Role of ICT Literacy in Driving Economic Prosperity in Africa

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Abstract

The study examines the impact of ICT policy variables, specifically mobile phone and internet usage, on economic growth in Africa. A robust methodological framework was employed, encompassing pooled, fixed effects, random effects, and system GMM approaches to analyze data from 45 countries spanning 2008–2023 period. The findings reveal that ICT variables significantly and positively influence economic growth in the region. Conversely, the education variable, which reflects literacy level, shows a negative and significant relationship with economic growth. This outcome may stem from the relatively low literacy rates in Africa compared to other regions globally. The study concludes that policymakers should prioritize initiatives to enhance ICT infrastructure penetration. Moreover, measures should be put in place to address the barriers impeding the achievement of basic literacy goals in the region.

Keywords: ICT, literacy, digital tech, Africa.

Introduction

Information and Communication Technology (ICT) literacy is increasingly recognized as a critical driver of economic development globally, and Africa is not an exception. With rapid technological advancements and widespread mobile penetration, ICT has become a powerful tool for enhancing productivity, fostering innovation, and improving access to information and services. In Africa, ICT literacy has equipped individuals with the skills needed to effectively utilize digital tools, thus enabling them to participate more fully in the digital economy and contribute to sustainable economic growth [18].

In recent years, ICT literacy has emerged as a critical component for economic growth in Africa. ICT literacy is the ability to use digital tools, access information networks, and apply technology in everyday life and professional tasks. It enables individuals and businesses to participate more fully in the digital economy. In Africa, empirical studies have shown that increased usage of mobile phones and Internet services correlates with higher GDP growth, primarily because ICT reduces transaction costs, enhances communication, and facilitates access to markets beyond local boundaries [2; 16].

Furthermore, ICT literacy contributes not only to macroeconomic indicators but also to improvements in livelihoods and broader development. For example, in Africa, digital tools and mobile applications have been used to enhance productivity by delivering timely information and market prices, thus increasing income [7]. Additionally, ICT enables micro-enterprises, particularly those run by women to improve marketing, reduce costs, and diversify income sources, which supports poverty reduction and socio-economic inclusion [14]. Nonetheless, challenges such as limited access to reliable infrastructure, low awareness or skills in many communities, and regulatory gaps have continued to constrain the full realisation of ICT literacy's economic potential across Africa.

Moreover, Africa's economic landscape is undergoing transformation due to digital technologies, with ICT literacy serving as a foundational element in this shift. Through improving the region's population's ability to use digital platforms, African countries can expand entrepreneurship opportunities, facilitate financial inclusion, and boost employment in technology-driven sectors. Furthermore, ICT literacy enhances education and health service delivery through e-learning, essential for improving human capital and a determinant of economic prosperity [12]. Thus, investing in ICT education and digital skills training is crucial for closing the digital divide and ensuring that the benefits of technological progress are broadly shared.

Despite notable improvements in digital infrastructure, Africa continues to face a significant ICT literacy gap that undermines its economic development potential. As of 2023, only 37% of Africans have access to the internet, while mobile internet usage in Sub-Saharan Africa remains at approximately 27%, highlighting persistent disparities in digital inclusion [19]. In Nigeria, only 7% of youths aged 15–24 possess the ICT skills necessary to effectively participate in the digital economy [18]. Moreover, only about half of African countries have integrated computer literacy into their school curricula, compared to the global average of 85% [11]. These statistics demonstrate that despite infrastructural progress, limited ICT literacy constrains innovation, restricts employment opportunities, and perpetuates inequality across African societies. Addressing this challenge is critical for fostering inclusive growth and ensuring that Africa can fully leverage the digital economy for sustainable economic prosperity.

Additionally, despite the promising role of ICT literacy, significant challenges remain in Africa, including inadequate

infrastructure, limited access to affordable internet, and uneven educational quality. Addressing these challenges requires coordinated efforts from governments, the private sector, and international organizations to build inclusive digital ecosystems. Enhancing ICT literacy prepares the workforce for the demands of the Fourth Industrial Revolution and also supports economic diversification and resilience in African economies [1]. As such, strengthening ICT literacy is a strategic priority for unlocking Africa's economic potential and achieving long-term development goals. As presented in Figure 1, the overall ICT literacy and education gaps in Africa suggest that the region needs to act fast to increase inclusion.

Although a growing body of work documents the link between ICT access and macroeconomic gains in Africa, important gaps remain in the literature, especially concerning ICT literacy (the skills and competences to use digital tools effectively) rather than mere access. Existing regional and sectoral reports emphasize usage and infrastructure (e.g., Internet and mobile adoption statistics) but do not consistently measure or evaluate how levels of ICT literacy translate into equitable economic benefits across gender and informal-sector divides [12; 11]. To address these gaps, this research will leverage a panel data and a dynamic estimation approach for this study.
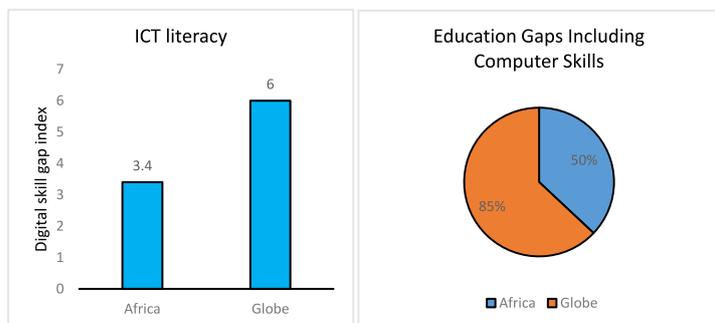

