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Determinants of Digital Technology Adoption in SMEs: A Gendered TOE Analysis Across Emerging Economies with Implications for European Policy

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Abstract. *The European Union's digital trade and development agenda increasingly intersects with the question of how intelligent technologies diffuse among small and medium-sized enterprises (SMEs) in emerging economies. This study examines the key technological, organisational, and environmental factors that facilitate or hinder the adoption of digital and artificial intelligence technologies among SMEs across Sub-Saharan Africa and Asia. The central research question asks what determines technology adoption in emerging-market SMEs and how gender ownership moderates these patterns and their effect on firm performance outcomes. The study employs a systematic literature review with thematic meta-synthesis, drawing on 37 peer-reviewed studies selected through a rigorous PRISMA-compliant screening process covering the period 2015-2024. The analysis is structured within the Technology-Organisation-Environment (TOE) framework, complemented by the Technology Acceptance Model, the Resource-Based View, the Dynamic Capabilities View, the Diffusion of Innovation theory, and Institutional Theory. The findings reveal that perceived usefulness, infrastructure availability, management support, innovation culture, institutional quality, and cultural norms are the primary determinants of technology adoption, with gender ownership systematically shaping adoption trajectories across all contexts. Women-owned SMEs face compounding barriers including lower digital literacy, constrained access to financial capital, weaker mentorship networks, and more restrictive cultural and institutional environments. The results identify targeted digital infrastructure investment, gender-inclusive financing mechanisms, and institutional reforms as essential policy responses. By mapping how EU regulatory and financing frameworks (including the AI Act, the Global Gateway strategy, and EIB/EBRD instruments) intersect with technology adoption conditions in emerging economies, this study offers a bridge between emerging market research and European trade and development policy.*

Keywords: digital technology adoption, emerging economies, European policy, gender ownership, TOE framework

JEL Codes: J16, L26, O12, O33

1. Introduction

The digital transformation of small and medium-sized enterprises (SMEs) has emerged as a central concern of both development economics and European trade policy. As the European Union advances its Global Gateway strategy and implements the world's first comprehensive regulatory framework for artificial

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intelligence, the question of how intelligent technologies diffuse across emerging economies has acquired direct relevance for European policymakers, development finance institutions, and businesses operating in global value chains. Understanding what drives or impedes digital technology adoption among SMEs in emerging markets is no longer merely an academic question; it is a precondition for designing effective EU trade, development, and regulatory partnerships.

SMEs constitute the economic backbone of Sub-Saharan Africa and Asia, accounting for over 90 per cent of businesses and more than 50 per cent of employment across both regions (ILO, 2019). Yet these enterprises remain significantly under-studied in the technology adoption literature, particularly at the firm level. Those that fail to adopt digital and intelligent technologies risk falling into a persistent competitiveness trap, unable to match the productivity gains of digitally advanced competitors while operating in institutional environments that constrain their capacity to invest in technological transformation (Baabdullah et al., 2021).

A structural inequality compounds this challenge. Women-owned SMEs, which represent a disproportionate share of micro and small enterprises across both regions, face systematically higher barriers to technology adoption than their male-owned counterparts, including lower digital literacy, constrained access to financial capital, weaker mentorship networks, and more restrictive cultural and institutional environments (Mhlanga, 2024; Sultan and Al-Ayed, 2024).

This study addresses three interconnected research questions. *First, what technological, organisational, and environmental factors facilitate or hinder digital technology adoption in emerging-market SMEs? Second, how does gender ownership moderate the relationship between these factors and adoption decisions? Third, what are the implications of these findings for European Union trade, development, and regulatory policy?*

To address these questions, we employ the Technology-Organisation-Environment (TOE) framework as the primary analytical structure, integrating complementary perspectives from the Technology Acceptance Model, the Resource-Based View, the Dynamic Capabilities View, the Diffusion of Innovation theory, and Institutional Theory. The study draws on a systematic literature review of 37 peer-reviewed studies selected through a PRISMA-compliant process covering the period 2015-2024.

