEs. From these, 12 articles were extracted and synthesized for dimensions guiding the assessment of digital readiness, particularly for MSEs in rural Indonesia (IC).

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Interview

Interviews were conducted with business actors who are native villagers, spread across eleven villages in Sumedang Regency. Micro and small businesses dominate the types of business in the eleven villages (Sumedang Regency Central Bureau of Statistics, 2022). Micro industry includes industries with a workforce of less than five people, while small industry includes industries with a workforce of between 5 and 19 people (Central Bureau of Statistics, 2023). Below in Table 2 is a list of participants in this study:

Table 2. List of participants

Name of Village	Participant Code	Type of Business
Cilayung	P1	Archery
	P2	Cilembu sweet potato
Cileles	P3	Catfish farming
	P4	Banana crackers
	P5	Bag
	P6	Cake and Bakery
Cipacing	P7	Craft
	P8	Kite
Cisempur	P9	Convection
	P10	Flower crafts
Cintamulya	P11	Shrimp
	P12	Curtains and wallpapers
Mekargalih	P13	Salted egg
	P14	Production of Mashed Sambal and Meatball Oil
Sayang	P15	Bakery
	P16	Banana fritters
Cikeruh	P17	Drink shop
	P18	Food & beverage
Cibeusi	P19	Sumedang Tofu
	P20	Convection
Jatimukti	P21	Salted egg
	P22	Shrimp
Jatiroke	P23	Cake and Bakery
	P24	Cake and Bakery

The study reached saturation after 24 interviews, using a blended coding approach of inductive and deductive methods. First-cycle coding employed inductive coding based on informants' terms, while second-cycle coding incorporated deductive coding using pre-defined codes from existing literature. This approach allowed for theoretical analysis, grouping

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categories into themes, and potentially developing new models or theories (Skjott Linneberg & Korsgaard, 2019).

RESULTS AND DISCUSSION

Results of a SLR Regarding Dimensions for Assessing Digital Readiness of MSMES

This section is the answer to the first research question. The synthesis results from 12 articles included in the SLR. Obtained ten dimensions to assess MSMEs digital readiness: strategy, organization, people, technology, market, product, financial, business activities/process, integration, and macro environment. The synthesis results are in Table 3 below:

Table 3. Synthesis results regarding the digital readiness dimensions of MSMEs

Dimensions	Definition	Authors
Strategy	It is a technology implementation plan and vision. How clear the strategy is across the company, how much employees understand the strategy, and how the company responds to new digital business models.	Trischler & Li-Ying (2022) Silva et al. (2022) Kumar & Sharma (2023) Choirunnisa et al. (2021) Yezhebay et al. (2021) Pirola et al. (2020) Brozzi et al. (2020) Sándor & Gubán (2021) Borštnar & Pucihar (2021)
Organization	It is an organizational structure and culture that adapts to digital developments. As well as covering internal organizational processes (such as communication and innovation).	Trischler & Li-Ying (2022) Okfalisa et al. (2022) Silva et al. (2022) Kumar & Sharma (2023) Sándor & Gubán (2021) Borštnar & Pucihar (2021)
People	Covers leadership, employment, education and digital skills, and efforts to improve digital skills. Leadership is the leader's personal integrity, also referring to decisions facing digital change conditions.	Trischler & Li-Ying (2022) Okfalisa et al. (2022) Kumar & Sharma (2023) Choirunnisa et al. (2021) Yezhebay et al. (2021) Pirola et al. (2020) Brozzi et al. (2020) Sándor & Gubán (2021) Borštnar & Pucihar (2021)
Technology	The technological dimension evaluates the existence of digital technology, such as infrastructure, hardware, software, internet usage, VPN connection, IoT, AI, big data, cloud computing, social media, mobile, robotics, chatbot, individual domain name, unique email address, and business phone.	Trischler & Li-Ying (2022) Okfalisa et al. (2022) Kumar & Sharma (2023) Choirunnisa et al. (2021) Yezhebay et al. (2021) Cunha & Sousa (2021) Pirola et al. (2020) Brozzi et al. (2020) Sándor & Gubán (2021) Borštnar & Pucihar (2021)
Market	It is an investment in technology to meet market demand and respond to competition, how the company scans competitors, and the type of customer involvement in adopting new technology.	Trischler & Li-Ying (2022) Okfalisa et al. (2022) Silva et al. (2022) Kumar & Sharma (2023)

