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| RESEARCH ARTICLE

How Has Digitalisation Impacted the Economies of African Countries?

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| ABSTRACT
Digitalisation has been transforming industries around the world and impacting economies. The pace of digital transformation across countries has been asymmetric. This study examines digitalisation's impact on African countries' economic growth. Digitalisation is expected to improve operational efficiency, productivity, better communications, and enhanced consumer experience, catalysing economic growth for African countries. For our research objectives, we employ data from forty African countries for the period of 2000-2020. Our results indicate that investments in digitalisation are expected to contribute to economic growth in African countries. Key proposals are provided in the paper's conclusion to promote Africa's sustainable economic growth.

| KEYWORDS

Digitalisation; African Countries; economies; digital transformation; economic growth

| ARTICLE INFORMATION

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1. Introduction

Digitalisation has increased over time, perhaps more than ever in human history (Rapke & Christensen, 2013). Digitalisation has impacted how society, companies, and individuals organise economic activities. Many things are done via digital technologies, from banking transactions to hiring a cab. Digitalisation is also expected to impact economic growth through improved business processes, better user experience, and investment in digital technologies that benefit economies (Cascio & Montealegre, 2016). Because of its advantages, digitalisation is the way forward for economic and social development (Smith, 2023). However, digitalisation also poses challenges, such as the displacement of jobs and exacerbation of income inequality, as those with the necessary skills to thrive in the digital economy benefit disproportionately. In contrast, others are left behind (Brynjolfsson & McAfee, 2014). Thus, while digitalisation offers numerous opportunities for economic advancement, addressing its negative impacts is crucial for ensuring inclusive and sustainable growth.

Digitalisation has become pivotal in reshaping industries worldwide, catalysing innovation, and redefining competitive advantages. Across manufacturing and finance sectors, organisations harness the power of advanced technologies like cloud computing, artificial intelligence, big data analytics, and blockchain to drive efficiencies, unlock new opportunities, and create new business models. For instance, Berdiyeva et al. (2021) report that using artificial intelligence in financial services has increased. Embracing digital transformation empowers companies to stay competitive in today's rapidly evolving landscape, enabling them to adapt to changing market dynamics, anticipate customer needs, and capitalise on emerging trends. By leveraging technology to streamline operations, enhance collaboration, and deliver value-added services, industries are poised to thrive in the digital era.

The impact of digitalisation is shaped by the level of development in a country or region. In advanced economies with improved digital infrastructure, embracing digital technologies leads to significant gains in productivity and innovation, ultimately fuelling economic expansion (Brynjolfsson & McAfee, 2014). Digitalisation also creates highly skilled jobs in finance, technology, healthcare, etc. However, in developing economies, digital transformation may be slow due to low education levels, awareness, and technology

adoption. In these countries, targeted investments are essential to ensure equitable participation in and benefits from the digital economy, thereby fostering sustainable economic development.

African countries are adopting digital technologies, albeit with significant variations across countries. According to the International Telecommunication Union (ITU), by the end of 2020, Africa had achieved a mobile cellular penetration rate of 85%, with over 1.15 billion mobile subscriptions (ITU, 2020). The proliferation of mobile phones has facilitated access to digital services, particularly in finance, where mobile money transactions have surged. However, challenges such as limited internet infrastructure, digital skills gaps, and affordability constraints persist, hindering the full realisation of Africa's digital potential (McKinsey & Company, 2019). Nonetheless, these statistics underscore the transformative impact of digitalisation on Africa's socio-economic landscape and the opportunities it presents for inclusive growth and development.

Ali et al. (2024) examined the impact of digitalisation on the economic growth of OIC countries and reported positive effects. Torok (2024) examined the impact of digitalisation on economic growth in European countries. They measured digitalisation through the International Digital Economy and Society Index (i-DESI), composed of five subsets: connectivity, human capital, use of the internet, integration of digital technology, and digital public services. Generally, they reported positive results of digitalisation; however, their results were higher for more digitalised countries than less digitalised ones. For African countries, the impact of digitalisation has not been thoroughly tested on economic growth, which provides us with a research gap that we shall try to achieve in this study.

2. Literature Review

The pace of digitalisation has increased over time, transforming industries such as finance, healthcare, services, etc. For instance, integrating electronic health records (EHRs) and telemedicine platforms has enhanced patient care delivery and accessibility to medical services (Huang et al., 2018). Similarly, the financial sector has witnessed a paradigm shift by adopting technologies such as blockchain, big data analytics, and cloud computing, resulting in numerous startups offering better financial services worldwide. Digitalisation has improved customer experience and operational efficiency. However, it has also disrupted the job market and traditional business models.

