

# Challenges and Opportunities in the Digital Integration of Rural Micro, Small and Medium Enterprises in Siaya County, Kenya

Oguturu Samuel Trevor, Joseph Mutungi, & Rosalind N Macharia

National Defence University, Kenya (NDU K)

DOI: <https://doi.org/10.51584/IJRIAS.2026.11090047>

Received: 13 September 2026; Accepted: 18 September 2026; Published: 08 October 2026

## ABSTRACT

This study explored the challenges and opportunities of digitally integrating rural Micro, Small, and Medium Enterprises (MSMEs) in Siaya County, Kenya, guided by the Technology Acceptance Model (TAM) and Diffusion of Innovations (DOI) theory. This study used a descriptive mixed-methods survey design. The population covered 4,800 MSMEs across 6 sub-counties of Siaya County. The MSME sample size was determined using Yamane's formula, yielding 370 MSMEs and 10 key informants were purposively selected for qualitative information. A total of 300 questionnaire responses were received and were valid for quantitative analysis. The study used structured questionnaires and semi-structured interviews to collect data. Data analysis used quantitative methods (frequency, percentage, mean, and standard deviation) and qualitative methods (thematic analysis). Findings showed both opportunities and challenges for rural MSMEs in digital integration. There are opportunities to market, access the market, sell, and make financial transactions on digital platforms, but there are gaps in formal training on digital skills, financing, infrastructure, and institutional support. The study recommends providing practical digital-skills training for rural MSMEs in Siaya County, as well as improving access to relevant financing, adequate power supply and internet connectivity, and robust institutional support for MSMEs in rural areas of Siaya County.

**Keywords:** Digital Integration; Rural MSMEs; Digital Adoption; Digital Skills; Digital Finance

## INTRODUCTION

Digitalization plays a vital role in modern business, transforming how businesses produce, market, sell, and manage goods and services. Digital platforms have empowered small businesses to reach and educate customers, facilitate payments, and access markets previously out of reach. As a result, adopting technology and embracing digital transformation are increasingly important for the competitiveness and sustainability of small businesses (Faruque et al., 2024). Government support is also crucial, as it promotes technology use, boosts innovation, improves skills, and enables digital transformation (Chen et al., 2021). For MSMEs, digital integration is more than a technological change; it is part of the ongoing evolution of business operations in today's market.

This difference is especially notable among rural MSMEs, whose work environments differ from those in well-connected urban areas. While rural entrepreneurs may own a mobile phone or have access to social media, digital marketplaces, and mobile money, their devices often face connectivity issues, lack electricity, or have high data costs, and they may lack digital skills. Digital platforms offer opportunities to reach larger markets and improve financial transactions, but these benefits depend on the enterprise's resources and its ability to use the platform effectively. Empirical studies from developing economies show that digital tools can improve business operations and market engagement, yet evidence indicates that limited skills and infrastructure hinder their use (Gao et al., 2023). Therefore, both technological opportunities and enterprise conditions influence the adoption of digital solutions in rural areas.

MSMEs in Kenya play a crucial role in the economy through employment and income, and their adaptation to technology is vital for economic resilience. The nation promotes digital transformation via the National Digital Master Plan (2022–2032), with digital financial services boosting online transactions (Kenya National

Treasury, 2023). Mobile money and e-commerce have expanded opportunities for businesses to serve customers better and grow their reach. Nevertheless, benefits are not evenly distributed geographically. Recent studies highlight ongoing challenges such as inconsistent internet, high digital tool costs, and low digital literacy outside urban areas (Irer, 2022). Development opportunities and barriers to participation continue to shape Kenya's digital evolution.

The digital integration of MSMEs in Siaya County is evident, with many enterprise activities now connected to web marketing and electronic transactions. However, access to supporting infrastructure remains uneven. Rural businesses face limitations in using and maintaining digital technologies because of poor internet connectivity, unreliable electricity, limited digital skills, and insufficient access to funds (Gao et al., 2023). Successful participation in the digital economy depends on government support, training, and incentives that strengthen small enterprises' capacity (Lunyungu, 2024). Key factors in overcoming challenges and seizing opportunities include developing digital skills, improving infrastructure, securing finance, and providing institutional support—all of which are vital.

## AIM

To examine the challenges and opportunities influencing the digital integration of rural Micro, Small and Medium Enterprises (MSMEs) in Siaya County, Kenya.

## THEORETICAL FRAMEWORK

### Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis (1989), explains technology acceptance through two central constructs: perceived usefulness and perceived ease of use. Perceived usefulness refers to the extent to which users believe that a technology can improve their performance, while perceived ease of use refers to the extent to which they perceive the technology as requiring minimal effort. In the context of rural MSMEs, these constructs provide a basis for examining how business owners perceive the usefulness and practicality of digital technologies such as digital payments, online marketing, e-commerce, and other digital business solutions. The model is relevant to this study because the adoption of digital technologies may depend not only on their availability but also on whether MSME operators perceive them as useful, manageable, and appropriate for their business activities.