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		Cunha & Sousa (2021)
Product	Relates to digital product features, equipping products with ICT components, or collecting customer feedback.	Kumar & Sharma (2023) Yezhebay et al. (2021) Cunha & Sousa (2021) Sándor & Gubán (2021)
Financial	As a readiness for SME financial assets through loans or capital assistance, grants, and resource support programs through training, seminars, and exhibitions. As well as the budgeted costs for developing an online store.	Okfalisa et al. (2022) Choirunnisa et al. (2021)
Business activities/process.	It is adopting technology in business activities or operations, namely production, distribution, service and supply chain management activities.	Okfalisa et al. (2022) Silva et al. (2022) Kumar & Sharma (2023) Yezhebay et al. (2021) Pirola et al. (2020) Borštnar & Pucihar (2021)
Integration	Analyze the level of digitalization and integration with other actors in the value chain in the form of horizontal integration and vertical integration. Horizontal integration is the exchange of information between companies with similar profiles. Vertical integration is the real-time exchange of data between machines and workstations.	Kumar & Sharma (2023) Cunha & Sousa (2021) Pirola et al. (2020)
Macro Environment	It is an external influence factor that influences SMEs, namely. Demographics, economics, technology, environment, politics, government support, culture and the broader competitor landscape.	Okfalisa et al. (2022)

Source: Study results

Coding Results From Interviews

From the first cycle of coding, we found more than 200 codes. Next, we grouped these codes into 45 categories. An overview of the interview results determination of codes and categories is in Table 4 below:

Table 4. Overview of determining codes and categories from the study (first-cycle coding -inductive coding)

Some Interview Results	Codes	Category
P14: I have made it online with students, but I do not know whether or not I will take care of it in the future. P2: The number of employees is uncertain P16: It is better to go directly to consumers. If you order online, some people do not have the product. P17: There is social media, but not very active.	Have been helped online by other parties, but I am not yet sure about the future. Production is uncertain. Uncertain workers. There is technology, but it is not very active.	Sustainability of the technology that has been implemented. Sustainability of organizations and business processes

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P2: The weather is different from last year. Last year's harvest was successful, but now almost everyone's harvest has failed. P21: During the dry season, the production of salted eggs is very difficult. It can even go up to 2 months without production.	Raw materials from farmers depend on the weather. Seasonal production depends on the weather.	Climatic factor
P9: door to door is more convenient than online. Luckily, it is not much if you go online. P8: I do not use the website. Even offline orders are already overwhelming P17: Technology helps make payments easier.	There is little advantage to being online. More buyers than offline. ICT can develop business.	Perceptions of the benefits of technology
P11: I do not want to use technology because it is difficult. P16: It is better to be comfortable with the manual.	Technology is considered complicated.	Perceptions regarding ease of using technology
P7: I am just offline because I am not interested in entering the online business realm yet. P4: Yes, I am interested, too, but I do not understand how to implement it yet	Have no expectations online. I desire to go online but cannot afford it due to various limitations.	Motivation to use technology
P8: No intention of having another branch because it is enough to be a family business. P10: I am taking care of it online with my child. My mother does not understand. P2: The employees are all family	The nature of the business is hereditary and family-owned Helped by family. The family managed to go online.	Family
P7: My strategy is to prioritize customer trust and satisfaction P6: If you use different hands, I fear the taste will be different. Poor customer.	Focus more on strategies that prioritize trust	social trust
P16: Many students have been successful in developing it from studying here. P18: My principle is business first, education second, then the third is empowerment	Strategy to empower local communities. Developing in other areas	Empowerment
P3: If you have enough, that is enough. However, if you think less, you will have less. Because someone has already arranged your fortune P8: I am quite satisfied with my current business. I have no intention of opening an online P14: This much is enough	You already have someone to regulate your fortune. You do not feel like you are competing. Receive good fortune or conditions. Feel satisfied with the existing conditions.	life satisfaction
P10: The results are for eating, the important thing is not to borrow them from the shop, that is enough. Just like this hobby, there are no rivals. P11: Not using technology is enough as long as your needs are met, and you can return your investment.	Without ICT, it is enough to meet daily needs.	Fulfillment daily needs
P11: I need training and financial assistance.	Partnership.	Partnership and Support