2. Research Elaboration

2.1. Theoretical Framework

Despite the growing body of research on technology adoption in emerging markets, three significant gaps persist in the existing literature. First, the TOE framework has been applied extensively in developed economy contexts but remains underutilised as an analytical lens for firm-level technology adoption in Sub-Saharan Africa and Asia simultaneously. Second, gender ownership has been treated predominantly as a demographic control variable rather than as a structural moderator that systematically shapes adoption processes across all three TOE dimensions. Third, the intersection between emerging market technology adoption conditions and European Union regulatory and financing frameworks has received virtually no theoretical attention, despite its growing practical relevance for export-oriented SMEs. This study addresses all three gaps within a single integrated analytical framework.

The primary theoretical structure is the Technology-Organisation-Environment (TOE) framework, developed by Tornatzky and Fleischer (1990). The TOE framework explains firm-level technology adoption through three interrelated contexts: the Technological context (perceived usefulness, ease of use, compatibility, infrastructure); the Organisational context (firm size, management support, innovation culture, digital literacy, financial resources); and the Environmental context (institutional frameworks, cultural norms, government policy, competitive pressure, regulatory requirements). Three features make the TOE

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framework particularly suited to this study: it operates at the firm level rather than the individual level; it integrates internal organisational attributes and external environmental forces simultaneously; and it accommodates the moderating role of ownership characteristics on adoption readiness and capacity.

This study advances a Gender-Moderated TOE Model for Emerging-Market SMEs as its original theoretical contribution. The model reconceptualises gender ownership not as a background demographic characteristic but as a structural moderating variable that operates across all three TOE dimensions simultaneously, shaping both the direction and magnitude of factor-adoption relationships. Specifically, the model proposes that gender ownership moderates: (a) the relationship between technological context factors and adoption decisions, through differential ease-of-use weighting and technical confidence effects; (b) the relationship between organisational context factors and adoption capacity, through structurally constrained resource access and mentorship network deficits; and (c) the relationship between environmental context factors and adoption enablement, through compounding institutional, cultural, and regulatory disadvantages. The model further incorporates a fourth dimension absent from the original TOE framework: the European Regulatory-Financing Interface, capturing how EU regulatory standards and financing instruments function as external environmental pressures and enablers for emerging-market SMEs operating in or seeking access to European value chains.

Several complementary theories enrich the analytical framework. The Technology Acceptance Model (Davis, 1989) identifies perceived ease of use and perceived usefulness as primary adoption determinants. Research by Venkatesh and Morris (2000) demonstrates that men tend to prioritise perceived usefulness while women place greater emphasis on ease of use, providing the micro-level mechanism through which gender moderates the technological context dimension. The Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) extends this by incorporating social influence and facilitating conditions, particularly relevant in the collectivist cultures prevalent across Sub-Saharan Africa and Asia (Bokhari and Myeong, 2023). The Resource-Based View (Wernerfelt, 1984) explains why resource-rich firms adopt digital technologies more readily and how gender bias in resource allocation creates structural adoption disadvantages for women-owned SMEs (Utami and Alamanos, 2022). The Dynamic Capabilities View (Eisenhardt and Martin, 2000) explains how organisational agility mediates the adoption-performance relationship. Finally, Institutional Theory (DiMaggio and Powell, 1983) examines how regulatory frameworks and cultural expectations shape adoption behaviour, with institutional voids in many emerging markets exacerbating gender biases in technology deployment (Comunale and Manera, 2024).