In this study, TAM was used to assess digital awareness, digital skills, training opportunities, and the perceived usefulness and usability of digital technologies in business operations. The study examined these aspects alongside respondents' reported experiences with digital integration. The study therefore used TAM to interpret the individual-level dimensions of digital technology use among rural MSMEs. For example, digital skills and training were considered relevant to the extent to which MSME operators can use digital technologies effectively. In contrast, perceptions of digital benefits relate to TAM's usefulness dimension. This application allows the study to distinguish between awareness or access to technology and the capacity and willingness to use it in business activities.

A limitation of TAM is that it emphasizes individual perceptions and technology acceptance more than the broader organizational and environmental conditions surrounding adoption. In rural MSMEs, factors such as financing, electricity reliability, internet connectivity, institutional support, and access to digital hardware may affect the ability to use technologies even where they are perceived as useful and easy to use. The present study therefore treats these structural conditions as complementary factors when interpreting digital integration rather than attributing digital adoption solely to individual perceptions. TAM provides the study's individual-level perspective, while DOI offers a broader explanation of how digital technologies are adopted and diffused within the MSME environment.

### Diffusion of Innovations (DOI) Theory

According to the Diffusion of Innovations (DOI) theory developed by Rogers (1962), new ideas, technologies,

and practices spread over time within a social system. The theory examines five factors that influence an innovation's adoption – relative advantage, compatibility, complexity, trialability, and observability. These concepts refer to the perceived benefits of an innovation relative to existing practices, the consistency of an innovation with existing needs and practices, the difficulty of understanding or using the innovation, the opportunity to experiment with the innovation, and the visibility of the results of the innovation, respectively. These dimensions provide a useful framework for discussing the conditions under which MSMEs in rural areas decide to use or adopt digital technologies.

This study used the DOI framework to analyze perceived benefits of digital technologies, digital awareness, digital skills and training, experimentation and learning, and the compatibility of digital technologies with MSME business activities. Digital marketing, e-commerce, digital payments, and other digital solutions are innovations that can develop significantly, depending on the benefits business operators perceive, their knowledge of the innovations, their skills to apply them, and their capacity to incorporate them into business processes. The theory also guides the analysis of how informal learning, peer support, and interactions with other digitally engaged businesses relate to the diffusion of digital practices among rural entrepreneurs.

The study also took into account broader factors that might allow or hinder the spread of digital technologies: access to funding, internet connectivity, electricity supply reliability, digital hardware, government programs, and institutional support. These factors were analyzed as contextual factors of the adoption process but were not considered direct DOI constructs. This distinction matters because DOI mainly describes an innovation's traits and its spread in a social system, and this study also aimed to identify practical barriers confronting rural MSMEs. Therefore, combining TAM and DOI enables a more comprehensive understanding of digital technology diffusion. TAM aims to measure users' perceptions of usefulness and ease of use.

### **Application of TAM and DOI in the Study**

The two theories were applied in a complementary way. TAM was included to explore the individual facets of technology acceptance, including perceptions of usefulness and ease of use related to digital awareness, skills, training, and the use of digital technologies. The conceptualization of innovation and the social-context dimensions of digital integration, built on the DOI, was informed by the abovementioned. This study also included financing, infrastructure, and institutional support as contextual factors that can help or hinder the effective use of digital technologies.

Therefore, digital integration, as the study's lens, allowed the researcher to consider two related perspectives: MSME operators' perspectives on digital integration and how digital technologies are used, and the broader rural business environment in which digital technologies are integrated. This theoretical mini-mix was very pertinent for the study, as the findings indicated that digital awareness and use have coexisted despite gaps in formal training, financing, infrastructure, and institutional support. This led to the theories offering complementary lenses for understanding the opportunities and challenges for digital integration for rural MSMEs in Siaya County.

## **METHODOLOGY**

This study used a descriptive mixed-methods survey design to gain an in-depth understanding of the factors and opportunities affecting the digital integration of Micro, Small, and Medium Enterprises (MSMEs) in rural areas of Siaya County, Kenya. The quantitative study included 4,800 MSMEs across Siaya County's six sub-counties. Additionally, 10 key informants were purposively sampled to provide qualitative insights for analysis of MSMEs' digital integration issues. For the MSMEs, the sample size was calculated using Yamane's formula, yielding 370 MSMEs at a 5% margin of error. The study purposively selected 10 key informants. The study used stratified random sampling, stratified by the six sub-counties, with simple random sampling within each sub-county. The study used structured questionnaires to collect quantitative data and semi-structured questionnaires to collect qualitative data from the key informants. A pre-test was conducted on a pilot scale with 37 MSMEs in Busia County to test the instrument's validity and reliability, and Cronbach's alpha was used to assess its internal consistency. The study conducted a descriptive quantitative analysis of the quantitative data, computing frequencies, percentages, means, and standard deviations. The study analyzed

qualitative interview data using themes.

