JOURNAL OF INTERDISCIPLINARY PERSPECTIVES
PRINT ISSN: 2984-8288 | ONLINE ISSN: 2984-8385
https://doi.org/10.69569/jip

TWR Publishing

Research Article

Digital Technology for MSME Innovation and Sustainability: Toward a Management Framework

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Article History:

Date received: June 20, 2026
Date revised: October 12, 2026
Date accepted: October 22, 2026

Recommended citation:

Galan, R.V., Ducena, G., Romano, N., & Alegre, S.M. (2026). Digital technology for MSME innovation and sustainability: Toward a management framework. *Journal of Interdisciplinary Perspectives*, *4*(11), 211-225. https://doi.org/10.69569/jip.2026.392x

Abstract. This study examined the role of digital technology enablement in linking innovation management practices to the sustainability of micro, small, and medium enterprises (MSMEs) in a regional context. Despite the growing importance of digital transformation, limited evidence exists on how digital technology strengthens the relationship between innovation management and business sustainability among MSMEs. The study aimed to determine the level of digital technology enablement, innovation management practices, and sustainability, as well as to assess the mediating effect of digital technology on the relationship between innovation management and sustainability. A mixed-method research design was employed using survey data from randomly selected MSMEs and key informant interviews. Results showed that MSMEs exhibited low adoption of e-commerce and cloud computing but effectively utilized social media, digital marketing, and human resource systems. Innovation management was strong in sensing and seizing opportunities but weak in transforming practices, while sustainability was high in economic performance but relatively low in environmental and social dimensions. Mediation analysis confirmed that digital technology significantly strengthened the positive influence of innovation management on sustainability. The findings highlight the need to enhance digital capabilities and innovation practices through government-supported training and development programs to achieve balanced and sustainable MSME growth.

Keywords: *Digital technology enablement; Innovation management; Sustainability; MSMEs; Mixed-method research.*

Micro, small, and medium enterprises (MSMEs) are central to economic growth, employment generation, and innovation in developing economies. In the Philippines, they account for more than 99% of registered businesses and provide most employment opportunities (DTI, 2022). In Butuan City, MSMEs dominate the local business landscape, yet many remain constrained by limited financial resources, technological readiness, and managerial capacity. While social media and digital marketing are widely adopted, advanced technologies such as e-commerce platforms, cloud computing, and integrated management systems are less prevalent, restricting their potential contribution to long-term sustainability.

Innovation management has emerged as a strategic capability enabling firms to sense opportunities, seize them, and transform resources into competitive advantage (Teece, 2020). However, innovation alone does not guarantee sustainability. Digital technologies can mediate, strengthening the link between innovation management and sustainability outcomes. At the same time, organizational characteristics such as enterprise size, number of workers, and business type may moderate these relationships, influencing their strength or direction.

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Distinguishing clearly between mediation and moderation is essential for building a sound theoretical model.

Existing studies confirm that digitalization enhances innovation and sustainability (Al Nuaimi et al., 2024; Asad et al., 2023), but localized evidence in regional economies remains scarce. In Butuan City, MSMEs often employ digital tools for operational convenience rather than as strategic mechanisms for innovation and sustainable development. This creates a significant gap in understanding how digital technology enablement strengthens innovation management toward sustainability outcomes in resource-constrained contexts.

This study aimed to investigate how digital technology enables innovation management and sustainability among MSMEs in Butuan City. It sought to determine the profile of MSMEs in terms of number of workers, years of operation, starting capital, and type of business. The study further examined the level of digital technology enablement across e-commerce platforms, social media, human resource systems, and accounting systems, as well as the extent of innovation management in terms of sensing, seizing, and transforming capabilities. In addition, it assessed MSMEs' sustainability status across economic, environmental, and social dimensions. Beyond descriptive analysis, the study examined whether digital technology significantly mediates the relationship between innovation management and sustainability, and whether innovation management directly affects sustainability outcomes. It also examined whether innovation management and sustainability differ when MSMEs are grouped by profile, and whether demographic characteristics significantly moderate the innovation–sustainability relationship. Finally, the study integrated qualitative findings from MSME owners and managers to explain and expand the quantitative results, culminating in a proposed Innovation Management and Sustainability Framework tailored to the local context of Butuan City.

Methodology

Research Design

This study used a sequential explanatory mixed-methods design, beginning with quantitative data collection and analysis, followed by qualitative inquiry to explain the statistical results in greater depth. The quantitative findings guided the selection of interview participants, the development of interview questions, and the coding process. Integration was achieved by connecting quantitative patterns with qualitative themes, ensuring that the qualitative material was not presented merely as supporting quotations but as systematic evidence that informed the development of the proposed Innovation Management and Sustainability Framework.

Participants and Sampling Technique

The study involved 396 registered MSMEs in Butuan City, determined using Slovin's formula based on the total population of 17,671 enterprises. Eligible respondents were owners or managers actively operating within the city. A proportionate convenience sampling technique was employed to reflect the distribution of micro, small, and medium enterprises, though this method does not constitute random selection or guarantee full representation. Of the 396 surveys distributed, 391 were valid and complete, while five cases were excluded due to missing data (see Table 1). The study documented the missing-data procedure, response rate, recruitment process, and inclusion/exclusion criteria to ensure transparency. For the qualitative phase, the researchers purposively selected ten MSME owners or managers based on enterprise size and years of operation to provide explanatory insights.