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P19: In the export of raw goods, there is a role for the government, which connects distributors and consumers. P22: there is a funding application program in other villages. However, here, we do not have any. They say you have to have a group first. We do not join a group because we are in our own business. P16: Yes, my mother used to have a student for three months.	Hope for assistance from the government and universities. Support from the community or group. Help from students.	

Source: Study results

Furthermore, in the second coding cycle, 15 themes were obtained as a result of grouping the 45 previously obtained categories. This grouping is an analytical activity with theoretical support. A comparison was also carried out with the Pre-defined list of codes resulting from the SLR so that new themes were obtained as findings. Below in Table 5 are the results of Second-Cycle Coding.

Table 5. Second-cycle coding (deductive coding)

Pre-defined list of codes generated from SLR	Categories and themes generated from coding (from MSEs participants)
1. Strategy	1. Strategy
- Implementation plan and technology vision. - Clarity of strategy - Employee understanding of strategy - How companies respond to new digital business models.	- Implementation plan and technology vision. - Clarity of strategy - Employee understanding of strategy
2. Organization	2. Organization
- Organizational structure - Organizational culture - Internal organizational processes (such as communication and innovation	- Organizational structure - Organizational culture - Internal organizational processes (such as communication and innovation)
3. People	3. People
- Leadership - Employment - Education - Digital skills.	- Leadership - Employment: Sufficient number of workers, worker stability (new theme) - Digital qualifications in worker recruitment (new theme) - Education - Digital skills - Resource support through training and seminars (new theme)
4. Technology	4. Technology
Infrastruktur, Hardware, Software, Internet usage, Digital technology (IoT, AI, big data, cloud computing, mobile, robotics, chatbot), Unique email address, Business phone, Social media	- Network Infrastruktur - Hardware. - Software. - Internet usage. - Digital technology. - Social media - System characteristic (new theme)
5. Financial	5. Financial
- Loans or capital assistance, - Grant - Resource support through training, seminars and exhibitions. - Costs for online store development.	- Loans or capital assistance. - Ability to pay workers and manage finances for business operations. (new theme) - Costs for online store development.

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6. Product	6. Product
- Digital product features - Product equipment with ICT components	- Product quality so it can be sold online (new theme) - Stock products to be sold online (new theme) - Product equipment with ICT components
7. Business activities/process/operation Digital business model	7. Business activities/process
Adoption of technology in activities: - Production - Distribution - Service - Supply chain management.	Adoption of technology in activities: - Production - Distribution - Service - Supply chain management
8. Market/Pelanggan	8. Market
- Investment in technology to meet market demand - Responding to competition - Types of customer involvement in adopting new technology	- Investment in technology to meet market/customer demand. - Responding to competition - Types of customer involvement in adopting new technology
9. Integration	9. Integration
- Horizontal integration - Vertical integration.	- Horizontal integration - Vertical integration
New theme- Findings	10. Sustainability
	- Sustainability of technology application - Sustainability of strategy, organization, people, finance and product. - Sustainability of business processes, markets and integration.
10. Macro Environment	11. Macro Environment
External influencing factors affecting SMEs: Demography, Economy, Technology, Environment, Politics, Government support, Culture	- Socio-economic factors - Level of education - Income level - Demographics - Climatic Factors
New theme- Findings	12. Perceptions and motivations for using technology - Perceived usefulness - Perceived ease of use
New theme- Findings	13. Social Capital - Social interaction through face-to-face - Friendship - Family - Social trust - Caring and helping each other - Empowerment
New theme- Findings	14. Subjective well-being - life satisfaction - Fulfillment daily needs
New theme- Findings	15. Knowledge-based development and innovativeness - Socialization towards Internalization. - Partnership and Support. (such as the triple helix or quadruple helix).