### Measurement Instrument and Operationalization of Constructs

The study used a questionnaire and a semi-structured interview guide to collect quantitative and qualitative data, respectively. Based on TAM and DOI theory and the study objectives and research questions, the questionnaire was developed. It includes digital adoption and integration, digital skills and training, access to financing, digital infrastructure, government and institutional support, and economic-security outcomes. The questionnaire included categorical items, multiple-response items, and 5-point Likert scales ranging from 1 = Strongly Disagree to 5 = Strongly Agree. We used revenue stability, market reach, business continuity, and employment outcomes as measures of economic security. The constructs were operationalized using observable indicators of training, financing, infrastructure, institutional support, and economic security.

**Table 1: Operationalization of Constructs and Measurement Items**

| Construct                                            | Operational definition                                                                      | No. of items | Measurement scale | Cronbach's Alpha* |
|------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------|-------------------|-------------------|
| <b>Digital skills and training</b>                   | Availability of digital skills, training opportunities and digital awareness                | 3            | 1–5 Likert scale  | 0.78              |
| <b>Access to financing</b>                           | Availability of finance and financing-related barriers to digital investment                | 3            | 1–5 Likert scale  | 0.81              |
| <b>Digital infrastructure</b>                        | Internet connectivity, electricity reliability and digital hardware accessibility           | 3            | 1–5 Likert scale  | 0.76              |
| <b>Government policies and institutional support</b> | Government policies, county programmes and institutional support for digital transformation | 3            | 1–5 Likert scale  | 0.83              |
| <b>Economic security</b>                             | Revenue stability, business continuity, market reach and employment outcomes                | 12           | 1–5 Likert scale  | 0.86              |

### Validity, Pilot Testing and Reliability

Research instruments were determined to be valid through expert review and pilot testing. Two academic supervisors from the National Defence University-Kenya and two practitioners in MSME digitalization and economic development reviewed the questionnaire and interview guide for clarity, relevance, logical order, and adequacy. Based on their recommendations, the authors revised the wording, sequencing, structure, and item coverage. To assess question clarity, response categories, and internal consistency, a pilot study was conducted with responses from 37 MSMEs, representing a mere 10% of the calculated sample size of 370 in Busia County. Items that lacked context, were repetitive, were not relevant, or were poorly aligned were revised. Cronbach's alpha was computed in SPSS version 25 to assess the instrument's reliability, with 0.70 as the acceptable cut-off.

### Qualitative Data Analysis and Trustworthiness

The semi-structured interviews yielded qualitative data that were analyzed thematically. The recorded and transcribed interviews were read several times to become acquainted with the material. Initial codes were selected for meaningful statements and responses regarding adoption, skills, funding, infrastructure, institutional support, and economic security in relation to digitalization. Codes were grouped into (SUB THEMES) and then condensed into more general themes (THEMES) according to the overall study goals and insights gained during the study. The study achieved high credibility and trustworthiness through careful transcription, consistent coding, cross-checking responses across key informants, and verifying emerging interpretations against the original interview responses. The additional themes presented alongside the quantitative findings served as complementary explanations for the final themes.

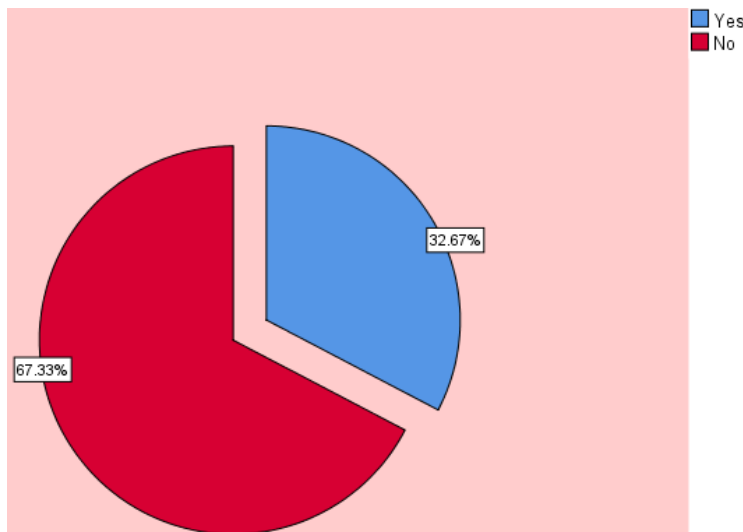
## RESULTS

### Challenges and opportunities

This study aimed to identify the challenges and opportunities of MSME digital integration in Siaya County. To meet this objective, structured questions were asked, and results are presented below;

#### Formal Digital-Skills Training

Respondents were asked, “Have you or your employees received any formal digital-skills training in the last two years?” Their responses are presented below.