The role of digitalisation in fostering economic growth in African countries has been debated. Doe & Smith (2023) argue that digitalisation enhances capital and labour productivity, reduces transaction costs, and facilitates access to global markets. Emerging technologies improve accessibility to goods and services, potentially enabling developing economies to achieve a transition to developed economy status through leapfrogging. The proliferation of mobile phones in developing nations has enabled long-distance communication despite limited investments in fixed telecommunications infrastructure. Mobile banking, for instance, has significantly enhanced access to financial services for many in poverty-stricken rural areas. In Sub-Saharan Africa, mobile banking has facilitated a transition from agricultural to non-farm enterprises, potentially increasing per capita consumption and reducing poverty rates over time.

Smith & Johnson (2023) highlights a phenomenon known as de-industrialisation in many developed nations, evidenced by declining employment in the manufacturing sector. This pattern is also observed in developing and least developed nations, where it is referred to as “premature de-industrialisation.” Scholars argue that this trend is prevalent in low-income countries, which often lack the comparative advantage in manufacturing and are more inclined to import manufactured products. Sub-Saharan African nations like Ghana, Nigeria, and Botswana are examples of premature de-industrialisation. Despite the economic expansion, their growth trajectory deviates from the conventional path of industrialisation. As Oladapo & Okoye (2022) noted, the Nigerian economy transitioned from an agrarian-based economy to a service-based economy, bypassing industrialisation.

Doe and Smith (2023) raise questions about Sub-Saharan Africa's potential to leverage the digital revolution for economic growth. Despite widespread ICT adoption contributing to global prosperity, a persistent digital divide between developed and developing nations remains (Smith, 2020). Significant digital access and capabilities disparities persist between Sub-Saharan Africa and other developing regions, characterised by differences in digital competencies among various cohorts, rural and urban areas, genders, and age groups (ITU, 2020). Predominantly in urban areas, broadband deployment is unlikely to change significantly without public measures. By the end of 2016, internet usage in Africa was only 20%, compared to nearly 50% globally. Sub-Saharan Africa showed a notable disparity in internet accessibility compared to other regions. Internet penetration was lower in Sub-Saharan Africa than in South Asia in 2016. High ICT costs, inadequate infrastructure, and logistical challenges impede digitalisation in Sub-Saharan Africa (ITU, 2020). The lack of a reliable electricity grid and sufficient energy resources limits preparedness for digital technologies. Figures 1 and 2 present the level of digitalisation in different African countries based on 2020 data, showing that high-income countries like South Africa, Nigeria, Kenya, and Egypt have relatively higher broadband connections and mobile penetration rates.

The advancement of ICT has led to the emergence of e-commerce, providing a unique avenue for Small and Medium Enterprises (SMEs) in developing nations to access global markets. Mobile money and improved internet connectivity have fostered new digital business practices in various African economies (ITC, 2015). While domestic e-commerce has grown significantly, international e-

commerce remains weak due to institutional challenges and the digital divide. Government regulations, inadequate infrastructure, and political barriers impede e-commerce in Africa (ITC, 2015). The limited use of credit cards and low electricity access also hinder ICT infrastructure utilisation. A reliable and cost-effective ICT infrastructure is crucial for successful e-commerce implementation. Figure 1 illustrates the number of fixed broadband subscriptions per 100 inhabitants in various African countries in 2020. The data reveals the extent of internet penetration across these countries. Figure 2 showcases the number of mobile phones owned per 100 inhabitants in the same African countries for the year 2020. It highlights the level of mobile phone penetration, which is generally higher than broadband penetration. South Africa leads in broadband subscriptions, with 13 subscriptions per 100 inhabitants, followed by Tunisia (9) and Egypt (8). Many other countries, such as Nigeria and Kenya, have lower broadband penetration rates, indicating potential areas for infrastructure development. South Africa also has the highest mobile phone ownership, with 146 phones per 100 inhabitants, indicating widespread mobile usage. Other countries, such as Tunisia (130), Morocco (125), and Algeria (116), also show high mobile penetration. Even in countries with lower broadband subscriptions, mobile phone ownership is relatively high, suggesting mobile technology is a critical tool for connectivity.