Source: Study results

Digital Readiness of Micro and Small Enterprises in Rural Areas (Indonesian Case)

This section is the answer to the second research question. The empirical conditions of the application of technology in MSEs in rural areas are described in the categorization in Table 6 below**:**

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Table 6. Empirical conditions for the application of ICT in MSEs in rural areas

(Indonesian case)

Category	Participants	Several supporting and inhibiting factors
Have implemented online and consistent for business development using various platforms.	P12, P17, P18, P19, P20 (20,8%)	Education and training; join and be helped by the community; business location close to busy centers and universities.
Already using technology but limited to sales using simple technology (social media)	P3, P6, P9, P10, P23, P24 (25%)	Limited to social media: WhatsApp, IG, Facebook. Helped by family.
Have used technology in marketing but are not actively using technology now.	P14, P16 (8,3%)	Students have made it, but they are too lazy to run it. More profitable offline sales.
They desire to apply technology but have various limitations, so they have not implemented it.	P2, P4, P5, P13, P15, P21, P22 (29,2 %)	There are various obstacles/limitations: strategy, worker, digital skills, availability of technology, capital limitations, age and time, partnership, quality, quantity, availability of products to be sold online, and licensing issues.
Do not have the desire and do not apply technology	P1, P7, P8, P11 (15,38%)	Do not want to manage an online business. ICT is considered complicated, prioritizes interaction with customers, and feels enough without the help of technology.

Source: Study results

Participants with successful online businesses strategically implement technology in sales, product development, and customer satisfaction. Tech-savvy participants establish digital marketing departments and hire skilled workers. Conversely, family businesses prioritizing generational legacies rely on assistance for online sales, managed by designated individuals without a clear strategy. Family businesses maintain informal structures, hindered by limited staff, uncertain employment conditions, and minimal focus on digital skills. Financial constraints, particularly limited capital, impede the development of online ventures and adoption of digital technology. Participants often seek support from friends and family, feeling government aid distribution is uneven. Adapting to limitations, they utilize accessible mobile applications like WhatsApp, Facebook, Instagram, Shopee, Tokopedia, Go Food, and Grab Food. Digital payments are prevalent among online-focused participants, while Google advertising is managed by a few. Social media platforms, especially WhatsApp, Facebook, and Instagram, dominate technology usage. The village's digital infrastructure is supportive, with strong cell phone signals and widespread 4G/LTE internet (Central Bureau of Statistics, 2022).

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The number of cellular telephone towers and cellular telephone service operators in Jatinangor District is shown in Figure 2.
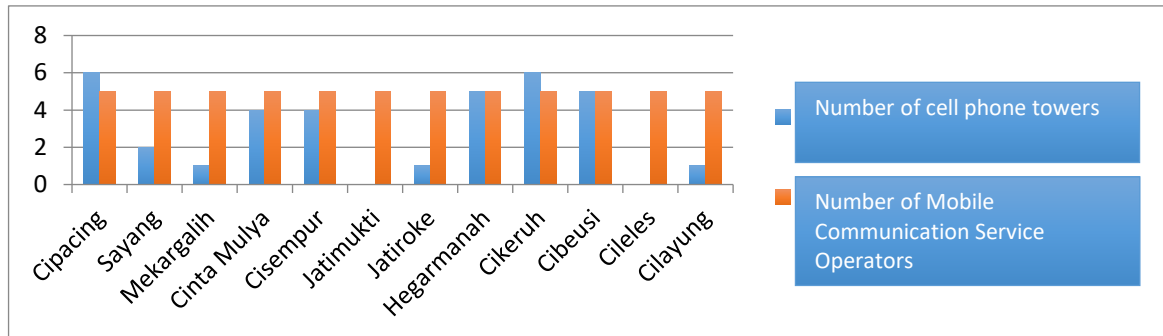
Figure 2. Number of cellular telephone towers and cellular telephone communication service operators in Jatinangor District
Source: processed from Sumedang Regency Central Bureau of Statistics, 2022

Financial constraints hinder broader technology adoption among MSEs. While successful online businesses strategically embrace technology, family businesses face challenges in organizational structure, finance, and digital skills, relying on accessible applications for adaptation. Technology is primarily used in sales and communication, with other business processes mostly done manually. Although some machinery exists in production, it is not yet digital. Products are typically local, and production depends on the number of workers and raw material availability. Owners are reluctant to add workers due to concerns about product quality. Raw materials are often sourced locally, and product packaging faces licensing obstacles.