**Figure 1: Formal Digital-Skills Training**

(Source: Researcher, 2026)

Figure 1 shows that most respondents (67.3%) have not received formal digital skills training, while only 32.7% reported receiving structured digital training. These results may indicate that, despite MSMEs' digital integration in Siaya County, it remains largely informal, based on learning and adaptation through experience rather than formal capacity-building models. The link between untrained operators and variability in digital performance and economic security may be partly due to their prevalence. To place these quantitative findings in context, qualitative interviews provided insight into issues of low-structured digital training opportunities:

*“In the majority of cases, formal training programs are not available, and most MSME owners acquire digital skills through trial and error or with the help of peers or mentors.”* (KI6, Digital Innovation Hub Representative, Interview, 2026)

Another stakeholder reinforced this perspective:

*“We have the occasional workshops, which are not reaching out to most of the rural entrepreneurs, who require regular capacity building in digital issues.”* (KI2, Trade Development Officer, Interview, 2026)

These results align with previous empirical studies. According to Matambo (2023), insufficient formal training in digital skills limits rural companies' ability to use technology successfully. Similarly, Mer and Viridi (2024) observed that informal learning processes prevail in digital adoption mechanisms in developing settings, often creating uneven technological savvy and inefficient business practices. The small number of formally trained respondents suggests the need to expand organized digital capacity-building programs that support positive, sustainable digital integration and strengthen MSMEs' long-term economic and financial security.

### Provider of Formal Digital-Skills Training

The study sought to examine the Provider of Formal Digital-Skills Training, and results were as presented below;

**Table 2: Provider of Formal Digital-Skills Training**

|                      | Frequency | Percent |
|----------------------|-----------|---------|
| County Government    | 19        | 18.10%  |
| Private Organization | 45        | 42.90%  |
| Self-sponsored       | 41        | 39.00%  |
| Total                | 105       | 100.00% |

(Source: Researcher, 2026)

According to Table 2, private organizations had the highest share of respondents reporting that they provided formal training in digital skills, with 42.9% of respondents in this subgroup reporting it. Also, 39.0% of respondents said they were self-sponsored for training, and 18.1% received training from the County Government. Private organizations and self-sponsored training were the predominant types of formal digital-skills training reported by respondents providing data on training providers. This indicates greater investment in the formal development of digital skills by the private sector and individuals than by the County Government. A key informant noted:

*“A majority of formalized online training programs are being provided by privately based innovation hubs and NGOs with little to no government participation.”* (KI6, Digital Innovation Hub Representative, Interview, 2026)

Another respondent emphasized:

*“Entrepreneurs consider it important to invest in their own online learning since a wait till county programs can delay business development.”* (KI5, MSME Association Representative, Interview, 2026)

These results are consistent with larger empirical data suggesting that private-sector actors often stay ahead of the curve in digital skills in emerging economies. The researchers found that non-governmental and private institutions play a crucial role in reducing digital inequities in places where the training system is not well developed (Parkinson, 2024). Similarly, Nwoke et al. (2022) noted that self-funded learning reflects entrepreneurial adaptability but can also increase inequality between resource-endowed and resource-constrained businesses. In Siaya County, only 18.1% of MSMEs have digital capacity deemed adequate, indicating that the county should pursue more effective institutional collaboration to achieve sustainable and equitable digital coverage across the county.

### Institutional Support and Digital Capacity Indicators

This section sought to evaluate the respondent’s perception of Institutional Support and Digital Capacity Indicators, and the results are as revealed below;

**Table 3: Institutional Support and Digital Capacity Indicators**

| Indicator                                         | Yes         | No          | Total (N) |
|---------------------------------------------------|-------------|-------------|-----------|
| Has staff dedicated to digital operations         | 56.7% (170) | 43.3% (130) | 300       |
| Has access to credit/loans for digital investment | 55.7% (167) | 44.3% (133) | 300       |

|                                                   |             |             |     |
|---------------------------------------------------|-------------|-------------|-----|
| Aware of County/National digital support programs | 56.0% (168) | 44.0% (132) | 300 |
| Benefited from government program/incentive       | 60.0% (180) | 40.0% (120) | 300 |

(Source: Researcher, 2026)

