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Original Article

Information and Communication Technology Penetration and Performance of Small and Medium-Sized Enterprises in East Africa: A Systematic Literature Review

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ABSTRACT

Information and Communication Technology (ICT) penetration has become an important enabler of Small and Medium Enterprise (SME) performance, competitiveness, innovation, and growth. However, empirical evidence on the relationship between ICT penetration and SME performance in East Africa remains fragmented across countries, technologies, sectors, and methodological approaches. This study systematically reviews empirical evidence on ICT penetration and SME performance in East Africa to synthesise existing findings, identify adoption barriers, and establish research gaps. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. Peer-reviewed empirical studies published between 2015 and 2026 were identified, screened, and assessed using predefined eligibility criteria, resulting in 15 studies included in the final synthesis. The findings indicate that ICT penetration enhances SME performance through improved operational efficiency, market access, customer engagement, innovation, financial inclusion, business growth, and competitiveness. However, these benefits are constrained by limited digital skills, high technology adoption costs, inadequate ICT infrastructure, financial constraints, cybersecurity concerns, weak organisational readiness, and limited institutional support. The review further reveals that existing research is predominantly cross-sectional and country-specific, with limited comparative evidence across East Africa. Significant gaps remain concerning emerging technologies, rural and informal SMEs, long-term sustainability outcomes, and the mechanisms through which digital capabilities influence SME performance. The study concludes that sustainable digital transformation requires not only access to ICT but also affordable infrastructure, digital skills, organisational capabilities, and supportive institutional ecosystems.

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INTRODUCTION

Small and Medium Enterprises (SMEs) are widely recognised as important contributors to economic growth, employment creation, innovation, and poverty reduction across both developed and developing economies. Globally, SMEs constitute a substantial proportion of business establishments and play a central role in entrepreneurship development, private sector growth, and inclusive economic transformation. In Sub-Saharan Africa, SMEs represent the backbone of economic activity by providing employment opportunities, supporting household incomes, and contributing to local economic development. Despite their importance, however, SMEs continue to face persistent challenges, including limited access to finance, restricted market opportunities, low productivity, weak innovation capacity, and inadequate technological capabilities, which constrain their competitiveness, growth, and long-term sustainability.

In response to these challenges, Information and Communication Technology (ICT) penetration has emerged as an important enabler of enterprise development and competitiveness. ICT penetration refers to the availability, accessibility, and diffusion of digital technologies within an economy or business environment, including internet connectivity, mobile communication systems, digital platforms, and information-sharing technologies. Although closely related, ICT penetration differs from ICT adoption, which focuses on the extent to which individual firms integrate digital technologies into their operations. The expansion of ICT penetration creates an enabling environment through which SMEs can adopt digital solutions to improve information access, facilitate electronic transactions, strengthen customer relationships, coordinate business activities, and access wider markets. Consequently, ICT has increasingly evolved from being a supportive operational tool into a strategic capability influencing enterprise performance (Kazakov, 2021).

Globally, digital transformation has become a significant determinant of organisational competitiveness and sustainable enterprise development. Existing evidence indicates that ICT-enabled transformation allows firms to automate processes, reduce transaction costs, improve decision-making, enhance customer engagement, and develop innovative products and services. Digital transformation provides SMEs with opportunities to improve operational effectiveness and create sustainable business value (Philbin et al., 2022). Digital technologies also enhance SME resilience, innovation capacity, and sustainability outcomes (Costa et al., 2023), while digitalisation improves organisational flexibility and adaptability within increasingly competitive markets (Kallmuenzer et al., 2025). These findings suggest that the strategic value of ICT extends beyond technology availability to include the ability of enterprises to effectively integrate digital capabilities into their business processes.

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The contribution of ICT to SME performance has attracted increasing attention in developing economies where enterprises often operate under structural constraints. Empirical studies indicate that digital technologies support SME development by improving market visibility, customer engagement, financial inclusion, operational efficiency, and innovation. Evidence from Ghana shows that digital marketing adoption improves sustainable SME growth by expanding customer reach and strengthening competitive positioning (Bruce et al., 2023). Similarly, digital marketing capabilities enhance SME performance through improved innovation and competitiveness in emerging markets (Deku et al., 2024). A systematic review further demonstrates that ICT adoption generally contributes positively to SME performance in developing countries, although the magnitude of these benefits depends on contextual factors such as infrastructure availability, institutional support, technological readiness, and digital literacy (Dimoso & Utonga, 2024).

Within East Africa, ICT penetration has expanded rapidly due to increasing internet connectivity, mobile communication growth, mobile money innovations, and government-led digital transformation initiatives. Countries such as Kenya, Uganda, Tanzania, Rwanda, and Ethiopia have invested substantially in digital infrastructure as part of broader strategies to promote economic development and private sector competitiveness. The widespread availability of mobile technologies, digital financial services, and internet-based platforms has created new opportunities for SMEs to improve communication, access financial services, engage customers, and participate in broader markets. Existing evidence from the region suggests that ICT contributes positively to SME performance through improved productivity, reduced operational constraints, enhanced innovation, and increased market accessibility. ICT utilisation has been found to improve SME productivity and market participation in East African economies (Matambalya & Wolf, 2019). Digital transformation enhances SME innovation capabilities and market expansion (Kobusingye et al., 2026).

Despite these developments, SME performance challenges remain widespread across East Africa. Many SMEs continue to experience limited productivity, weak competitiveness, inadequate innovation capacity, and difficulties integrating into regional and global markets. Furthermore, empirical studies examining ICT and SME performance remain fragmented across countries, sectors, technologies, and methodological approaches. Most existing studies focus on individual country contexts, specific ICT applications, or firm-level adoption behaviours, limiting understanding of how broader ICT penetration influences SME performance across East African economies (Mwangi & Kyallo, 2023; Omoga et al., 2025).

Additionally, existing research has predominantly examined ICT adoption at the micro-level, focusing on how individual SMEs utilise specific technologies. While such studies provide valuable insights into firm-level technology usage, they provide limited evidence regarding how broader ICT penetration, including digital infrastructure availability, internet connectivity, and technological diffusion, influences SME performance across countries and over time. This distinction is important because improvements in national digital ecosystems may create enabling conditions that influence SME competitiveness beyond individual firm-level decisions. Although internationally comparable datasets and increasing digital transformation initiatives provide opportunities for broader analysis, a comprehensive synthesis of existing empirical evidence on ICT penetration and SME performance in East Africa remains limited.

Therefore, this systematic literature review seeks to consolidate empirical evidence on the relationship between ICT penetration and SME performance in East Africa. Guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework, the study systematically identifies,

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evaluates, and synthesises existing research to establish current knowledge, methodological patterns, and emerging research gaps. The review contributes to the literature by providing a regional understanding of how ICT penetration influences SME outcomes while highlighting the contextual factors, including infrastructure development, institutional environments, technological capabilities, and digital literacy, that shape digital transformation outcomes.

The study also contributes to broader international and regional development priorities. Enhancing ICT penetration among SMEs supports Sustainable Development Goal (SDG) 8, which promotes inclusive economic growth and decent employment opportunities, and SDG 9, which emphasises resilient infrastructure, industrial innovation, and technological advancement (United Nations, 2015). Furthermore, the study aligns with the African Union Agenda 2063, which identifies science, technology, and innovation as key drivers of Africa's socio-economic transformation and digital integration (African Union Commission, 2015). By synthesising evidence on ICT penetration and SME performance, this review provides insights that can support policymakers, development partners, and researchers in designing effective digital transformation strategies for enhancing SME competitiveness and sustainable economic development in East Africa.

Problem Statement

Small and Medium Enterprises (SMEs) are important contributors to employment creation, income generation, innovation, and economic activity across East Africa, while Information and Communication Technology (ICT) increasingly provides opportunities for SMEs to improve business processes, access information, engage customers, reach wider markets, and strengthen competitiveness. The expansion of mobile technologies, internet connectivity, digital financial services, e-commerce, and other digital technologies has created opportunities to overcome traditional constraints related to geographical reach, information access, transaction efficiency, and market participation. However, ICT availability and adoption do not automatically translate into improved SME performance. The benefits derived from digital technologies depend on digital skills, technological readiness, affordability, infrastructure, organisational capabilities, and institutional support. Empirical evidence generally associates ICT adoption with improvements in business growth, operational efficiency, market access, innovation, customer engagement, and competitiveness, but these findings remain dispersed across countries, sectors, technologies, and methodological approaches (Bruce et al., 2023; Deku et al., 2024; Dimoso & Utonga, 2024; Omrani et al., 2024).

The evidence is further fragmented by the concentration of research in individual countries, particularly Uganda, Kenya, and Tanzania, limiting a coherent regional understanding of how differences in infrastructure, institutional environments, technological readiness, and business contexts shape the ICT–SME performance relationship. Important areas also remain insufficiently examined, including the long-term effects of ICT adoption, emerging technologies, rural and informal SMEs, and the organisational and contextual mechanisms through which digital capabilities translate into improved performance (Kallmuenzer et al., 2025). Consequently, a systematic synthesis of empirical evidence is needed to establish what is known about ICT penetration and SME performance in East Africa, the technologies and performance outcomes examined, the barriers constraining effective adoption, and the gaps requiring further investigation. This systematic literature review therefore synthesises empirical evidence published between 2015 and 2026 to provide a regional assessment of ICT technologies, SME performance outcomes, adoption barriers, methodological approaches, and research gaps, thereby informing future scholarship, policy formulation, and strategies for inclusive and sustainable SME digital transformation in East Africa.

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Review Objective

The main objective of this systematic literature review is to synthesise and critically evaluate empirical evidence on the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance in East Africa.

The review specifically seeks to:

- Examine the evidence on the relationship between ICT penetration and SME performance in East Africa.
- Identify the ICT technologies and dimensions examined in relation to SME performance.
- Examine the methodological approaches, contexts, and performance measures used in existing studies.
- Identify the technological, organisational, financial, and institutional factors that influence effective ICT adoption and utilisation among SMEs.
- Identify research gaps and propose directions for future research on ICT penetration and SME performance in East Africa.

Review Questions

To achieve the review objectives, the study addresses the following research questions:

- RQ1: What evidence exists regarding the relationship between ICT penetration and SME performance in East Africa?
- RQ2: What ICT technologies and dimensions have been examined in relation to SME performance?
- RQ3: What methodological approaches, contexts, and performance measures have been adopted in studies examining ICT penetration and SME performance?
- RQ4: What technological, organisational, financial, and institutional factors influence ICT adoption and its contribution to SME performance?
- RQ5: What research gaps remain in the literature on ICT penetration and SME performance in East Africa, and what directions should future research pursue?

Significance of the Review

This systematic literature review contributes to the growing body of knowledge on ICT adoption and SME development by providing a consolidated synthesis of empirical evidence on the relationship between ICT penetration and SME performance in East Africa. Rather than focusing on a single technology, country, or performance indicator, the review brings together evidence concerning different ICT applications, including mobile technologies, internet services, digital financial services, e-commerce, social media, cloud-based solutions, and broader digital transformation initiatives. This provides a more comprehensive understanding of how digital technologies contribute to different dimensions of SME performance, including business growth, operational efficiency, market access, innovation, financial inclusion, and competitiveness.

The review also makes a methodological contribution by mapping the research designs, samples, analytical approaches, ICT technologies, sectors, and performance measures employed in the existing literature. This synthesis helps identify methodological patterns and limitations, including the predominance of cross-sectional research and the concentration of evidence within selected East African countries. By highlighting these limitations, the review provides a basis for future studies to adopt longitudinal, comparative, mixed-method, and other approaches capable of providing deeper explanations of ICT-driven SME transformation.

From a theoretical and conceptual perspective, the review highlights the importance of examining ICT adoption as more than technology

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acquisition. The evidence indicates that the performance effects of ICT are shaped by complementary organisational capabilities, digital skills, financial resources, infrastructure, technological readiness, and institutional conditions. The review therefore supports a broader understanding of digital transformation as an interaction between technological resources, organisational capabilities, and the external business environment.

The review also has important policy and practical significance. For policymakers and development partners, the findings identify the conditions that can strengthen the effectiveness of SME digitalisation initiatives, particularly affordable connectivity, digital skills development, financial support, cybersecurity capacity, and enabling regulatory frameworks. For SME owners and managers, the findings demonstrate the importance of developing the organisational and human capabilities required to integrate digital technologies into business operations and strategies. Technology providers and financial institutions can similarly use the evidence to develop affordable, accessible, and context-appropriate digital solutions for SMEs.

Overall, the review provides a regional evidence base for understanding ICT penetration and SME performance in East Africa. By synthesising the available evidence, identifying persistent barriers and research gaps, and highlighting implications for policy and practice, the study supports efforts to promote inclusive, effective, and sustainable digital transformation among SMEs across the East African region.

REVIEW METHODOLOGY

Review Design

This study adopted a systematic literature review (SLR) design to systematically identify, synthesise, and critically evaluate empirical evidence on the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance in East Africa**.** The review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework to promote transparency, methodological rigour, and reproducibility throughout the processes of study identification, screening, eligibility assessment, and inclusion (Page et al., 2021).

The review focused on peer-reviewed empirical studies published between 2015 and 2026 that examined the adoption, use, or penetration of ICT and digital technologies among SMEs in East African countries. The technologies considered included mobile technologies, internet services, digital financial services, e-commerce, social media, cloud computing and Software-as-a-Service (SaaS), digital transformation technologies, and other emerging digital solutions. The review examined their reported effects on SME performance, including business growth, profitability, operational efficiency, market access, customer engagement, innovation, competitiveness, financial inclusion, and sustainability**.** 15 studies.

A structured review protocol was applied to ensure consistency in the identification and assessment of eligible studies. The final synthesis comprised studies that satisfied the predefined inclusion criteria and methodological quality requirements. The evidence from these studies was synthesised narratively to identify patterns in ICT adoption, performance outcomes, adoption barriers, methodological approaches, and research gaps within the East African SME context.