Figure 1: ICT literacy and education gaps in Africa
Source: *World Bank, 2023*

Literature Review

Empirical research examining ICT's macroeconomic effects in Sub-Saharan Africa finds a generally positive relationship between ICT diffusion and economic growth, but the mechanisms frequently depend on complementary human capital and institutions. Studies using cross-country panels and transmission-channel analyses report that ICT stimulates GDP growth by improving market access, enhancing productivity, and attracting FDI, and further reveal that the size of the effect is larger where education levels and institutional quality are higher [2; 6]. These studies show that mere access is insufficient. Human capacity requirements to use ICT meaningfully is a critical mediator of aggregate gains.

Microeconomic evidence shows how ICT literacy (digital skills) drives firm-level productivity and market participation, particularly in small and informal enterprises. Case studies and firm surveys in African and developing-country contexts show that firms with higher digital skills adopt e-commerce and digital bookkeeping more readily, reduce transaction costs, and expand customer reach, outcomes associated with higher growth [18]. Quasi-experimental and survey work also show that training interventions that combine skills development with inexpensive digital tools produce larger productivity gains than providing technology alone, stressing the complementary role of skills [19].

Evidence on education systems and higher-education institutions shows persistent gaps in digital literacy despite investments in education technology. Systematic reviews and national assessments reveal that many African universities have uneven integration of digital skills into curricula; where digital pedagogy is adopted, outcomes depend heavily on instructor capacity, infrastructure reliability, and contextualized content [15; 17]. These studies show that digital-skills interventions yield better learning and employability outcomes when embedded within broader pedagogical reforms rather than delivered as stand-alone modules.

Gender and inclusion studies emphasize that ICT literacy improvements are necessary but not sufficient to close digital divides: sociocultural constraints, affordability, and safety concerns mediate impact. Empirical work documents that women, rural residents, and older adults report lower digital literacy and higher barriers to effective internet use; interventions that address social norms and provide tailored skills training achieve higher uptake among marginalized groups [11]. Empirical evaluations that disaggregate outcomes by gender and location consistently find distributional heterogeneity—highlighting that equity-focused design is crucial for inclusive economic gains.

Finally, appraisals of digital-skills research in Africa call for standardized, multi-dimensional measures of ICT literacy and for blended research designs that combine time series and cross-section data [15]. Filling these methodological gaps would clarify causal pathways from ICT literacy to productivity, inclusive economic outcomes and improve targeting of digital-skills investments across African contexts [19].

Methodology

This study employs a dynamic panel data estimation technique to estimate the data of collected variables. Given that the number of cross-sectional units (countries) exceeds the time periods, the key methodological concern lies in appropriately modeling the error term in the regression framework. To address potential endogeneity arising from omitted variables and feedback effects, the study applied a dynamic panel estimator, specifically the one-step System Generalized Method of Moments (GMM). The inclusion of a lagged dependent variable in the GMM framework helps control for endogeneity and unobserved heterogeneity, thus improving the efficiency of the estimates.

The System GMM estimator, developed by [4], and extended by [5] and [9], is recognized as more robust than static models because it simultaneously controls for country-specific and time-specific effects through first-differencing and instrumental variable techniques. Hence, dynamic models generally outperform static estimators in addressing simultaneity and heterogeneity biases, and provide consistent and stable results [8; 10]. The choice of these methods in this study is guided by the nature of the dataset, which represents a micro panel with a large number of countries (45) and a relatively short time span (15 years). Such panel characteristics typically exhibit stationarity, thus eliminating the need for unit root testing. Equally, random effects (RE) and fixed effects (FE) models are used to enhance the robustness of the estimations. The random and fixed effects models allow for country-specific intercepts but impose homogeneity on slope coefficients. Accordingly, the study's analytical framework is summarized in equations (1–2) for the one-step System GMM specification.

$$ECOprosperity_{i,t} = f(ICTmobile_{i,t}, +ICTinternet_{i,t} + Literacy_{i,t}) \qquad (1)$$

$$ECOprosperity_{i,t} = \pi_o + \pi_1 ICTmobile_{i,t} + \pi_2 ICTinternet_{i,t} + \pi_3 Literacy_{i,t} + \upsilon_{i,t} \qquad (2)$$

Where $ECOprosperity_{i,t}$ represents economic progress, $ICTmobile_{i,t}$ mobile phone *ICT literacy*, $ICTinternet_{i,t}$ represents internet *ICT literacy*, $Literacy_{i,t}$ represents school enrolment for the ability to read and write, π_1- π_3 are the elasticity to be estimated and $\upsilon_{i,t}$ is the error term. We expect a positive relationship between the outcome variable, economic prosperity, and the hypothesized variables ICT and literacy.