Figure 1. Fixed Broadband Subscriptions per 100 Inhabitants (2021)

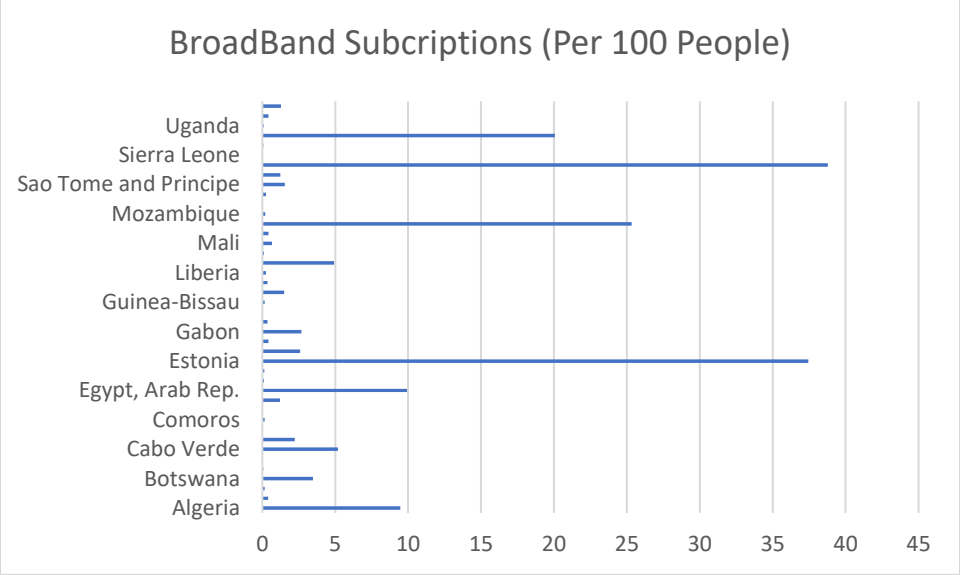
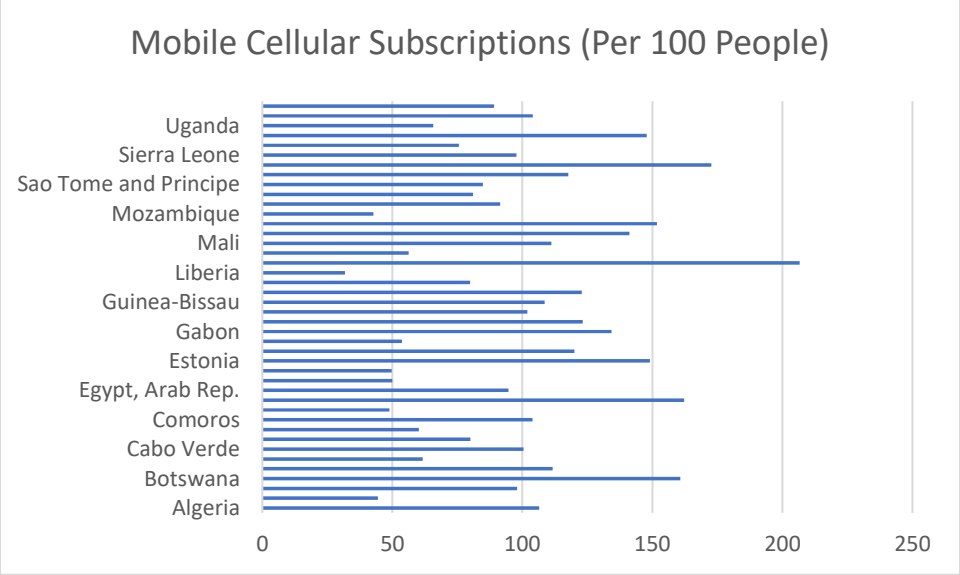


Figure 2: Mobile Phone Subscriptions Per 100 Inhabitants (2020)



This study examines the impact of digitalisation on the economies of African countries, many of which are low-income. Our goal is to determine whether digitalisation has positively impacted their economic growth. Digitalisation continues to be a driving force

behind economic growth, offering many benefits across sectors. Firstly, it enhances productivity by optimising processes and enabling automation. This results in cost efficiencies and increased output, positively impacting economic growth (Bughin et al., 2018). Secondly, digitalisation fuels innovation by providing tools and platforms for experimentation and development. It fosters the creation of new products, services, and business models, stimulating economic dynamism and competitiveness (World Economic Forum, 2020). Thirdly, digitalisation expands market access, particularly for small and medium-sized enterprises (SMEs), by leveraging digital platforms for global trade and e-commerce. This enables SMEs to access new markets and customer segments, driving economic growth and job creation (Ng, 2020). Overall, the benefits of digitalisation on economic growth encompass improved productivity, enhanced innovation, and broader market reach, contributing to sustained prosperity. Li et al. (2024) find that digitalisation is the main driver of economic growth in BRICS economies.

