Research Article

Digital Tranformation of MSMEs and Its Implications for Economic Resilience: A Qualitative Study Using NVivo

Yohan Rayhan[1]*, Rizna Nur Rahmadhinta[2]

[1] State Intelligence College, Bogor, West Java, Indonesia, yhnryhn@gmail.com
[2] State Intelligence College, Bogor, West Java, Indonesia
* Corresponding Author: yhnryhn@gmail.com

Abstract: This study explores the role of digital transformation in strengthening the economic resilience of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia. Despite their significant contribution to employment and GDP, MSMEs face uneven progress in adopting digital technologies due to limited literacy, inadequate infrastructure, and financial constraints. Employing a qualitative design, the research draws on in-depth interviews with four key stakeholders—Kominfo, Kemenkop UKM, the UMKM Association, and an economic analyst—and analyzes the data using NVivo 12 Plus through thematic coding, matrix queries, cluster analysis, and concept mapping. The findings highlight five major themes: (1) digital capacity building through literacy, training, and mentoring; (2) infrastructure readiness and accessibility, revealing disparities between urban and rural regions; (3) ecosystem integration and market access, emphasizing collaboration with e-commerce platforms; (4) financing challenges related to capital limitations, literacy gaps, and credit access; and (5) innovation and economic impact, demonstrating productivity gains, efficiency improvements, and market expansion. Cross-case and cluster analyses reveal complementary stakeholder roles, while concept mapping shows that digital innovation emerges from the synergy of capacity, infrastructure, ecosystem, and financing. The study concludes that MSME digitalization is a multi-layered process that enhances resilience by improving adaptability, productivity, and market reach, offering strategic insights for inclusive and sustainable policy frameworks.

Keywords: Digital Transformation; Economic Resilience; MSMEs; NVivo Thematic Analysis; Qualitative Study

1. Introduction

The Covid-19 pandemic brought significant disruption to Indonesia's economy, including the Micro, Small, and Medium Enterprises (MSMEs) sector, which has long served as the backbone of national economic activity. Large-scale social restrictions, business closures, and supply chain disruptions caused substantial revenue declines across sectors such as tourism, restaurants, retail, and creative industries. International reports highlight MSMEs as the most vulnerable business group during the crisis due to limited capital, weak bargaining power, and dependency on physical operations (OECD, 2020; World Bank, 2021). Moreover, financial institutions tightened lending in response to heightened economic uncertainty, further worsening MSMEs' operational conditions. Nevertheless, some MSMEs demonstrated resilience through adaptive strategies such as shifting to digital marketing, utilizing e-commerce platforms, and diversifying products, including the production of personal protective equipment, as part of their response to rapidly changing market demands.

Indonesia has the largest number of MSMEs in Southeast Asia, with approximately 64.2 million business units recorded in 2022 (Saroyo, 2023). This scale positions MSMEs as the

dominant sector within the national economic structure. Data from the Ministry of Cooperatives and MSMEs indicates that the sector contributes 61.07% to the national Gross Domestic Product (GDP) and absorbs more than 97% of the labor force, positioning MSMEs as a key pillar of economic stability (Nasution, 2023). In addition to their contribution to GDP, MSMEs account for around 60% of domestic investment, although their share of non-oil and gas exports remains relatively small at around 15% due to various structural limitations. As part of the national economic recovery program, the Ministry of Finance allocated Rp70.1 trillion in industrial support and Rp150 trillion for MSME assistance (Nugroho, 2020). These data underscore the sector's role not only as a driver of economic activity but also as a critical instrument in reducing unemployment following the pandemic using digital technologies and integration with e-commerce platforms.

The acceleration of digitalization in the post-pandemic period has become a key factor in supporting the recovery and strengthening of MSMEs in Indonesia. The integration of technology into business operations serves not only as a marketing channel but also to improve operational efficiency, expand market access, and enhance competitiveness amid shifting consumer behavior. E-commerce adoption has proven effective in enabling MSMEs to market products at lower costs, speed up distribution processes, and expand their reach beyond traditional methods (Kala'lembang, 2020). Furthermore, digital marketing allows MSMEs to engage new consumer segments through social media, creative content, and digital-based interactions. Studies have shown that the use of digital marketing positively affects MSME sales performance, customer acquisition, and market expansion (Aditya & Rusdianto, 2023; Sasongko et al., 2020; Syukri & Sunrawali, 2022). However, the success of digital transformation depends heavily on human capital capacity. MSME actors require knowledge of digital technology, content management, and data-driven marketing strategies to adapt effectively within the digital business ecosystem. (Laksono, 2022) emphasizes that digital capability is an essential prerequisite for improving business performance within a digital ecosystem and enabling MSMEs to utilize technology optimally. Conversely, low digital literacy and lack of technological skills remain major barriers for many MSMEs, necessitating systematic support through training, mentoring, and collaboration among enterprises, government agencies, and digital platforms.