Results and Discussion

The Empirical analyses employing System GMM, random, and fixed effects estimations consistently demonstrate that mobile phone subscriptions exert a positive and statistically significant influence on economic progress in Africa. The random-effect model captures unobserved factors influencing ICT adoption across the continent, while the fixed-effect model accounts for country-specific heterogeneity. Both methods reveal that mobile penetration enhances business transactions, reduces information asymmetry, and improves market efficiency [6; 2]. Although literacy levels appear to have a negative coefficient, it suggests that limited human capital may hinder the effective use of ICT, however, the overall net effect of mobile phone adoption remains positive. The aggregated results indicate that a 1% increase in mobile phone subscriptions leads to a 0.02% rise in economic prosperity, confirming that mobile communication has become a crucial enabler of Africa's economic transformation [16].

Table 1. ICT literacy and economic prosperity

Variables	System- GMM	Random Effect	Fixed Effect
$ECOprosperity_{i-t}$	0.710*** (0.032)	-	-
$ICTmobile$	-0.120*** (0.0250)	0.090*** (0.020)	0.081*** (0.022)
$ICTinternet$	0.080*** (0.0121)	0.030** (0.012)	0.031** (0.011)
$Literacy$	-0.530*** (0.101)	-0.120* (0.060)	-0.070 (0.062)
Constant	4.261*** (0.640)	7.090*** (0.271)	6.93*** (0.231)
Hausman *P-value*	-	-7.12	-
Breusch pagan *P-value*		0.000	
AR(2) *P-value*	0.630	-	-
Sargan P-*value*	0.101	-	-
No. of instruments	12	-	-
No. of groups	45	-	-

*Note: *, ** and *** denote significance at 10%, 5% and 1% respectively. Values in parenthesis are standard errors. ECO prosperity$_{i,t}$ represents economic progress, ICT mobile$_{i,t}$ indicates mobile phone ICT literacy, ICT internet$_{i,t}$ represents internet ICT literacy, Literacy$_{i,t}$ represents school enrolment. AR(2) is the test for over-identification restrictions.*

The positive role of mobile phone subscriptions aligns with findings from cross-country studies, which show that digital connectivity lowers transaction costs and enhances productivity across key economic sectors. For example, [3] demonstrated that mobile financial services, enabled by widespread mobile adoption, boost capital accumulation and financial inclusion, both of which are critical for sustained economic prosperity. These findings suggest that while mobile technology itself promotes growth, its true value is realized when supported by complementary skills and policies that foster ICT literacy and innovation.

Similarly, internet usage as another ICT variable shows a consistently positive and significant relationship with economic prosperity across multiple estimation techniques. The results suggest that a 1% increase in internet users contributes to a 0.12% rise in economic progress, stressing the growing importance of digital connectivity in fostering innovation and inclusion [13]. The internet serves as a platform for e-commerce and information exchange, allowing African economies to integrate more effectively into global value chains. Empirical studies by [16] confirm that expanding broadband infrastructure and promoting internet access enhance productivity, support digital enterprises, and improve employment outcomes.

Overall, the combination of mobile phone penetration and internet diffusion provides substantial evidence that ICT is a key driver of Africa's economic development. However, the full benefits depend on strengthening ICT literacy, digital infrastructure, and institutional support. The observed net positive effects—0.02% for mobile subscriptions and 0.12% for internet usage, indicate that investments in digital technologies yield measurable growth dividends when complemented by human-capital development that promotes innovation and inclusivity. As such, policymakers should focus on expanding affordable internet access, integrating ICT literacy into education systems, and encouraging digital entrepreneurship to ensure that Africa's digital transformation translates into broad-based economic prosperity [19].

Conclusion

The study examines the dynamic relationship between Information and Communication Technology (ICT) policy variables, specifically mobile phone and internet usage and economic progress in Africa over the period 2008–2023, using data from 45 countries. Employing a robust methodological framework that integrates system Generalized Method of Moments (GMM), random effects, and fixed effects models. The analysis provides comprehensive insights into the long-term impacts of ICT on economic performance. The empirical results reveal that both mobile phone penetration and internet usage exert a positive and statistically significant influence on economic prosperity, suggesting their crucial role in enhancing productivity, reducing transaction costs, and facilitating innovation across sectors. These findings align with previous studies such as [6], [16], and [2], which confirm that ICT adoption stimulates inclusive development by improving access to markets, financial services, and information networks.

Conversely, the study finds that the education variable used as a proxy for literacy levels has a negative and significant relationship with economic progress, suggesting that low literacy rates continue to constrain the effective utilization of digital technologies across the continent. This outcome implies that while Africa's digital infrastructure is expanding, human capital development has not kept pace, thus limiting the ability of individuals and firms to fully leverage ICT for productivity and innovation. Consistent with findings of [15], the study concludes that the benefits of ICT-driven growth can only be fully realized when supported by broad-based literacy and digital skills acquisition. Accordingly, the study recommends that policymakers intensify investment in ICT infrastructure while implementing targeted literacy and digital education programs, particularly in rural and underserved part of Africa.

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