Search Strategy

A comprehensive and systematic literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework (Page et al., 2021) to identify empirical studies examining the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance in East Africa. Searches were conducted across Scopus, Web of Science Core Collection, ScienceDirect, Emerald Insight,

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SpringerLink, Taylor & Francis Online, Wiley Online Library, African Journals Online (AJOL), and Google Scholar**.** These databases were selected to provide broad coverage of international, multidisciplinary, and African-focused research relevant to ICT adoption and SME development.

The search strategy combined keywords related to ICT, digital technologies, SMEs, business performance, and the geographical context using Boolean operators. The principal search string was:

> *("ICT" OR "information and communication technology" OR "digital technology" OR "digital transformation" OR "internet" OR "mobile technology" OR "e-commerce" OR "fintech" OR "cloud computing") AND ("SME" OR "small and medium enterprise" OR "small business") AND ("performance" OR "growth" OR "productivity" OR "competitiveness" OR "innovation" OR "market access") AND ("East Africa" OR Uganda OR Kenya OR Tanzania OR Rwanda OR Burundi OR Ethiopia OR Somalia OR South Sudan OR Djibouti OR Eritrea).* *

The search was restricted to studies published between 2015 and 2026. Retrieved records were exported to reference-management software for organisation and duplicate removal. Titles and abstracts were subsequently screened against the predefined eligibility criteria, followed by full-text assessment of potentially relevant studies. The identification, screening, eligibility, and inclusion stages were documented using the PRISMA 2020 flow diagram.

Inclusion and Exclusion Criteria

Predefined inclusion and exclusion criteria were established before the final study selection to ensure consistency and transparency in the review process. Studies were eligible for inclusion if they were peer-reviewed empirical journal articles published in English between 2015 and 2026, employed quantitative, qualitative, or mixed-methods designs, and examined ICT-related technologies in relation to SME performance in East Africa. Eligible ICT technologies included, but were not limited to, mobile technologies, internet services, digital financial services, e-commerce, social media, cloud computing, Software-as-a-Service (SaaS), digital platforms, and broader digital transformation technologies.

Studies were required to report at least one SME performance-related outcome, including business growth, profitability, productivity, operational efficiency, market access, innovation, competitiveness, customer engagement, financial inclusion, or sustainability. Comparative studies were eligible where they included evidence relating to East African SMEs.

Studies were excluded where they were non-peer-reviewed publications, including conference papers, theses, dissertations, books, book chapters, reports, editorials, commentaries, working papers, or unpublished manuscripts. Studies published in languages other than English, studies for which the full text was unavailable, studies focusing on populations other than SMEs, and studies conducted entirely outside East Africa without relevant comparative evidence were also excluded. Studies that examined ICT adoption without linking it to an SME performance outcome were excluded. Finally, studies that failed to satisfy the predefined methodological quality requirements were excluded from the final synthesis.

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Table 1: Inclusion and Exclusion Criteria

Criterion	Inclusion Criteria	Exclusion Criteria
Study focus	Empirical studies examining ICT penetration, digital technologies, or digital transformation and their relationship with SME performance.	Studies unrelated to ICT, digital technologies, or SME performance.
Population	Small and Medium Enterprises (SMEs) operating in East African countries.	Large enterprises, multinational corporations, households, public institutions, or non-business organisations.
Geographical scope	Studies conducted in East Africa or comparative studies containing relevant evidence from East African countries.	Studies conducted entirely outside East Africa without relevant comparative evidence.
Publication type	Peer-reviewed journal articles.	Conference papers, theses, dissertations, books, book chapters, reports, editorials, commentaries, working papers, and unpublished manuscripts.
Language	Studies published in English.	Publications in languages other than English.
Publication period	Studies published between 2015 and 2026.	Studies published before 2015 or after 2026.
Research design	Quantitative, qualitative, and mixed-methods empirical studies.	Conceptual papers, theoretical papers, literature reviews, opinion articles, and other non-empirical studies.
Accessibility	Full-text articles available for assessment.	Studies with unavailable or inaccessible full texts.
Outcome measures	Studies reporting SME performance outcomes such as productivity, profitability, growth, innovation, competitiveness, operational efficiency, market access, customer engagement, financial inclusion, or sustainability.	Studies discussing ICT adoption without reporting a relevant SME performance outcome.
Methodological quality	Studies meeting the predefined methodological quality appraisal criteria.	Studies with substantial methodological weaknesses or inadequate reporting that failed to meet the quality threshold.

Source: *Authors' compilation based on the predefined eligibility criteria.*

Study Selection Process

The study selection process followed the four-stage process recommended by PRISMA 2020**,** comprising identification, screening, eligibility assessment, and inclusion (Page et al., 2021). During the identification stage, records were retrieved from the selected electronic databases using the predefined search strategy. The retrieved records were consolidated, and duplicate records were removed before screening.

During the screening stage, titles and abstracts were examined against the predefined eligibility criteria. Records that clearly failed to address ICT and SME performance, fell outside the geographical scope, or did not meet the publication and study-design requirements were excluded. Potentially relevant studies were retained for full-text assessment.

During the eligibility stage, the full texts of potentially relevant articles were examined in greater detail. Articles were excluded where they failed to establish a relevant relationship between ICT-related technologies and SME performance, did not provide sufficient empirical evidence, fell outside the geographical or publication-period

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requirements, or did not satisfy the methodological quality threshold.

Following completion of the screening, full-text assessment, and methodological quality appraisal, 15 studies met all predefined eligibility requirements and were included in the final qualitative synthesis. These studies formed the evidence base for the subsequent analysis of ICT technologies, SME performance outcomes, adoption barriers, methodological characteristics, and research gaps.

Data Extraction

A standardised data extraction form was developed to ensure systematic, consistent, and accurate extraction of information from the included studies. For each eligible study, the following information was recorded: author(s) and publication year, country of study, study objective, research design, sample characteristics, ICT technology investigated, SME sector, performance measures, analytical methods, key findings, and reported challenges**.**

The extracted information was organised into an evidence matrix, which facilitated systematic comparison of the characteristics and findings of the included studies. The matrix also provided the basis for identifying patterns and differences in ICT technologies, SME performance outcomes, methodological approaches, adoption barriers, and contextual factors across the studies. The resulting evidence was synthesised narratively because of the methodological and contextual heterogeneity among the 15 included studies.

Quality Assessment

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists, with the checklist selected according to the methodological design of each study. The appraisal considered relevant aspects of methodological rigour, including clarity of the research question or objectives, appropriateness of the study design, sampling procedures, data collection methods, validity and reliability of measurement where applicable, appropriateness of analytical techniques, and the credibility of reported findings.

Each study was assessed against the relevant JBI criteria, and the appraisal results were used to determine whether the evidence met the minimum methodological quality threshold established for the review. Studies demonstrating substantial methodological weaknesses or insufficient reporting were excluded from the final synthesis where these weaknesses affected the credibility or interpretability of the findings.

The quality assessment also informed the interpretation of the review findings by allowing greater consideration of methodological differences across the included studies. Following the eligibility screening and quality appraisal, 15 studies satisfied the predefined inclusion criteria and methodological quality requirements and were retained for the final qualitative synthesis.

RESULTS

Search Results and Study Selection

The systematic search was conducted across nine electronic databases: Scopus, Web of Science Core Collection, ScienceDirect, Emerald Insight, SpringerLink, Taylor & Francis Online, Wiley Online Library, African Journals Online (AJOL), and Google Scholar. The search aimed to identify empirical studies examining the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance within the East African context.

The initial search yielded 214 records. After removing 67 duplicate records, 147 unique records remained for title and abstract screening. During the screening stage, 89 records were excluded because they did not directly examine ICT penetration and SME performance, focused on large enterprises or non-SME populations, fell outside the geographical scope, or did not satisfy the predefined eligibility criteria.

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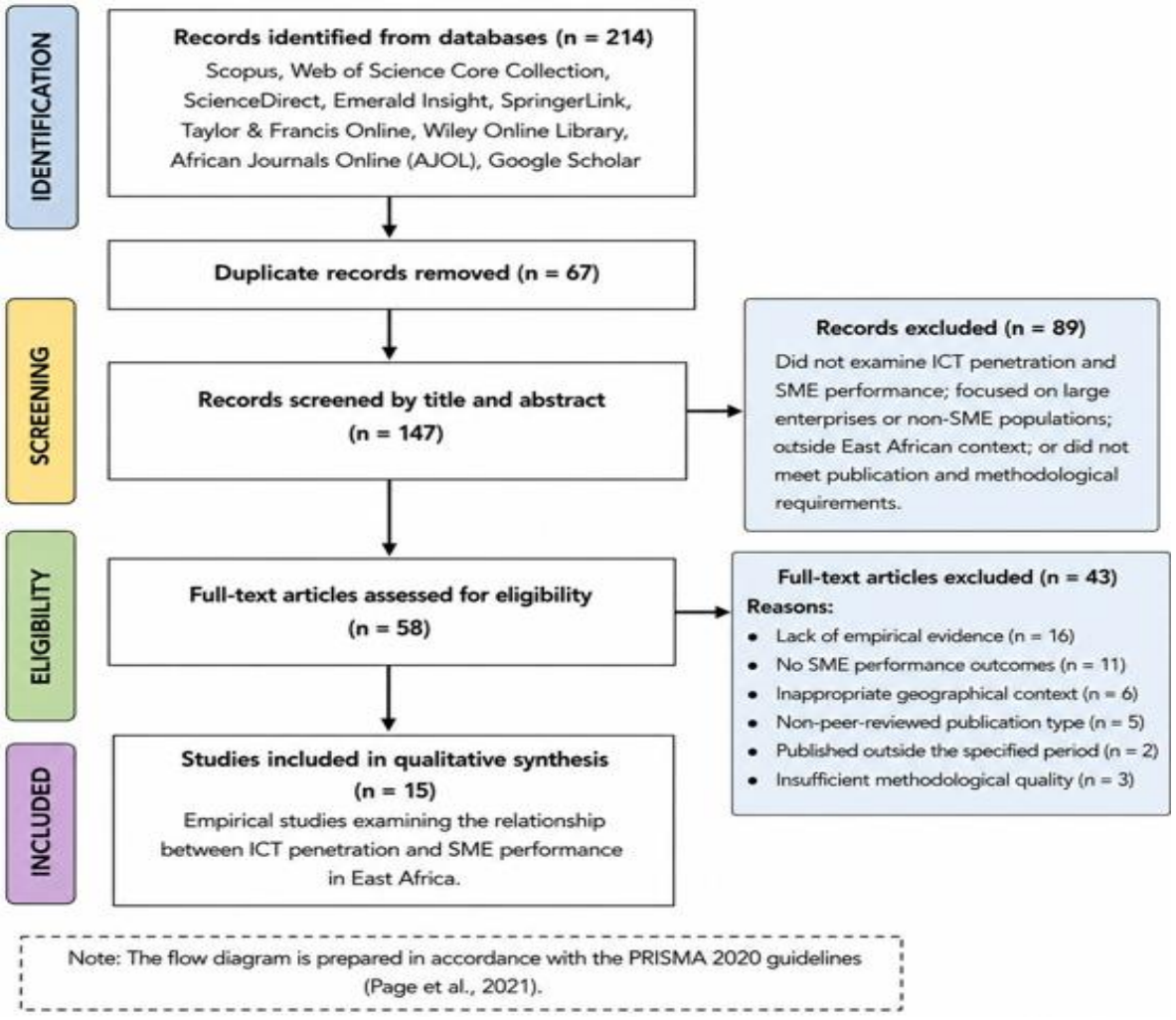
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Following title and abstract screening, 58 articles were retrieved for full-text assessment. Detailed full-text eligibility assessment resulted in the exclusion of 43 studies. These studies were excluded because they lacked sufficient empirical evidence, did not report relevant SME performance outcomes, had an inappropriate geographical focus, were not peer-reviewed, failed to meet the methodological quality requirements, or otherwise did not satisfy the predefined inclusion criteria.

Consequently, 15 empirical studies met all eligibility and methodological quality requirements and were included in the final qualitative synthesis. The included studies examined a range of ICT technologies, including mobile technologies, internet services, mobile money and digital financial services, e-commerce, social media, cloud computing and Software-as-a-Service (SaaS), digital transformation technologies, and other emerging digital solutions. The studies investigated various SME performance outcomes, including business growth, profitability, productivity, operational efficiency, market access, innovation, competitiveness, customer engagement, financial inclusion, and sustainability.

The complete process of study identification, duplicate removal, title and abstract screening, full-text eligibility assessment, and final inclusion is presented in Figure 1, following the PRISMA 2020 guidelines (Page et al., 2021).

Figure 1: PRISMA 2020 Flow Diagram Showing the Study Selection Process



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Characteristics of Included Studies

The characteristics of the included studies were analysed based on publication year, geographical coverage, research design, sample characteristics, ICT technologies investigated, SME sectors, performance indicators, analytical approaches, key findings, and reported implementation challenges. After screening and eligibility assessment, the final synthesis comprised 15 empirical studies examining the relationship between ICT penetration and SME performance in East Africa and comparable developing economy contexts. The extracted characteristics of the included studies are presented in Table 2.

The reviewed studies demonstrate increasing scholarly interest in the role of ICT in enhancing SME performance, particularly after 2015, coinciding with the rapid expansion of digital technologies, mobile connectivity, and digital financial services across developing economies. Most studies employed quantitative research designs, mainly cross-sectional surveys, while a smaller proportion adopted qualitative and mixed-method approaches to provide deeper insights into ICT adoption processes and contextual factors.