Despite the opportunities created by digital transformation, MSMEs still face several structural challenges that may hinder the effectiveness of digital adoption. Persistent issues include disparities in digital infrastructure between urban and rural areas, limited digital literacy, and restricted access to financing, barriers that are consistently identified in national and international reports (OECD, 2021; UNCTAD, 2023). These challenges are compounded by limited innovation capacity among MSMEs and continued reliance on traditional economic sectors that are less adaptive to technological change (Guo et al., 2023). If not addressed, such limitations may widen the digital divide and weaken the contribution of MSMEs to national economic performance. Given these conditions, this study aims to better understand how digital transformation shapes the capacity of MSMEs to remain resilient in a rapidly changing economic environment. Specifically, the research seeks to answer two main questions: (1) How do key stakeholders perceive the opportunities and challenges of MSME digitalization in Indonesia? (2) How does digital transformation contribute to strengthening MSME resilience as part of broader national economic stability?

2. Literature Review
Digital Transformation Theory

Digital transformation refers to the integration of information and communication technologies into the operational, managerial, and strategic dimensions of an organization. Digital transformation encompasses the adoption of digital tools such as e-commerce

platforms, social media, electronic payment systems, and business management applications to enhance efficiency, expand market reach, and stimulate innovation (Bharadwaj et al., 2013). This process is not merely about adopting new technologies; rather, it involves a broader shift in business paradigms that requires improved digital capabilities, technological literacy, and adjustments in marketing and production strategies.

The relevance of digital transformation for MSMEs increased significantly in the post–Covid-19 period, as business owners were compelled to adapt to shifts in consumer behavior and limitations on physical interactions. Digital literacy has therefore become a critical factor enabling MSMEs to fully leverage technological tools. (Laksono, 2022) highlights that the quality of human resources and the ability to adapt to digital environments determine the success of MSMEs in entering the digital business ecosystem. Furthermore, multiple studies indicate that digital technologies can improve productivity, operational efficiency, and market access for MSMEs when supported by adequate training and mentoring (OECD, 2021; UNCTAD, 2023).

Economic Resilienc

Economic resilience refers to the ability of an economy to absorb, withstand, and recover from systemic or external shocks. In a comprehensive study conducted by (Briguglio, 2022), economic resilience is defined as the intrinsic capacity of a country or region to recover from adverse impacts of crises, while simultaneously adjusting its economic structures to maintain optimal performance. Their research emphasizes that prudent macroeconomic policies, market flexibility, and effective governance are the core pillars that shape economic resilience. Economies with high resilience tend to experience lower growth volatility and demonstrate faster recovery following major disruptions.

A more evolutionary perspective is presented by (Simmie & Martin, 2010), who conceptualize economic resilience as a dynamic process rather than merely the ability to return to a previous state ("bounce back"). In this view, resilience includes the capacity for continuous adaptation and transformation of economic structures in response to technological, market, and institutional changes. Innovation, entrepreneurship, and economic diversification emerge as critical factors for building long-term resilience, particularly in regions heavily dependent on a limited number of economic sectors.

(Putritamara et al., 2023) finds that economic resilience in the ASEAN region is influenced by regional integration, the quality of human capital, and the level of digital technology adoption. The study further demonstrates that nations with inclusive economic policies, enhanced digital capabilities, and sustained investment in structural transformation tend to have stronger resilience against external shocks, including global economic crises and pandemics. Thus, the concept of economic resilience cannot be separated from digital adaptation and innovation, especially for the MSME sector, which forms the foundation of national economic stability.

MSMEs

The definition of Micro, Small, and Medium Enterprises (MSMEs) in Indonesia is based on Law No. 20 of 2008 concerning Micro, Small, and Medium Enterprises. The law stipulates that MSMEs are productive economic activities owned by individuals or business entities, classified according to net asset value and annual sales turnover. Micro enterprises possess assets of up to Rp50 million and annual turnover up to Rp300 million; small enterprises have assets above Rp50 million up to Rp500 million with annual turnover between Rp300 million and Rp2.5 billion; while medium enterprises possess assets ranging from Rp500 million to Rp10 billion with annual turnover between Rp2.5 billion and Rp50 billion (Undang-Undang (UU) Nomor 20 Tahun 2008 Tentang Usaha Mikro, Kecil, Dan Menengah, 2008). In addition

to asset and turnover criteria, Statistics Indonesia (BPS) classifies MSMEs by workforce size: micro enterprises (≤4 workers), small enterprises (5–19 workers), and medium enterprises (20–99 workers).

MSMEs play a strategic role in Indonesia's national economy due to their substantial contributions to employment, basic goods production, and economic distribution. During the Covid-19 pandemic, MSMEs acted as a primary buffer sector that absorbed workers affected by layoffs and maintained local economic activity (Nugraha, 2024). Data further indicate that the number of MSMEs increased significantly, reaching more than 65.5 million units between 2015 and 2019, although formal data collection remains a challenge as many enterprises have yet to be officially registered (Anastasya, 2023).