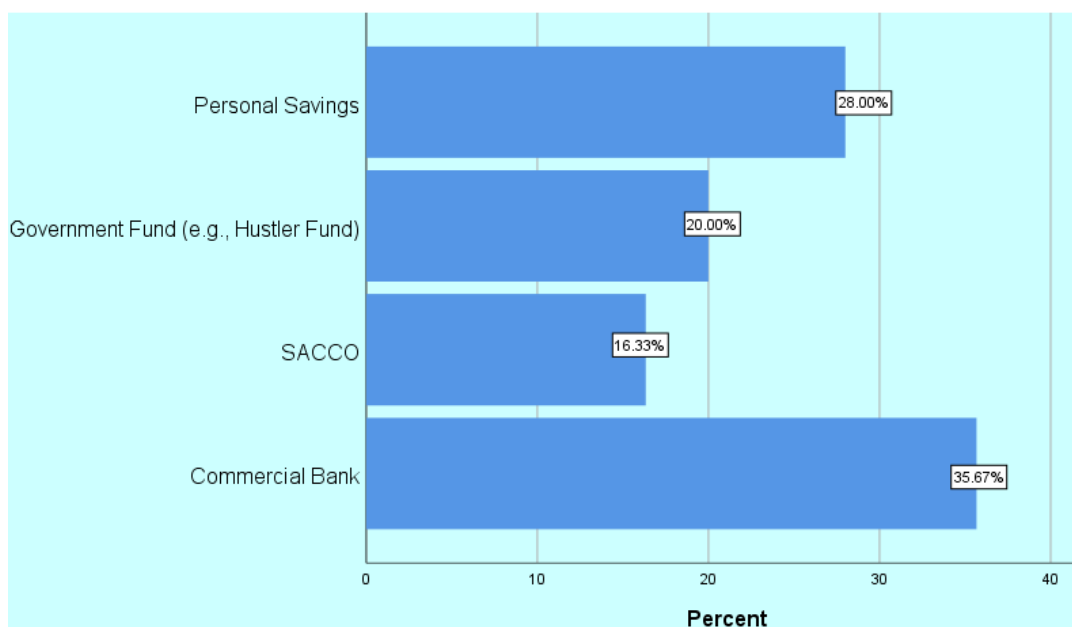
Table 3 shows a moderate level of institutional and financial backing for digital integration among MSMEs in Siaya County. A little more than half of respondents reported having dedicated digital staff (56.7%), access to credit to invest in digital (55.7%), and knowledge of government digital support schemes (56.0%). Also, 60.0% reported benefiting from such programs, suggesting partial and uneven institutional facilitation. To put these quantitative results into perspective, interview responses indicated both progress and structural deficiencies in institutional reach:

*“There are government programs, though these are usually based on awareness, networking, or previous interaction with county offices.”* (KI2, Trade Development Officer, Interview, 2026)

The findings can be compared with a larger body of empirical evidence supporting the importance of institutional ecosystems in facilitating MSME digital transformation. According to Okoye and Mensah (2025), access to credit facilities and knowledge of government digitalization initiatives play a significant role in increasing the likelihood of technology adoption among small businesses. Subsidies and strategic alignment through policy awareness ease entry and increase investment. Similarly, Sharma et al. (2023) posit that digital preparedness initiatives, even when government-led, can produce discrepancies in enterprise-level results due to uneven distribution, bureaucracy, resource-limited structures, and a lack of outreach mechanisms in rural and resource-limited conditions.

### Most Common Source of Financing

Respondents were asked, *“What is your most common source of financing?”* and their responses were as presented below;



**Figure 2: Most Common Source of Financing**

(Source: Researcher, 2026)

Figure 2 shows that commercial banks are the most common source of financing for MSMEs in Siaya County, cited by 35.7% of respondents. Personal savings are next at 28.0%, followed by government funds such as the Hustler Fund at 20.0%. SACCOs are the least used at 16.3%. These results are notable because they suggest that funding from formal financial institutions and internal capital remain the primary sources for digital and

operational investments. To put these results in perspective, some qualitative findings from the study include: Financing constraints despite multiple financing options:

*“Many businesses prefer commercial banks as they offer larger amounts of loans; however, they have stringent requirements which often restrict accessibility for smaller enterprises.”*  
(KI4, Financial Institution Representative, Interview, 2026)

These results align with a broader literature identifying access to finance as a key driver of MSME growth and digital transformation. Siasulingana (2024) argues that structured lending mechanisms offered by formal banking institutions improve enterprise expansion, capital investment, and technological upgrading. Access to institutional credit would allow businesses to invest in digital tools and operate more efficiently. However, Unegbu et al. (2024) note that heavy reliance on personal savings often reflects low eligibility for formal credit, especially among micro-enterprises in rural areas, limiting scale and long-term financial sustainability.

