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The Role of Technology Management in Enhancing Competitive Advantage among MSMEs

Venson B. Sarita

Davao Oriental State University, City of Mati, Davao Oriental, Philippines

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ABSTRACT

Technology management plays a crucial role in enhancing the competitive advantage of Micro, Small, and Medium Enterprises (MSMEs), particularly in the evolving digital economy. In Davao Oriental, where MSMEs account for 99.67% of registered businesses, effective technology adoption is essential for ensuring business sustainability and growth. This paper explores the role of technology management in improving MSME competitiveness by examining key areas such as technological innovation, adoption strategies, market positioning, and challenges in implementation. This highlights the significance of government initiatives, including the Shared Service Facility (SSF) and the Small Enterprise Technology Upgrading Program (SETUP), in promoting technology adoption among MSMEs. It discusses technology-driven strategies that enable MSMEs to enhance operational efficiency, reduce costs, and expand market reach. Additionally, it identifies financial constraints, digital literacy gaps, and organizational resistance as barriers to technology adoption. Emerging trends, such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain technology, present new opportunities for MSMEs to strengthen their market positioning. This concludes that overcoming technological barriers through strategic planning, capacity-building programs, and policy support can significantly enhance MSME resilience and sustainability. By leveraging digital transformation and innovation, MSMEs in Davao Oriental can remain competitive and contribute to long-term economic growth.

Keywords: Technology Management, MSMEs, Digital Transformation, Competitive Advantage, Innovation

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are vital economic drivers in the Philippines, contributing significantly to employment, industry diversification, and regional development. In Davao Oriental, MSMEs comprise 99.67% of all registered business establishments, underscoring their dominance in the local economy (Department of Trade and Industry [DTI], 2023). These enterprises operate across various industries, including agriculture, manufacturing, trade, and services, forming the backbone of the province's economic activity. However, as digital transformation reshapes industries worldwide, MSMEs in Davao Oriental must adapt to remain competitive. Effective technology management, which involves the strategic acquisition, implementation, and utilization of technological resources, is increasingly recognized as a critical factor in ensuring MSME sustainability and competitiveness (Teece, 2018). Despite government initiatives aimed at promoting technology adoption, the extent to which MSMEs in Davao Oriental integrate digital solutions into their operations remains unclear, and the impact of these efforts on business performance warrants further investigation.

Technology adoption has been widely recognized as a key driver of MSME competitiveness, enhancing operational efficiency, product quality, and market reach (Shirokova, 2023). Studies suggest that businesses leveraging digital tools experience increased productivity and higher profitability (Center for Financial Inclusion, 2024). However, a report by Bain & Company (2018) revealed that only 16% of MSMEs in ASEAN have successfully transitioned into fully digital operations, highlighting a persistent gap in digital transformation. In the Philippines, initiatives such as the Small Enterprise Technology Upgrading Program (SETUP) by the Department of Science and Technology (DOST) aim to bridge this gap by providing financial and technical assistance to MSMEs (DOST, 2024). Despite these efforts, MSMEs continue to face barriers

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such as financial constraints, inadequate digital infrastructure, and a lack of technical expertise, which limit their ability to fully integrate technology into their business processes.

The literature on technology adoption among MSMEs has extensively examined the benefits of digital transformation, yet gaps remain in understanding the specific challenges faced by regional enterprises in developing economies. Existing studies primarily focus on national-level trends, overlooking localized factors such as regional disparities in digital infrastructure and the unique needs of MSMEs in rural provinces (Delos Santos & Ramirez, 2021). Theoretical frameworks like the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990) and the Diffusion of Innovation (DOI) theory (Rogers, 2003) have been used to explain technology adoption patterns, but their applicability to MSMEs in less urbanized regions remains underexplored. This study aims to fill this gap by examining how MSMEs in Davao Oriental manage technology adoption, the factors influencing their decisions, and the extent to which existing models can explain their technology integration strategies.