Geographically, the evidence was concentrated mainly in East African countries, particularly Uganda, Kenya, and Tanzania. Uganda emerged as the most frequently studied context, reflecting growing research attention on digital transformation and SME development. The studies investigated a wide range of ICT applications, including mobile technologies, internet services, digital communication tools, e-commerce platforms, mobile money, cloud computing, Software-as-a-Service (SaaS), and broader digital transformation initiatives.

Regarding performance outcomes, the reviewed studies assessed ICT contributions through indicators such as business growth, sales performance, profitability, productivity, operational efficiency, innovation capability, competitiveness, market expansion, and financial inclusion. Across the studies, ICT adoption was generally associated with improved SME performance by strengthening access to information, enhancing customer engagement, reducing transaction costs, improving operational processes, and creating new market opportunities. However, the extent of these benefits was influenced by contextual factors, including digital literacy, affordability of ICT services, infrastructure availability, organisational readiness, and institutional support. Table 2 presents the detailed characteristics of the included studies.

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Table 2: Characteristics of Included Studies

Author (Year)	Country	Objective	Design	Sample	ICT Technology	SME Sector	Performance Measure	Analysis	Key Findings	Challenges
Kabanda & Brown (2017)	Tanzania	Examined adoption and use of e-commerce among SMEs	Qualitative case study	32 SMEs	E-commerce, websites, mobile technologies	SMEs across sectors	Market access, customer engagement, business visibility	Thematic/interpretive analysis	SMEs used websites mainly for marketing and mobile technologies for transactions; e-commerce supported market visibility and interaction.	Limited use of websites, weak transaction systems, and dependence on external technical partnerships.
Ndiege (2019)	Kenya	Examined social-media technology adoption and strategic positioning of SMEs	Qualitative multiple-case study	15 SME owners	Social media technologies	SMEs in Nairobi	Strategic positioning, customer reach, competitiveness	Thematic analysis	Social media supported strategic positioning and enabled SMEs to respond to customers and competitors.	Limited strategic use and incomplete exploitation of social-media capabilities.
Eton et al. (2019)	Uganda	Examined ICT adoption and SME growth	Quantitative cross-sectional survey	SME owners in Kampala	Internet, computers, bulk SMS, printers, scanners, digital communication	Trade and service SMEs	Business growth	Regression analysis	ICT adoption was associated with SME growth and improved communication and information access.	Limited ICT expertise, maintenance costs, inadequate specialist skills and difficulty keeping technologies updated.
Ibrahim et al. (2019)	Uganda	Examined factors affecting e-commerce adoption and its influence on SME growth	Quantitative cross-sectional survey	172 SME owners/managers	E-commerce and Internet technologies	SMEs across sectors	SME growth, competitiveness, operational efficiency	Regression analysis	E-commerce adoption significantly influenced SME growth.	Slow adoption, limited experience and challenges associated with e-commerce implementation.
Mwantimwa (2019)	Tanzania	Examined ICT use in business processes and factors affecting effective usage	Mixed quantitative and qualitative cross-sectional survey	182 firms	Mobile phones, computers, Internet, networks, social media	Business firms, including SMEs	Business efficiency and process improvement	Descriptive/inferential and thematic analysis	ICT supported material processing, management, service and marketing activities and improved business-process efficiency.	Limited financial capital, ICT infrastructure, knowledge and expertise.

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Kyakulumbye & Pather (2022)	Uganda	Examined factors influencing ICT adoption among SMEs	Quantitative survey/mixed approach	SME owners/managers	Internet technologies, ICT applications and digital tools	SMEs across sectors	ICT adoption and potential business improvement	Correlation analysis and participatory design	Perceived benefits, learnability, user confidence and user-friendliness were important determinants of ICT adoption.	Low adoption, affordability constraints, ICT scepticism and inadequate digital skills.
Rollin et al. (2022)	Uganda	Examined the relationship between ICT adoption and SME performance	Mixed-method cross-sectional survey	140 SME owners/managers	ICT systems, Internet and digital communication	Trade and service SMEs	SME performance and growth	Correlation analysis	ICT adoption had a significant positive relationship with SME performance (r = .913, p < .001).	High ICT costs, inadequate infrastructure, limited skills and security concerns.
Shaitu (2022)	Tanzania	Assessed ICT adoption and SME performance	Quantitative survey	100 SME owners/managers	Mobile phones, Internet and digital communication	SMEs across sectors	Market access, productivity and sales growth	Descriptive and inferential statistics	ICT adoption improved market access, productivity and sales performance.	Limited ICT knowledge, weak digital capabilities and affordability constraints.
Majengo & Mbise (2023)	Tanzania	Examined determinants of SaaS adoption among SMEs	Quantitative survey	139 SMEs	Cloud computing and Software-as-a-Service	SMEs across sectors	Operational efficiency and ICT readiness	Regression analysis	Relative advantage, compatibility, awareness, cost, security, reliability, management support and trading-partner pressure significantly influenced SaaS adoption.	Cost, security/privacy concerns, compatibility problems and limited awareness.
Mushi (2024)	Tanzania	Examined digital marketing strategies and SME performance	Quantitative survey	335 SMEs	SEO, content marketing, social media, email, influencer marketing, paid advertising and data analytics	Service SMEs	Sales growth, market share and market development	PLS-SEM	Digital marketing strategies were significantly associated with SME performance.	Limited digital marketing capabilities and challenges in effectively exploiting digital strategies.
Musebe (2024)	Kenya	Examined adoption of advanced manufacturing technology and its effect on	Mixed methods	SME owners/managers	Advanced manufacturing technologies	Manufacturing SMEs	Production efficiency, product quality and competitiveness	Stepwise regression and qualitative analysis	AMT adoption positively correlated with operational performance, production efficiency,	Technology adoption costs, skills requirements and implementation constraints.

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		SME performance							product quality and market competitiveness.	
Kobusingye et al. (2025)	Uganda & Tanzania	Examined digital transformation, innovation, market expansion and organisational growth	Quantitative survey	634 SME owners/managers/IT executives	Digital platforms, ICT applications and digital transformation technologies	SMEs across sectors	Innovation, market expansion and organisational growth	SmartPLS/PROCESS analysis	Digital transformation enhanced innovation capability and market expansion, supporting organisational growth	Limited digital capabilities, technological turbulence and resource constraints.
Bindeeba et al. (2025)	Uganda	Examined digital business-process integration and SME sustainability	Quantitative explanatory survey	228 SMEs	Digital business-process integration and integrated systems	SMEs across sectors, including manufacturing	Economic and environmental performance	CB-SEM/AMOS	Digital process integration significantly improved economic and environmental outcomes, partly through operational efficiency.	Digital infrastructure requirements, resource constraints and limited digital capabilities.
Omoga et al. (2025)	Kenya	Examined digital transformation and entrepreneurial performance of SMEs	Quantitative correlational survey	317 SMEs	Digital literacy, technology infrastructure and digital transformation	SMEs across sectors	Entrepreneurial performance and revenue growth	Correlation analysis	Digital literacy, leadership commitment, organisational culture and technology infrastructure were positively associated with SME performance.	Digital-literacy gaps, infrastructure limitations and organisational readiness challenges.
Uwiringiyimana et al. (2025)	Rwanda	Examined ICT adoption and micro-enterprise performance	Quantitative survey	Agricultural micro-enterprises	ICT/mobile technologies and digital tools	Agricultural micro-enterprises	Income, productivity and market integration	Regression/statistical analysis	ICT adoption was associated with improved business outcomes, productivity and market integration.	Limited digital ability, infrastructure and institutional constraints.

Source: *Author's compilation based on the systematic review and data extracted from the included studies*

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The evidence presented in Table 2 highlights several common patterns across the reviewed literature. First, ICT adoption consistently demonstrates a positive relationship with SME performance, although the mechanisms through which this relationship occurs vary depending on the type of technology adopted. For example, mobile technologies and digital financial services primarily improved financial access and customer interaction, while e-commerce platforms enhanced market reach and competitiveness. More advanced technologies, including cloud computing, digital platforms, and integrated digital systems, contributed to operational efficiency, innovation, and sustainable growth.

Second, methodological patterns indicate that most studies relied on cross-sectional survey designs, limiting the ability to establish long-term causal relationships between ICT penetration and SME performance. Furthermore, many studies focused on individual countries, particularly Uganda, Kenya, and Tanzania, creating limited evidence on regional variations within East Africa. Finally, despite the demonstrated benefits of ICT adoption, recurring challenges included high technology costs, inadequate digital skills, weak ICT infrastructure, cybersecurity concerns, and limited institutional support.

These findings provide a basis for the subsequent thematic synthesis of the role of ICT penetration in improving SME performance and identifying existing research gaps within the East African context.

ICT Technologies Examined in the Reviewed Studies

The reviewed studies examined a broad range of information and communication technology (ICT) applications through which SMEs in East Africa seek to improve business processes, market access, innovation, and overall performance. The evidence demonstrates a progression from relatively basic technologies, such as mobile phones, Internet connectivity, and electronic communication, towards more integrated digital applications, including e-commerce, social media marketing, cloud-based services, digital marketing, advanced manufacturing technologies, and digital business-process integration. This progression reflects the increasing incorporation of digital technologies into SME operations and competitive strategies across East Africa. Table 3 summarises the principal ICT technologies identified across the 15 studies included in the systematic review.

Table 3: ICT Technologies Examined in the Reviewed Studies

ICT Technology	Description/Application	Representative Studies	Contribution to SME Performance
Mobile technologies and digital communication	Use of mobile phones, mobile communication, SMS, and related digital communication tools to exchange information, communicate with customers, and support business activities.	Eton et al. (2019); Mwantimwa (2019); Rollin et al. (2022); Shaitu (2022); Uwiringiyimana et al. (2025)	Improved communication, information exchange, customer interaction, market connectivity, and business efficiency.
Internet and online technologies	Use of Internet connectivity, online information resources, websites, and Internet-based applications to support business communication, information access, and operations.	Eton et al. (2019); Ibrahim et al. (2019); Kyakulumbye & Pather (2022); Mwantimwa (2019)	Enhanced access to information, communication efficiency, operational processes, customer reach, and business growth.
E-commerce and online business platforms	Use of websites, electronic marketplaces, online transaction systems, and Internet-based	Kabanda & Brown (2017); Ibrahim et al. (2019)	Expanded market access, improved customer reach,

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ICT Technology	Description/Application	Representative Studies	Contribution to SME Performance
	platforms for marketing, selling, and purchasing goods and services.		reduced transaction constraints, and supported SME growth and competitiveness.
Social media technologies	Use of social networking and digital communication platforms for marketing, customer engagement, brand visibility, and business communication.	Ndiege (2019); Mushi (2024); Omoga et al. (2025)	Strengthened customer engagement, market visibility, marketing effectiveness, strategic positioning, and revenue-related performance.
Digital marketing technologies	Use of search engine optimisation, content marketing, social media marketing, email marketing, influencer marketing, online advertising, and digital data analysis.	Mushi (2024)	Improved sales growth, market share, market development, customer reach, and overall SME performance.
Cloud computing and Software-as-a-Service (SaaS)	Use of Internet-based software and cloud services to access business applications and digital resources without extensive investment in physical ICT infrastructure.	Majengo & Mbise (2023)	Enhanced access to digital applications, operational flexibility, scalability, and potential efficiency improvements.
ICT applications for business-process integration	Integration of digital technologies into business processes such as operations, management, marketing, service delivery, and information management.	Mwantimwa (2019); Bindeeba et al. (2025); Kobusingye et al. (2025)	Improved operational efficiency, economic performance, environmental sustainability, innovation, and organisational growth.
Advanced manufacturing technologies	Application of advanced digital and technology-enabled manufacturing systems to improve production processes, quality, and efficiency.	Musebe (2024)	Increased production efficiency, product quality, operational performance, and market competitiveness.
Digital transformation and digital capabilities	Integration of digital technologies, technological infrastructure, digital literacy, organisational capabilities, and technology-enabled processes into SME strategy and operations.	Kobusingye et al. (2025); Omoga et al. (2025)	Strengthened innovation capability, market expansion, organisational growth, revenue performance, and competitiveness.
Digital ICT adoption capabilities	Organisational readiness, digital skills, user confidence, technology usability, and access to ICT infrastructure that enable SMEs to adopt and effectively utilise digital technologies.	Kyakulumbye & Pather (2022); Uwiringiyimana et al. (2025); Omoga et al. (2025)	Increased capacity to adopt ICT, improve business processes, access markets, and translate technology use into business outcomes.

Source: *Authors' compilation based on data extracted from the 15 studies included in the systematic review.*

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The evidence presented in Table 3 shows that the ICT technologies examined in East African SMEs can broadly be grouped into communication and connectivity technologies, digital marketing and market-access technologies, cloud-based technologies, business-process technologies, and broader digital transformation capabilities**.** Mobile technologies, Internet connectivity, and digital communication remain important foundational technologies because they provide SMEs with relatively accessible mechanisms for communication, information exchange, and interaction with customers. Studies in Uganda and Tanzania demonstrate that ICT use supports business processes, communication, information access, and operational activities (Eton et al., 2019; Mwantimwa, 2019; Rollin et al., 2022; Shaitu, 2022). Mwantimwa (2019), in particular, found that ICT was applied across several business processes, although effective utilisation was constrained by financial, infrastructural, and skills-related limitations.

E-commerce and digital platforms constitute another important category identified in the review. Evidence from Tanzania and Uganda indicates that online business technologies can enable SMEs to reach customers beyond their immediate geographical markets, improve marketing activities, and support business growth (Ibrahim et al., 2019; Kabanda & Irwin, 2017). In Uganda, Ibrahim et al. (2019) found that e-commerce adoption significantly influenced SME growth, while Kabanda and Brown (2017) demonstrated the importance of e-commerce in enabling Tanzanian SMEs to undertake marketing and other business activities through digital platforms. These findings suggest that Internet-based commercial technologies can reduce geographical barriers and create opportunities for SMEs to participate in wider markets.