Some participants use technology in marketing but prefer direct consumer interactions. Initially, consumers are local and familiar with the business owners. Exports are facilitated through agents. Business owners prioritize customer trust and satisfaction over digital strategies for competitive scanning. Most respect competitors and consider them partners, as they produce different local products.

Integration and real-time data exchange are lacking. Most participants have one shop, some with warehouses. Data exchange between departments and communication with suppliers and partners are conducted manually and via social media. The digital readiness of MSEs in rural Indonesia is still at the initial or basic level. According to Choirunnisa et al. (2022), they have low readiness in all dimensions (level 1). Using Blatz, Bulander, & Dietel (2018), the impact on the company and processes is minimal (level 1). For those not implementing

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technology, they are at level 0 (Outsiders) using Yezhebay et al. (2021) or level 1 (Initial) using Sándor & Gubán (2022). Participants implementing online business consistently are at level 1 (Beginner) per Yezhebay et al. (2021) or level 2 (Pathfinder) per Sándor & Gubán (2022).Various limitations affect technology adoption in MSEs in rural areas, which will be discussed in the findings and discussion section.

Discussion

Findings are obtained from comparisons with literature reviews in the form of new concepts that have not been previously discussed in the literature. From the digital readiness assessment dimension, the findings obtained in the people dimension are the adequacy of the number of workers, worker stability, and digital qualifications in worker recruitment. In the technology dimension, the findings obtained are system characteristics in the form of ease of use of technology. In the financial dimension, the findings are the ability to pay workers and manage finances for business operations. In the product dimension, the findings obtained are product quality, which can be sold online, and product stock to be sold online. There are also findings, namely the sustainability of all dimensions of the digital readiness assessment. Sustainability is needed to achieve a higher level of digital readiness or maintain the existing level. Sustainability is defined as the continuation of program activities, measurement of sustainable benefits or results, and maintenance of capacity.

We also found more findings from the factors that influence MSEs digital readiness: macro environment, perception and motivation in using technology, social capital, subjective well-being, and knowledge-based development and innovativeness. Our findings for the macro environment include socio-economic factors (which consist of education level, income level, and demographics) and climatic factors. A different aspect from Okfalisa et al. (2022) is climatic factors. The climatic factor is one of the factors that influences the availability of raw materials in production. Small farmers have fewer resources and strategies to cope with climate variability (Singh & Awais, 2019). This explains the behavior of business owners who are not yet fully online due to uncertain production and quantity of goods.

Another aspect that influences MSEs digital readiness is the perception of technology. Business owners who do not have the desire and do not apply technology think that technology is complicated and less profitable than offline. This perception makes business

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owners not motivated to use technology. This condition can be explained by the Technology Acceptance Model (TAM), that an individual's behavioral intention to use IT is determined by perceived usefulness and perceived ease of use. Positive and high perception will increase motivation (Pardede, 2020)

Other findings are social capital and subjective well-being. Social capital includes social interaction through face-to-face, friendship, family, social trust, caring and helping each other, and empowerment. Social capital from village communities also influences MSEs business processes in rural areas. Participants generally prefer to meet in person, empowering the local community, prioritizing trust and good relationships with each other, including competitors. Some even believe that if you are online, it means you have no friends. Technology is used more as a social interaction tool to communicate than to develop online businesses. In line with conditions in China, social capital in rural areas is based on face-to-face communication and interactions (Lee, Wang, Desouza, & Evans, 2021). Similar to conditions in Uganda, the highest importance of ICT use is in social interaction compared to economic opportunities, increasing income and politics (Kivunike, Ekenberg, Danielson, & Tusubira, 2011). Furthermore, this social capital can limit or create social and economic opportunities (Fitzpatrick, Baycan, & Akgüngör, 2023). Studies in China show that a lower level of education causes a greater likelihood of small business entrepreneurship. However, there is a difference between 'entrepreneurship by opportunity' and 'necessity entrepreneurs'. Where 'necessity entrepreneurs' do not create additional jobs, they only support household needs (Fitzpatrick et al., 2023).