The government has launched various initiatives to support MSME transformation, including the Online Single Submission (OSS) licensing platform and technology adoption training programs. Studies report that 83.8% of MSME actors have begun using digital technologies to support operational, marketing, and distribution activities. Nevertheless, MSME digitalization is still considered suboptimal. Although many MSMEs participate in e-commerce platforms, a large proportion operate primarily as resellers, while approximately 90% of the products sold are imported goods. This indicates that the contribution of MSMEs to Indonesia's digital economy does not yet reflect their true potential. More comprehensive strategies are therefore required to ensure that digitalization genuinely strengthens national economic resilience (Nugraha, 2024).

3. Materials and Method
Materials

This study employs two types of data: primary and secondary data. Primary data were collected through semi-structured interviews with four key informants selected for their relevance and expertise in MSME digitalization issues, namely representatives from the Ministry of Communication and Informatics (Kominfo), the Ministry of Cooperatives and MSMEs, the UMKM Association, and an economic analyst. All interviews were recorded with the informants' consent, transcribed verbatim, and subsequently imported into NVivo 12 Plus, which served as the main analytical tool. Secondary data were obtained from official government documents, international reports, regulatory frameworks, scholarly publications, and literature related to MSME digital transformation and economic resilience. Both types of data were used complementarily to strengthen thematic analysis and enhance the validity of the study's findings.

Methods

This study employs a descriptive qualitative method using a thematic analysis approach, which enables the identification of meaning patterns and conceptual relationships within interview data. Thematic analysis was selected due to its flexibility and suitability for exploring multi-stakeholder perspectives on MSME digitalization (Braun & Clarke, 2006). The analytical process followed six core stages: data familiarization, open coding, axial coding, theme development, thematic relation analysis, and interpretation of findings.

All interview transcripts were analyzed using NVivo 12 Plus, which facilitated systematic data organization and analytical visualization. The process began with data familiarization through repeated, comprehensive readings of the transcripts. This was followed by open coding, wherein meaningful units of text were manually coded to maintain interpretive accuracy. In the axial coding phase, similar codes were grouped into subthemes. These subthemes were subsequently consolidated into five major themes that reflect the structural components of the MSME digitalization ecosystem. Advanced analysis was conducted using NVivo features such as Matrix Coding Query to compare perspectives across informants,

Cluster Analysis to examine similarity patterns, and Concept Mapping to visualize inter-theme relationships.

The final stage involved interpretation, in which strategic insights were drawn from thematic patterns and linked to the broader framework of national economic resilience. This multi-step approach provides a transparent and replicable analytical structure, thereby enhancing the credibility and trustworthiness of the study's findings (Nowell et al., 2017).

Proposed Workflow

The flow diagram in Figure 1 illustrates the NVivo-based thematic analysis workflow employed in this study.

Data Input

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Data Preparation

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Open Coding

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Axial Coding

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Theme Development

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Query Analysis
(Matrix, Cluster, Concept Map)

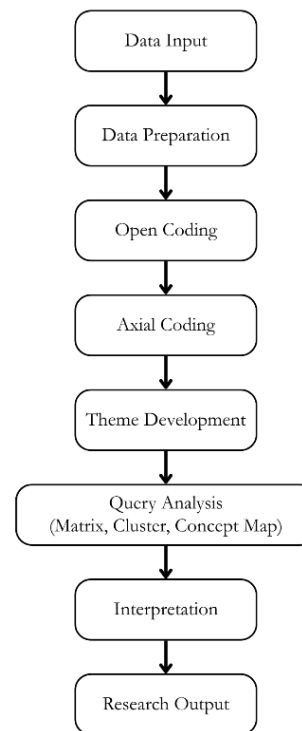↓

Interpretation

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Research Output

Figure 1. NVivo-Based Thematic Analysis Workflow.

The process begins with the data input stage, which involves collecting and transcribing interview data from the four key informants. All transcripts then undergo data preparation, including importing the files into NVivo 12 Plus and conducting an initial review to ensure the data are ready for analysis. The next stage is open coding, where meaningful units of text are manually coded to identify ideas or issues expressed by the participants. Codes with similar characteristics are grouped during theme development, resulting in broader thematic structures; in this study, this process produced five major themes related to MSME digitalization. After the themes are established, query analysis is conducted using NVivo's analytical features, including Matrix Coding Query, Cluster Analysis, and Concept Mapping. These tools enable the examination of inter-theme relationships, comparison of perspectives across informants, and visualization of thematic patterns in a comprehensive manner. The final stage, research output, integrates all analytical results into coherent findings, encompassing thematic mapping, conceptual linkages, and strategic recommendations for strengthening national economic resilience through MSME digitalization.

4. Results and Discussion
Dataset Overview & Coding Summary

This study analyzes four semi-structured interview transcripts obtained from key stakeholders directly involved in the digitalization ecosystem of MSMEs in Indonesia, namely: (1) the Ministry of Communication and Informatics (Kominfo), (2) the Ministry of Cooperatives and MSMEs, (3) the UMKM Association, and (4) an independent economic analyst. All interviews were transcribed verbatim, resulting in a corpus of approximately ±13,000 words, with each transcript representing a distinct institutional perspective on the MSME digital transformation process.