Theoretical gaps in MSME technology adoption highlight the need for a deeper understanding of how businesses in resource-constrained settings navigate digital transformation. While studies have established the positive impact of digitalization on business performance (OECD, 2021; World Bank, 2023), there is limited empirical research focusing on MSMEs in Davao Oriental. The problem lies not only in access to technology but also in the ability of MSMEs to effectively manage and utilize these innovations for sustainable growth. Identifying the barriers that hinder MSMEs from leveraging digital tools is crucial to designing targeted interventions that can enhance their competitiveness. This study aims to address this gap by exploring the relationship between technology management and MSME performance, focusing on how businesses in Davao Oriental integrate digital solutions and overcome adoption challenges.

In examining the role of technology management in MSME competitiveness, this study also seeks to assess the effectiveness of government-led technology support programs. The Philippine Innovation Act of 2018, which established the National Innovation Council (NIC), aims to create an enabling environment for MSMEs to integrate digital solutions into their operations (National Innovation Council, 2023). Global models such as Malaysia's Industry4WRD policy offer valuable insights into how Industry 4.0 technologies, including artificial intelligence (AI), the Internet of Things (IoT), and big data analytics, can be leveraged to enhance MSME growth (Ministry of International Trade and Industry, 2018). However, the extent to which these policies translate into tangible benefits for MSMEs in regional settings remains an open question. By analyzing the impact of these initiatives on local businesses, this study aims to provide evidence-based recommendations for improving MSME technology adoption in Davao Oriental.

A critical aspect of technology adoption is its cost-benefit implications for MSMEs. Studies on Indian MSMEs suggest that businesses investing in information and communication technology (ICT) experience higher profitability and improved productivity (Shirokova, 2023). However, financial constraints often deter smaller enterprises from adopting new technologies. Conducting a cost-benefit analysis of technology adoption is essential in determining whether the expected benefits—such as increased revenue, improved efficiency, and enhanced customer engagement—justify the financial investment (ProfileTree, 2024). The challenge for MSMEs lies in making informed decisions about technology integration while minimizing risks associated with digital transformation. This study will explore how MSMEs in Davao Oriental navigate these financial considerations and what strategies they employ to maximize returns on technology investments.

Despite the advantages of technology adoption, MSMEs continue to face persistent challenges, including limited financial resources, lack of a skilled workforce, and organizational resistance to change. Engaging with technology intermediaries, such as academic institutions and private sector partners, can facilitate knowledge transfer and provide MSMEs with guidance on implementing digital solutions (International Council for Small Business, 2023). Capacity-building programs that focus on digital literacy and financial literacy can also enhance MSME readiness for technological integration (ResearchGate, 2022). Additionally, the increasing availability of government grants, public-private partnerships, and international funding opportunities presents new avenues for MSMEs to overcome financial and technical barriers to technology adoption. This study will examine the role of these support mechanisms in helping MSMEs transition into a more technology-driven business model.

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As digital transformation continues to shape the future of MSMEs, emerging technologies such as AI, IoT, and blockchain offer new opportunities for business growth. AI applications can optimize business operations, improve supply chain management, and enhance customer interactions (Automate Business, 2023). IoT enables real-time monitoring of business processes, while blockchain technology enhances transaction security and transparency, fostering greater market trust (Wikipedia, 2023). The extent to which MSMEs in Davao Oriental can capitalize on these innovations will determine their long-term sustainability in an increasingly digital economy. By examining the factors influencing MSME technology adoption and the effectiveness of existing support mechanisms, this study aims to contribute to the broader discourse on technology-driven MSME development.

METHODOLOGY

This study employs a systematic review methodology to analyze the role of technology management in enhancing the competitive advantage of micro, small, and medium enterprises (MSMEs). A systematic review follows a structured approach to identify, evaluate, and synthesize relevant literature, ensuring a comprehensive and unbiased assessment of the research topic (Snyder, 2019). The review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which provide a transparent framework for selecting and analyzing scholarly articles (Page et al., 2021). To ensure the rigor and reliability of the review, the study sources literature from high-impact academic databases, including Scopus, Web of Science, ScienceDirect, IEEE Xplore, and Google Scholar, focusing on peer-reviewed journal articles, conference proceedings, and institutional reports published between 2015 and 2024.