Table 1. *Distribution of Sample Size Across Categories*

Category	Population	Sample Size
Micro	17328	387
Small	295	7
Medium	48	2
Total	**17,671**	**396**

Research Instrument

The study utilized three main instruments: a researcher-developed Digital Technology Enablement Scale, an Innovation Management Scale adapted from Teece's dynamic capabilities framework (2007), and a Sustainability Scale based on Elkington's triple bottom line (1998). The researcher developed the Digital Technology Enablement Scale in 2024, drawing on prior studies of MSME digital adoption (Nguyen et al., 2023; Bon et al., 2023). It consisted of 24 items across four domains—e-commerce platforms, social media, human resource systems, and accounting systems. Items were rated on a 4-point Likert scale (Never = 1, Sometimes = 2, Often = 3, Always = 4), with cutoffs defined as 1.00–1.49 "Low," 1.50–2.49 "Moderate," 2.50–3.49 "High," and 3.50–4.00 "Very High."

The Innovation Management Scale, adapted from Teece (2007), included 15 items distributed across sensing, seizing, and transforming capabilities. Items were phrased in behavioral terms to capture MSME practices, such as monitoring competitors, responding to market changes, and adopting digital tools for transformation.

The Sustainability Scale, based on Elkington's (1998) triple bottom line, comprised 12 items measuring economic, environmental, and social performance. Items reflected MSME practices such as maintaining profitability, reducing waste, and engaging in socially responsible activities. Three industry specialists and two academic reviewers validated all instruments to establish content validity. Pilot testing with 30 MSME owners confirmed clarity and relevance, while exploratory factor analysis supported construct validity by grouping items into their intended dimensions. Reliability was reported separately for each subscale: digital technology enablement (α = .88), innovation management—sensing (α = .84), seizing (α = .86), transforming (α = .80), and sustainability—economic (α = .83), environmental (α = .81), social (α = .82). These results demonstrated strong internal consistency and ensured that the instruments were appropriate for assessing the constructs in the MSME context of Butuan City.

Data Gathering Procedure

Before data collection, the researchers obtained permission from the concerned government agencies and participating enterprises. The researchers administered survey questionnaires through face-to-face distribution and online platforms using Google Forms. Participation was voluntary, and informed consent was secured before data collection. After the completion of the quantitative phase, qualitative data were gathered through individual semi-structured interviews with a different set of MSME owners and managers. Interviews were conducted by appointment, audio-recorded with participants' permission, and transcribed for subsequent analysis. The qualitative findings were used to explain and validate the quantitative results.

Data Analysis

Quantitative data were analyzed using descriptive statistics to determine the levels of digital technology enablement, innovation management, and sustainability. Pearson product–moment correlation was employed to examine relationships among variables, while independent-samples t-tests and one-way ANOVA were used to test differences based on MSME profiles. Multiple regression analysis was conducted to assess the direct effects of innovation management on sustainability. Mediation analysis was performed to evaluate the indirect effect of digital technology, with paths (a, b, c, c′), indirect effect (ab), standard errors, and bootstrapped confidence intervals reported to ensure accuracy. Moderation analysis included interaction terms (e.g., Innovation Management × Number of Workers) and appropriate dummy coding for categorical variables, with conditional effects and simple slopes presented where relevant.

Qualitative interview data were analyzed using thematic analysis. Transcripts were coded in multiple stages, beginning with open coding, followed by codebook development, and culminating in theme identification. Trustworthiness was enhanced through reflexivity, triangulation, and negative-case analysis. Integration of quantitative and qualitative findings was achieved through joint displays that connected statistical results with qualitative themes, highlighting areas of convergence, divergence, and expansion. This systematic integration ensured that qualitative insights provided explanatory depth and informed the development of the Innovation Management and Sustainability Framework.

Ethical Considerations

Ethical standards were strictly observed throughout the study. Participation was voluntary, informed consent was obtained, and respondents were assured of confidentiality and the right to withdraw at any time. The appropriate research ethics committee approved the study, and the approval number and date were documented. Data were anonymized, password-protected, and retained only for the approved period before secure destruction. Safeguards were implemented to protect commercially sensitive information, recognizing that generic labels such as "Food Business Owner" may still risk identification in a small local population. Ethical considerations were consolidated into a single section to avoid redundancy and ensure clarity and compliance with the Data Privacy Act of 2012.

Results and Discussion

Profile of MSMEs Across Indicators

Table 2. *Distribution of MSMEs Across Profile Indicators*

Profile Indicators	Frequency	Percentage
Number of Workers		
1-9	382	97.7%
10-99	7	1.80%
100-199	2	0.50%
Years of Experience		
4-6 years	203	51.9%
7-9 years	188	48.1%
Starting Capital		
Less than 3 million	382	97.8%
3 million to 15 million	7	1.80%
15 million to 50 million	2	0.50%
Type of Business		
Trading	181	46.3%
Service	172	44.0%
Manufacturing	38	9.70%

The Asian Development Bank (2021) noted that MSMEs contribute significantly to Gross Domestic Product (GDP), estimated at about 35% to 40% nationally. Mendoza et al. (2017) explained that many business establishments in the Philippines are micro-level enterprises based on declared capital and workforce size. Table 2 presents the profile of MSMEs in Butuan City. Similar to the information from previous research, the results in the table revealed that most business establishments in Butuan City have 1-9 employed workers (97.7%), have been operating for 4-6 years (51.9%) and 7-9 years (48.1%), have a starting capital of less than 3 million pesos (97.8%), and are into trading (46.3%) and service (44.0%).