The analysis was conducted using NVivo 12 Plus, which served as the primary software for organizing data, performing coding, grouping subthemes, and generating analytical visualizations. The initial stage involved familiarization through repeated readings of all transcripts, followed by open coding to identify meaningful units of text from each informant's narrative. The initial codes generated from this process were subsequently grouped through axial coding into subthemes based on conceptual similarity.

In total, 37 subthemes emerged from the coding process. These subthemes were then consolidated into five overarching themes (Theme 1–Theme 5) representing the core structure of MSME digitalization: (1) Digital Capacity Building, (2) Digital Infrastructure and Accessibility, (3) Digital Ecosystem and Market Access, (4) Financing and MSME Challenges, and (5) Innovation and Digitalization Impact. These thematic structures were developed inductively based on cross-interview narrative consistency. Table 1 presents the resulting coding tree, illustrating the hierarchical relationships among initial codes, subthemes, and the five major themes that form the analytical foundation for the subsequent sections.

Table 1. NVivo Coding Structure (Themes & Subthemes).

Theme 1 – Digital Capacity Building for MSMEs	
Government–Private Sector Training Partnerships	Mentoring Programs
Community-Based Training	MSME Assistance and Guidance
Collaborative MSME Communities	MSME Digital Literacy
Continuous Digital Training	Digital Skill Development Programs

Theme 2 – Digital Infrastructure and Access Equity	
Remote Area Prioritization	Acceleration of Digital Infrastructure
Region-Based Digital Training	Equitable Internet Access
MSME Utilization of Digital Infrastructure	Digital Infrastructure Expansion

Theme 3- Digital Ecosystem and Market Access	
Mentoring and Advisory Support	MSME–International Market Linkages
Collaboration with the Private Sector	Gernas BBI (Proudly Made in Indonesia) Program
Collaboration with Chamber of Commerce	Collaboration with Multi-Stakeholder Partners
Attracting Investors through Strategic Policy Measures	Integrated Digital Ecosystem

Theme 4 – MSME Financing and Challenges	
Limited Internet Access	Financing with Low-Interest Schemes
Dependence on Conventional Methods	Collaboration with Financial Institutions
Low Digital Literacy	Capital Constraints

Theme 5 – Innovation & the Impact of Digitalization	
Technology-Based Operational Efficiency	Market Access Expansion
Digital-Driven Product Innovation	Media-Based Public Education
Competitive Business Models	Case-Based Learning Approaches
MSME Contribution to GDP	Efforts to Increase Digital Awareness
Productivity Improvement	

Thematic Findings

Theme 1 – Digital Capacity Building for MSMEs

Theme 1 demonstrates that strengthening digital capacity is the primary foundation for accelerating the digital transformation of MSMEs in Indonesia. The NVivo analysis shows that all key informants emphasized the importance of basic digital competencies, ranging from digital literacy to the effective use of online platforms, as prerequisites for MSMEs to adapt to post-pandemic market shifts. This is reflected in the frequent appearance of codes related to *digital literacy*, *training*, *mentorship*, *community collaboration*, and *skill development* within the coding structure.

The informant from the Ministry of Communication and Information (Kominfo) highlighted that digital literacy is the essential starting point for enabling MSMEs to participate in the digital ecosystem. Programs such as the *Digital Talent Scholarship (DTS)* and *Digital Leadership Academy (DLA)* were mentioned as key instruments for capacity building:

"Kominfo plays an important role in providing digital literacy to the public, including MSME actors. DTS and DLA are designed to enhance their digital skills."

Within the NVivo results, the subthemes of *digital literacy*, *digital training*, and *skill development* appeared across three out of four informants, indicating strong cross-institutional agreement on their importance. The informant from the Ministry of Cooperatives and MSMEs stressed that capacity building cannot rely solely on short-term workshops. Instead, sustainable digital education, continued mentoring, and community-based learning models are seen as more effective in enhancing adaptive capabilities:

"We focus on developing digital literacy through continuous training and building collaborative communities among MSMEs so they can learn from one another."

NVivo analysis shows that *mentorship*, *continuous digital training*, and *ongoing support* were the most frequently coded subthemes within Theme 1, signaling the urgent need for long-term and structured digital capacity development. Meanwhile, the MSME Association emphasized the importance of multi-stakeholder collaboration, particularly with private sector actors, KA-DIN, and international trade associations. Such collaborations not only expand training opportunities but also expose MSMEs to digital competence standards relevant for global markets:

"We coordinate with KADIN to expand the market reach of MSMEs, and this collaboration also opens access to training and mentoring from private-sector partners."

The NVivo coding further shows consistent emergence of subthemes such as *collaborative communities* and *public–private training partnerships*, underscoring the role of collective learning and ecosystem-wide support—especially for early-stage MSMEs that rely heavily on best practices shared through communities.

Theme 2 – Digital Infrastructure and Access Equity

Theme 2 highlights the fundamental role of digital infrastructure in ensuring equitable digital transformation for MSMEs across Indonesia. Based on the NVivo coding results, this theme comprises five major subthemes: *digital infrastructure development*, *internet access equity*, *remote-area prioritization*, *region-based digital training*, and *MSME utilization of digital infrastructure*. Overall, the theme reinforces that digitalization cannot succeed without robust and evenly distributed infrastructure.