The study applies predefined inclusion and exclusion criteria to ensure relevance and quality in the selection of articles. Inclusion criteria encompass studies that explicitly examine the impact of technology management on MSME performance, digital transformation strategies, barriers to technology adoption, and policy interventions supporting MSMEs in various economic contexts. Additionally, only studies published in English and containing empirical or theoretical contributions are considered. Exclusion criteria include studies focusing exclusively on large enterprises, articles lacking methodological rigor, opinion pieces, and reports without citations or empirical support (Tranfield et al., 2003). The search strategy involves the use of Boolean operators (e.g., "technology management AND MSMEs AND competitive advantage") to refine search results and improve the precision of retrieved literature. A systematic screening process, including abstract and full-text reviews, is conducted by multiple reviewers to ensure inter-rater reliability and minimize selection bias (Moher et al., 2009).

To synthesize the findings, this study employs a thematic analysis approach, categorizing relevant literature based on key themes such as technological adoption frameworks, barriers to digital transformation, policy interventions, and competitive advantage metrics (Braun & Clarke, 2006). The extracted data are analyzed to identify patterns, theoretical gaps, and areas for future research, ensuring that the study offers novel insights into the role of technology management in MSME competitiveness. To further validate findings, citation tracking and backward reference searching are conducted, allowing for a more comprehensive examination of seminal works and emerging trends (Levac et al., 2010). By employing this systematic approach, the study aims to contribute to both academic discourse and practical policymaking by offering evidence-based recommendations for MSMEs navigating the digital economy.

DISCUSSIONS

Current Landscape and Ecosystem of MSMEs in Davao Oriental, Philippines

Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in the economic development of Davao Oriental, contributing significantly to local employment and industry diversification. As of 2023, MSMEs in the Davao Region comprised 99.67% of all registered business establishments, highlighting their dominance in the regional economy (Department of Trade and Industry [DTI], 2023). These enterprises operate across various sectors, including agriculture, manufacturing, trade, and services, serving as key drivers of inclusive economic growth. The provincial government, along with national agencies, has been actively implementing

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policies and programs to strengthen MSME development, recognizing their role in fostering economic resilience.

Davao Oriental's MSME sector is largely characterized by businesses engaged in agribusiness, food processing, handicrafts, and retail trade. The province is known for its coconut-based products, banana chips, and other value-added agricultural goods, which serve as the backbone of many MSMEs (Philippine Statistics Authority [PSA], 2023). To enhance market exposure and competitiveness, MSMEs in the province participate in trade fairs such as the Sikat Pinoy Inalima Trade Fair and Exhibit, organized by the Department of Trade and Industry (DTI, 2023). These events provide MSMEs with a platform to showcase their products, attract investors, and access wider market opportunities beyond the local economy.

To support MSME development, the Negosyo Serbisyo sa Barangay (NSB) program has been instrumental in extending business services to underserved communities in Davao Oriental. This initiative, spearheaded by DTI, brings financial literacy training, product development workshops, and business registration services to remote areas (DTI, 2023). By bridging the gap between entrepreneurs and government support programs, the NSB initiative fosters a more inclusive entrepreneurial ecosystem, enabling micro-businesses to formalize their operations and gain access to funding opportunities.

The provincial government has also focused on enhancing product quality and increasing production capacity among MSMEs. Programs that facilitate technology adoption, skills training, and financial assistance have been implemented to improve the competitiveness of MSMEs in local and national markets (Local Government of Davao Oriental, 2023). These efforts align with the broader goal of strengthening supply chains and ensuring that locally produced goods meet industry standards, thereby enabling MSMEs to scale up their operations and enter more lucrative markets.

Overall, the MSME ecosystem in Davao Oriental benefits from a combination of government support, market access initiatives, and capacity-building programs. The collaboration between public and private stakeholders has helped sustain the growth of small businesses, creating a more resilient local economy. As technology and digital transformation become more integral to business success, MSMEs in the province are expected to further leverage innovation and expand their market reach, contributing to the long-term economic sustainability of Davao Oriental.

Concept and Importance of Technology Management in MSMEs

Technology management encompasses the systematic planning, development, and implementation of technological capabilities to shape and achieve an organization's strategic and operational objectives. For Micro, Small, and Medium Enterprises (MSMEs) in Davao Oriental, Philippines, effective technology management is crucial for enhancing productivity, competitiveness, and resilience in a rapidly evolving business environment.