Level of Digital Technology Enablement Among MSMEs in terms of E-Commerce Platforms

Table 3. *Level of Digital Technology Enablement Among MSMEs in terms of E-Commerce Platforms*

Items	Mean	Verbal Description	Verbal Interpretation
Helps reach new customers	2.03	Sometimes	Moderate
Effectively increase sales for the business	2.03	Sometimes	Moderate
Contributes significantly to the growth of the business	2.01	Sometimes	Moderate
Provides with an easy-to-use and reliable online storefront	2.02	Sometimes	Moderate
Enhances customer engagement and experience	2.00	Sometimes	Moderate
Overall	**2.02**	**Sometimes**	**Moderate**

Results indicate that MSMEs demonstrate a moderate level of digital technology enablement through e-commerce platforms (M = 2.02). Respondents acknowledged that e-commerce platforms improve business visibility and expand customer reach, particularly through Facebook and Instagram advertisements. Interview data support these findings:

> *"We usually pay for advertisements so more people can see our business."* – Videography Business Owner
> *"When we started the business, we immediately used Facebook and Instagram to boost our page."* – Food Business Owner

Respondents also noted that the benefits of e-commerce are not always sustained. While some businesses experienced improved operational efficiency and faster customer acquisition, others emphasized that sales performance still depends on employee attitude and personal customer interactions.

> *"Before using Facebook, it took about three months to fill a vacancy; now it only takes a few weeks."* – Rental Service Owner
> *"Sales still depend on the attitude of our sales agents."* – Medical Supplies Distributor

Additionally, adoption remains uneven, as some MSMEs rely on Messenger for faster communication while others continue to prefer traditional, face-to-face business practices.

"We use Messenger because it allows faster communication and feedback." – Construction Business Owner
"Our business still follows traditional practices." – Motorcycle Parts Retailer

These findings suggest that while e-commerce platforms support marketing and customer communication, their integration into broader business operations remains limited. This finding is consistent with El Ragal et al. (2022), who found that digital platforms enhance MSME competitiveness primarily by improving market access and customer engagement, although the extent of business benefits depends on organizational readiness and effective adoption of digital technology activities.

Level of Digital Technology Enablement among MSMEs in terms of Social Media

Table 4. *Level of Digital Technology Enablement Among MSMEs in terms of Social Media*

Items	Mean	Verbal Description	Verbal Interpretation
Effectively promote business	3.55	Always	Very High
Help engage target audience	3.53	Always	Very High
Allow to manage business more effectively	3.52	Always	Very High
Increase brand awareness and recognition	3.49	Always	Very High
Help generate leads and convert them into customers	3.53	Always	Very High
Overall	**3.52**	**Always**	**Very High**

Results indicate that MSMEs demonstrate a very high level of digital technology enablement through social media (M = 3.52), particularly for business promotion, customer engagement, brand awareness, and lead generation. Respondents consistently reported using Facebook and Instagram to increase business visibility and reach more customers. Interview data support these findings:

"We pay for advertisements so our business can be seen by more people." – Videography Business Owner
"When we started the business, we immediately used Facebook and Instagram." – Food Business Owner

Respondents also emphasized that social media helps attract customers, strengthen brand recognition, and accelerate business activities.

"Facebook is our main platform for showcasing our portfolio." – Videography Business Owner
"Whenever I post, I immediately receive customer responses." – Rental Service Owner
"Technology makes business operations much faster." – Food Business Owner

These findings suggest that social media has become an essential tool for marketing, customer engagement, and business growth among MSMEs. This supports the findings of Abdul Talib Bon et al. (2023), who reported that social media adoption significantly enhances customer engagement, brand visibility, and business performance among small and medium enterprises.

Level of Digital Technology Enablement Among MSMEs in Terms of Human Resource System

Results indicate that MSMEs demonstrate a very high level of digital technology enablement in human resource systems (M = 3.54). Respondents reported that HR systems support workforce planning, employee monitoring, communication, scheduling, and record management, resulting in more efficient business operations.

Table 5. *Level of Digital Technology Enablement Among MSMEs in Terms of Human Resource System*

Items	Mean	Verbal Description	Verbal Interpretation
Help accurately process employees' needs	3.57	Always	Very High
Enable to track employee progress and performance	3.5	Always	Very High
Foster better communication between employees and the management	3.54	Always	Very High
Strengthen workforce management scheduling	3.55	Always	Very High
Help manage employee records efficiently	3.55	Always	Very High
Support organization's HR strategic planning	3.99	Always	Very High
Overall	**3.54**	**Always**	**Very High**

Interview data support these findings:

> *"It reduces the workload and makes tasks faster."* – Food Business Owner

Despite these benefits, respondents identified challenges such as limited digital skills among older employees and concerns about data privacy.