All informants agreed that the digital divide between urban and rural areas remains one of the most significant barriers to MSME digitalization. The informant from Kominfo emphasized the government's commitment to expanding connectivity, especially in underserved areas:

"The government is currently developing digital infrastructure in more than 12,000 villages without internet access. The goal is to ensure equitable connectivity across all regions."

This aligns with the NVivo coding pattern, which shows a high density of references related to internet access equality and infrastructure expansion. The informant from the Ministry of Cooperatives and MSMEs added that limited internet access not only hinders digital adoption but also exacerbates regional economic disparities:

"We prioritize infrastructure development in remote regions so that MSMEs there can access the same digital training and technology available in urban areas."

The emergence of subthemes such as *remote-area prioritization* and *region-based digital training* indicates that geographical challenges extend beyond connectivity issues to include unequal distribution of training services and access to digital platforms. Furthermore, the MSME Association and the economic analyst highlighted that even when infrastructure is available, many MSMEs have yet to utilize it effectively. NVivo coding supports this, showing the subtheme *utilization of digital infrastructure by MSMEs* primarily appearing in interviews with these two informants:

"The infrastructure is available, but many MSMEs still do not utilize it due to limited digital skills and insufficient support."

This suggests that infrastructure alone is insufficient; it must be supported by education, enabling regulations, and operational incentives to generate meaningful impact.

Theme 3 – Digital Ecosystem and Market Access

Theme 3 focuses on how the digital ecosystem is built through multi-stakeholder collaboration, expanded market access via digital platforms, and the interaction between MSMEs and other economic actors. NVivo coding shows that this theme includes several subthemes: *government–private sector collaboration*, *the role of KADIN*, *integration with the e-commerce ecosystem*, *international trade associations*, *export market strengthening*, and national initiatives such as *Gernas BBI*. This theme underscores that digitalization is not solely about skills or technology, but also about integrating MSMEs into modern market networks.

Multi-stakeholder collaboration emerges as the central component of this theme. Informants from Kominfo, the Ministry of Cooperatives and MSMEs, and the MSME Association emphasized that cross-institutional collaboration is key to accelerating MSME integration into the digital ecosystem. The MSME Association stressed that partnerships with KADIN and international trade bodies are essential for expanding market networks and attracting investors:

"We coordinate with KADIN to expand MSME market access. Additionally, we partner with international trade associations to strengthen global market opportunities."

Such collaboration not only facilitates access expansion but also provides credibility for MSMEs entering more competitive markets. Informants from Kominfo and the Ministry of Cooperatives and MSMEs repeatedly highlighted the role of e-commerce platforms as the most accessible channel for expanding MSME market reach. Integration into digital marketplaces is seen to enhance product visibility, broaden market penetration, and reduce

distribution costs. However, these benefits can only be realized when MSMEs possess adequate digital readiness:

"We collaborate with e-commerce platforms to help MSMEs connect with broader markets, both domestically and internationally."

NVivo results show that the subthemes *integrated digital ecosystem* and *collaboration with the private sector* dominate TM3, indicating that digital platforms play a strategic role in MSME growth. Beyond domestic markets, several informants highlighted the importance of international market access. The MSME Association pointed to their involvement in initiatives such as the National Movement for Proudly Made in Indonesia (Gernas BBI) as a systematic effort to strengthen the competitiveness of local products in global markets:

"Gernas BBI opens opportunities for MSMEs to expand their market reach and strengthen the position of local products internationally."

The emergence of subthemes such as *international trade*, *investor engagement*, and *global market access* illustrates the growing opportunities available to MSMEs that can effectively leverage digital platforms.

Theme 4 – MSME Financing and Challenges

Theme 4 highlights the structural barriers faced by MSMEs in the digitalization process, particularly limited capital, constrained access to financing, and low digital literacy among a significant portion of business actors. NVivo analysis shows that TM4 consists of the following subthemes: *limited capital, low-interest financing schemes, cooperation with financial institutions, low digital literacy, dependence on conventional methods,* and *operational constraints faced by MSMEs.* This theme illustrates that digital transformation requires not only digital readiness, but also adequate financial support and capacity building.

Limited capital emerges as the most prominent barrier encountered by MSMEs in the digitalization journey. The Ministry of Cooperatives and MSMEs emphasized that this challenge becomes more complex due to restricted access to financing and the high cost of adopting new technologies:

"Limited capital and low digital literacy are the biggest challenges. Therefore, we collaborate with financial institutions to provide low-interest financing access."

The strong presence of subthemes such as *low-interest financing* and *collaboration with financial institutions* in the coding results reflects the need for more assertive policy interventions. Although government financing schemes exist, informants from the MSME Association and economic observers highlighted that access to financing remains uneven—particularly for MSMEs that lack formal financial records or adequate collateral:

"Many MSMEs find it difficult to access financing because they do not have organized financial records or sufficient collateral.