Social media and digital marketing technologies have also become increasingly prominent in the reviewed literature. Social media technology has demonstrated strategic relevance to Kenyan SMEs, particularly in relation to customer interaction and strategic positioning (Rumo & Ndiege, 2019). More recent evidence from Tanzania indicates that digital marketing encompasses multiple applications, including search engine optimisation, content marketing, social media marketing, email marketing, influencer marketing, paid advertising, and data analysis. Mushi (2024), based on 335 SMEs in Tanzania, found a significant relationship between digital marketing strategies and SME performance, measured through dimensions including sales growth, market share, and market development.

The review further indicates an emerging shift towards cloud computing and Software-as-a-Service (SaaS). Majengo and Mbise (2022) examined SaaS adoption among Tanzanian SMEs and identified perceived benefits, compatibility, cost, security, reliability, management support, and awareness as important considerations in adoption. This indicates that SMEs are increasingly moving beyond basic ICT infrastructure towards technology models that provide access to software and digital services through Internet-based platforms. Such technologies can improve operational flexibility and provide access to advanced applications while reducing the need for substantial investment in physical ICT infrastructure (Majengo & Mbise, 2022).

A further development evident in Table 3 is the increasing integration of ICT into business processes and organisational capabilities. Rather than examining individual technologies in isolation, recent studies increasingly consider digital transformation as an organisational capability involving digital platforms, technological infrastructure, digital skills, and integrated business processes (Kobusingye et al., 2026). Kobusingye et al. (2026) examined digital transformation in relation to innovation, market expansion, and organisational growth among SMEs in Uganda and Tanzania. Similarly, Bindeeba et al. (2025) examined digital business-process integration among Ugandan SMEs and found that digital integration was associated with economic and environmental performance, with

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operational efficiency playing an important mediating role (Bindeeba et al., 2025).

The Kenyan evidence similarly demonstrates a movement towards more advanced forms of digitalisation. Musebe (2024) examined advanced manufacturing technology among Kenyan SMEs and found a positive relationship between technology adoption and operational performance, including production efficiency, product quality, and market competitiveness (Musebe, 2024). Omoga et al. (2025), meanwhile, examined digital transformation among SMEs in Kenya and reported positive relationships between SME performance and factors including digital literacy, leadership commitment, organisational culture, and technology infrastructure (Omoga et al., 2025).

Despite these technological advances, the reviewed studies consistently identify digital capability, infrastructure, affordability, and organisational readiness as important constraints. Limited digital skills and user confidence can restrict effective ICT adoption, while high technology costs, inadequate infrastructure, security concerns, and limited organisational capacity can prevent SMEs from fully exploiting available technologies (Kyakulumbye & Pather, 2022; Majengo & Mbise, 2022; Omoga et al., 2025). The Rwandan evidence similarly highlights the importance of digital capability in translating ICT adoption into improved micro-enterprise outcomes (Uwiringiyimana & Atmajaya, 2025).

Overall, the evidence presented in Table 3 demonstrates that ICT penetration among East African SMEs extends beyond the adoption of individual digital devices. It increasingly encompasses interconnected technologies and organisational capabilities that support communication, market access, marketing, operational efficiency, innovation, and business growth. The reviewed studies therefore suggest a gradual transition from basic ICT access towards broader digital integration and transformation**.** However, the performance benefits of ICT penetration remain contingent upon SMEs' ability to acquire, integrate, and effectively utilise these technologies within their organisational and market environments.

Effect of ICT Penetration on SME Performance

The reviewed studies demonstrate that ICT penetration is associated with improvements in several dimensions of SME performance, including business growth, operational efficiency, market access, customer engagement, innovation, competitiveness, and sustainability. However, the nature and extent of these benefits vary according to the type of ICT adopted, the capabilities of the SME, sector characteristics, and the broader technological and institutional environment. Table 4 synthesises the principal SME performance outcomes associated with ICT penetration across the 15 studies included in the systematic review.

Table 4: Impact of ICT Penetration on SME Performance Outcomes

SME Performance Outcome	ICT Contribution	Supporting Studies	Key Findings
Business growth and revenue performance	ICT improves communication, customer reach, market opportunities, and business processes, thereby creating conditions for sales and business growth.	Eton et al. (2019); Ibrahim et al. (2019); Rollin et al. (2022); Shaitu (2022); Uwiringiyimana et al. (2025)	ICT adoption was associated with improved business growth, sales performance, market access, and broader enterprise outcomes.
Operational efficiency	Digital technologies facilitate information	Mwantimwa (2019); Rollin et al. (2022);	ICT use and digital process integration supported more

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SME Performance Outcome	ICT Contribution	Supporting Studies	Key Findings
	exchange, business-process integration, coordination, and more efficient use of organisational resources.	Majengo & Mbise (2023); Bindeeba et al. (2025)	efficient business processes and resource utilisation, although benefits depended on technological and organisational capacity.
Market access and customer engagement	Internet technologies, e-commerce, social media, and digital marketing enable SMEs to reach wider markets, interact with customers, and improve business visibility.	Kabanda & Brown (2017); Ndiege (2019); Ibrahim et al. (2019); Mushi (2024)	Digital platforms expanded customer reach, strengthened customer interaction, enhanced visibility, and supported market development.
Innovation capability	Digital technologies provide access to information, digital platforms, new business processes, and technology-enabled approaches to products and services.	Ndiege (2019); Kobusingye et al. (2025); Omoga et al. (2025)	Digital transformation and digital capabilities supported innovation and helped SMEs develop new approaches to business and market engagement.
Competitiveness and strategic positioning	ICT enables SMEs to improve responsiveness, product and service delivery, market positioning, and production efficiency.	Ndiege (2019); Musebe (2024); Kobusingye et al. (2025); Omoga et al. (2025)	ICT-enabled capabilities contributed to improved strategic positioning, production performance, market competitiveness, and organisational growth.
Sustainability and organisational performance	Digital business-process integration and digital transformation improve operational processes, resource utilisation, and organisational capabilities.	Bindeeba et al. (2025); Kobusingye et al. (2025); Omoga et al. (2025)	Digital integration and transformation were associated with improved economic, environmental, organisational, and longer-term performance outcomes.
Overall SME performance	ICT adoption combines improvements in communication, operations, market access, innovation, and organisational capabilities.	Eton et al. (2019); Rollin et al. (2022); Shaitu (2022); Kobusingye et al. (2025)	Across different East African contexts, ICT adoption generally demonstrated positive associations with SME performance, although the strength of the relationship varied across technologies and contexts.

Source: *Authors' compilation based on data extracted from the 15 studies included in the systematic review.*

The evidence presented in Table 4 indicates that ICT penetration contributes to SME performance through several interconnected pathways rather than through a single mechanism. The most consistently reported pathway concerns business growth and revenue-related performance. Studies from Uganda, Tanzania, and Rwanda indicate that ICT adoption can improve communication, customer reach, market opportunities, and business processes, thereby supporting enterprise

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growth (Eton et al., 2019; Ibrahim et al., 2019; Rollin et al., 2022; Shaitu, 2022; Uwiringiyimana et al., 2025). Eton et al. (2019), for example, found evidence linking ICT adoption with SME growth in Kampala, while Rollin et al. (2022) reported a significant positive relationship between ICT adoption and perceived SME performance in Wakiso District. Similarly, Shaitu (2022) found that ICT adoption supported market access, productivity, and sales among SMEs in Tanzania.

A second important pathway is operational efficiency. ICT enables SMEs to improve communication, information management, coordination, and business-process execution. Mwantimwa (2019) found that ICT was used across different business processes in Tanzanian firms, including management, marketing, service delivery, and information-related activities. More recent evidence indicates a shift from the use of individual ICT applications towards integrated digital business processes. Bindeeba et al. (2025) found that digital business-process integration among Ugandan SMEs was associated with improved economic and environmental outcomes, with operational efficiency playing an important role in this relationship. Similarly, Majengo and Mbise (2023) demonstrated the relevance of cloud-based Software-as-a-Service adoption to SMEs' ability to access and utilise digital applications. These findings suggest that the performance effects of ICT increasingly arise from how effectively technologies are integrated into business processes, rather than merely from technology ownership.

The third pathway concerns market access and customer engagement. Internet-based technologies, e-commerce, social media, and digital marketing enable SMEs to overcome geographical constraints and establish more direct relationships with customers. Kabanda and Brown (2017) found that Tanzanian SMEs used e-commerce technologies to support marketing and business activities, while Ibrahim et al. (2019) reported a significant relationship between e-commerce adoption and SME growth in Uganda. Ndiege (2019) further demonstrated the strategic importance of social media technology for Kenyan SMEs, particularly in relation to customer engagement and strategic positioning. More recent evidence from Tanzania indicates that digital marketing strategies can contribute to sales growth, market share, and market development (Mushi, 2024). Thus, ICT can enhance SME performance by expanding the firm's market reach and capacity to interact with customers.

ICT penetration also appears to strengthen innovation capability. Digital technologies provide SMEs with access to information, communication networks, digital platforms, and new ways of organising business activities. Ndiege (2019) showed that social media technology could support strategic positioning, while Kobusingye et al. (2025) found that digital transformation was linked to innovation capability, market expansion, and organisational growth among SMEs in Uganda and Tanzania. Omoga et al. (2025) similarly identified digital capabilities and technology-related organisational factors as important in explaining entrepreneurial performance among Kenyan SMEs. Collectively, these findings suggest that ICT can facilitate innovation not only through the adoption of specific technologies but also by strengthening the organisational capabilities required to identify and exploit digital opportunities.

Another important outcome is competitiveness and strategic positioning. ICT can improve the ability of SMEs to respond to customers, access information, improve production processes, and compete in increasingly digital markets. Evidence from Kenya shows that advanced manufacturing technologies can improve production efficiency, product quality, and market competitiveness among SMEs (Musebe, 2024). In addition, Ndiege (2019) found that social media technologies could support the strategic positioning of Kenyan SMEs. Evidence from Uganda and Tanzania further indicates that digital transformation can support market expansion and organisational growth (Kobusingye et al., 2025). These findings indicate that ICT can become a

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strategic resource through which SMEs strengthen their position relative to competitors.

The reviewed studies also provide evidence of an emerging relationship between digital transformation and sustainability. Rather than treating ICT as a stand-alone operational tool, recent studies increasingly examine how digital technologies become embedded within broader organisational systems. Bindeeba et al. (2025) demonstrated that digital business-process integration can contribute to economic and environmental performance through improved operational efficiency. Kobusingye et al. (2025) linked digital transformation with innovation, market expansion, and organisational growth, while Omoga et al. (2025) highlighted the importance of digital capabilities, leadership commitment, organisational culture, and technology infrastructure for entrepreneurial performance. This evidence suggests that the longer-term contribution of ICT may depend on the extent to which digital technologies are incorporated into the strategic and organisational capabilities of SMEs.

Despite the predominantly positive evidence, the review shows that ICT penetration alone does not automatically translate into superior SME performance. The benefits of ICT are influenced by digital skills, financial resources, infrastructure, organisational readiness, management support, and the ability of firms to integrate technology into existing business processes. Kyakulumbye and Pather (2022) identified user confidence, perceived benefits, technology usability, and affordability as important considerations in ICT adoption among Ugandan SMEs. Majengo and Mbise (2023) similarly identified cost, security, compatibility, awareness, and management support as relevant to SaaS adoption. The evidence from Kenya and Rwanda also highlights the importance of digital capabilities and technological infrastructure in translating technology adoption into business outcomes (Omoga et al., 2025; Uwiringiyimana et al., 2025).

An important finding emerging from the synthesis is therefore that the relationship between ICT penetration and SME performance is context-dependent and capability-mediated. SMEs may have access to similar technologies but derive different performance outcomes depending on their digital skills, financial capacity, organisational readiness, infrastructure, and strategic use of technology. The evidence consequently points to a progression from simple technology adoption towards effective technology utilisation and digital integration as a more meaningful determinant of SME performance.

Overall, the evidence synthesised in Table 4 demonstrates that ICT penetration is positively associated with multiple dimensions of SME performance in East Africa, particularly business growth, operational efficiency, market access, customer engagement, innovation, competitiveness, and sustainability. However, the findings also indicate that the performance benefits of ICT are not automatic. They depend on SMEs' ability to acquire appropriate technologies, develop the capabilities required to use them effectively, and integrate them into business processes and organisational strategies. The review therefore suggests that policies aimed at improving SME performance through ICT should move beyond infrastructure provision alone and address digital skills, affordability, organisational readiness, technology integration, and supportive digital ecosystems.

Challenges and Barriers Affecting ICT Adoption among SMEs in East Africa

Although the reviewed evidence demonstrates that ICT adoption can improve several dimensions of SME performance, the findings also reveal persistent technological, financial, human, and organisational barriers that constrain effective adoption and utilisation of digital technologies. These barriers affect not only SMEs' ability to acquire ICT but also their capacity to integrate technologies into business processes and translate digital investments into improved performance. The challenges identified across the 15 studies include limited digital skills, high adoption costs,

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inadequate infrastructure, limited financial capacity, low awareness, security concerns, and organisational readiness constraints. Table 5 summarises the major barriers identified across the reviewed studies.

