Global Youth Science Journal

AI Adoption Barriers for SMEs in Addis Ababa: A TOE-Based Analysis within the Digital Ethiopia Framework

OVERVIEW: This manuscript examines the main barriers limiting artificial intelligence adoption among small and medium enterprises in Addis Ababa. It uses the Technology-Organization-Environment framework to organise current evidence and identify practical policy responses.

AUTHORS: Fikremarkos Belay (Grade 9 Student, Haile-Manas Academy, Debre Birhan, Ethiopia)

KEYWORDS: Artificial intelligence; SMEs; Addis Ababa; TOE framework; Digital Ethiopia 2030

ABSTRACT

Ethiopia's transition toward a knowledge-based economy has created new opportunities for digital growth, yet small and medium enterprises in Addis Ababa continue to face a significant gap in artificial intelligence adoption. This study uses a qualitative systematic review and the Technology-Organization-Environment framework to synthesise evidence from 2024–2026 institutional and policy sources. The findings show that the main barriers are technological, including high hardware costs and limited access to local-language data; organisational, including low digital literacy and talent shortages; and environmental, including a weak private-sector AI ecosystem and compliance uncertainty. The paper concludes that Ethiopia's next phase of digital policy should move beyond infrastructure expansion and focus on SME enablement through fiscal support, open local datasets, and affordable AI services.

INTRODUCTION

1.1 Background of Digital Ethiopia 2025

The Digital Ethiopia 2025 strategy was launched as a national roadmap to transform Ethiopia into a digitally enabled and inclusive economy. By prioritising agriculture, manufacturing, IT-enabled services, and tourism, the government aimed to use the Fourth Industrial Revolution to support national prosperity. By 2026, the strategy had established an important digital foundation, including wider 4G and 5G coverage, the rollout of the Fayda national ID, and the creation of the Ethiopian Artificial Intelligence Institute. These developments were intended to move Ethiopia from a labour-heavy economy toward a knowledge-based one in which artificial intelligence supports productivity.

1.2 Problem Statement: The SME Adoption Gap

Despite rapid growth in national digital infrastructure, a clear adoption gap remains in the private sector, especially among small and medium enterprises in Addis Ababa. Large organisations such as Ethiopian Airlines and the Commercial Bank of Ethiopia have begun using AI for logistics and fraud detection, while many SMEs remain outside this transition. The result is a digital paradox: SMEs are expected to drive economic growth, but they face barriers such as high hardware costs, limited access to local-language datasets, and a shortage of affordable AI expertise.

1.3 Research Objectives

The main objective of this research is to identify and analyse the barriers that hinder AI adoption among SMEs in Addis Ababa. The study classifies these barriers using the Technology-Organization-Environment framework, examines how current regulation affects small-business access to AI tools, and proposes recommendations for the Digital Ethiopia 2030 roadmap.

1.4 Significance of the Study

This research offers a ground-level view of Ethiopia’s digital transformation. It is relevant to policymakers refining Digital Ethiopia 2030, to SME owners navigating structural obstacles, and to researchers studying the digital divide in East Africa. By explaining why AI is not yet reaching small businesses at scale, the study helps clarify how future policy can be made more inclusive.

1.5 Scope and Limitations

The study focuses on Addis Ababa as Ethiopia’s economic and technological hub. It concentrates on SMEs in the service, retail, and light manufacturing sectors. Because AI technology and Ethiopian regulation are changing quickly, some claims about local large language models are based on early-stage reports.

1.6 Definition of Key Terms

In this paper, SME refers to small and medium enterprises that typically employ between 6 and 100 people in the Ethiopian context. The TOE framework refers to a model that studies technology adoption through technological, organisational, and environmental factors. EAII refers to the Ethiopian Artificial Intelligence Institute, the main government body for AI research and policy.

RESULTS

The reviewed evidence suggests that Addis Ababa has a layered AI ecosystem. While Digital Ethiopia 2025 built a national backbone, SMEs continue to experience a secondary digital divide. The barriers are grouped below using the TOE framework.

4.1 Technological Barriers: The Foundational Gap

Even with the presence of 5G in Addis Ababa, SMEs remain constrained by the basic requirements of AI readiness: connectivity, compute, context, and competency. Hardware costs are especially restrictive. AI systems depend on high-end graphics processing units, yet imported hardware is affected by customs duty, excise tax, VAT, surtax, and withholding tax. As a result, essential equipment can cost far more than international market prices, which effectively shuts many SMEs out of local AI development. There is also a data gap. Although the Ethiopian Artificial Intelligence Institute has advanced local-language model development, SMEs still lack access to clean, industry-specific datasets in Amharic, Afan Oromo, and Tigrigna. Local datasets have grown, but they remain limited compared with English-language resources, which reduces model accuracy for tasks such as customer sentiment analysis.

4.2 Organisational Barriers: The Human and Financial Gap

The internal readiness of Addis Ababa's SMEs is one of the strongest barriers to adoption. Many business owners still see AI as a tool for government or military use rather than as a practical business asset. This perception is reinforced by a digital literacy gap at management level. At the same time, specialised AI talent is scarce. Graduates trained at Addis Ababa University and AASTU are often absorbed by state agencies, telecom companies, or larger firms, leaving SMEs with limited access to affordable technical support.