> *"Older employees, like my parents' generation, are not very familiar with technology."* – Retail Business Owner
> *"We do not easily share information because of privacy concerns."* – MSME Manager

Nevertheless, respondents recognized the importance of HR systems in improving efficiency and supporting organizational compliance.

> *"It is important because it speeds up work, especially compliance requirements."* – MSME Manager

These findings suggest that although adoption challenges remain, MSMEs consider human resource systems essential for improving operational efficiency and supporting long-term business sustainability. This finding is consistent with Alshurideh et al. (2022), who found that digital HRM practices improve organizational efficiency and employee performance while emphasizing the need to address digital competency and data privacy concerns.

Summary of Leadership Practices

Table 6. *Summary Table of the Extent of Leadership Practices of Family-Owned Higher Education Institutions*

Items	Mean	Verbal Description	Verbal Interpretation
Help maintain the efficiency of financial operations	3.52	Always	Very High
Enables better analysis of financial reports for decision-making.	3.48	Always	Very High
Allow accurate processing of financial transactions.	3.47	Always	Very High
Help track the management of financial needs of the company.	3.51	Always	Very High
Ensure compliance with government financial regulations	3.5	Always	Very High
Enhance financial budgeting capabilities	3.98	Always	Very High
Overall	**3.50**	**Always**	**Very High**

Results indicate that MSMEs demonstrate a very high level of digital technology enablement in accounting systems (M = 3.50), recognizing their value in improving financial management, accuracy, and decision-making. However, many businesses still rely on manual processes due to cost, system complexity, and limited digital skills.

Interview data support these findings:

> *"We shifted to Da Vinci because it is easier to use and properly licensed."* – Videography Business Owner
> *"A computerized system is simpler and reduces manual work."* – Construction Business Owner
> *"Our challenge with inventory systems is that they are expensive, and we do not know how to use them."* – Food Business Owner

These findings suggest that while MSMEs recognize the benefits of accounting technologies, financial constraints and limited digital literacy continue to hinder full adoption. Nevertheless, respondents acknowledged that digital accounting systems improve efficiency, transparency, and business growth. This finding is supported by Al-Okaily et al. (2022), who found that the adoption of digital accounting information systems enhances financial decision-making and operational efficiency, although implementation is often constrained by financial and technical capabilities among SMEs.

Extent of Innovation Management Among MSMEs in terms of Sensing

Results indicate that MSMEs use digital technologies to identify business opportunities and expand market reach. Respondents highlighted the effectiveness of social media advertisements in increasing business visibility. Interview data support these findings:

> *"It makes all of our outputs visible to more people."* – Videography Business Owner

Table 7. *Extent of Innovation Management Among MSMEs in terms of Sensing*

Items	Mean	Verbal Description
Actively examine business practices to improve operations and decision-making	3.50	Always
Regularly observe developments in market conditions to identify opportunities and adapt business strategies	3.41	Always
Monitor competitors' business progress to stay informed about industry trends and maintain a competitive edge	3.47	Always
Keep track of innovative methods to enhance the quality and efficiency of products or services	3.49	Always
Continuously analyzing market trends, competitor strategies, and industry innovations as essential for the success of the business	3.50	Always
Overall	**3.47**	**Always**

However, cost remains a major barrier, particularly for microenterprises.

"It is difficult if we have to pay for it, but if it is free, it is acceptable." – Agriculture Trading Business Owner

Younger entrepreneurs were more receptive to adopting digital technologies, while traditional businesses continued to rely on manual practices.

"I want to modernize our business so we can keep up with global trends." – MSME Owner

These findings suggest that although MSMEs recognize the benefits of digital technologies, financial constraints and traditional business practices continue to limit adoption. This finding is consistent with Garad et al. (2021), who reported that digital technologies create new market opportunities and improve competitiveness among SMEs, but adoption is often constrained by financial resources and organizational readiness.

Extent of Innovation Management Among MSMEs in terms of Seizing

Table 8. *Extent of Innovation Management Among MSMEs in terms of Seizing*

Items	Mean	Verbal Description	Verbal Interpretation
Quickly gather information about changes in business practices to stay informed and adapt strategies	3.55	Always	Very High
Make an effort to respond promptly to changes in the business environment to maintain competitiveness	3.46	Always	Very High
Actively use information about industry trends and market shifts to support business development	3.45	Always	Very High
Continuously monitor business practices to identify opportunities for improvement and innovation	3.55	Always	Very High
Adapting quickly to business changes is essential for long-term success and growth	3.55	Always	Very High
Overall	**3.51**	**Always**	**Very High**

Results indicate that MSMEs demonstrate a very great extent of seizing capability (M = 3.51), reflecting their ability to act on market opportunities and adapt to changing business conditions. Interview data support these findings:

"We now accept bank transfers and already have clients outside Butuan." – MSME Owner
"With a proper system, we can eventually expand and even franchise the business." – Food Business Owner

Respondents also emphasized that digital systems improve planning and decision-making.

"I can monitor the remaining stocks and immediately prepare the schedule." – MSME Owner

However, cost remains a challenge for some businesses.

"It is difficult if we have to pay for it, but if it is free, it is acceptable." – MSME Owner

Despite these limitations, respondents expressed a willingness to innovate and adopt new technologies.