Table 5: Challenges and Barriers Affecting ICT Adoption among SMEs in East Africa

Challenge/Barrier	Description	Supporting Studies	Implication for SME Performance
Limited digital skills and ICT literacy	SME owners and employees may lack the knowledge, confidence, and technical skills required to select, implement, and effectively use digital technologies.	Kyakulumbye & Pather (2022); Omoga et al. (2025); Uwiringiyimana et al. (2025)	Limits effective ICT utilisation, reduces the ability to exploit advanced technologies, and constrains potential productivity and innovation gains.
High cost of ICT adoption	Costs associated with devices, Internet services, software, digital platforms, maintenance, and technology upgrades can discourage adoption, particularly among resource-constrained SMEs.	Rollin et al. (2022); Majengo & Mbise (2023); Kobusingye et al. (2025)	Discourages investment in advanced technologies and can result in partial or basic ICT adoption.
Inadequate ICT infrastructure and connectivity	Limited access to reliable Internet connectivity and supporting digital infrastructure constrains the availability and effective use of ICT.	Mwantimwa (2019); Kyakulumbye & Pather (2022); Omoga et al. (2025); Uwiringiyimana et al. (2025)	Restricts reliable technology use, limits access to digital markets, and reduces the scalability of digital business activities.
Limited financial resources	SMEs may have insufficient financial capacity to invest in ICT equipment, digital systems, training, subscriptions, and continuous technology upgrades.	Kobusingye et al. (2025); Bindeeba et al. (2025); Majengo & Mbise (2023)	Delays adoption of more sophisticated technologies and limits the ability of SMEs to sustain digital transformation.
Low awareness and perceived complexity	Limited awareness of available technologies, uncertainty about their benefits, and perceptions that digital solutions are difficult to use can reduce adoption intentions.	Kyakulumbye & Pather (2022); Majengo & Mbise (2023)	Reduces willingness to adopt ICT and slows the transition from basic technology use to more advanced digital applications.
Security and trust concerns	Concerns about data security, online risks, privacy, and the reliability of digital platforms can influence SMEs' willingness to adopt and expand digital technologies.	Rollin et al. (2022); Majengo & Mbise (2023); Kabanda & Brown (2017)	Reduces confidence in digital platforms and may limit participation in online transactions and digital business activities.

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Challenge/Barrier	Description	Supporting Studies	Implication for SME Performance
Limited organisational readiness and management support	Some SMEs lack the organisational structures, strategic orientation, management support, and internal capabilities required to integrate ICT effectively.	Majengo & Mbise (2023); Kobusingye et al. (2025); Omoga et al. (2025)	Limits effective technology integration and reduces the ability to convert ICT investments into sustained performance improvements.
Difficulties integrating ICT into business processes	Adoption of ICT does not necessarily result in effective digitalisation when technologies are not adequately integrated into existing operational and management processes.	Mwantimwa (2019); Bindeeba et al. (2025); Kobusingye et al. (2025)	Limits operational efficiency and reduces the performance benefits that could arise from integrated digital processes.
Organisational and contextual constraints	Differences in organisational capacity, business environment, sector characteristics, and local digital ecosystems affect SMEs' ability to adopt and utilise ICT effectively.	Ndiege (2019); Kabanda & Brown (2017); Kobusingye et al. (2025); Omoga et al. (2025)	Creates uneven ICT adoption and explains differences in digital performance outcomes across SMEs and geographical contexts.

Source: *Authors' compilation based on data extracted from the 15 studies included in the systematic review.*

The evidence presented in Table 5 indicates that limited digital skills and ICT literacy constitute one of the most important barriers to effective technology utilisation. The availability of ICT infrastructure does not necessarily guarantee effective adoption when SME owners and employees lack the knowledge, confidence, or skills required to use digital technologies. Kyakulumbye and Pather (2022) identified user confidence, perceived benefits, and technology usability as important considerations influencing ICT adoption among Ugandan SMEs. Similarly, evidence from Rwanda indicates the importance of digital capability in enabling micro-enterprises to derive value from ICT adoption (Uwiringiyimana et al., 2025). More recent evidence from Kenya also demonstrates the importance of digital capabilities and organisational factors in explaining SME performance in increasingly digital business environments (Omoga et al., 2025).

A second major barrier is the high cost of ICT adoption. SMEs frequently operate with constrained financial resources and therefore face difficulties financing ICT equipment, Internet connectivity, software, subscriptions, maintenance, employee training, and technology upgrades. Rollin et al. (2022) identified cost-related constraints among the factors limiting ICT utilisation among Ugandan SMEs, while Majengo and Mbise (2023) identified cost as an important consideration in the adoption of Software-as-a-Service among Tanzanian SMEs. Kobusingye et al. (2025) similarly highlight resource constraints as an important consideration in SME digital transformation. These findings suggest that affordability influences not only whether SMEs adopt ICT but also the depth and sophistication of technology adoption.

The review also identifies inadequate ICT infrastructure and connectivity as an important constraint. Effective digitalisation requires reliable access to Internet connectivity and supporting infrastructure. Where connectivity is unreliable, expensive, or unavailable, SMEs may be unable to participate consistently in online

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markets or make effective use of cloud-based and other Internet-dependent applications. Mwantimwa (2019) identified infrastructural conditions among the factors affecting ICT use in Tanzanian firms, while Kyakulumbye and Pather (2022) identified affordability and technology-related constraints affecting ICT adoption among Ugandan SMEs. Evidence from Kenya and Rwanda similarly points to the importance of technological infrastructure and digital access in supporting effective SME digitalisation (Omoga et al., 2025; Uwiringiyimana et al., 2025).

Closely related to infrastructure is the problem of limited financial capacity. ICT adoption frequently involves continuing rather than one-off expenditure because SMEs must maintain connectivity, renew software subscriptions, upgrade hardware, train employees, and adapt systems as technologies change. Kobusingye et al. (2025) identified resource constraints as an important challenge to digital transformation, while Bindeeba et al. (2025) demonstrate the importance of organisational capacity when integrating digital business processes. Thus, SMEs with limited financial resources may adopt basic digital technologies but struggle to progress towards more comprehensive digital transformation.

The studies further identify low awareness, perceived complexity, and uncertainty about the benefits of technology as barriers to adoption. Kyakulumbye and Pather (2022) found that perceived benefits, user confidence, and technology usability influence ICT adoption decisions among SMEs. Similarly, Majengo and Mbise (2023) identified awareness, perceived benefits, compatibility, and other organisational and technological factors as relevant to SaaS adoption. This suggests that technology adoption is partly a matter of perceived value and usability, rather than simply technology availability. SMEs are more likely to adopt technologies when they understand their benefits and perceive them as compatible with their existing business operations.

Security and trust concerns constitute another barrier, particularly as SMEs increasingly engage in e-commerce, online communication, and cloud-based services. Concerns about data security, privacy, cyber risks, and the reliability of digital platforms can discourage firms from expanding their online activities. Kabanda and Brown (2017) identified challenges associated with the digital business environment among Tanzanian SMEs, while Rollin et al. (2022) reported security concerns among the challenges associated with ICT utilisation. Majengo and Mbise (2023) similarly identified security as an important consideration in SaaS adoption. These findings indicate that trust and perceived security are important conditions for sustained participation in digital business environments.

The review additionally highlights organisational readiness and management support as important determinants of effective ICT adoption. Technology can generate limited benefits when SMEs lack the organisational structures, management commitment, skills, and strategic orientation necessary to integrate it into business activities. Majengo and Mbise (2023) identified management support as an important factor in SaaS adoption, while Kobusingye et al. (2025) and Omoga et al. (2025) demonstrate the importance of organisational and managerial capabilities in broader digital transformation. Consequently, ICT adoption should be viewed not simply as a technological decision but also as an organisational transformation process.

Another important issue emerging from the review is the difficulty of integrating ICT into existing business processes. The evidence indicates that the mere possession of digital technologies does not necessarily produce performance improvements. SMEs need to integrate ICT into activities such as marketing, communication, operations, information management, customer service, and decision-making. Mwantimwa (2019) demonstrates the importance of ICT use across business processes, while Bindeeba et al. (2025) show that digital business-process integration is associated with

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improved performance outcomes. Kobusingye et al. (2025) similarly highlight the importance of broader digital transformation rather than isolated technology adoption. This suggests that the depth of ICT integration may be more important for performance than simple technology ownership.

Finally, the reviewed studies indicate that ICT adoption is shaped by organisational and contextual conditions. SMEs operate in different sectors, locations, regulatory environments, and digital ecosystems, and these differences affect their ability to adopt and exploit digital technologies. Ndiege (2019) highlights the strategic role of social media technology among Kenyan SMEs, while Kabanda and Brown (2017) demonstrate the influence of the business environment on e-commerce adoption among Tanzanian SMEs. More recent evidence from Uganda, Kenya, Tanzania, and Rwanda further suggests that digital transformation outcomes depend on the interaction between technological resources and organisational capabilities (Kobusingye et al., 2025; Omoga et al., 2025; Uwiringiyimana et al., 2025).

Overall, the evidence synthesised in Table 5 demonstrates that the barriers to ICT adoption among East African SMEs are interrelated rather than isolated. Limited financial resources can restrict access to technology and training; inadequate infrastructure can reduce the usefulness of digital applications; limited digital skills can prevent SMEs from exploiting available technologies; and weak organisational readiness can hinder integration of ICT into business processes. Consequently, improving SME digitalisation requires a multidimensional approach that combines affordable and reliable digital infrastructure, digital skills development, financial support, cybersecurity awareness, management capacity, and organisational readiness**.**

The findings therefore suggest that policies designed to enhance ICT penetration among SMEs should move beyond simply increasing technology availability. Greater attention is required to the capacity of SMEs to adopt, integrate, and strategically utilise digital technologies. Addressing these complementary barriers would increase the likelihood that ICT adoption translates into improved productivity, market access, innovation, competitiveness, and sustainable SME performance across East Africa.

Research Gaps Identified from the Reviewed Studies

Although the 15 studies included in the systematic review provide evidence that ICT adoption and digital transformation can contribute to SME performance, the literature remains fragmented in terms of geographical coverage, research design, conceptualisation of ICT penetration, sectoral coverage, and understanding of the mechanisms through which digital technologies generate performance outcomes. The synthesis also reveals limited evidence on the longer-term and contextual dimensions of SME digital transformation. Table 6 summarises the principal research gaps identified from the reviewed studies and indicates areas requiring further investigation.

Table 6: Research Gaps Identified from the Reviewed Studies

Research Gap	Evidence from Reviewed Studies	Implication for Future Research
Limited regional comparative evidence	The reviewed studies were predominantly conducted within individual countries, particularly Uganda, Kenya, and Tanzania, while only limited evidence provides a comparative East African perspective.	Future studies should adopt comparative and multi-country designs to examine how national digital ecosystems, infrastructure, policies, and institutional environments influence ICT adoption and SME performance.

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Research Gap	Evidence from Reviewed Studies	Implication for Future Research
Predominance of cross-sectional designs	Most studies employed quantitative cross-sectional surveys, providing evidence of ICT adoption and performance at a particular point in time.	Longitudinal, panel, and repeated-measures studies are needed to establish how ICT adoption and digital transformation influence SME performance over time.
Inconsistent conceptualisation and measurement of ICT penetration	The reviewed studies examined different dimensions of ICT, including Internet use, e-commerce, social media, SaaS, digital marketing, advanced manufacturing technology, digital capabilities, and digital transformation.	Future research should develop more consistent multidimensional measures of ICT penetration, digital adoption, and digital maturity to facilitate comparison across studies and countries.
Limited examination of technology integration	Several studies examined individual technologies or specific applications, while fewer studies investigated how multiple technologies are integrated across business processes and organisational functions.	Future studies should examine the depth and breadth of ICT integration and distinguish between basic technology adoption and comprehensive digital transformation.
Limited sector-specific evidence	Most studies examined SMEs broadly rather than systematically comparing how ICT creates value across sectors such as agriculture, manufacturing, trade, and services.	Sector-specific and comparative research is needed to determine whether the performance effects and barriers associated with ICT vary according to business activity and technological requirements.
Limited examination of mediating and moderating mechanisms	The reviewed literature provides evidence of relationships between ICT adoption and SME outcomes but offers comparatively limited examination of the organisational and contextual mechanisms explaining these relationships.	Future research should investigate mediating and moderating factors such as digital skills, organisational readiness, management support, financial capacity, innovation capability, and institutional conditions.
Limited evidence on long-term sustainability and resilience	Most studies emphasised outcomes such as growth, sales, efficiency, innovation, competitiveness, or organisational performance, while relatively fewer examined longer-term sustainability, resilience, and the capacity of SMEs to withstand changing economic conditions.	Future studies should examine the contribution of ICT to SME resilience, continuity, sustainability, and long-term competitiveness.
Limited qualitative understanding of SME digitalisation experiences	Quantitative surveys dominate the reviewed evidence, while relatively few studies provide detailed accounts of how SME owners and managers experience technology adoption, interpret its benefits, and respond to adoption challenges.	Qualitative and mixed-method research should explore the lived experiences, decision-making processes, perceptions, and contextual realities underlying SME digitalisation.
Limited evidence on rural, micro, and underserved enterprises	The reviewed studies provide evidence from SMEs in several geographical settings, but rural, micro, and less digitally connected enterprises remain comparatively less visible in the evidence base.	Future research should examine digital inclusion and technology adoption among rural, micro, informal, and underserved enterprises.
Limited integration of technological,	Existing studies tend to emphasise particular technologies or	Future research should develop integrated frameworks that

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Research Gap	Evidence from Reviewed Studies	Implication for Future Research
organisational, and environmental factors	organisational factors, with fewer studies simultaneously considering technological capabilities, organisational readiness, financial conditions, infrastructure, and the wider business environment.	explain ICT adoption and SME performance as outcomes of interacting technological, organisational, and environmental conditions.

Source: *Authors' synthesis based on data extracted from the 15 studies included in the systematic review.*

The synthesis presented in Table 6 reveals that the first major gap concerns the fragmented geographical coverage of the evidence. Although the reviewed studies provide evidence from Uganda, Kenya, Tanzania, and Rwanda, most investigations were conducted within individual countries rather than through systematic regional comparisons. This limits understanding of how differences in national digital infrastructure, regulatory environments, institutional support, and digital-market development shape the relationship between ICT adoption and SME performance. Comparative East African studies would therefore provide stronger evidence on whether observed ICT-performance relationships are consistent across national contexts or are shaped by country-specific conditions.