### Digital Adoption Barriers, Infrastructure and Policy Environment

The study sought to assess respondents’ perceptions of Digital Adoption Barriers, Infrastructure, and the Policy Environment. To answer this question, a structured questionnaire was administered, and respondents indicated the extent to which they agreed with the statements, with 1 representing Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

**Table 4: Digital Adoption Barriers, Infrastructure and Policy Environment**

| Statement                                      | Strongly Disagree | Disagree   | Neutral     | Agree      | Strongly Agree | Mean        | SD          |
|------------------------------------------------|-------------------|------------|-------------|------------|----------------|-------------|-------------|
| Lack of digital skills limits adoption         | 28.3% (85)        | 7.0% (21)  | 13.3% (40)  | 17.7% (53) | 33.7% (101)    | 3.21        | 1.64        |
| Training opportunities readily available       | 27.7% (83)        | 10.0% (30) | 12.3% (37)  | 22.7% (68) | 27.3% (82)     | 3.12        | 1.59        |
| Digital awareness has improved                 | 16.7% (50)        | 9.0% (27)  | 22.7% (68)  | 23.0% (69) | 28.7% (86)     | 3.38        | 1.41        |
| Adequate access to financing                   | 17.3% (52)        | 7.0% (21)  | 22.0% (66)  | 22.3% (67) | 31.3% (94)     | 3.43        | 1.43        |
| Loan requirements hinder growth                | 4.7% (14)         | 14.7% (44) | 32.0% (96)  | 21.7% (65) | 27.0% (81)     | 3.52        | 1.17        |
| Govt-funded programs improved credit access    | 6.3% (19)         | 12.0% (36) | 29.7% (89)  | 22.7% (68) | 29.3% (88)     | 3.57        | 1.21        |
| Internet connectivity supports operations      | 7.3% (22)         | 7.7% (23)  | 32.0% (96)  | 21.3% (64) | 31.7% (95)     | 3.62        | 1.21        |
| Electricity reliability affects digital use    | 7.0% (21)         | 7.7% (23)  | 29.3% (88)  | 22.3% (67) | 33.7% (101)    | 3.68        | 1.21        |
| Digital hardware affordable                    | 4.7% (14)         | 9.7% (29)  | 29.0% (87)  | 22.7% (68) | 34.0% (102)    | 3.72        | 1.17        |
| Govt policies promote digital participation    | 6.3% (19)         | 6.3% (19)  | 31.3% (94)  | 31.7% (95) | 24.3% (73)     | 3.61        | 1.11        |
| County programs support digital transformation | 0.0% (0)          | 12.7% (38) | 33.3% (100) | 29.0% (87) | 25.0% (75)     | 3.66        | 0.99        |
| County–National collaboration sufficient       | 2.0% (6)          | 15.3% (46) | 21.0% (63)  | 30.7% (92) | 31.0% (93)     | 3.73        | 1.12        |
| Average                                        |                   |            |             |            |                | <b>3.52</b> | <b>1.28</b> |

(Source: Researcher, 2026)

Table 4 reveals moderate but differentiated perceptions of digital adoption barriers and enabling conditions. In total, 51.4% (17.7% agree; 33.7% strongly agree, citing a lack of digital skills as limiting adoption) and 35.3% (disagree, with a mean of 3.21) were observed. Training availability showed 50.0% agreeing and 50.0% disagreeing (M = 3.12), signaling unequal access. Financial constraints are also a major issue, as 48.7% agreed

that loan requirements make growth more difficult ( $M = 3.52$ ). Infrastructure factors showed stronger agreement, with electricity reliability affecting digital use (56.0%,  $M = 3.68$ ) and hardware affordability (56.7%,  $M = 3.72$ ). The overall mean of 3.52 indicates moderate recognition of the significant role that structural, financial, and infrastructural conditions play in the level of digital integration.

*“Entrepreneurs are more conscious than ever of the opportunities in the digital space and technical know-how hinders the effective implementation of such opportunities.”* (KI6, Digital Innovation Hub Representative, Interview, 2026)

This statement reinforces the statistical finding that 51.4% perceive digital skill limitations as the barrier to adoption. Although 51.7% agreed that digital awareness has improved ( $M = 3.38$ ), competence gaps persist. The relatively high standard deviation (1.64) indicates dispersion in skill levels across enterprises. Mushinzimana et al. (2025) similarly found that growth in awareness of digital technologies correlates more strongly with adoption than technical mastery in rural MSMEs. Due to these factors and limited technical skills, digital adoption is often superficial rather than strategic. Similarly, Adebayo et al. (2024) argue that inadequate training structures reduce the effectiveness of digital technology use, leading to smaller productivity improvements despite increased exposure to digital platforms.

*“Loan conditions trade-off as a big hurdle; Small Enterprises, even with eligibility programs, struggle to stumble over eligibility requirements.”* (KI4, Financial Institution Representative, Interview, 2026)

This qualitative insight aligns with 48.7% agreeing that loan requirements inhibit digital growth ( $M = 3.52$ ), even though 53.6% report better access thanks to government programs ( $M = 3.57$ ). The 32.0% neutral responses further indicate conditional or uncertain access to credit. Nyeko et al. (2024) observed that despite the growth of financial programs that increase loan availability for projects at all levels, collateral requirements and bureaucracy tend to block micro-enterprises' access. Similarly, Mahesh et al. (2022) showed that restrictive lending criteria moderate the positive effects of digital financing initiatives, limiting investment in technological upgrades by smaller firms.