"I want to modernize our business so we can keep up with global trends." – MSME Owner

These findings suggest that MSMEs actively capitalize on market opportunities and adapt to changing business conditions, although financial constraints continue to influence technology adoption. This finding is supported by Teece et al. (2021), who emphasized that seizing capability enables firms to transform identified opportunities into competitive advantage through timely investments, innovation, and strategic decision-making.

Extent of Innovation Management Among MSMEs in terms of Transforming

Table 9. *Extent of Innovation Management Among MSMEs in terms of Transforming*

Items	Mean	Verbal Description	Verbal Interpretation
Actively utilize digital technology to improve business operations and efficiency	1.94	Sometimes	Moderate
Easily adapt to changes in the business environment to stay competitive	2.01	Sometimes	Moderate
Take immediate action to make necessary repairs or improvements when issues arise in my business	2.03	Sometimes	Moderate
Embrace changes and innovations that contribute to the growth and success of my business	1.95	Sometimes	Moderate
Believe that leveraging digital technology and adapting to change are essential for business sustainability and expansion	2.00	Sometimes	Moderate
Overall	**1.99**	**Sometimes**	**Moderate**

Results indicate that MSMEs demonstrate a moderate extent of transforming capability (M = 1.99), suggesting that digital transformation and process improvements are recognized but not consistently implemented.

Interview data support these findings:

"We still do our accounting manually because we do not have accounting software." – Retail Business Owner
"The challenge is learning and adapting to new technologies." – Rental Services Owner
"We check PHILGEPS, but our processes are still manual." – Medical Supplies Distributor

Despite these challenges, respondents acknowledged the benefits of digital transformation and automation.

"Business operations become much smoother when you have software." – Agriculture Trading Business Owner

These findings suggest that while MSMEs recognize the value of digital transformation, reliance on manual systems, limited digital skills, and adaptation challenges continue to hinder its full implementation. This finding is consistent with Wang et al. (2022), who found that SMEs often face barriers to digital transformation due to limited resources, technological capabilities, and employee readiness, despite recognizing its potential to improve operational performance.

Status of MSMEs Sustainability in terms of Environment

Results indicate that MSMEs demonstrate a low level of environmental sustainability practices (M = 1.54), with limited engagement in waste management, energy conservation, and environmental protection initiatives. Interview data support these findings:

"We are not familiar with environmental regulations." – Retail Business Owner
"No one informs us about programs on energy conservation or proper waste management." – MSME Owner

Respondents also said environmental actions are often driven by regulatory compliance rather than sustainability.

"We avoid spills because the penalties are expensive." – MSME Owner

Table 10. *Status of MSMEs' Sustainability in terms of Environment*

Items	Mean	Verbal Description	Verbal Interpretation
Take actions that help reduce air emissions	1.54	Never	Low
Effectively manage waste through sustainability initiatives	1.53	Never	Low
Take steps to minimize the use of hazardous, harmful, or toxic materials	1.53	Never	Low
Follow procedures to prevent environmental accidents	1.56	Never	Low
Practice energy conservation and efficiency to support energy savings	1.53	Never	Low
Overall	**1.54**	**Never**	**Low**

These findings suggest that limited awareness, inadequate guidance, and resource constraints hinder MSMEs' adoption of environmental sustainability practices. This finding is supported by Qalati et al. (2022), who found that SMEs' environmental sustainability practices are often constrained by limited knowledge, financial resources, and institutional support, resulting in compliance-driven rather than proactive environmental initiatives.

Status of Social Sustainability of MSMEs

Table 11. *Status of Social Sustainability of MSMEs*

Items	Mean	Verbal Description	Verbal Interpretation
Take actions that help reduce air emissions	1.54	Never	Low
Effectively manage waste through sustainability initiatives	1.53	Never	Low
Take steps to minimize the use of hazardous, harmful, or toxic materials	1.53	Never	Low
Follow procedures to prevent environmental accidents	1.56	Never	Low
Practice energy conservation and efficiency to support energy savings	1.53	Never	Low
Overall	**1.54**	**Never**	**Low**

Results indicate that MSMEs demonstrate a low level of social sustainability practices (M = 1.50), with limited attention given to employee welfare and community engagement.

Interview data support these findings:

> *"We do not have enough resources to provide health benefits."* – Videography Business Owner
> *"We pay our employees, but we cannot yet provide benefits such as insurance."* – Retail Business Owner

Community involvement was also limited, as many MSMEs focused primarily on daily business operations.

> *"We do not have enough time to participate in community activities."* – Food Business Owner

Despite these limitations, some respondents expressed willingness to adopt social sustainability initiatives if adequate support were available.

> "*If there are free training programs, we would be willing to participate."* – MSME Owner

These findings suggest that financial constraints and limited resources hinder the adoption of social sustainability practices, although MSMEs remain open to participating in such initiatives when provided with adequate support. This finding is consistent with Qalati et al. (2022), who found that resource limitations significantly affect SMEs' ability to implement social sustainability practices, while external support and capacity-building programs encourage greater participation.

Status of Economic Sustainability of MSMEs

Results indicate that MSMEs demonstrate a high level of economic sustainability (M = 3.53), supported by proactive financial management, savings, cost control, and diversified income sources.

Interview data support these findings:

> *"We always make sure we have savings for emergencies."* – Videography Business Owner
> *"We avoid excessive borrowing and always have a backup plan."* – Retail Business Owner

Respondents also emphasized income diversification and continuous efforts to maintain financial stability.