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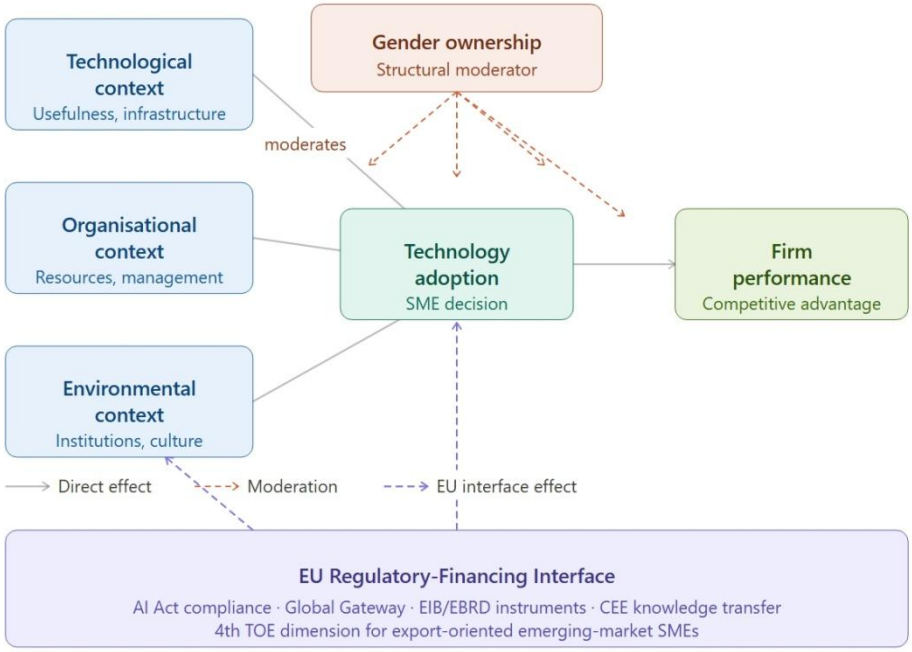

Figure 1: Gender-Moderated TOE Model for Emerging-Market SMEs with European Regulatory-Financing Interface
(Source: Authors' own elaboration, 2026)

2.2. Research Methodology

This study employs a systematic literature review with thematic meta-synthesis, following the protocol established by Tranfield et al. (2003) and reporting standards consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Six databases were searched: Business Source Complete, Web of Science, Scopus, ABI/INFORM, EconLit, and Google Scholar, covering the period 2015-2024.

Studies were included if they: focused on digital or artificial intelligence technology adoption in a business context; examined SMEs as the primary unit of analysis; were situated in Sub-Saharan Africa, Asia, or comparable emerging market contexts; and were published as peer-reviewed articles in English. Studies focused exclusively on individual-level consumer acceptance, developed economy contexts only, or large multinational corporations were excluded.

The selection process followed four PRISMA stages. The database search yielded 1,847 records, with an additional 23 identified through hand-searching of reference lists. After duplicate removal and title/abstract screening, 458 records were retained for full-text review. Following eligibility assessment, 421 were excluded for the following reasons: no SME focus (n=187), outside the geographic scope (n=134), insufficient methodological detail (n=62), and duplicate datasets (n=38). A final set of 37 studies was included in the synthesis. Each included study was represented by a single eligible publication, with no instances of multiple linked reports for the same dataset (e.g., a conference paper subsequently extended into a journal article). The number of reports of included studies therefore coincides with the number of included studies (n = 37)