Likewise, in the Indonesian case. Not many business owners in rural areas have higher education. Participants felt satisfied with the existing conditions, so they do not feel competitive. Without ICT, it is considered that it is important enough to be able to meet daily needs. This condition also shows that entrepreneurship in villages is trapped within the framework of needs, as stated by Fitzpatrick et al. (2023), so it can hinder development.

Other findings are knowledge-based development and innovativeness, which includes socialization towards internalization, as well as partnerships and support (such as the triple helix or quadruple helix). There are several cases of business actors who succeeded in developing online businesses because they joined groups and thus received various information and support. On the other hand, some participants had problems implementing technology, stating that they lacked information, socialization and training. These participants

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hope for assistance from the government and universities. Some business owners also receive assistance from universities and students, however the obstacle faced is the sustainability of the technology that has been built. This knowledge-based regional development can be explained by the SECI (Socialization, Externalization, Combination, and Internationalization) model that companies have become successful because of their skills and expertise in organizational knowledge creation. Internalization was considered a product or outcome of socialization (Batzke & Ernst, 2023). Socialization refers to how individuals are taught the skills, behavioral patterns, values, and motivation necessary to function competently in their culture (Raeff, 2014). Socialization has an impact on individual or group readiness and awareness (Ren & Wang, 2022).

Knowledge creation and innovation in rural areas are also created through partnerships and support from various actors, such as in the triple helix and quadruple helix interactions. The triple helix and its successors for economic development are based on the ideas of universities, the business world, and public sector organizations to encourage innovation and economic growth in remote, rural and less-favored regions. Social groups and communities often play a dominant entrepreneurial role in areas with no universities or business communities. In this case, the quadruple helix concept is very useful.

A Digital Readiness Model for Micro and Small Enterprises (MSEs) in Rural Areas

This section is the answer to the third research question. Based on the findings that have been obtained, the following Figure 3 of the digital readiness model for MSEs in rural areas:

There are nine dimensions in assessing the digital readiness of MSEs in rural areas: strategy, organization, people, technology, financial, product, business activities/process, market, and integration. The sustainability of these nine dimensions is needed to achieve a higher level of digital readiness for digital transformation. The aspects of each dimension are listed in Table 5 in the form of categories and themes obtained from coding. External factors also influence the digital readiness of MSEs in rural areas, which can be supporting or inhibiting factors. Factors that influence the digital readiness of MSEs in rural areas are the macro environment, perceptions of technology that can influence motivation to use technology, social capital and subjective well-being, where social capital is related to subjective well-being, as well as knowledge-based development and innovativeness which plays a role in forming