A second gap concerns the predominance of cross-sectional research designs. Most of the reviewed studies collected data at a single point in time, making them useful for identifying associations between ICT adoption and SME outcomes but less capable of demonstrating how these relationships evolve. For example, studies examining ICT adoption, e-commerce, SaaS, digital marketing, and digital transformation provide valuable evidence of adoption patterns and performance relationships, but they generally provide limited insight into the cumulative effects of digitalisation over several years (Eton et al., 2019; Ibrahim et al., 2019; Majengo & Mbise, 2023; Mushi, 2024; Kobusingye et al., 2025). Longitudinal and panel research could therefore provide stronger evidence on whether initial ICT investments generate sustained improvements in productivity, growth, innovation, and competitiveness.

The review further identifies inconsistency in the conceptualisation and measurement of ICT penetration. The included studies examined different forms of technology, ranging from Internet and mobile communication to e-commerce, social media, SaaS, digital marketing, advanced manufacturing technologies, and broader digital transformation capabilities (Kabanda & Brown, 2017; Ndiege, 2019; Majengo & Mbise, 2023; Musebe, 2024; Omoga et al., 2025). This diversity reflects the multidimensional nature of ICT but also makes direct comparison across studies difficult. Future research should therefore distinguish clearly between ICT access, ICT adoption, ICT utilisation, ICT integration, and digital transformation, and develop multidimensional measures that capture differences in digital maturity among SMEs.

A related gap concerns the depth of technology integration. The reviewed evidence suggests that SMEs increasingly use combinations of technologies rather than isolated applications. For example, digital transformation studies examine the integration of digital platforms, infrastructure, organisational capabilities, and business processes (Kobusingye et al., 2025; Omoga et al., 2025), while Bindeeba et al. (2025) focus specifically on digital business-process integration. Nevertheless, comparatively limited research examines how the integration of several ICT applications across marketing, operations, finance, customer management, and decision-making produces cumulative performance effects. Future studies should therefore move beyond measuring whether an SME has adopted ICT and examine how extensively and strategically ICT is embedded within the organisation.

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The review also identifies a sectoral gap. Although the included studies cover SMEs operating in different sectors, most treat SMEs as a relatively homogeneous category. However, the value and requirements of ICT are likely to differ between agricultural, manufacturing, trade, service, and other enterprises. For example, advanced manufacturing technologies may be particularly relevant to production-oriented enterprises, whereas social media and digital marketing may be more important for customer-facing businesses (Musebe, 2024; Mushi, 2024). Future research should therefore undertake sector-specific and cross-sector comparisons to determine how business characteristics influence the adoption and performance effects of ICT.

Another important gap concerns the mechanisms through which ICT affects SME performance. The reviewed studies generally establish positive relationships between technology adoption and outcomes such as growth, innovation, market access, efficiency, and competitiveness. However, there is comparatively less evidence explaining why the magnitude of these benefits differs across SMEs. Factors such as digital skills, management support, organisational readiness, financial capacity, perceived benefits, technology compatibility, and innovation capability emerge across the studies as potentially important explanatory conditions (Kyakulumbye & Pather, 2022; Majengo & Mbise, 2023; Kobusingye et al., 2025; Omoga et al., 2025). Future studies should therefore develop and test models incorporating mediating and moderating mechanisms to explain how and under what conditions ICT adoption translates into improved SME performance.

The review further reveals limited evidence on long-term sustainability and resilience. Most studies focus on relatively immediate outcomes such as business growth, sales, market development, operational efficiency, innovation, and competitiveness. Although recent studies have begun to consider sustainability and organisational performance, evidence remains limited regarding whether ICT adoption enables SMEs to withstand economic shocks, maintain business continuity, adapt to changing markets, and achieve sustained competitiveness over time (Bindeeba et al., 2025; Kobusingye et al., 2025). Future research should therefore extend performance measures beyond short-term financial outcomes to include resilience, adaptability, continuity, and long-term sustainability.

A further methodological gap is the limited qualitative understanding of SME digitalisation experiences. Quantitative surveys dominate the reviewed evidence and provide useful information about the prevalence and statistical relationships associated with ICT adoption. However, they provide less insight into how SME owners and managers make technology decisions, how they perceive the risks and benefits of digitalisation, and how contextual circumstances shape their adoption experiences. Qualitative and mixed-method studies could therefore complement the existing evidence by examining the processes and experiences underlying observed statistical relationships.

The review also indicates limited evidence concerning rural, micro, informal, and otherwise underserved enterprises. Digital opportunities and constraints are unlikely to be distributed evenly across SMEs because access to infrastructure, finance, skills, and digital markets varies geographically and organisationally. Evidence from Uganda, Kenya, Tanzania, and Rwanda indicates the importance of infrastructure, affordability, digital capabilities, and organisational readiness, but more focused research is required to understand how these constraints affect smaller and less digitally connected enterprises (Kyakulumbye & Pather, 2022; Uwiringiyimana et al., 2025; Omoga et al., 2025).

Finally, the reviewed literature demonstrates a need for more integrated conceptual approaches. The evidence suggests that ICT adoption is not determined by technology availability alone. Instead, adoption and performance outcomes reflect interactions among technological factors,

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organisational capabilities, financial resources, human skills, infrastructure, management support, and the wider business environment. Future research should therefore integrate technological, organisational, and environmental dimensions when examining ICT penetration and SME performance. Such approaches would provide a more comprehensive explanation of why some SMEs are able to convert digital technologies into improved performance while others experience limited returns from ICT investments.

Overall, the systematic review demonstrates that the existing evidence has established a generally positive association between ICT adoption and SME performance but remains fragmented in terms of geographical coverage, research design, measurement, sectoral analysis, explanatory mechanisms, and long-term outcomes. These gaps provide a strong basis for future empirical research using comparative, longitudinal, qualitative, and mixed-method approaches. More importantly, the evidence suggests that future studies should shift from examining ICT adoption as a simple technology-availability phenomenon towards understanding ICT as a multidimensional organisational capability embedded within broader technological, financial, institutional, and market environments.

DISCUSSION

The purpose of this systematic review was to synthesise empirical evidence on the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance in East Africa. Drawing on 15 empirical studies, the findings demonstrate that ICT has evolved from a basic communication and information-access tool into an increasingly important strategic resource for SMEs. Across the reviewed studies, ICT adoption was associated with improvements in business growth, operational efficiency, market access, innovation, competitiveness, and organisational performance. However, the evidence also demonstrates that these benefits are not automatic. The extent to which SMEs derive value from ICT depends on complementary factors, including digital skills, financial resources, infrastructure, organisational readiness, management support, and the broader institutional environment.

The findings are consistent with the wider digital transformation literature, which suggests that technology creates business value when organisations possess the capabilities required to integrate and strategically utilise digital resources. In the East African SME context, therefore, ICT penetration should not be understood simply in terms of access to or ownership of technologies. Rather, attention should also be given to how SMEs utilise, integrate, and strategically deploy ICT within their business processes. The following discussion interprets the major findings of the review in relation to the empirical evidence and contextual realities of SMEs in East Africa.

ICT Penetration as a Driver of SME Performance

The findings of this review confirm that ICT penetration is an important contributor to SME performance in East Africa. Across the reviewed studies, ICT adoption was generally associated with improvements in business growth, operational efficiency, market access, innovation, and competitiveness. These findings indicate that ICT functions not merely as an operational support mechanism but increasingly as a strategic resource through which SMEs can overcome constraints associated with information access, customer reach, market participation, and resource utilisation.

One important pathway through which ICT improves SME performance is by enhancing access to information and business opportunities. Internet technologies, mobile communication tools, and digital platforms enable SMEs to obtain business information, communicate with customers and suppliers, and respond more rapidly to market developments. Evidence from the reviewed studies indicates that ICT use improves communication, information exchange, and access to markets, thereby strengthening SMEs' capacity to undertake business activities

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more efficiently (Eton et al., 2019; Mwantimwa, 2019; Ndiege, 2019). This is particularly important in East African markets, where geographical distance, information asymmetries, and limited access to formal business networks can constrain SME growth.

The review also demonstrates the importance of mobile and digital communication technologies in SME activities. Mobile technologies provide relatively accessible mechanisms for communication, customer interaction, information exchange, and business coordination. Studies from Uganda, Kenya, and Tanzania indicate that mobile and Internet-based technologies have enabled SMEs to strengthen customer relationships, improve communication, and expand access to business opportunities (Ndiege, 2019; Rollin et al., 2022; Shaitu, 2022). Rather than replacing traditional business practices completely, these technologies often complement existing SME activities and provide relatively affordable mechanisms for improving day-to-day business operations.

ICT penetration also contributes to operational efficiency by improving information management, coordination, and business-process integration. The reviewed evidence indicates that digital technologies can enable SMEs to streamline activities, improve access to information, and support more efficient resource utilisation. Mwantimwa (2019) demonstrates the relevance of ICT use to organisational activities, while Bindeeba et al. (2025) provide evidence that digital business-process integration can enhance SME performance. Similarly, Majengo and Mbise (2023) show that adoption of Software-as-a-Service is influenced by factors such as perceived benefits, compatibility, cost, security, and management support. Collectively, these findings suggest that the performance value of ICT increases when technologies are integrated into business processes rather than used only as isolated applications.

The review further highlights the contribution of ICT to market access and customer engagement. E-commerce, social media, digital marketing, and online communication platforms provide SMEs with opportunities to reach customers beyond their immediate geographical locations. Kabanda and Brown (2017) demonstrate the importance of digital platforms in supporting SME engagement with online markets, while Ndiege (2019) highlights the strategic value of social media technologies for SME activities. More recent evidence on digital marketing similarly indicates that digital channels can support customer engagement and business performance (Mushi, 2024). These findings suggest that ICT can reduce some of the geographical and informational barriers that traditionally limit SME market expansion.

Another important contribution of ICT is its role in innovation and competitiveness. Digital technologies can enable SMEs to access information and knowledge, develop new approaches to service delivery, improve products and processes, and respond more rapidly to changing customer requirements. Evidence from Kobusingye et al. (2025), Musebe (2024), and Omoga et al. (2025) indicates that digital capabilities and technology adoption are associated with innovation, competitiveness, and organisational performance. This reinforces the argument that the strategic value of ICT lies not simply in possessing digital technologies but in the ability of firms to convert those technologies into organisational capabilities.

However, the findings also demonstrate that ICT adoption alone does not guarantee improved performance. SMEs require complementary capabilities to convert technological resources into business value. Digital skills enable employees and owners to use technologies effectively; financial resources enable firms to acquire and maintain appropriate systems; management support facilitates organisational implementation; and reliable infrastructure makes digital applications usable. The importance of these complementary conditions is evident in studies examining ICT adoption among Ugandan and Tanzanian SMEs (Kyakulumbye & Pather,

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2022; Majengo & Mbise, 2023). This finding is consistent with the resource-based view, which emphasises that sustainable competitive advantage depends not simply on possessing resources but on the organisational capability to deploy valuable resources effectively.

The implication is that ICT penetration should be understood as part of a broader digital capability-building process. Policies aimed at improving SME performance should therefore move beyond increasing technology access and address digital skills, affordability, infrastructure, management capacity, and organisational readiness. Such an approach would increase the likelihood that ICT adoption translates into measurable improvements in SME performance.

Digital Transformation and SME Competitiveness in East Africa

The findings further demonstrate that digital transformation is becoming an increasingly important pathway through which SMEs can improve competitiveness. While basic ICT adoption generally involves the use of individual technologies such as mobile phones, Internet services, social media, or communication applications, digital transformation involves a deeper integration of digital technologies into organisational processes, customer engagement, decision-making, and business models. The reviewed studies suggest that SMEs are gradually moving from basic technology use towards broader forms of digital integration, although the extent of this transition varies considerably across firms and contexts.

A major contribution of digital transformation to SME competitiveness is its capacity to improve market reach and customer engagement. Digital platforms, e-commerce applications, social media, and digital marketing tools allow SMEs to communicate with customers, promote products, strengthen brand visibility, and access markets beyond their immediate physical locations. Evidence from Kabanda and Brown (2017) and Ndiege (2019) demonstrates the importance of digital platforms and social media in enhancing SME market engagement. More recent evidence on digital marketing further indicates that digital channels can contribute to customer reach and business performance (Mushi, 2024). These findings are particularly relevant to East African SMEs because digital platforms provide relatively accessible mechanisms for overcoming some geographical and informational barriers to market participation.

Digital transformation also contributes to innovation capability. As SMEs acquire and integrate digital capabilities, they can access information more efficiently, redesign business processes, introduce new forms of customer interaction, and develop alternative approaches to value creation. Kobusingye et al. (2025) demonstrate the relationship between digital transformation and SME growth and innovation, while Omoga et al. (2025) highlight the importance of digital capabilities in strengthening SME performance. Musebe (2024) similarly demonstrates the relevance of advanced technology adoption to innovation-related outcomes. These findings suggest that competitiveness increasingly depends on an SME's capacity to use digital technologies to create and capture value rather than simply on the possession of digital devices.

Another pathway is operational efficiency and process integration. Digital transformation enables SMEs to connect different activities within the organisation and improve the flow of information across business functions. Bindeeba et al. (2025) provide evidence on the contribution of digital business-process integration to SME performance, while Majengo and Mbise (2023) demonstrate the relevance of cloud-based Software-as-a-Service adoption to organisational technology use. The combined evidence suggests that deeper technology integration can produce greater performance benefits than fragmented or isolated technology adoption.

The review nevertheless reveals that digital transformation remains uneven among East African SMEs. Many firms continue to depend

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primarily on basic technologies, while more comprehensive integration of digital applications across business processes remains comparatively limited. This does not necessarily mean that advanced technologies are absent; rather, the evidence suggests that there is considerable variation in the depth, breadth, and maturity of digital adoption. Some SMEs use individual digital applications for communication or marketing, whereas others are beginning to integrate digital technologies into broader operational and strategic activities.