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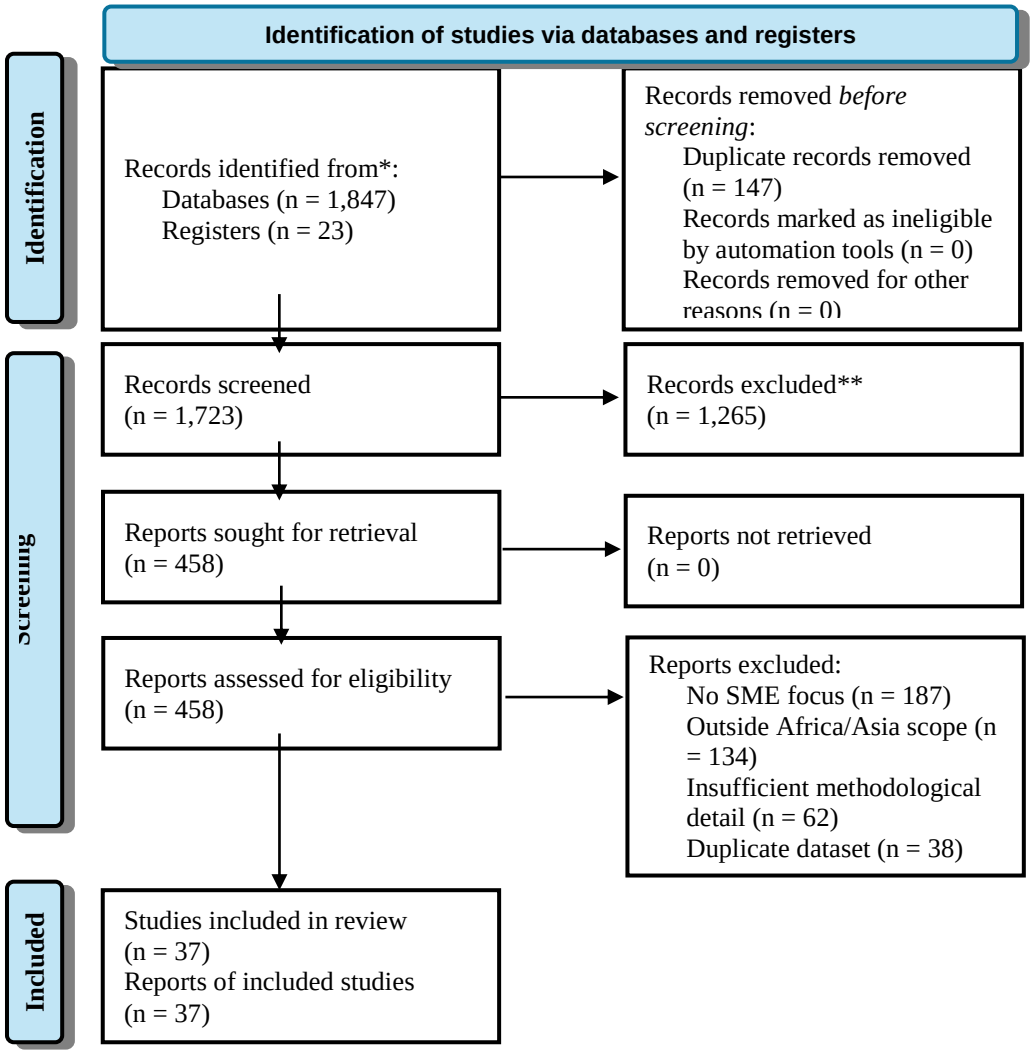

Figure 2: PRISMA 2020 Flow Diagram - Study Selection Process.
(Sources: Own elaboration based on PRISMA, 2026).

The methodological quality of all included studies was assessed using a modified Mixed Methods Appraisal Tool (MMAT, Hong et al., 2018), evaluating each study across five dimensions: clarity of objectives, appropriateness of design, rigour of data collection, quality of analysis, and relevance of findings. No included study scored below 6 out of 10, confirming adequate methodological quality across the corpus. Synthesis proceeded through thematic analysis within the TOE framework, gender-differentiated analysis, regional comparative SWOT analysis, and development of cross-cutting propositions.

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Table 2: Quality Appraisal of Key Included Studies.

Study	Objectives (2)	Design (2)	Data (2)	Analysis (2)	Relevance (2)	Total (10)	Quality
Agrawal et al. (2024)	H	H	H	H	H	10	High
Wahab & Radmehr (2024)	H	H	H	H	H	10	High
Abaddi (2024)	H	H	M	H	H	9	High
Kasseeah (2024)	H	H	H	M	H	9	High
Ishengoma & John (2025)	H	H	M	H	H	9	High
Sultan & Al-Ayed (2024)	H	M	H	M	H	8	High
Aiswarya and Sangeetha (2023)	H	M	H	M	H	8	High
Bhatnagar & Yadav (2023)	H	M	M	M	H	7	Medium
Wang et al. (2022)	H	H	M	H	M	8	High
Lateef & Keikhosrokiani (2023)	H	H	M	H	M	8	High
Ahmed (2021)	H	M	H	M	H	8	High
Mhlanga (2024)	H	M	M	M	H	7	Medium
Fayyaz (2024)	M	M	M	M	H	6	Medium
Iram et al. (2024)	H	H	M	H	M	8	High
Güner Gültekin et al. (2025)	H	M	H	M	H	8	High

Note: H = High (2), M = Medium (1), L = Low (0). Maximum score = 10. Studies scoring below 5 were excluded from synthesis.

(Sources: Prepared by authors based on studies'content 2026).