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perceptions, motivation, behavior, skills and innovation in rural areas. Aspects of each factor are also contained in Table 5 in the form of categories and themes obtained from coding. So that MSEs can be more digitally ready, these influencing factors must act as supporting factors.
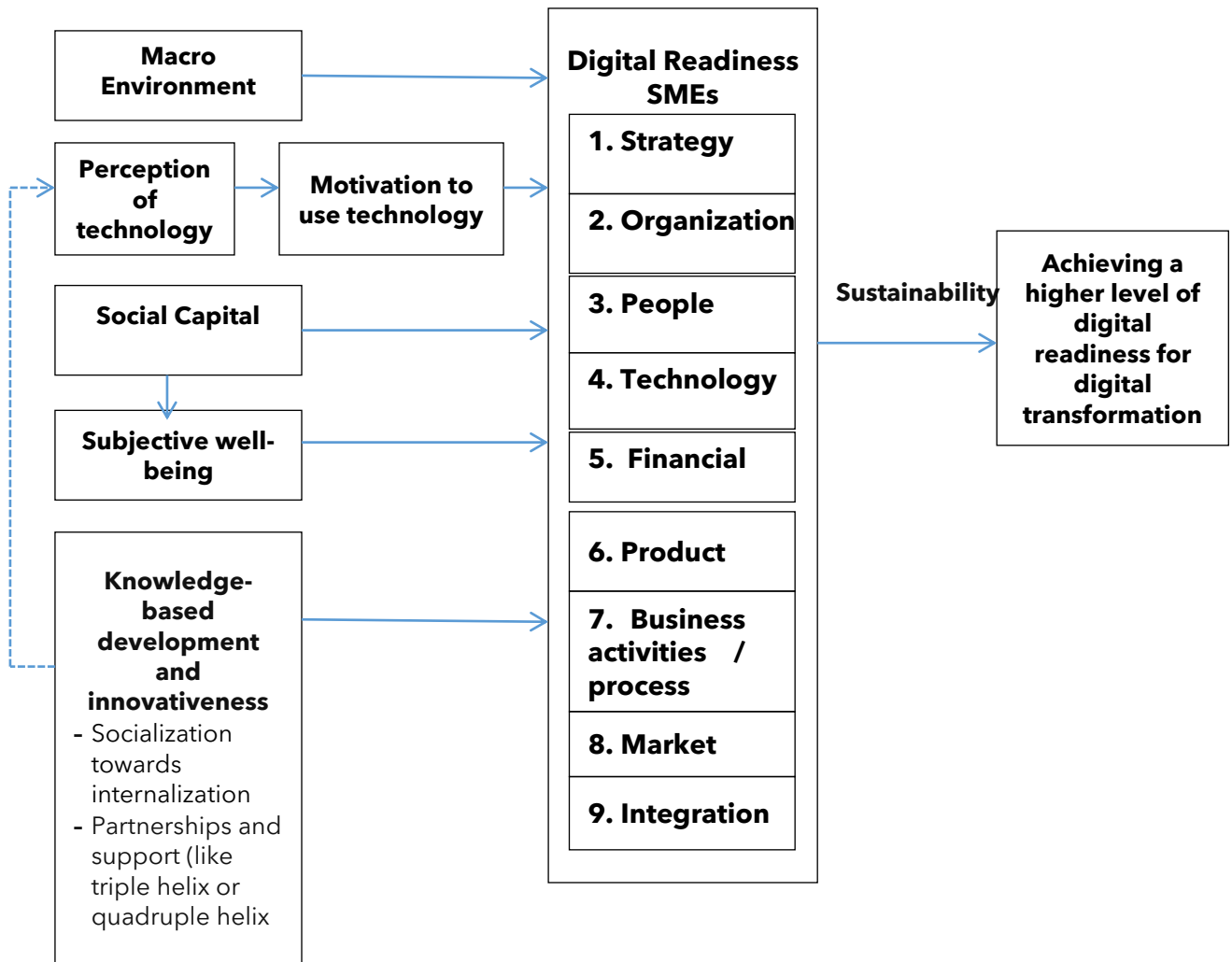
Figure 3. Digital readiness model for MSEs in rural areas

Source: Study results

CONCLUSION

Micro and small enterprises (MSEs) in rural areas often grapple with foundational challenges in digital readiness, marked by haphazard technology implementation, resistant organizational structures, limited investment in transformation, and a primary focus on digital

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technology for sales. Many business owners in this context find themselves at digital readiness level 0, denoted as "outsiders," indicating a lack of interest and non-adoption of technology. These enterprises, typically family-owned and managed, specialize in local products and face barriers like non-millennial ownership, varying education levels, and financial constraints, leading to reliance on social media for sales. While access and network infrastructure are not major issues, factors such as social capital, subjective well-being of the rural community, and a preference for direct interactions impede technology adoption for business purposes.

This study proposes a comprehensive model for assessing digital readiness, encompassing nine dimensions and highlighting five external factors influencing digital readiness for MSEs in rural areas. Practical implications emphasize collaborative efforts involving government, universities, communities, and businesses to enhance people and technology dimensions. Overcoming challenges demands sustained support, knowledge building, and innovation in rural areas to shift perceptions and motivations, along with improving digital and business skills among rural entrepreneurs. The pursuit of sustainability poses an additional challenge, requiring MSEs owners to adopt practices that promote higher digital readiness levels. The study acknowledges limitations related to uneven village distribution and suggests further research to explore villages with diverse social and economic characteristics, while also investigating technology sustainability in rural MSEs.

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