This indicates that digitalization demands not only digital capabilities, but also financial literacy and more adaptive support mechanisms from financial institutions. Beyond financing constraints, low digital literacy also serves as a major limiting factor. The economic observer provided insight into how many MSMEs continue to rely on traditional operational methods that are less efficient:

"Low digital literacy and limited internet access cause many MSMEs to remain dependent on conventional methods in managing their businesses."

The subthemes *dependence on conventional methods* and *low digital literacy* demonstrate that digitalization will remain uneven if not accompanied by education and sustained mentoring.

Theme 5 – Innovation and the Impact of Digitalization

Theme 5 illustrates how digitalization drives innovation among MSMEs and generates tangible impacts on efficiency, productivity, and national economic contribution. NVivo results indicate that TM5 consists of the following subthemes: *product innovation through digital technologies, operational efficiency, productivity improvement, contribution to GDP, expansion of domestic and*

international market access, and *emergence of new technology-driven business models.* This theme reflects the ultimate outcomes of a digital transformation process supported by digital capacity (TM1), infrastructure (TM2), market ecosystem integration (TM3), and financial readiness (TM4). The economic observer emphasized that digitalization enables MSMEs to develop new products, improve service quality, and create innovative business models that were previously inaccessible to small enterprises:

"Digital technology offers vast opportunities for developing new products, enhancing efficiency, and creating more competitive business models."

The subthemes *product innovation, competitive business models,* and *operational efficiency* consistently appeared across coding results, indicating that digitalization functions not merely as a marketing tool, but as an engine of innovation. Digital transformation also enhances operational efficiency among MSMEs. The use of digital applications for financial recording, inventory management, customer service, and marketing enables small businesses to operate more quickly, cost-effectively, and responsively to market demand:

"Digitalization improves operational efficiency because MSMEs can save time and costs by leveraging digital applications."

NVivo analysis shows that *operational efficiency* and *productivity improvement* had the highest coding density within TM5, suggesting that these impacts are the most frequently experienced by MSMEs undergoing digital transformation. Digitalization further expands MSME market reach, not only at the local level but also nationally and globally. The ability to promote products through digital platforms enhances competitiveness and strengthens MSMEs' contribution to the national economy:

"Digitalization allows MSMEs to access broader markets, both national and international, which directly contributes to the country's GDP."

Subthemes such as *market expansion, GDP contribution,* and *productivity gains* reinforce this claim. In the context of national economic resilience, expanded market reach and increased GDP contribution represent strategic impacts of digitalization. Digitalization also encourages the emergence of new, more adaptive business models. The use of social media, online stores, digital payments, and operational automation has created more modern and scalable business patterns. These models offer flexibility and open opportunities for revenue diversification among MSMEs.

NVivo Cross-Case Analysis
Matrix Coding Query

The matrix coding query analysis was used to compare the occurrence of subthemes across the four key informants. Although the coding process generated 37 subthemes, this article reports only the 15 most representative subthemes, those that appeared most frequently and were most relevant to the research questions. This selective reporting approach follows established qualitative research practices, which recommend presenting only the major thematic categories to maintain analytical clarity and focus (Braun & Clarke, 2006; Nowell et al., 2017). Table 1 presents the results of the matrix coding query for the 15 primary subthemes, based on inputs from the Ministry of Communication and Informatics (Kominfo), the Ministry of Cooperatives and MSMEs (Kemenkop UKM), the MSME Association, and the Economic Observer.

Table 2. Matrix Coding Query of 15 Representative Subthemes Across Four Informants.

Representative Subthemes	KOMINFO	KEMENKOPUKM	MSME Assoc.	Economic Obs.
Digital literacy for MSMEs	1	0	0	0
Continuous training & mentoring	0	1	1	1
Collaborative MSME communities	0	1	0	0
DTS/DLA digital capacity programs	1	0	0	0
Government–private sector training partnerships	0	0	1	1
Digital infrastructure	1	0	0	0
Internet access & remote village connectivity	1	1	0	0
Utilization of digital infrastructure by MSMEs	0	0	1	0
E-commerce ecosystem integration	0	1	1	0
Collaboration with KADIN	0	0	1	0
Expansion of international market access	0	0	1	1
MSME financing & low-interest credit	0	1	0	0
Capital constraints & low digital literacy	0	1	0	1
Technology-driven operational efficiency	0	0	0	1
Innovation & productivity improvement	0	0	0	1

The results of the matrix coding query reveal clear differentiation in the focus areas and perspectives of the four informants regarding MSME digitalization. Kominfo appears dominant in subthemes related to digital capacity building and structural aspects, such as digital literacy, skill development through DTS/DLA programs, digital infrastructure expansion, and equitable internet access. This pattern reflects Kominfo's institutional mandate to develop the country's national digital foundation. Meanwhile, the Ministry of Cooperatives and MSMEs places greater emphasis on operational issues more closely aligned with MSME needs, including continuous training, hands-on mentoring, low-interest financing schemes, as well as challenges related to limited capital and low digital literacy. This focus aligns with the Ministry's role as the primary institution responsible for strengthening MSME business capabilities.