3. Results and Discussions

3.1. Technological Context

The technological context encompasses factors intrinsic to the technology itself that influence adoption decisions. Perceived usefulness and perceived ease of use emerge consistently as primary determinants across the reviewed studies (Agrawal et al., 2024; Ishengoma and John, 2025). In Tanzania, Ishengoma and John (2025) identify perceived usefulness, ease of use, compatibility, observability, and trialability as significant adoption drivers in manufacturing SMEs, consistent with both TAM and Diffusion of Innovation predictions.

Infrastructure represents a critical technological barrier, particularly in African contexts. Poor connectivity, unreliable power supply, and limited access to cloud computing infrastructure restrict technology implementation in many Sub-Saharan markets (Ishengoma and John, 2025; Lateef and Keikhosrokiani, 2023). In Asian markets, infrastructure constraints are less pronounced in urban centres but persist in rural areas, creating intra-regional heterogeneity (Aiswarya and Sangeetha, 2023).

Digital technologies most commonly adopted by SMEs in both regions include chatbots and virtual assistants, supply chain analytics tools, customer relationship management systems, and mobile-based payment and financial services platforms. Aiswarya and Sangeetha (2023) find that while most women entrepreneurs in Kerala demonstrate awareness of basic digital applications such as billing, customer analysis, and virtual assistants, awareness and usage of more advanced applications including targeted marketing tools and financial forecasting systems remain limited.

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A consistent pattern emerges from the gender-disaggregated evidence: women entrepreneurs tend to report lower technical confidence and place greater weight on ease of use than on the full feature set of a given tool (Venkatesh and Morris, 2000; Goswami and Dutta, 2016). This has direct consequences for how digital products should be designed and how training programmes should be structured: simpler interfaces and jargon-free onboarding are likely decisive factors for adoption in women-owned SMEs.

3.2. Organisational Context

Organisational factors represent the internal characteristics and resources that shape a firm's capacity and willingness to adopt digital technologies. Financial constraints emerge as the most consistently reported barrier across both regions (Aiswarya and Sangeetha, 2023; Sultan and Al-Ayed, 2024). High installation and implementation costs deter adoption, particularly among micro and small enterprises operating on thin margins.

Management support and innovation culture are identified as significant enablers. Abaddi (2024) finds that innovation culture moderates the relationship between business innovativeness and technology adoption intention in Jordanian MSMEs, while management support directly influences adoption decisions. Wang et al. (2022) demonstrate that the participation of top management is among the primary drivers of intelligent transformation in Chinese SMEs, alongside development needs and human resource capacity.

Organisational agility emerges as a critical mediating variable. Wahab and Radmehr (2024) find that technology assimilation positively affects both absorptive capacity and customer agility in Lebanese firms, with organisational agility moderating the technology-performance relationship. This is consistent with Dynamic Capabilities View predictions that dynamic capabilities amplify the performance returns to technology adoption.

When organisational barriers are disaggregated by gender, a clear pattern emerges. Women-owned firms operate under qualitatively different constraints: capital is harder to access, technology talent is scarcer, and mentorship networks are thinner (Manwari et al., 2017; Sultan and Al-Ayed, 2024). When the resource base itself is structurally constrained by institutional and social factors, the adoption gap between men-owned and women-owned SMEs is unlikely to close on its own, regardless of firm size.

3.3. Environmental Context

The environmental context captures external forces shaping technology adoption decisions, including institutional frameworks, competitive pressure, cultural norms, and government policy.

Institutional quality is a significant determinant of technology diffusion. Comunale and Manera (2024) demonstrate that institutional voids exacerbate adoption barriers and perpetuate existing biases. In Sub-Saharan Africa, fragmented regulatory environments and limited enforcement capacity create uncertainty for technology-adopting firms. In Asia, complex regulatory landscapes, particularly in financial services, create compliance burdens that can deter adoption among resource-constrained SMEs (Gurrea-Martinez, 2020).

Competitive pressure provides an important adoption incentive. Güner Gültekin et al. (2025) find that technology adoption among entrepreneurial firms is driven by the need to address customer pain points and respond to market competition. The COVID-19 pandemic functioned as an environmental shock that accelerated digital adoption across both regions. Kasseeah (2024) demonstrates that self-employed women in Mauritius significantly increased their digital presence through social media platforms and online sales during the pandemic, developing new technology-enabled marketing and customer management capabilities.