4.3 Environmental Barriers: The Ecosystem Gap

The external environment also shapes adoption. Ethiopia's AI ecosystem remains strongly state driven, and many of the country's visible breakthroughs are concentrated in public institutions. There are still too few local AI-as-a-Service providers offering low-cost, subscription-based tools tailored to the needs of small businesses. Regulation also matters. Although recent proclamations have improved legal clarity, many SMEs lack the knowledge needed to comply with data protection rules, which creates compliance fear and discourages experimentation with data-driven tools.

4.4 Discussion: The Addis Ababa Paradox

The evidence points to an Addis Ababa paradox: the city has some of the strongest connectivity and AI research capacity in the region, yet the average SME is still far from meaningful AI adoption. This happens because policy has focused more on large-scale infrastructure than on

everyday business use. For Digital Ethiopia 2030 to succeed, the emphasis must shift from centres of excellence to SME incentives, including tax relief for AI hardware, local-language datasets for private developers, and affordable AI services for small firms.

Table 1. Summary of barriers and their impact on Addis Ababa SMEs.

Category	Key barrier (2025-2026 data)	Impact on Addis Ababa SMEs
Technological	High hardware markup	Prevents local AI hosting and development.
Organisational	Brain drain to state agencies	SMEs struggle to find or afford AI talent.
Environmental	Limited AI-as-a-Service options	Small firms lack affordable off-the-shelf tools.

MATERIALS AND METHODS

3.1 Research Design: Qualitative Systematic Review

This study used a qualitative systematic review approach because the AI landscape in Ethiopia is changing quickly. A synthesis of recent policy and institutional reports was therefore more useful than a small primary survey for identifying recurring barriers across the technological, organisational, and environmental domains.

3.2 Data Selection and the Four Cs Criteria

Data sources were selected using a four-part framework that covered connectivity, compute, context, and competency. These categories were used to organise evidence on broadband access, hardware costs, local-language model readiness, and digital skills.

3.3 Primary Data Sources (2024–2026)

The review focused on national strategy documents, international institutional reports, and local technical handbooks. The sources included Digital Ethiopia 2030, the National AI Policy, World Bank reports on AI foundations, GSMA digital economy reporting, and a handbook on generative AI tools for MSMEs in Ethiopia.

3.4 Data Analysis: Thematic Coding and TOE Mapping

The collected material was analysed in two stages. First, statements describing challenges or barriers were coded thematically. Second, the codes were mapped onto the TOE framework. Technological codes covered hardware, data, and cloud access; organisational codes covered management literacy, finance, and brain drain; and environmental codes covered regulation and market structure.

3.5 Ethical Considerations and Rigor

Although the study relied on secondary data, rigor was strengthened through triangulation. Barriers mentioned in international reports were cross-checked against local sources from

Ethiopian institutions so that the final findings reflected more than one perspective on the same issue.

DISCUSSION AND RECOMMENDATIONS

5.1 Summary of Key Findings

The review shows that Addis Ababa has achieved important progress in digital infrastructure, but a usage gap remains among SMEs. The main barriers are not simply access to the internet; they are the high cost of AI hardware, weak local skills, and a fragmented private-sector ecosystem. Digital Ethiopia 2025 built the backbone, but SMEs still need targeted support to move from digital participation to AI-driven innovation.

5.2 Policy Recommendations for Digital Ethiopia 2030

The next phase of policy should focus on SME enablement. Targeted tax exemptions for AI hardware would reduce the cost of entry. Open, anonymised local-language datasets would help SMEs build culturally relevant tools. Regulatory sandboxes could let firms test AI applications with lower compliance burdens, and a stronger AI-as-a-Service market would make practical tools available to small businesses.

5.3 Limitations and Future Research

This study depended on secondary data from early 2026, so future research should include longitudinal surveys of SME owners to measure the actual return on investment from AI adoption. Comparative studies between Addis Ababa and other emerging African hubs such as Nairobi or Kigali would also help place Ethiopia’s AI policy in a regional context.

REFERENCES

Federal Democratic Republic of Ethiopia. 2025. Digital Ethiopia 2030: A Strategy for Inclusive Prosperity. Office of the Prime Minister.

Ethiopian Artificial Intelligence Institute. 2024. National Artificial Intelligence Policy Framework. EAII Publication.

GSMA. 2025. The State of the Digital Economy in Ethiopia: Connectivity and Adoption Trends. GSMA Intelligence Reports.

Niguse, K., and A. Borji. 2025. “Does AI Innovation Improve the Competitive Advantage of SMEs in Ethiopia?” Journal of African Technology and Innovation.

World Bank. 2025. Digital Progress and Trends Report: Strengthening AI Foundations in Emerging Markets. World Bank Group.

United Nations. 2026. Ethiopia’s National Report for the 2027 Midterm Review of the Doha Programme of Action. UN-OHRLLS.