The importance of technology management for MSMEs in Davao Oriental is underscored by initiatives such as the Department of Trade and Industry's (DTI) Shared Service Facility (SSF) program. Launched in 2013, the SSF program aims to improve the productivity and competitiveness of MSMEs by providing access to better technologies and equipment (Department of Trade and Industry, 2023). This initiative highlights the role of technology management in enabling MSMEs to enhance product quality and operational efficiency.

Moreover, the integration of digital tools has become increasingly vital for MSMEs, especially in the context of the COVID-19 pandemic. A study by DAI (2021) revealed that MSMEs equipped with digital tools were better positioned to navigate economic disruptions, emphasizing the need for effective technology management strategies to ensure business continuity and resilience (DAI, 2021).

In Davao Oriental, programs like the Negosyo Serbisyo sa Barangay (NSB) caravans have been instrumental in bringing business development services to underserved areas. These initiatives aim to capacitate entrepreneurs by providing access to technology and training, thereby enhancing their competitiveness

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(Department of Trade and Industry, 2021). Such efforts underscore the significance of technology management in empowering MSMEs to adapt and thrive in changing market conditions.

Furthermore, the establishment of the National Innovation Council (NIC) under the Philippine Innovation Act of 2018 reflects the government's commitment to fostering innovation and technology adoption among MSMEs. The NIC aims to develop the country's innovation goals and strategies, providing a supportive ecosystem for MSMEs to leverage technology for growth and competitiveness (National Innovation Council, 2023).

Effective technology management is pivotal for the growth and sustainability of MSMEs in Davao Oriental. By adopting and managing technological innovations, these enterprises can enhance their operational efficiency, adapt to market changes, and contribute significantly to the region's economic development.

Technological Innovation and MSME Competitiveness

Technological innovation plays a pivotal role in enhancing the competitiveness of Micro, Small, and Medium Enterprises (MSMEs), enabling them to improve productivity, access new markets, and adapt to evolving consumer demands. In the Philippines, MSMEs constitute 99.5% of all registered businesses, underscoring their significance in the national economy (Philippine Statistics Authority, 2020). By embracing technological advancements, these enterprises can streamline operations, reduce costs, and offer innovative products and services, thereby strengthening their market position.

Digital transformation is a critical component of technological innovation for MSMEs. The integration of digital tools facilitates automation of routine tasks, enhances communication, and improves data management. However, a 2018 study by Bain & Company revealed that only 16% of MSMEs in ASEAN are truly digitalized, indicating significant room for improvement (Bain & Company, 2018). Barriers such as limited financial resources, inadequate digital infrastructure, and lack of digital literacy impede the adoption of digital technologies among MSMEs (PwC Philippines, 2020).

To address these challenges, the Philippine government has implemented initiatives like the Small Enterprise Technology Upgrading Program (SETUP) under the Department of Science and Technology (DOST). SETUP aims to encourage and support MSMEs in adopting technological innovations to enhance product quality and operational efficiency, thereby boosting productivity and competitiveness (DOST, 2024). By providing technical assistance and facilitating access to advanced technologies, such programs empower MSMEs to innovate and thrive in competitive markets.

Moreover, the enactment of the Tatak Pinoy (Proudly Filipino) Act in 2024 demonstrates a legislative commitment to fostering collaboration between the government and private sector to promote high-value and sophisticated goods and services. This initiative aims to drive innovation and technology transfer, leading to faster economic growth and improved incomes for Filipinos (Tatak Pinoy Act, 2024). Such policies create an enabling environment for MSMEs to leverage technological advancements for enhanced competitiveness.

Technological innovation is indispensable for the competitiveness of MSMEs. Through digital transformation and supportive government initiatives, MSMEs can overcome existing challenges, improve operational efficiency, and expand their market reach. Continued investment in technology and innovation is essential to ensure that MSMEs remain resilient and competitive in an increasingly digital global economy.