This variation points to an important distinction between ICT adoption and digital transformation. Adoption refers to the decision to acquire or use a particular technology, whereas transformation involves the strategic integration of digital capabilities into organisational activities. The reviewed evidence indicates that future research should therefore examine not only whether SMEs have adopted ICT but also the extent to which ICT is embedded in their operations. Such an approach would provide a more accurate understanding of why similar levels of technology access can produce different performance outcomes across SMEs.

The findings also demonstrate that successful digital transformation requires organisational readiness and managerial capabilities. Technology implementation can be constrained when SMEs lack appropriate skills, management support, financial resources, or organisational structures. Kyakulumbye and Pather (2022) identify user confidence and perceived benefits as relevant to ICT adoption, while Majengo and Mbise (2023) highlight the importance of compatibility, cost, security, and management support in SaaS adoption. Kobusingye et al. (2025) further demonstrate the importance of organisational capabilities in digital transformation. These findings reinforce the view that digital transformation is not exclusively a technological process but also an organisational and strategic process.

The uneven nature of digital transformation also has important policy implications. Improving SME competitiveness through digitalisation requires coordinated interventions that address both technology supply and SME capabilities. Governments and SME-support institutions should therefore promote affordable and reliable digital infrastructure, digital skills development, access to technology financing, cybersecurity awareness, and managerial capacity building. Technology providers and financial institutions can also contribute by developing affordable and scalable solutions appropriate to the resource constraints of SMEs.

Overall, the evidence indicates that digital transformation represents an important pathway to SME competitiveness in East Africa, but its effectiveness depends on the ability of SMEs to move beyond basic technology adoption towards meaningful integration and strategic utilisation. The central issue is therefore not simply whether SMEs have access to ICT, but whether they possess the capabilities and enabling conditions required to convert ICT resources into improved business processes, innovation, market opportunities, and sustainable competitive advantage.

Implications of the Findings for SME Development

Taken together, the findings suggest that the relationship between ICT penetration and SME performance should be viewed as a capability-dependent relationship. ICT provides SMEs with opportunities to improve performance, but the realisation of these opportunities depends on the interaction between technology, human capabilities, organisational resources, and the wider business environment. This explains why SMEs operating within similar technological environments may experience different performance outcomes.

The evidence also suggests that the digital transformation agenda in East Africa should move from a primary focus on ICT access towards ICT utilisation, integration, and digital maturity.

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Expanding connectivity remains important, but connectivity alone is unlikely to eliminate the performance differences observed among SMEs. Investments in digital literacy, management capabilities, organisational readiness, affordable technology financing, and supportive institutional frameworks are equally important.

For researchers, the findings point towards the need for more comparative, longitudinal, qualitative, and mixed-method research. Such approaches would help establish how ICT adoption evolves over time, how contextual conditions influence outcomes, and how SME owners and managers experience and interpret digital transformation. Future research should also develop more consistent measures of ICT penetration and digital maturity and investigate the mediating and moderating mechanisms through which ICT affects SME performance.

In conclusion, the reviewed evidence demonstrates that ICT penetration has become an important strategic resource for SME development in East Africa. Its contribution extends beyond communication and information access to include market expansion, operational efficiency, innovation, competitiveness, and organisational development. However, ICT does not generate these benefits automatically. Sustainable performance improvements depend on SMEs' ability to integrate digital technologies with appropriate skills, financial resources, management capabilities, infrastructure, and institutional support. The future of SME digitalisation in East Africa therefore lies not simply in increasing technology adoption, but in enabling SMEs to effectively integrate and strategically utilise ICT as an organisational capability for sustainable growth and competitiveness.

Barriers to Effective ICT Adoption among SMEs

Despite the demonstrated contribution of ICT to SME performance, the findings of this systematic review indicate that SMEs in East Africa continue to face significant barriers that constrain effective technology adoption, integration, and utilisation. The barriers identified across the 15 reviewed studies are multidimensional and include technological, financial, human, organisational, and contextual factors. The evidence suggests that the challenge facing SMEs is therefore not limited to gaining access to digital technologies but also concerns their ability to acquire, integrate, and strategically utilise these technologies to generate sustained business value.

A major barrier identified across the reviewed studies is limited digital skills and ICT literacy among SME owners and employees. Although digital technologies are increasingly available, SMEs may lack the technical competencies and confidence required to select appropriate technologies, operate digital platforms, manage digital information, and integrate ICT into business processes. Kyakulumbye and Pather (2022) identified user confidence, perceived benefits, and technology usability as important considerations influencing ICT adoption among Ugandan SMEs. More recent evidence also emphasises the importance of digital capabilities and organisational competencies in enabling SMEs to benefit from digital transformation (Kobusingye et al., 2025; Omoga et al., 2025). This suggests that expanding access to technology without strengthening human capabilities may produce limited performance benefits.

A second major challenge is the high cost of ICT adoption and maintenance. SMEs often operate with constrained financial resources and may face difficulties financing hardware, Internet connectivity, software subscriptions, cloud services, employee training, and technology upgrades. Rollin et al. (2022) identified cost-related constraints among the challenges affecting ICT utilisation, while Majengo and Mbise (2023) identified cost as an important consideration in Software-as-a-Service adoption. Kobusingye et al. (2025) similarly identify resource constraints as an important challenge to digital transformation. Consequently, financially constrained SMEs may adopt basic technologies

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while lacking the resources required for deeper and more integrated digital transformation.

The review also identifies inadequate ICT infrastructure and connectivity as an important constraint. Reliable and affordable Internet access and supporting infrastructure are essential for effective utilisation of digital technologies. Where connectivity is unreliable, expensive, or unavailable, SMEs may experience difficulties participating in online markets, using cloud-based applications, communicating with customers, or integrating digital systems into their operations. Mwantimwa (2019) and Kyakulumbye and Pather (2022) provide evidence of technology and infrastructure-related constraints affecting ICT utilisation and adoption. Evidence from Kenya and Rwanda further indicates the importance of technological infrastructure and digital access to SME digitalisation (Omoga et al., 2025; Uwiringiyimana et al., 2025).

Closely associated with these barriers is limited organisational readiness. ICT adoption requires more than purchasing technology; it requires management support, appropriate organisational structures, employee capabilities, and willingness to modify existing business processes. Majengo and Mbise (2023) identified management support and compatibility as relevant considerations in SaaS adoption, while Kobusingye et al. (2025) emphasised organisational capabilities in the broader digital transformation process. SMEs that lack strategic readiness may therefore struggle to integrate ICT effectively, even when technologies are available.

The review further identifies low awareness and perceived complexity of digital technologies as barriers to adoption. SME owners may be uncertain about the benefits of particular technologies or may perceive them as too complex, expensive, or unsuitable for their business operations. Kyakulumbye and Pather (2022) found that perceived benefits, user confidence, and technology usability influence ICT adoption decisions, while Majengo and Mbise (2023) identified perceived benefits and compatibility among factors affecting SaaS adoption. These findings indicate that adoption decisions are influenced not only by the objective availability of technology but also by how SME owners perceive its usefulness and suitability.

Security and trust concerns also represent important barriers, particularly as SMEs increasingly participate in online business activities. Concerns relating to data protection, privacy, cyber risks, online fraud, and the security of digital platforms can discourage firms from expanding their digital activities. Rollin et al. (2022) identified security concerns among the challenges associated with ICT use, while Majengo and Mbise (2023) identified security as a consideration in SaaS adoption. Kabanda and Brown (2017) also demonstrate the importance of contextual and trust-related considerations in the adoption of digital business platforms. These concerns may therefore affect both the willingness of SMEs to adopt ICT and the extent to which they use digital technologies for commercially sensitive activities.

Another barrier concerns difficulties in integrating ICT into existing business processes. The reviewed evidence suggests that technology ownership alone does not guarantee performance improvements. SMEs need to embed digital technologies into marketing, communication, operations, information management, customer service, and decision-making processes. Mwantimwa (2019) demonstrates the relevance of ICT to organisational activities, while Bindeeba et al. (2025) provide evidence that digital business-process integration can contribute to SME performance. This indicates that the depth of integration is an important determinant of whether technology investments generate meaningful business value.

The review also points to contextual and institutional constraints. SMEs operate within different infrastructure, market, regulatory, and support environments, which influence their capacity to adopt and utilise ICT. Ndiege (2019), Kabanda and Brown (2017), Kobusingye et al.

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(2025), and Omoga et al. (2025) collectively demonstrate the importance of the wider business and organisational environment in shaping technology adoption and performance outcomes. This suggests that SME digital transformation cannot be addressed solely at the firm level; the surrounding ecosystem also matters.

Overall, the barriers identified in the review demonstrate that ICT adoption among SMEs is shaped by the interaction of technology availability, affordability, digital capabilities, organisational readiness, infrastructure, security, and contextual conditions. Addressing one constraint in isolation is unlikely to produce comprehensive digital transformation. Effective interventions therefore need to combine affordable connectivity, digital skills development, technology financing, management capacity, cybersecurity awareness, and supportive institutional environments. Such an integrated approach would improve the likelihood that ICT adoption translates into sustained improvements in SME productivity, innovation, competitiveness, and growth.

THEORETICAL AND PRACTICAL IMPLICATIONS

The findings of this systematic review have important theoretical and practical implications for understanding ICT penetration and SME performance in East Africa. The synthesis of 15 studies demonstrates that the relationship between ICT adoption and SME performance is not determined by technology availability alone. Rather, it reflects the interaction between technological characteristics, organisational capabilities, financial resources, human competencies, and the wider business environment.

Theoretical Implications

From a Technology–Organisation–Environment (TOE) perspective, the findings provide strong support for understanding ICT adoption as a multidimensional process. The reviewed studies demonstrate that technological factors such as compatibility, perceived benefits, security, cost, and usability influence adoption, while organisational factors such as management support, digital skills, financial resources, and organisational readiness also matter (Kyakulumbye & Pather, 2022; Majengo & Mbise, 2023). Environmental and contextual conditions, including infrastructure and the wider digital ecosystem, further influence the ability of SMEs to adopt and utilise ICT effectively. The findings therefore reinforce the usefulness of the TOE framework for explaining SME digitalisation in East African contexts.

The findings also provide support for the Diffusion of Innovation (DOI) perspective, particularly the importance of perceived benefits, compatibility, and complexity in technology adoption decisions. Kyakulumbye and Pather (2022) demonstrate the importance of perceived benefits and usability, while Majengo and Mbise (2023) identify compatibility and other technology-related considerations in SaaS adoption. These findings suggest that SMEs are more likely to adopt technologies when they perceive clear business value and compatibility with existing operations. Conversely, technologies perceived as costly, complex, insecure, or difficult to integrate are less likely to be adopted extensively.

The review further supports the Resource-Based View (RBV) by demonstrating that technology itself does not automatically constitute a sustainable competitive advantage. ICT infrastructure and digital tools become strategically valuable when SMEs possess complementary resources and capabilities, including skilled employees, management capacity, innovation capability, and the ability to integrate technology into business processes. The positive performance outcomes reported by studies such as Kobusingye et al. (2025), Bindeeba et al. (2025), and Omoga et al. (2025) can therefore be interpreted as evidence that organisational capabilities influence the extent to which SMEs convert ICT resources into performance advantages.

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Taken together, these theoretical perspectives suggest that ICT penetration should be conceptualised as more than simple technology acquisition. The evidence supports a capability-based interpretation of digital transformation, in which technology, organisational capabilities, and environmental conditions interact to determine SME outcomes. This provides a useful basis for developing future models that examine mediating and moderating mechanisms in the ICT–SME performance relationship.

Practical Implications

From a practical perspective, the findings indicate that policymakers should move beyond policies focused solely on increasing ICT access and develop broader SME digital transformation ecosystems. Governments and development agencies should prioritise affordable and reliable Internet connectivity, digital infrastructure, digital skills development, and institutional support. Such interventions should recognise that SMEs require both access to technology and the capabilities necessary to use it productively.

For SME owners and managers, the findings emphasise the importance of strategic rather than purely operational ICT adoption. SMEs should assess the compatibility of technologies with their business models, invest in employee digital skills, strengthen cybersecurity practices, and progressively integrate digital technologies into marketing, communication, operations, customer management, and decision-making. Strategic integration is more likely to produce sustained performance benefits than isolated technology acquisition.

Financial institutions and technology providers can also contribute by developing affordable and scalable financing and technology solutions appropriate for SMEs. Flexible technology financing, affordable software subscriptions, technical support, and user-friendly digital platforms can reduce adoption barriers for resource-constrained enterprises. Partnerships between governments, financial institutions, technology firms, universities, and SME associations could further strengthen the digital ecosystem.

Overall, the theoretical and practical implications indicate that sustainable SME digital transformation requires an integrated approach combining technology, organisational capability, human skills, financial resources, and enabling environmental conditions. Such an approach can improve the capacity of SMEs to convert ICT investments into innovation, efficiency, market expansion, competitiveness, and sustainable performance.

IMPLICATIONS FOR POLICY AND SME DEVELOPMENT IN EAST AFRICA

The findings provide important implications for policymakers, development agencies, financial institutions, and organisations responsible for SME development in East Africa. Although ICT penetration is associated with improved SME performance, the evidence shows that digital transformation remains uneven because SMEs differ in infrastructure access, financial capacity, digital skills, organisational readiness, and exposure to supportive institutional environments.

First, governments should strengthen affordable and reliable digital infrastructure. Investment should focus on broadband connectivity, mobile network coverage, reliable Internet services, and supporting infrastructure, particularly in rural and underserved areas. Infrastructure policies should also address affordability because the availability of connectivity does not necessarily mean that resource-constrained SMEs can use it intensively.