Cultural norms constitute a significant environmental barrier, particularly for women entrepreneurs. Patriarchal norms in many Sub-Saharan African and Asian societies restrict women's business participation

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and technology engagement. Adisa et al. (2019) demonstrate that patriarchal hegemony in Nigeria limits women's access to resources and decision-making authority. Sultan and Al-Ayed (2024) find similar cultural barriers in Saudi Arabia, where societal expectations and limited awareness constrain women's involvement in technology-driven businesses.

An increasingly consequential environmental factor is the extraterritorial reach of the European Union's Artificial Intelligence Act (EU AI Act), which entered into force in August 2024 (European Parliament, 2024). As the world's first comprehensive legal framework for intelligent technologies, the EU AI Act establishes risk-based compliance requirements that affect any firm, including SMEs in emerging economies, that deploys technology systems whose outputs are used within the EU market. For export-oriented SMEs, compliance with EU standards on transparency, data governance, and algorithmic accountability is becoming a de facto market access condition. At the same time, SMEs that proactively adopt EU-compliant digital tools gain a credible quality signal that can enhance their competitiveness in European markets.

3.4. Regional Comparative Analysis

Despite significant geographical distance and distinct cultural contexts, both Sub-Saharan Africa and Asia exhibit comparable challenges alongside region-specific strengths and opportunities. Sub-Saharan Africa's primary strengths lie in its entrepreneurial dynamism, mobile payment innovation, and the potential of Industry 4.0 and agri-tech platforms to leapfrog traditional infrastructure constraints. However, poor physical infrastructure, fragmented markets, and entrenched patriarchal norms remain significant barriers. Asia benefits from stronger tech leadership, higher baseline digital literacy, and more developed institutional support structures. Cultural norms and financial constraints nonetheless limit adoption among women-owned firms across both regions.

Drawing on the synthesis of evidence across all three TOE dimensions and the regional comparative analysis, this study advances four theoretical propositions for future empirical testing:

Proposition 1 (Technological Context): In emerging-market SMEs, the positive relationship between perceived ease of use and technology adoption intention is significantly stronger for women-owned firms than for men-owned firms, reflecting gender-differentiated technology prioritisation patterns.

Proposition 2 (Organisational Context): The positive relationship between management support and technology adoption is moderated by gender ownership, such that women-owned SMEs require proportionally greater institutional support to achieve equivalent adoption outcomes due to compounding resource access constraints.

Proposition 3 (Environmental Context): Institutional quality positively moderates the gender ownership gap in technology adoption rates, such that improvements in institutional quality disproportionately benefit women-owned SMEs by reducing the compounding environmental barriers they face.

Proposition 4 (European Regulatory-Financing Interface): Exposure to EU regulatory standards (including AI Act compliance requirements) and access to EU-backed financing instruments positively moderates technology adoption intentions among export-oriented emerging-market SMEs, with stronger effects for women-owned firms due to their relatively greater responsiveness to external institutional enablers.

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Table 2: SWOT Comparison of digital technology adoption in SMEs - Africa vs. Asia.

Aspect	Africa	Asia
Strengths	- High entrepreneurial spirit - Mobile payment innovation (Ishengoma & John, 2025) - Motivations for digital technology adoption- Emerging digital platforms (Fayyaz, 2024) - Enhanced access to education through Industry 4.0 (Mhlanga, 2024)	- Strong tech leadership (Iram et al., 2024) - Increased digital literacy and digital technology adoption during the pandemic (Bhatnagar & Yadav, 2023) - Positive attitudes towards digital technology adoption - Effective use of social media (Aiswarya & Sangeetha, 2023)
Weaknesses	- Poor infrastructure (Ishengoma & John, 2025) - Technical challenges hinder implementation (Lateef & Keikhosrokiani, 2023) - Fragmented markets - Limited digital technology awareness among women entrepreneurs - Financial barriers (Manwari et al., 2017) - Limited leadership representation (Mhlanga, 2024) - Patriarchal cultural norms	- Complex regulations (Gurrea-Martinez, 2020) - Limited awareness of advanced digital technology (Aiswarya & Sangeetha, 2023) - Variability in digital technology understanding among women entrepreneurs - Financial constraints - Cultural norms (Sultan & Al-Ayed, 2024) - Concerns about job displacement (Madgavkar et al., 2020)
Opportunities	- Agri-tech growth (Fayyaz, 2024) - Digital financial inclusion (Ahmed, 2021) - Increasing collaboration platforms (Ishengoma & John, 2025)	- Digital ecosystems (Bhatnagar & Yadav, 2023) - Youth entrepreneurship - Government and institutional support (Aiswarya & Sangeetha, 2023) - Educational programs (Lee, 2018)
Threats	- Political instability - Cultural resistance (Ahmed, 2021) - Limited technical skills and capital access (Fayyaz, 2024)	- Economic vulnerability - Technological turbulence (Iram et al., 2024) - Global competition