> *"We supply restaurants, markets, and direct customers, so we are not dependent on a single source of income."* – Food Business Owner
> *"We are always looking for new clients to keep our income stable."* – MSME Owner

Table 12. *Status of Economic Sustainability of MSMEs*

Items	Mean	Verbal Description	Verbal Interpretation
Business has a consistent and predictable revenue stream	3.53	Always	Very high
Business has developed a diversified customer base, reducing reliance on a single revenue source	3.48	Always	Very high
Business maintains a manageable level of debt in relation to its profit	3.54	Always	Very high
Established contingency plans to mitigate potential financial risks	3.56	Always	Very high
Business invests in innovation and technology to improve productivity and efficiency	3.51	Always	Very high
Overall	**3.53**	**Always**	**Very high**

Despite challenges such as limited access to financing and market uncertainty, MSMEs relied on prudent financial management and business expansion strategies to sustain their operations. This finding is consistent with Qalati et al. (2022), who reported that sound financial management, income diversification, and strategic planning significantly contribute to the economic sustainability and resilience of SMEs.

Status of MSMEs Sustainability in Butuan City in terms of Mission and Vision

Table 13. *Status of MSMEs Sustainability in Butuan City in terms of Mission and Vision*

Items	Mean	Verbal Description	Verbal Interpretation
Contribute to creating meaningful and sustainable value for society	3.49	Always	Very high
Actively support the continuity and preservation of cultural traditions	3.48	Always	Very high
Contribute to the development and enhancement of cultural well-being in the community	3.51	Always	Very high
Engage in practices that nurture spiritual well-being and sense of purpose	3.48	Always	Very high
Strengthen faith and cultivate a deeper relationship with God through actions	3.52	Always	Very high
Overall	**3.50**	**Always**	**Very high**

Results indicate that MSMEs demonstrate a high level of sustainability in terms of mission and values (M = 3.50), reflecting strong alignment between business practices and ethical, spiritual, and community-oriented principles.

Interview data support these findings:

> *"Our business is not just about making money; we also want to give back to the community and live out our values."* – MSME Owner

Respondents emphasized that business decisions are guided by integrity, social responsibility, and a commitment to serving the community while pursuing long-term growth.

These findings suggest that MSMEs are strongly value-driven, with mission and values serving as the foundation of their business operations despite financial and competitive challenges. This finding is consistent with Tencati et al. (2020), who found that SMEs with clearly defined ethical values and socially responsible business practices are more likely to achieve long-term sustainability and strengthen stakeholder trust.

Mediating Effect of Digital Technology on the Relationship between Innovation Management and Sustainability of MSMEs

Table 14. *Mediating Effect of Digital Technology on the Relationship between Innovation Management and Sustainability of MSMEs*

Path / Effect	Estimate (β)	SE	p-value	95% Bootstrapped CI
Path a: Innovation Management → Digital Tech	0.42	0.07	<.001	[0.28, 0.56]
Path b: Digital Tech → Sustainability	0.91	0.12	<.001	[0.68, 1.15]
Path c: Total Effect (IM → Sustainability)	0.81	0.09	<.001	[0.63, 0.99]
Path c′: Direct Effect (IM → Sustainability, controlling for Digital Tech)	0.43	0.08	<.001	[0.27, 0.59]
Indirect Effect (ab)	0.38	0.06	–	[0.27, 0.51]

The mediation analysis confirmed that digital technology enablement significantly mediates the relationship between innovation management and sustainability. Path a showed that innovation management positively predicts digital technology adoption ($\beta = 0.42$, $p < .001$), while path b demonstrated that digital technology strongly predicts sustainability outcomes ($\beta = 0.91$, $p < .001$). The total effect (path c) of innovation management on sustainability was significant ($\beta = 0.81$, $p < .001$), but when digital technology was included in the model, the direct effect (path c′) was reduced to $\beta = 0.43$, $p < .001$. The indirect effect (ab) was $\beta = 0.38$, with a 95% bootstrapped CI [0.27, 0.51], confirming mediation since the confidence interval did not include zero. Approximately 53% of the total effect was explained by the indirect pathway, indicating that digital technology serves as a substantial mechanism through which innovation management enhances sustainability among MSMEs. This finding supports Al Nuaimi et al. (2024), who argue that digitalization strengthens the link between innovation and sustainable performance in resource-constrained enterprises.

Table 15. *Multiple Regression Analysis Showing the Effect of Innovation Management on the Sustainability of MSME*

Innovation Management	Sustainability		5% Level of Significance H0 is	Conclusion
	ρ	p		
Transforming	.384	.000	Reject	Significant
Seizing	.350	.000	Reject	Significant
Sensing	.086	.002	Reject	Significant
Overall	**.874**	**.000**	**Reject**	**Significant**

Note. R = .874, R^2=. 763, Adjusted R^2=.761

Regarding the significant effect of innovation management on MSME sustainability, the results indicate that transforming, seizing, and sensing capabilities significantly influence MSME sustainability, with transforming and seizing showing the strongest effects. This highlights the importance of innovation practices in supporting long-term business success.