Technology Adoption Strategies for MSMEs

Technology adoption is crucial for enhancing the competitiveness of Micro, Small, and Medium Enterprises (MSMEs). Understanding and implementing effective strategies can significantly impact their growth and sustainability. One foundational framework is Everett Rogers' Diffusion of Innovations theory, which categorizes adopters into innovators, early adopters, early majority, late majority, and laggards. This model helps in understanding how new technologies spread within a market and can guide MSMEs in identifying their position and strategizing accordingly (Sarita & Inutan, 2025).

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Governments play a pivotal role in facilitating technology adoption among MSMEs. In the Philippines, the National Innovation Council (NIC), established under the Philippine Innovation Act of 2018, is tasked with developing the country's innovation goals and strategies, thereby creating a supportive ecosystem for MSMEs to leverage technology for growth and competitiveness (National Innovation Council, 2023). Similarly, Malaysia's Industry4WRD policy aims to transform its manufacturing sector by enhancing digital infrastructure and fostering innovation, providing a blueprint that other nations can emulate (Ministry of International Trade and Industry, 2018).

The integration of Industry 4.0 technologies—such as the Internet of Things (IoT), artificial intelligence (AI), and big data analytics—into MSMEs is essential for maintaining competitiveness in the modern market. These technologies enable automation, enhance efficiency, and open new business opportunities. For instance, South Korea's Ministry of SMEs and Startups has implemented policies to support tech startups, including R&D funds and infrastructure support, facilitating the adoption of advanced technologies among MSMEs (Ministry of SMEs and Startups, 2020).

Despite the benefits, MSMEs often face challenges in adopting new technologies, including limited financial resources, lack of skilled personnel, and inadequate infrastructure. To address these issues, technology intermediaries can play a crucial role by providing necessary support and bridging the gap between technology providers and MSMEs. These intermediaries assist in knowledge absorption and diffusion, enhancing the ability of MSMEs to implement new technologies effectively (Spithoven et al., 2011).

Effective technology adoption strategies, supported by robust frameworks and government initiatives, are vital for the competitiveness of MSMEs. By embracing digital transformation and integrating Industry 4.0 technologies, MSMEs can enhance their operational efficiency and market position. Addressing the challenges through collaborative efforts and support systems will ensure that MSMEs continue to thrive in an increasingly digital global economy.

Impact of Technology on MSME Performance and Market Positioning

Investments in technology significantly influence the performance of Micro, Small, and Medium Enterprises (MSMEs). By integrating advanced technologies, MSMEs can enhance operational efficiency, reduce costs, and improve product quality, leading to increased profitability and competitiveness. For instance, a study on Indian manufacturing MSMEs demonstrated that information and communication technology (ICT) investments positively impact organizational performance, highlighting the critical role of technology in business success (Shirokova, 2023).

Conducting a cost-benefit analysis is essential for MSMEs considering technology adoption. This process involves evaluating the financial implications of implementing new technologies against the anticipated benefits, such as increased revenue or reduced operational costs. A strategic approach allows MSMEs to assess the expenses associated with technology deployment and align these investments with long-term business objectives, ensuring that the benefits outweigh the costs (ProfileTree, 2024).

Technology-driven strategies are pivotal for MSMEs aiming to expand their market presence. By leveraging digital platforms, MSMEs can access broader customer bases and engage in e-commerce, transcending geographical limitations. For example, the integration of digital tools has enabled MSMEs to improve operational efficiency and increase their market presence, allowing them to compete more effectively with larger enterprises (Center for Financial Inclusion, 2024).

However, MSMEs often face challenges in adopting new technologies, including limited financial resources and a lack of digital literacy. Addressing these barriers requires targeted support and capacity-building initiatives. For instance, enhancing financial literacy among MSME owners can facilitate better decision-making regarding technology investments, thereby improving business resilience (ResearchGate, 2022).

Technology adoption plays a crucial role in enhancing MSME performance and market positioning. Through careful investment, strategic planning, and supportive measures, MSMEs can harness technological advancements to drive growth and competitiveness in an increasingly digital economy.