(Source: Compiled from reviewed literature, 2026).

3.5. Technology Adoption and Firm Performance

Across the reviewed studies, where SMEs adopt digital technologies, the performance benefits are real and wide-ranging. Abrokwah-Larbi and Awuku-Larbi (2024) establish the significance of digital technology in marketing for achieving financial performance, customer performance, internal business process performance, and learning and growth performance among Ghanaian SMEs. Lateef and Keikhosrokiani (2023) find that business intelligence adoption enhances operational efficiency and overall performance in Nigerian SMEs, with knowledge management and entrepreneurial orientation as critical enablers.

Technology adoption contributes to competitive advantage through at least five channels: operational efficiency gains from process automation; enhanced market access through digital platforms; improved customer intelligence through analytics and personalisation; greater resilience to market shocks through real-time data capabilities; and accelerated innovation through technology-assisted product development. These channels are broadly consistent across both regional contexts, though their relative importance varies by sector and institutional environment.

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The performance returns to technology adoption are moderated by gender ownership. Women-owned SMEs that successfully adopt digital technologies demonstrate comparable efficiency gains, but face higher adoption costs measured in time, financial resources, and social capital, due to the institutional and cultural barriers documented above. Iram et al. (2024) highlight that flat organisational hierarchies in women-owned manufacturing firms facilitate technology awareness dissemination and knowledge sharing, suggesting that organisational design choices can partially offset environmental constraints.

3.6 Policy Implications

The findings point to several areas where policy could meaningfully shift current dynamics.

First, governments should invest in digital infrastructure as a foundational precondition for technology adoption, particularly in rural and peri-urban areas. Public-private partnerships that expand broadband connectivity, cloud computing access, and mobile data affordability will lower technological context barriers for all SMEs, with disproportionate benefits for resource-constrained women-owned firms.

Second, targeted digital literacy and training programmes should be designed with the specific needs of women entrepreneurs in mind, emphasising practical ease-of-use-focused applications delivered through trusted community and business association networks (Mhlanga, 2024).

Third, gender-inclusive financing mechanisms are essential to overcoming the financial barriers that disproportionately constrain women-owned SMEs, including technology-specific grant programmes, concessional lending facilities, and credit guarantee schemes (Sultan and Al-Ayed, 2024; Manwari et al., 2017).

Fourth, policymakers in emerging economies should actively leverage European funding and partnership frameworks to accelerate digital technology adoption. Central and Eastern European EU member states, including Slovakia, offer a particularly instructive model: having undergone rapid digital transformation supported by EU Structural Funds and cohesion policy instruments, these economies possess practical institutional knowledge of how to absorb and channel European development finance effectively. The EU Global Gateway strategy, which commits 300 billion euros to sustainable investment in developing regions through 2027, explicitly targets digital infrastructure and technology transfer as priority areas (European Commission, 2021). The European Investment Bank and the European Bank for Reconstruction and Development both operate SME financing facilities in eligible markets, including dedicated digital transformation windows. Women entrepreneurs specifically should be directed to the EIB's Women in Business programme and EU-backed blended finance instruments that combine grants with loans to reduce the effective cost of technology investment for under-capitalised firms.