Interview data support these findings:

> *"We can easily monitor our expected revenue for the month."* – Videography Business Owner
> *"With just one click, the transaction is completed within seconds."* – Food Business Owner
> *"We immediately check the iPad and assign the work."* – Construction Business Owner

However, respondents identified cost as an ongoing barrier to adopting innovation.

> *"We still have to purchase the software license, and it is expensive."* – MSME Owner

These findings suggest that innovation practices, supported by digital technologies, play a vital role in sustaining MSMEs despite financial and capability constraints. This finding is consistent with Teece (2021), who emphasized that sensing, seizing, and transforming capabilities enable firms to continuously innovate, adapt to changing environments, and achieve sustainable competitive advantage.

Regarding significant differences in MSME innovation management by profile, the results indicate that innovation management varies by workforce size, capital, and business type, but not by years of operation. MSMEs with greater resources demonstrated stronger innovation practices and wider use of digital technologies.

Interview data support these findings:

"The biometric system makes attendance monitoring more transparent and fair." – Large Enterprise Personnel
"Usability is not the problem – the cost is." – MSME Owner
"We monitor Facebook inquiries so we can plan our manpower accordingly." – MSME Owner

Table 16. *Test on the Significant Difference in Innovation Management Practices When Grouped According to Profile Indicators*

Profile Indicators	Innovation Management	χ^2	p	Conclusion	Decision
Number of Workers	Sensing	26.7	< .001	Significant	Reject Ho
	Seizing	25.5	< .001	Significant	Reject Ho
	Transforming	27.1	< .001	Significant	Reject Ho
Starting Capital	Sensing	24.8	< .001	Significant	Reject Ho
	Seizing	23.9	< .001	Significant	Reject Ho
	Transforming	25.6	< .001	Significant	Reject Ho
Type of Business	Sensing	22.7	< .001	Significant	Reject Ho
	Seizing	21.9	< .001	Significant	Reject Ho
	Transforming	23.4	< .001	Significant	Reject Ho
Years of Experience	Sensing	0.16	0.69	Not Significant	Accept Ho
	Seizing	0.08	0.78	Not Significant	Accept Ho
	Transforming	0.06	0.81	Not Significant	Accept Ho

These findings suggest that innovation management is influenced more by organizational resources and business needs than by years of experience alone. This finding is consistent with Kraus et al. (2022), who reported that firm size, resource availability, and organizational characteristics significantly influence innovation capability and digital technology adoption among SMEs.

Table 17. *Test on the Significant Difference in Sustainability When Grouped According to Profile Indicators*

Profile Indicators	Sustainability Indicator	χ^2	p	Conclusion	Decision
Number of Workers	Environmental	27.3	< .001	Significant	Reject Ho
	Social	27.4	< .001	Significant	Reject Ho
	Economic	24.8	< .001	Significant	Reject Ho
	Mission and Vision	25.7	< .001	Significant	Reject Ho
Starting Capital	Environmental	26.9	< .001	Significant	Reject Ho
	Social	26.4	< .001	Significant	Reject Ho
	Economic	25.2	< .001	Significant	Reject Ho
	Mission and Vision	26.1	< .001	Significant	Reject Ho
Type of Business	Environmental	25.8	< .001	Significant	Reject Ho
	Social	26.0	< .001	Significant	Reject Ho
	Economic	24.9	< .001	Significant	Reject Ho
	Mission and Vision	25.5	< .001	Significant	Reject Ho
Type of Business	Environmental	22.7	< .001	Significant	Reject Ho
	Social	24.9	< .001	Significant	Reject Ho
	Economic	21.9	< .001	Significant	Reject Ho
	Mission and Vision	23.4	< .001	Significant	Reject Ho
Years of Experience	Environmental	1.15	0.28	Not Significant	Accept Ho
	Social	0.01	0.95	Not Significant	Accept Ho
	Economic	1.26	0.26	Not Significant	Accept Ho
	Mission and Vision	0.51	0.48	Not Significant	Accept Ho

On the significant difference in sustainability when grouped according to the profile, results indicate that MSME sustainability varies significantly by number of workers, starting capital, and type of business, but not by years of operation. Firms with greater resources tend to demonstrate stronger sustainability practices across environmental, social, economic, and mission and values dimensions.

Interview data support these findings:

"Because we have more capital, we were able to install solar panels and provide health benefits to our employees." – Large Enterprise Personnel
"Our priority is maintaining a stable supply and consistent income." – MSME Owner
"I have been in business for many years, but our operations are still quite basic." – Long-time Business Owner

These findings suggest that sustainability depends more on organizational resources and business context than

on years of experience alone. This finding is consistent with Kraus et al. (2022), who found that resource availability and organizational characteristics are stronger determinants of SME sustainability than firm age, as greater resources enable businesses to invest in sustainable practices and long-term resilience.

Regarding the demographic profile of MSMEs as a moderator in the relationship between innovation management and MSME sustainability, Table 18 shows that the number of workers and years of experience strengthen the relationship between innovation management and MSME sustainability, while starting capital is not a significant moderator. Type of business also has a strong moderating effect, indicating that industry context shapes innovation outcomes.