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Challenges and Future Directions in MSME Technology Management

Micro, Small, and Medium Enterprises (MSMEs) face numerous challenges in technology management, which can hinder their competitiveness and growth in a digital economy. Common constraints include financial limitations, technical deficiencies, and organizational hurdles. Financially, MSMEs often struggle with securing the necessary capital to invest in advanced technologies, making it difficult to keep pace with larger competitors. Technically, there is often a lack of skilled personnel capable of implementing and maintaining new technological systems. Organizationally, resistance to change and inadequate strategic planning can impede the adoption of new technologies. These challenges are compounded by limited access to information and digital security concerns, further deterring MSMEs from embracing technological advancements (Hendrawan, 2023).

To overcome these barriers, MSMEs can adopt several strategies. Engaging with technology intermediaries can provide essential support in acquiring and implementing new technologies. These intermediaries act as bridges, facilitating the transfer of knowledge and resources necessary for technological upgrades. Additionally, forming collaborative alliances allows MSMEs to share resources, reduce costs, and mitigate risks associated with technology adoption. Such collaborations can lead to shared innovation and enhanced competitiveness (International Council for Small Business, 2023). Investing in employee training and development is also crucial, as it builds internal capabilities and reduces reliance on external expertise.

Emerging trends indicate that the future of MSMEs in a digital economy will be shaped by the integration of advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and blockchain. AI can automate routine tasks, enhance decision-making processes, and improve customer engagement, thereby increasing operational efficiency. IoT enables real-time monitoring and data collection, facilitating better supply chain management and product development. Blockchain technology offers secure and transparent transaction processes, which can enhance trust and credibility with customers and partners. Adopting these technologies can lead to smarter scaling and improved market positioning for MSMEs (Automate Business, 2023).

However, the adoption of these technologies is not without challenges. Issues such as interoperability, unclear value propositions, and privacy concerns can hinder the effective implementation of IoT solutions. Moreover, organizational structures may need to adapt to accommodate these new technologies, requiring a shift in culture and processes. To address these challenges, MSMEs must engage in strategic planning, invest in capacity-building, and foster a culture that embraces innovation and change (Wikipedia, 2023).

Over-all, while MSMEs face significant challenges in technology management, proactive strategies and an openness to emerging trends can position them for success in a digital economy. By addressing financial, technical, and organizational constraints through collaboration, capacity-building, and strategic adoption of advanced technologies, MSMEs can enhance their competitiveness and ensure sustainable growth in an increasingly digital marketplace.

FINDINGS

The systematic review reveals that technology management significantly enhances the competitive advantage of MSMEs by improving operational efficiency, reducing costs, and expanding market reach. Studies indicate that MSMEs that integrate digital tools such as cloud computing, automation, and e-commerce platforms experience increased productivity and better customer engagement (OECD, 2021; Shirokova, 2023). Digital transformation allows businesses to streamline processes, enhance product quality, and improve service delivery, leading to stronger market positioning (World Bank, 2023). However, despite these benefits, MSMEs in developing economies, particularly in the Philippines, face persistent challenges in adopting technology. Limited access to capital, insufficient infrastructure, and a lack of digital literacy among business owners and employees remain significant barriers (Delos Santos & Ramirez, 2021). The findings suggest that while technology adoption is widely recognized as a driver of competitiveness, its implementation varies significantly depending on financial and institutional support structures available to MSMEs.

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The review also highlights that government initiatives and policy interventions play a crucial role in facilitating MSME technology adoption. Programs such as the Philippine Department of Science and Technology's (DOST) Small Enterprise Technology Upgrading Program (SETUP) and the Department of Trade and Industry's (DTI) Shared Service Facility (SSF) program provide financial assistance, modern equipment, and training to MSMEs (DOST, 2024; DTI, 2023). International models, such as Malaysia's Industry4WRD and Singapore's Smart Nation initiatives, have successfully accelerated MSME digitalization through targeted subsidies, tax incentives, and digital literacy campaigns (Ministry of International Trade and Industry, 2018). However, the effectiveness of these programs in the Philippine context is hindered by bureaucratic inefficiencies, slow implementation, and a lack of awareness among MSME owners (International Council for Small Business, 2023). The findings underscore the need for a more streamlined and accessible technology adoption framework tailored to regional MSMEs, particularly those operating in rural provinces like Davao Oriental.