*“Internet access has been enhanced, but short-term power supply still interrupts online activities for many rural businesses.”* (KI2, Trade Development Officer, Interview, 2026)

This finding aligns with 56.0% agreeing that electricity reliability influences digital use ( $M = 3.68$ ) and 53.0% agreeing that an internet connection supports operations ( $M = 3.62$ ). Although infrastructure improvements are evident, utility instability keeps operational continuity at risk. Tyali (2024) argues that digital transformation in the rural economy depends heavily on infrastructure, particularly energy reliability. Similarly, Nyeko et al. (2024) find that an inconsistent power supply is a major factor undermining digital efficiency and customer trust, even in places where internet penetration has improved.

## DISCUSSION

The findings show that developing practical digital capabilities is a problem among MSMEs in Siaya, while sensitization about digital technologies is not. Digital awareness increased among 51.7% of respondents, although 67.3% had not received formal training in digital skills. Qualitative evidence also revealed that many young entrepreneurs learn their skills through trial and error, as well as from peers and mentors, rather than through a formal program. This corroborates Matambo (2023), who noted the need for formal digital training to help enterprises in rural areas use technology effectively. Similarly, Mer and Viridi (2024) noted that informal learning can lead to differences in technological ability. The report indicates that growing up with digital technologies does not automatically make them effective at integrating them without ongoing skill development.

Financial and institutional conditions also appeared to influence MSMEs' capacity to adopt digital technologies. Respondents reported access to credit for digital investment for 55.7% and improved credit access through government-funded programs for 53.6%. Respondents agreed that loan requirements hinder

business development, with 48.7% indicating this. Nevertheless, commercial bank financing was the most common source, accounting for 35.7% of financing sources, and traditional and internal financing sources remained the main sources (28.0%). Siasulingana (2024) links formal lending to enterprise growth and technological upgrading, while Unegbu et al. (2024) suggest that reliance on personal savings may indicate limited access to formal credit options. The results reveal funding opportunities; however, eligibility criteria may limit smaller rural businesses.

Infrastructure is another major factor shaping whether digital opportunities translate into long-term business activity. More than half of respondents (53.0%) see sustained internet connectivity as a key operational component, and more than half reported that electricity reliability affects internet use (56.0%) and that digital hardware is affordable (56.7%). The qualitative data, however, indicated that electricity disruptions did affect internet activities. Tyali (2024) also emphasizes the importance of energy supply in the context of digital transformation in the rural sector, and Nyeko et al. (2024) highlight how unreliable electricity provision reduces digital efficiency and customer trust. From an institutional perspective, 60.0% indicated they benefited from government programs, with 18.1% of trained respondents saying the county government provided the training. The evidence suggests that infrastructure and institutional reach are two necessary – but complementary – elements for effective rural digital integration.

## CONCLUSION

The study shows that digital integration for Siaya County's rural MSMEs has great potential but also faces key challenges. These businesses are increasingly engaging online, using social media marketing, and handling digital transactions, recognizing the importance of digital tech for reaching new markets and maintaining operations. However, their progress is limited by skills gaps in managing digital tools, lack of complementary skills, limited financial resources, and varying levels of digital readiness. Findings indicate that digital visibility often does not translate into full digital integration, as many still rely on informal processes despite using online platforms. The extent of digital integration depends on how MSMEs interact with their environment.

The study highlights the need for stronger enterprise capacities and institutional support to achieve sustainable digital integration. Opportunities for MSMEs to participate more fully in the digital economy include better access to credit, government programs, internet, reliable electricity, affordable technology, and supportive policies. However, policy limitations, inadequate training, and infrastructure disruptions hinder these opportunities. The research concludes that improving digital skills, expanding financing options, upgrading infrastructure, and fostering stronger links between county and national initiatives are essential steps. These interventions can enhance business growth, market engagement, employment, and economic stability in Siaya County.

## RECOMMENDATIONS

County and national government bodies should regularly provide accessible and practical digital skills training near rural MSMEs to support their growth. Financial institutions ought to develop more flexible lending options with fewer strict requirements and promote investments in digital technology. Government funding programs need to improve outreach and ease of access. Investments should support rural business centers by ensuring stable power, affordable internet, and appropriate digital infrastructure. Additionally, county and national governments should coordinate better to reduce overlap and expand program reach, boosting digitalization initiatives. Efforts should also focus on raising MSME awareness of the importance of ongoing digital learning, encouraging the use of digital tools not only for marketing but also for payments, operations, customer management, and market growth.