Table 18. *Summary of Regression Parameters of MSMEs Profile as Moderator Between Innovation Management and Sustainability*

Moderating Variables	B	SE	t	p
No. of workers	.15	.07	2.14	.033
Years of Experience	.15	.02	2.33	.020
Starting Capital	.13	.03	1.02	.305ns
Type of Business	-.34	.03	-10.37	.000

R=.8164, R2=.666, MSE=.0172, F=257.8866 df1=3, df2=387, p=.000

Interview data support these findings:

> *"We currently have almost 20 employees."* – MSME Owner
> *"If you cannot compete, your business can easily fail."* – MSME Owner
> *"I did not invest my own money; the farmers supplied the products."* – MSME Owner
> *"We started with Instagram and Facebook because promoting the business is essential."* – MSME Owner

These findings suggest that innovation contributes more to sustainability when supported by workforce capacity, business experience, and industry context than by financial capital alone. This finding is consistent with Teece (2021), who emphasized that innovation effectiveness depends on firm-specific capabilities, organizational resources, and the competitive environment in which firms operate.

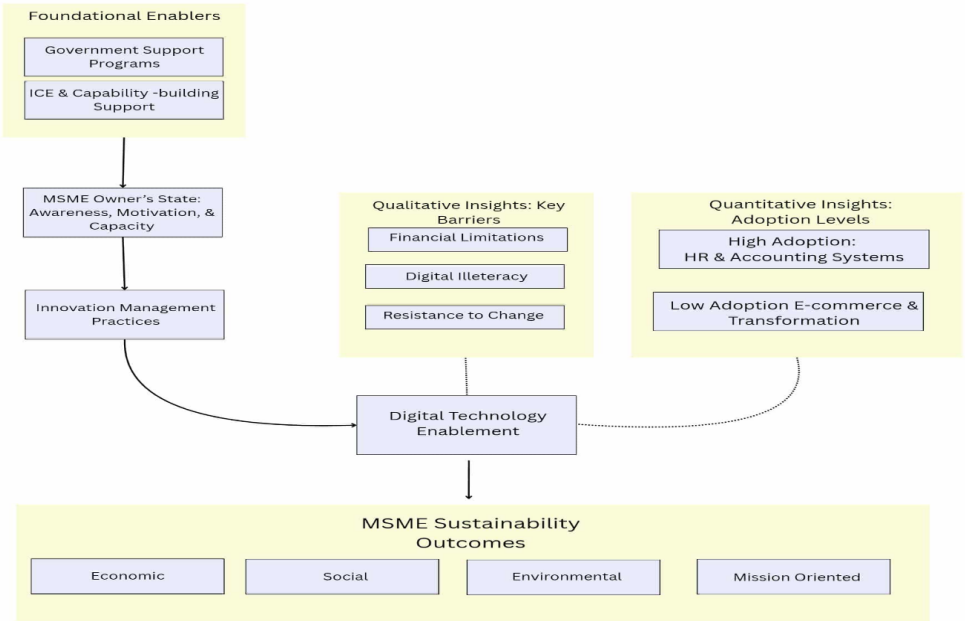


Figure 1. *Proposed MSME Innovation Framework for Sustainability*

In the proposed innovation framework for MSME sustainability in Butuan City, Figure 3 shows that MSME sustainability is driven by a system of interconnected factors: Government Support Programs, IEC and Capability-Building Support, Innovation Management Practices, and Digital Technology Enablement. Government support is the main external driver, reducing barriers such as limited funds, lack of technology, and low expertise. IEC and capability-building further strengthen MSMEs by improving knowledge, skills, and absorptive capacity, enabling owners to apply innovation more effectively. Innovation management (sensing, seizing, and transforming) is the core process, but the study found that while MSMEs are strong in sensing and seizing opportunities, they are weak in transformation due to limited systems and resources. This limits full sustainability outcomes. Digital technology supports and accelerates innovation by improving coordination, decision-making, and operational efficiency, although many MSMEs only use basic digital tools rather than full digital systems. Overall, MSME sustainability—covering economic, social, and environmental dimensions—is achieved when government support, capability-building, innovation practices, and digital transformation work together to move MSMEs beyond profit-focused operations toward more balanced and sustainable development.

Conclusion

This study shows that MSME sustainability in Butuan City is strengthened not only by innovation management but, more importantly, by integrating it with digital technology enablement. Innovation capabilities such as sensing, seizing, and transforming become more effective when digital tools improve coordination, decision-making, and operational efficiency. A key contribution of the study is identifying digital technology enablement as a mediating mechanism that amplifies innovation's impact on sustainability, highlighting that digital transformation is essential to converting innovative efforts into long-term economic, social, and environmental outcomes. This implies that MSME development initiatives should prioritize strengthening innovation capacity and digital readiness together, rather than treating them as separate interventions.

The findings also have important implications for policy, education, and future research. Policy-wise, they call for stronger ecosystem-based support involving LGUs, DTI, DOST, and academic institutions to address gaps in digital access, innovation capability, and sustainability practices among micro-scale enterprises. Educationally, entrepreneurship and innovation programs need to be strengthened by integrating practical digital skills and applied innovation management training. For future research, longitudinal and comparative studies are recommended to examine how MSMEs evolve in their adoption of innovation and digital technologies over time, and to explore other factors such as leadership, organizational culture, and external networks that may further influence sustainability outcomes.

Contributions of Authors

Not indicated

Funding

Not indicated

Conflict of Interests

Not indicated

Acknowledgment

Not indicated

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