On the other hand, the MSME Association highlights ecosystem-related issues and market access, particularly collaboration with KADIN, support for MSME actors, utilization of digital infrastructure, and efforts to expand access to international markets. This reflects the association's function as a connector between MSMEs and broader national and global business networks. Meanwhile, the economic observer provides a macro-level perspective on the impacts of digitalization, contributing subthemes related to innovation, productivity enhancement, technology-driven operational efficiency, and the contribution of digitalization to national economic performance.

Cluster Analysis

Cluster analysis was used to identify similarities in the pattern of perspectives across informants based on the distribution of coded subthemes. NVivo groups sources by measuring their degree of coding similarity, meaning that informants who exhibit similar thematic patterns are placed in closer clusters. Figure 2 presents the cluster analysis results for the four main informants: Kominfo, the Ministry of Cooperatives and MSMEs (Kemenkopukm), the MSME Association, and the Economic Observer.
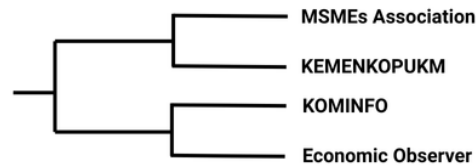
Figure 2. Items clustered by coding similarity.

The dendrogram shows that the MSME Association and the Ministry of Cooperatives & MSMEs form the closest pair in terms of thematic similarity. Both informants consistently highlight issues such as continuous training, field mentoring, MSME capacity building, and market expansion through cross-institutional collaboration. This proximity reflects their shared role in addressing the operational needs and development priorities of MSME actors.

Kominfo occupies a middle cluster position, neither very close nor very distant from these two actors. This indicates that Kominfo shares some thematic similarities, such as strengthening digital literacy and providing basic digital training, but differs significantly due to its primary emphasis on structural aspects, including digital infrastructure development and equitable internet access. This pattern reinforces Kominfo's technocratic role as the provider of the national digital foundation.

Meanwhile, the Economic Observer appears in the most distant cluster relative to the other informants. This distance emerges because the observer focuses on macro-level concerns such as productivity improvement, operational efficiency, technology-driven innovation, and the contribution of digitalization to national GDP. These perspectives differ substantially from the more programmatic and operationally oriented views of institutional informants.

Concept Map Analysis

The concept map illustrates the structural relationships among the five major themes (TM1–TM5) generated through the NVivo-based thematic analysis. This visualization helps explain that MSME digitalization is not a stand-alone process, but rather a sequence of interrelated factors that operate in a systematic manner. Each arrow in the diagram represents a direction of conceptual dependency, indicating how one theme influences or enables the development of another. Figure 3 Concept map illustrating the inter-theme relationships.
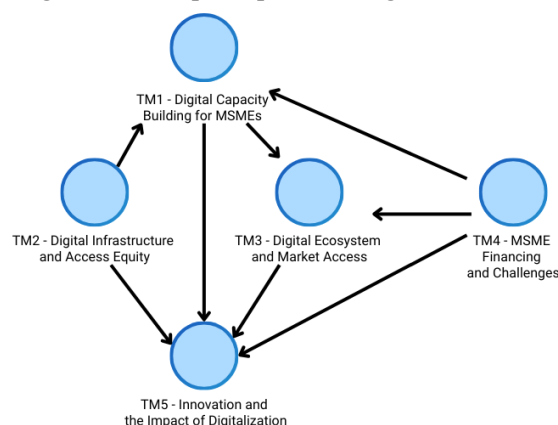

Figure 3. Concept map illustrating the inter-theme relationships derived from NVivo analysis.

First, TM1 – Strengthening MSME Digital Capacity is positioned at the top of the map as the foundational element. This theme includes digital literacy, continuous training, mentoring, and the strengthening of MSME communities. The arrows extending from TM1 toward TM2, TM3, and TM5 indicate that digital capacity serves as a prerequisite for leveraging

digital infrastructure, integrating into digital ecosystems, and generating innovation. In other words, without enhanced digital knowledge and skills, MSMEs are unlikely to fully absorb the benefits of digital transformation.

Second, TM2 – Digital Infrastructure & Access Equity is located on the left-middle section of the map. The directional arrow from TM2 toward TM5 demonstrates that the availability of digital infrastructure, such as internet access, network distribution, and supporting digital facilities, acts as an enabler for improving operational efficiency, expanding market reach, and fostering product and service innovation.

Third, TM3 – Digital Ecosystem & Market Access is placed at the center of the concept map, functioning as a key connector between MSME digital capacity and market expansion. The arrow leading from TM3 to TM5 indicates that MSME integration into digital marketplaces, cross-sector collaborations, and linkages with international trade directly contribute to increased productivity and innovation outcomes.

Fourth, TM4 – MSME Financing & Structural Challenges is shown on the right side of the map. This theme maintains bidirectional relationships with both TM1 and TM5. The arrow from TM4 to TM1 reflects the role of financial support in strengthening training programs and capacity-building initiatives. Meanwhile, the arrow from TM4 to TM5 indicates that capital and financing facilities are critical for implementing innovation strategies and adopting digital technologies.