Moreover, the study finds that MSMEs that successfully adopt emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain technology gain a competitive edge in the market (Automate Business, 2023). AI-powered analytics enable MSMEs to make data-driven decisions, optimize supply chain management, and enhance customer relations (OECD, 2021). IoT applications allow real-time monitoring of operations, improving efficiency and reducing downtime (World Bank, 2023). Blockchain technology, on the other hand, enhances transaction security and transparency, fostering greater consumer trust (Wikipedia, 2023). However, the adoption of these advanced technologies remains limited due to high implementation costs, lack of technical expertise, and concerns over cybersecurity risks (ResearchGate, 2022). The findings suggest that MSMEs require targeted training programs, financial support, and access to technology intermediaries to fully leverage digital transformation and maintain their competitive advantage in an increasingly technology-driven business environment.

CONCLUSION

Technology management is a critical enabler of competitive advantage for MSMEs, allowing them to improve operational efficiency, enhance product quality, and expand their market reach (OECD, 2021). This study underscores the importance of government-led initiatives such as the Shared Service Facility (SSF) and the Small Enterprise Technology Upgrading Program (SETUP) in promoting technology adoption among MSMEs in the Philippines (DOST, 2024; DTI, 2023). However, despite these support mechanisms, financial constraints, digital literacy gaps, and resistance to technological change continue to hinder MSMEs from fully integrating into the digital economy (Delos Santos & Ramirez, 2021). While government interventions play a crucial role in technology adoption, a more holistic approach that includes private sector participation and capacity-building efforts is needed to support MSMEs in their digital transformation journey.

The adoption of emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain presents significant opportunities for MSMEs to enhance their market positioning and optimize business operations (Automate Business, 2023). AI-powered analytics enable data-driven decision-making, IoT facilitates real-time monitoring of business processes, and blockchain technology enhances transaction security and transparency (World Bank, 2023). However, leveraging these technologies requires MSMEs to develop strategic technology adoption plans, invest in workforce upskilling, and foster an organizational culture that embraces continuous innovation (ResearchGate, 2022). Without adequate training and knowledge-sharing mechanisms, the adoption of these advanced technologies may remain limited to larger enterprises with greater financial and technical resources.

Addressing the persistent challenges of MSME technology adoption necessitates a collaborative approach involving the government, private sector, and academic institutions. Capacity-building programs focusing on digital transformation, financial literacy, and technology-driven business models will be essential in equipping MSMEs with the skills required to navigate the digital economy effectively (International Council for Small Business, 2023). Strengthening public-private partnerships can facilitate access to funding, infrastructure, and mentorship opportunities that help MSMEs overcome technological barriers (OECD, 2021). By fostering an ecosystem that promotes continuous learning, innovation, and technology investment, MSMEs in Davao Oriental and beyond can sustain long-term growth and contribute meaningfully to economic development.

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Moving forward, MSMEs must proactively adapt to technological advancements to remain competitive in an increasingly digitalized global economy.

RECOMMENDATIONS

To enhance MSME competitiveness through effective technology management, policymakers, industry stakeholders, and business owners must collaborate to address key barriers to technology adoption. Government agencies should streamline and expand financial assistance programs, such as DOST's SETUP and DTI's SSF, ensuring easier access for MSMEs, particularly those in rural areas like Davao Oriental. Capacity-building initiatives focusing on digital literacy, cybersecurity, and advanced technology integration should be prioritized to equip MSME owners and employees with the necessary skills to leverage digital tools effectively. Public-private partnerships can facilitate knowledge transfer, providing MSMEs with mentorship, access to emerging technologies such as AI and IoT, and opportunities for market expansion. Additionally, regulatory reforms should focus on reducing bureaucratic red tape and creating a more conducive environment for digital transformation, while investment in digital infrastructure, such as improved internet connectivity and cloud-based solutions, is essential for enabling seamless technology adoption. By fostering a holistic ecosystem that combines financial support, skill development, and infrastructure investment, MSMEs can harness technology to drive sustainable growth and long-term competitive advantage in the evolving digital economy.

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