Second, policymakers should prioritise digital skills and capability development. Training programmes should address practical SME needs, including digital marketing, e-commerce, cloud applications, data management, cybersecurity, digital communication, and the integration of digital technologies into business processes. Universities, technology providers, government agencies, and SME associations can collaborate to provide accessible and context-specific training.

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Third, there is a need for improved access to finance for digital transformation. SMEs often face difficulty financing technology acquisition, connectivity, software subscriptions, training, and system maintenance. Financial institutions and governments could therefore explore affordable technology loans, digital transformation financing schemes, targeted grants, and other appropriate mechanisms that reduce the initial and continuing costs of digitalisation.

Fourth, governments should strengthen digital regulatory and institutional frameworks. Clear and supportive policies concerning e-commerce, digital transactions, data protection, cybersecurity, and online business activities can improve confidence in digital markets. Stronger institutional support can also improve SMEs' access to training, information, technology providers, and business-development services.

Fifth, SME support programmes should adopt sector-sensitive approaches to digitalisation. The reviewed evidence demonstrates that ICT requirements differ across business activities. Technologies supporting e-commerce and digital marketing may be particularly valuable to customer-facing enterprises, while digital process integration, cloud-based systems, and advanced production technologies may have greater relevance to manufacturing and other operationally intensive firms. Consequently, digital transformation programmes should be designed around specific sector and enterprise needs rather than promoting a single technology solution for all SMEs.

Sixth, policymakers and development partners should promote inclusive digital transformation among rural, micro, informal, and underserved enterprises. These businesses may face greater barriers related to affordability, infrastructure, skills, and institutional access. Digital inclusion strategies should therefore consider the specific circumstances of smaller and less digitally connected enterprises and promote scalable technologies that can be adopted progressively.

Seventh, there is an opportunity for stronger regional cooperation within the East African Community. Regional collaboration can facilitate knowledge sharing, harmonisation of digital policies, development of compatible digital systems, and expansion of cross-border digital trade opportunities. A coordinated regional approach could strengthen the digital ecosystem within which East African SMEs compete.

Overall, the policy implications indicate that successful SME digitalisation requires an ecosystem approach. Governments, financial institutions, technology providers, universities, development partners, and SME support organisations should work collectively to address infrastructure, skills, affordability, security, and organisational-capability constraints. The policy objective should therefore shift from simply increasing ICT access towards enabling SMEs to adopt, integrate, and strategically utilise ICT for sustained performance improvement.

FUTURE RESEARCH DIRECTIONS

The systematic review identifies several areas requiring further empirical investigation. Although the 15 reviewed studies provide substantial evidence of a positive association between ICT adoption and SME performance, important gaps remain concerning the duration, mechanisms, context, and depth of digital transformation.

First, future research should employ longitudinal and panel designs to investigate the long-term effects of ICT adoption. Most of the reviewed studies employed cross-sectional designs, which provide useful evidence of associations but offer limited insight into how ICT investments affect SME performance over time. Longitudinal research could examine whether digital adoption produces sustained improvements in growth, productivity, innovation, competitiveness, resilience, and business continuity.

Second, more comparative East African studies are needed. The existing evidence is concentrated largely within individual countries, particularly

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Uganda, Kenya, and Tanzania. Future studies should compare countries systematically to determine how variations in digital infrastructure, policy environments, institutional support, market conditions, and economic development influence ICT adoption and SME performance.

Third, future research should improve the measurement of ICT penetration and digital maturity. The reviewed studies employ diverse measures, ranging from individual technologies to broader digital capabilities and digital transformation. Future studies should distinguish among ICT access, adoption, utilisation, integration, and digital transformation and develop multidimensional measures capable of capturing differences in SME digital maturity.

Fourth, future research should examine the integration of multiple digital technologies across SME business processes. Existing research often focuses on particular technologies or applications. More research is needed on how SMEs combine digital communication, e-commerce, digital marketing, cloud-based systems, business-process technologies, and other digital tools across marketing, operations, finance, customer management, and decision-making. This would help explain whether deeper technology integration generates greater performance benefits than isolated ICT adoption.

Fifth, there is a need to investigate mediating and moderating mechanisms in the ICT–SME performance relationship. Future studies should examine the roles of digital skills, management support, organisational readiness, financial capacity, innovation capability, entrepreneurial orientation, and institutional conditions. Such research would help explain why some SMEs obtain greater benefits from ICT than others operating under apparently similar technological conditions.

Sixth, future research should give greater attention to rural, micro, informal, and underserved SMEs. These enterprises remain comparatively underrepresented in the existing evidence and may experience different barriers to technology adoption. Research in these settings would provide valuable evidence for inclusive digitalisation policies.

Seventh, future studies should examine ICT in relation to broader SME sustainability and resilience outcomes. Existing studies predominantly focus on growth, sales, efficiency, innovation, competitiveness, and organisational performance. Future research should also consider business continuity, resilience to economic shocks, adaptability, employment sustainability, and other longer-term dimensions of SME development.

Eighth, future research should investigate emerging technologies, including artificial intelligence, Internet of Things, blockchain, big-data analytics, automation, and increasingly sophisticated cloud-based enterprise systems. These technologies should be treated as emerging research opportunities rather than established dominant findings of the present review. Examining their affordability, usability, readiness requirements, and performance implications would extend the current East African evidence base.

Ninth, greater use should be made of qualitative and mixed-method approaches. Quantitative surveys dominate the reviewed evidence and are useful for identifying statistical relationships, but qualitative research can provide deeper insight into SME owners' technology decisions, perceptions, experiences, and responses to adoption barriers. Mixed-method designs could combine these contextual insights with quantitative evidence of performance effects.

Finally, future research should evaluate the effectiveness of SME digitalisation policies and support programmes. There remains limited evidence concerning whether government training programmes, technology financing initiatives, infrastructure interventions, and public-private digital-support programmes produce measurable improvements in SME digital capabilities and

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performance. Evaluating these interventions would provide stronger evidence for policy design.

Overall, future research should conceptualise ICT adoption not merely as technology acquisition but as the development of a strategic organisational capability. Research that integrates technological, organisational, financial, and environmental dimensions will provide a more comprehensive explanation of how SMEs can convert ICT investments into sustainable performance advantages. Addressing these gaps would strengthen both theoretical understanding and evidence-based policy for SME digital transformation in East Africa.

CONCLUSION

Summary

This systematic literature review synthesised empirical evidence on the relationship between Information and Communication Technology (ICT) penetration and Small and Medium Enterprise (SME) performance in East Africa. Guided by the PRISMA 2020 framework, the review systematically identified, screened, and synthesised 15 eligible empirical studies published between 2015 and 2026. The review examined the ICT technologies adopted by SMEs, their contribution to different dimensions of SME performance, the barriers affecting effective ICT adoption, and the major gaps in the existing literature.

The findings demonstrate that ICT penetration is an important enabler of SME performance in East Africa. Across the reviewed studies, ICT adoption was associated with improvements in business growth, operational efficiency, market access, customer engagement, innovation, financial inclusion, and competitiveness. The technologies examined ranged from basic applications such as mobile phones, internet connectivity, and digital communication tools to more advanced solutions including e-commerce, mobile financial services, cloud computing, Software-as-a-Service (SaaS), digital transformation systems, and other emerging digital technologies. These findings suggest that ICT has increasingly evolved from a basic communication resource into a strategic business capability that can support SME value creation and competitiveness.

The review further established that ICT contributes to SME performance through several interconnected pathways. Mobile technologies and digital financial services facilitate communication, customer interaction, financial transactions, and access to wider markets. Internet technologies and e-commerce platforms improve information access, market visibility, customer reach, and business connectivity. Similarly, cloud-based applications and integrated digital systems can enhance operational efficiency, information management, coordination, and decision-making. More broadly, digital capabilities and transformation initiatives create opportunities for SMEs to strengthen innovation, develop new business models, and respond more effectively to changing market conditions.

However, the findings also demonstrate that the benefits of ICT penetration are not automatic. SMEs continue to face multiple technological, financial, human, organisational, and institutional barriers that constrain meaningful digital transformation. The most prominent challenges identified across the reviewed studies include limited digital skills and ICT literacy, high costs of technology adoption, inadequate ICT infrastructure, limited financial resources, low awareness of digital opportunities, cybersecurity and privacy concerns, organisational resistance, and weak institutional support. These barriers indicate that technology availability alone is insufficient to generate improved SME performance. Rather, SMEs require complementary capabilities and enabling conditions to effectively integrate digital technologies into their business activities.

The review also identified important conceptual, methodological, contextual, and empirical gaps in the existing literature. Research remains concentrated in individual countries, particularly

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Uganda, Kenya, and Tanzania, with limited comparative evidence across the wider East African region. The literature is also dominated by cross-sectional quantitative studies, limiting understanding of the long-term effects and causal mechanisms associated with ICT adoption. Furthermore, considerable attention has been given to basic ICT applications, while emerging technologies and advanced digital solutions remain comparatively underexplored. Limited research has also examined rural and informal SMEs, sector-specific differences, SME sustainability outcomes, and the mediating and moderating mechanisms through which ICT capabilities translate into improved performance.

The review therefore contributes to the literature by conceptualising ICT penetration not simply as technology acquisition, but as a broader organisational capability embedded within technological, organisational, and environmental conditions. The evidence indicates that SMEs are more likely to derive meaningful performance benefits from ICT when technology adoption is supported by appropriate digital skills, managerial capabilities, financial resources, organisational readiness, adequate infrastructure, and enabling institutional environments. This perspective reinforces the importance of considering ICT adoption within the broader context of digital transformation rather than treating technology access as an end in itself.

From a policy and development perspective, the findings suggest that East African governments and SME development stakeholders should adopt integrated approaches to SME digitalisation. Such approaches should combine affordable and reliable digital infrastructure, digital skills development, accessible financing, cybersecurity awareness, supportive regulatory frameworks, and sector-specific digital solutions. Collaboration among governments, financial institutions, technology providers, universities, development organisations, and SME associations is particularly important for creating inclusive digital ecosystems that enable SMEs to participate effectively in the digital economy.

In conclusion, ICT penetration represents an important driver of SME performance, competitiveness, and sustainable development in East Africa. Nevertheless, its contribution depends on the capacity of SMEs to adopt, integrate, and strategically utilise digital technologies. The focus of digital transformation policies and SME development initiatives should therefore move beyond expanding ICT access toward building the capabilities and institutional conditions required to convert digital technologies into sustainable business value.

Limitations of the Review

Although this systematic review provides a structured synthesis of evidence on ICT penetration and SME performance in East Africa, several limitations should be acknowledged. First, the review was restricted to English-language studies. Consequently, potentially relevant evidence published in other languages may not have been captured, particularly where research on SME digitalisation has been undertaken in multilingual contexts.

Second, the review was restricted to peer-reviewed empirical studies published between 2015 and 2026 and identified through the selected databases and search strategy. While these criteria helped maintain the relevance and academic quality of the evidence, they may have excluded potentially informative sources such as policy reports, institutional publications, conference proceedings, theses, and other grey literature. Such sources may contain additional evidence concerning national ICT policies, infrastructure development, and SME digitalisation initiatives.

Third, the 15 included studies demonstrated considerable methodological and contextual heterogeneity. The studies differed in research design, sample characteristics, ICT technologies examined, SME sectors, measures of ICT penetration, performance indicators, and analytical techniques. This heterogeneity limited the comparability of findings and made statistical aggregation inappropriate. Accordingly, the

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evidence was synthesised narratively rather than through a formal meta-analysis.

Fourth, a substantial proportion of the reviewed studies employed cross-sectional research designs. Although these studies provide useful evidence of associations between ICT adoption and SME performance, their designs limit the ability to establish temporal relationships and causal effects. The positive relationships identified in the review should therefore be interpreted primarily as evidence of association rather than definitive proof that ICT adoption causes improvements in SME performance. Longitudinal, panel, and experimental research would provide stronger evidence concerning causal mechanisms and long-term effects.

Fifth, the geographical coverage of the available evidence was uneven. The reviewed literature was concentrated mainly in Uganda, Kenya, and Tanzania, while evidence from some other East African countries was limited. This uneven distribution restricts the extent to which the findings can be generalised across the entire East African region. Differences in digital infrastructure, regulatory environments, economic structures, and levels of technological development may produce different ICT adoption and performance outcomes across countries.

Finally, the synthesis depended on the quality and completeness of reporting in the original studies. Differences in how researchers conceptualised and measured ICT penetration, digital capabilities, and SME performance created challenges in comparing findings across studies. In addition, the rapidly changing nature of digital technologies means that evidence concerning emerging technologies may evolve faster than the publication cycle of academic research.

Despite these limitations, the review provides a useful synthesis of the available empirical evidence and identifies important patterns concerning ICT adoption, SME performance, adoption barriers, and research gaps in East Africa. Future reviews could strengthen the evidence base by expanding database coverage, incorporating appropriate grey literature, undertaking meta-analysis where sufficient methodological homogeneity exists, and conducting periodic updates to capture developments in emerging technologies such as artificial intelligence, Internet of Things, blockchain, big-data analytics, cloud-based enterprise systems, and other advanced digital platforms**.**

Declarations

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Conflict of Interest

The authors declare that they have no conflict of interest regarding the publication of this systematic review.

Data Availability Statement

The data supporting the findings of this systematic review are available within the published articles and studies included in the review. The extracted data matrix and synthesis tables generated during the review process are available from the corresponding author upon reasonable request.

Ethical Approval Statement

Ethical approval was not required for this study because it involved a systematic review and synthesis of previously published studies and did not involve the collection of primary data from human participants.

AI Use Declaration.

The authors used AI-assisted tools only for language editing and manuscript organisation. The authors take full responsibility for the content, analysis, and conclusions presented in this manuscript.

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