Finally, TM5 – Innovation & Impacts of Digitalization is positioned at the bottom as the ultimate outcome of the overall process. All arrows converge toward TM5, emphasizing that innovation is the cumulative result of interactions among actor capacities, infrastructure readiness, market ecosystem dynamics, and financial accessibility. TM5 encapsulates the final impacts of digital transformation, including enhanced productivity, increased contribution to GDP, improved operational efficiency, and broader market reach for MSMEs.

Discussion of Key Findings

This section discusses the key findings by integrating the results of the thematic analysis (TM1–TM5), matrix coding queries, cluster analysis, and the NVivo concept map. Collectively, these analytical outputs show that MSME digitalization operates as a multi-dimensional process in which human capacity, digital infrastructure, ecosystem integration, financing access, and innovation outcomes reinforce one another. The discussion also aligns these findings with the literature on digital transformation, MSME development, and economic strengthening.

The NVivo results reveal that the five major themes (TM1–TM5) interact to form a holistic structure of MSME digitalization. TM1 – Strengthening MSME Digital Capacity serves as the foundational layer that enables MSMEs to enter the digitalization process. This aligns with (Simmie & Martin, 2010) argument that human capacity and adaptive abilities lie at the core of economic resilience amid structural change.

Meanwhile, TM2 – Digital Infrastructure & Access Equity emerges as a critical technical prerequisite. The digital access disparities highlighted by the Ministry of Communication and Informatics and the Ministry of Cooperatives and MSMEs reinforce the structural gaps identified by (Briguglio, 2022), who argued that unequal infrastructure weakens a nation's economic resilience. This suggests that without equitable digital infrastructure, the digital divide will continue to widen the gap between urban and rural MSMEs.

TM3 – Digital Ecosystem & Market Access demonstrates that e-commerce platforms, cross-stakeholder collaboration, and strategic partnerships are key factors accelerating MSME penetration into digital markets. These findings support the broader digital transformation literature, which emphasizes the importance of integrating technology, business collaboration, and distribution networks to enhance MSME competitiveness.

In contrast, TM4 – MSME Financing & Structural Challenges highlights financing as a major barrier. Limited financial literacy and the reliance on conventional operational methods significantly hinder MSMEs from investing in digital tools and technology. This echoes (Putritamara et al., 2023) findings that access to financing and adaptive capacity are the two most critical determinants of economic resilience among MSMEs in developing countries.

Finally, TM5 – Innovation & Impacts of Digitalization confirms that digitalization has a direct impact on productivity improvements, market expansion, operational efficiency, and MSME contributions to GDP. These findings are consistent with (Fatihah et al., 2024), who argued that digital marketing enhances market reach and increases MSME income through wider customer engagement.

5. Conclusion

This study aimed to examine how digitalization strengthens national economic resilience by enhancing the capacity and performance of the Micro, Small, and Medium Enterprise (MSME) sector. Through NVivo-based thematic analysis of interviews with four key stakeholders, the Ministry of Communication and Informatics, the Ministry of Cooperatives and MSMEs, MSME Associations, and an economic analyst, five interrelated themes were identified: (TM1) Strengthening MSME digital capacity, (TM2) Digital infrastructure and access equity, (TM3) Digital ecosystem and market access, (TM4) MSME financing and structural challenges, and (TM5) Innovation and the impacts of digitalization.

Overall, the findings demonstrate that MSME digitalization is a multilayered process that begins with capacity building, followed by equitable digital infrastructure, integration into the digital ecosystem, and adequate financial support, all of which collectively foster innovation and productivity gains. This synthesis reinforces the central argument that digital transformation not only enhances MSME operational efficiency but also contributes directly to national economic stability and resilience. The results support the proposition that digitalization can serve as a strategic national instrument for mitigating structural vulnerabilities and external shocks.

The implications of this study contribute strategically to policymakers and stakeholders. First, continuous digital literacy programs and long-term training initiatives are essential as foundational components. Second, accelerating digital infrastructure development in underserved regions must be prioritized to ensure equitable benefits from digitalization. Third, strengthening collaborative ecosystems among government, private sector, and MSME associations can expand opportunities for global market penetration. Fourth, inclusive and adaptive financing policies are necessary to enable MSMEs to innovate and adopt digital technologies. Collectively, these findings enrich the literature on MSME digitalization and offer practical and empirical insights relevant to the broader discourse on economic resilience.

This study has several limitations, including a relatively small number of informants and reliance solely on qualitative interview data without integration of macro-level quantitative datasets. In addition, the thematic nature of NVivo analysis does not capture the temporal dynamics of MSME digital transformation. Future research should employ mixed-methods approaches, expand informant coverage to include MSME practitioners directly, and incorporate digital network analysis or big-data-based market analytics to produce a more comprehensive understanding of MSME behavior in the digital economy.

Data Availability Statement: The data utilized in this study are not publicly available due to privacy and confidentiality considerations. Interview transcripts and NVivo project

files may be made available upon reasonable request to the author and are subject to ethical clearance.

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