## REFERENCES

1. Adebayo, A., Nuberu, M. O., & Adebayo, A. A. (2024). Digital entrepreneurship and sustainability of small and medium enterprises in Lagos State of Nigeria. *Fuoye International Journal of Business and Economics Education*, 1(1).

2. Chen, C. L., Lin, Y. C., Chen, W. H., Chao, C. F., & Pandia, H. (2021). Role of government in enhancing digital transformation in small service businesses. *Sustainability*, 13(3), 1028.
3. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
4. Faruque, M. O., Chowdhury, S., Rabbani, G., & Nure, A. (2024). Technology adoption and digital transformation in small businesses: Trends, challenges, and opportunities. *International Journal for Multidisciplinary Research*, 6(10.36948).
5. Gao, J., Siddik, A. B., Khawar Abbas, S., Hamayun, M., Masukujjaman, M., & Alam, S. S. (2023). Impact of e-commerce and digital marketing adoption on the financial and sustainability performance of MSMEs during the COVID-19 pandemic: An empirical study. *Sustainability*, 15(2), 1594.
6. Greenhalgh, T., Robert, G., Bate, P., Macfarlane, F., & Kyriakidou, O. (2004). *Diffusion of innovations in service organizations: Systematic review and recommendations*. *The Milbank Quarterly*, 82(4), 581–629.
7. Ileri, E. M. (2022). *Influence of digital distribution strategies on uptake of bank products and services in Kenya* (Doctoral dissertation).
8. Kenya National Treasury. (2023). *Kenya National Digital Master Plan (2022–2032)*. Government of Kenya.
9. Lunyungu, J. (2024). *Influence of knowledge management practices on performance of small and medium enterprises in Dodoma, Tanzania* (Master's thesis, University of Dodoma).
10. Mahesh, K. M., Aithal, P. S., & Sharma, K. R. S. (2022). Open Network for Digital Commerce-ONDC (E-Commerce) infrastructure: To promote SME/MSME sector for inclusive and sustainable digital economic growth. *International Journal of Management, Technology, and Social Sciences (IJMTS)*, 7(2), 320–340.
11. Matambo, E. (2023). Evaluation of barriers to e-commerce in Malawi using grey relational analysis. *International Journal of Grey Systems*, 3(1), 5–16.
12. Mer, A., & Viridi, A. S. (2024). Decoding the challenges and skill gaps in small-and medium-sized enterprises in emerging economies: A review and research agenda. In *Contemporary Challenges in Social Science Management: Skills Gaps and Shortages in the Labour Market* (pp. 115–134).
13. Mushinzimana, L., Faisal, A., & Teressia, A. (2025). Strategy for evaluating the strengths, weaknesses, opportunities, and threats of the business community in Rwanda in adopting digital transformation to increase financial benefits. *Indiana Journal of Economics and Business Management*, 5(1), 64–96.
14. Nwoke, L. I., Precious, A. O., Aisha, A., & Peter, S. (2022). The impact of cashless policy on the performance of MSMEs in Nigeria using artificial neural network. *International Journal of Social Sciences and Humanities Invention*, 9(08), 7182–7193.
15. Nyeko, K. E., Voon, M. L., Ngui, K. S., & Lim, T. Y. (2024). Financial literacy, access to finance and financial performance of youth-led small and medium-sized enterprises (SMEs): Evidence from Gulu City, Uganda. *e-Academia Journal*, 13(2).
16. Okoye, C. F., & Mensah, K. E. (2025). Challenges and prospects of technology adoption by small and medium enterprises in Rivers State, Nigeria. *Ayden Energies Journal*, 13(2), 1–15.
17. Parkinson, M. (2024). *An investigation into digital technology adoption by micro-business owners in the Northwest of England and the impact on productivity* (Doctoral dissertation, Manchester Metropolitan University).
18. Rogers, E. M. (1962). *Diffusion of innovations*. Free Press.
19. Sharma, S. K., Dwivedi, Y. K., Metri, B., Lal, B., & Elbanna, A. (Eds.). (2023). *Transfer, diffusion and adoption of next-generation digital technologies: IFIP WG 8.6 International Working Conference on Transfer and Diffusion of IT, TDIT 2023, Nagpur, India, December 15–16, 2023, proceedings, Part I* (Vol. 697). Springer Nature.
20. Siasulingana, M. (2024). *A study of the effects of mobile banking services on the financial performance of Zambian commercial banks: A case study of Atlas Mara* (Doctoral dissertation, The University of Zambia).
21. Tyali, A. T. (2024). *Digital transformation: The case of Cape Town-based SMEs in the manufacturing sector* (Doctoral dissertation, University of the Western Cape).

22. Unegbu, H. C., Yawas, D. S., & Dan-Asabe, B. (2024). The impact of digital transformation on Nigerian small and medium-sized enterprises (SMEs) in the global business landscape. *Jurnal Mekanikal*, 66–85.
23. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.