4. Conclusions

This study set out to examine the key determinants of digital technology adoption among SMEs in emerging economies and to assess how gender ownership moderates these patterns and their effect on firm performance. Drawing on 37 peer-reviewed studies selected through a PRISMA-compliant systematic literature review, the analysis mapped technological, organisational, and environmental factors that accelerate or impede technology diffusion across Sub-Saharan Africa and Asia, with explicit attention to the implications for European Union trade and development policy.

The findings reveal that perceived usefulness, infrastructure availability, management support, innovation culture, institutional quality, and cultural norms constitute the primary determinants of digital technology adoption in emerging-market SMEs. Gender ownership cuts across all three TOE dimensions,

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consistently disadvantaging women-led businesses in ways that go well beyond simple resource gaps. Women entrepreneurs who do manage to adopt digital technologies are not less capable of leveraging them effectively: where the institutional and policy environment supports adoption, their performance returns are comparable to those of their male-owned counterparts.

The regional comparison underlines that Sub-Saharan Africa and Asia are not a single story. Africa's strengths lie in mobile payment innovation and the leapfrogging potential of Industry 4.0 platforms; Asia brings stronger technical leadership and higher baseline digital literacy. Both regions share, however, a common set of structural obstacles: patriarchal cultural norms, limited access to finance, and low awareness of advanced digital tools among the entrepreneurs who stand to benefit most. This points firmly towards context-sensitive policy rather than blanket prescriptions.

From a European policy perspective, the findings carry direct relevance for the design of EU trade partnerships, development finance instruments, and regulatory frameworks. The extraterritorial reach of the EU AI Act creates new compliance incentives for export-oriented SMEs in emerging economies, while the Global Gateway strategy and EIB/EBRD financing facilities represent underutilised channels for supporting digital transformation in partner regions. Central and Eastern European member states, including Slovakia, occupy a distinctive position as conveyors of EU digital development knowledge, having themselves navigated rapid technology-driven transformation supported by European cohesion instruments.

This study makes four original contributions to the literature. First, it provides the most comprehensive systematic synthesis to date of firm-level digital technology adoption determinants in SMEs across Sub-Saharan Africa and Asia, drawing on 37 PRISMA-screened studies. Second, it advances a Gender-Moderated TOE Model that reconceptualises gender as a structural moderating variable operating across all three TOE dimensions simultaneously, rather than as a background demographic characteristic. Third, it introduces the European Regulatory-Financing Interface as a fourth theoretical dimension of the TOE framework, capturing the growing role of EU regulatory standards and financing instruments as external adoption enablers for emerging-market SMEs. Fourth, it derives four empirically testable propositions that provide a concrete agenda for future quantitative and longitudinal research.

Future research should employ primary data collection, including firm-level surveys and longitudinal studies, to test the four propositions advanced here and to quantify the performance penalties associated with adoption barriers facing women-owned SMEs. Structural equation modelling would be particularly suited to testing the proposed moderation effects across TOE dimensions. Cross-regional studies incorporating country-level institutional analysis, and specifically the perspective of Central and Eastern European EU member states such as Slovakia as both recipients and conveyors of EU digital development knowledge, would further enrich understanding of how the European Regulatory-Financing Interface operates in practice. Such a triangular research agenda connecting emerging market SME realities with Central and Eastern European implementation experience and EU policy design represents the most promising direction for advancing both theory and practice in this field.

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Author's note on the use of Generative AI

During the preparation of this manuscript, the authors used DeepL and ChatGPT to assist with translating the text from Slovak into English and to improve its language and readability, as English is not the authors' first language. These tools were not used to generate research content, conduct the analysis, or develop the theoretical contributions of the study. All output was reviewed and edited by the authors, who take full responsibility for the content of the publication.

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Appendix A: List of Abbreviations

Abbreviation	Full Term
AI	Artificial Intelligence

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EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EU	European Union
ILO	International Labour Organization
JEL	Journal of Economic Literature (classification codes)
MMAT	Mixed Methods Appraisal Tool
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SME	Small and Medium-sized Enterprise(s)
SWOT	Strengths, Weaknesses, Opportunities, Threats
TAM	Technology Acceptance Model
TOE	Technology-Organisation-Environment (framework)
VEGA	Slovak Scientific Grant Agency (Vedecká grantová agentúra)

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