According to the neoclassical growth model, exogenous variables, including population expansion, capital accumulation, and technical advancement, are responsible for long-term economic growth (Solow, 1956). In the Solow model's equilibrium state, there is no growth in output, consumption, or per capita capital. By considering exogenous influences like population growth and technological improvements, the growth phenomenon could be further explained.

3. Methodology

This study examines the impact of digitalisation on economic growth in African countries. We employ the standard economic growth model augmented with governance and digitalisation variables to facilitate analysis. The governance variable is an average of six indices. We have used mobile subscriptions, internet users, and broadband subscriptions for digitalisation. The variables used are explained in Table 1.

Table 1: Variables Definition

Variable Name	Definition
GDP Per Capita Growth (GDPPG)	Growth of gross domestic product divided by total population.
Trade Openness (TO)	The total of exports and imports as a share of gross domestic product.
Inflation (INF)	Annual percentage change in consumer prices
Gross Fixed Capital Formation (GFCF)	Cost of land improvements, construction of roads, machinery, etc.
Governance (GOV)	An Average of six sub-indices, including voice and accountability, political stability, regulatory quality, control of corruption, rule of law, government effectiveness
Mobile subscription (MOB)	Mobile-cellular telephone subscriptions per 100 inhabitants.
Broadband subscriptions (BB)	Fixed-broadband subscriptions per 100 inhabitants.

The data for economic variables has been taken from world development indicators, governance from worldwide governance indicators, and digitalisation from the International Telecommunication database**.** The equation for the panel model for GDP per capita growth and various explanatory variables are as follows.

$$GDPPCG=\alpha+ \beta_1 TO+\beta_2 INF+\beta_3 GFCF + \beta_4 GOV + \beta_5 MOB + \beta_6 BB +\epsilon$$

The study estimates the equation using the Ordinary Least Squares, Fixed Effects, and GMM models. Employing different techniques will ensure the robustness of the results (Shahid, 2022; Shaid et al., 2018). The GMM estimator is employed to deal with the dynamic panel data issues (unobserved country-specific effects, endogeneity), which is suitable for situations where cross sections are larger than data duration. The data stretches from 2000 to 2020 and is based primarily on digitalisation metrics. This period was chosen because reliable data on digitalisation metrics from 2000 onwards was available.

4. Results

In this section, we present the results of our analysis, mainly descriptive statistics, correlation, and regression analysis. Descriptive statistics summarise the dataset's distribution's central tendency, dispersion, and shape. These statistics indicate significant disparities in GDP per capita and digitalisation metrics among African AFRICAN member countries, highlighting varying levels of economic development and digital infrastructure. The low average broadband subscription rate suggests that broadband infrastructure is underdeveloped compared to mobile usage and the relatively poor state of the broadband infrastructure in African countries. Broadband subscriptions are only around 2.8%, which is very low and shows underdeveloped broadband infrastructure in African countries. Among other variables, the average GFCF is around 23,100 million dollars, and GC is around 13,200 million dollars. Looking at the correlation matrix, other than Inflation-Trade Openness, there has been no issue of multicollinearity.

Table 2: Descriptive Statistics

Variables	Observations	Mean	Std. Dev	Min	Max
GDPPG	800	1.8	3	-7.5	6
TO	800	50.1	30	1.5	300
INF	800	5.60	3.71	.07	18
GFCF	800	23100	45700	31.700	349000
GOV	800	.22	.4	(.50)	1.05
Mobile	800	50	44	11	200
BB	800	2.8	4.1	0.004	26.8

Table 3: Correlation Matrix

Variables	GDPPG	TO	INF	GFCF	GOV	MOB	BB
GDPPC	1						
TO	0.20	1					
INF	0.150	0.70	1				
GFCF	0.25	-0.01	-0.04	1			
GOV	0.61	0.30	0.21	-0.01	1		
Mob	0.19	0.20	0.37	0.02	0.50	1	
BB	0.45	0.42	0.34	-0.06	0.42	0.50	1

Next, we discuss the main results of our study, which focuses on digitalisation's impact on African countries' economic growth. Using the OLS, fixed effect, and GMM model, we examined the impact of Trade openness, Inflation, Gross fixed capital formation, governance, and mobile and broadband usage on economic growth. The GMM model has been used to tackle dynamic panel model issues such as endogeneity and heteroskedasticity. The OLS model showed that TO, GOV, MOB, and BB significantly contribute to economic growth. Specifically, a 1% increase in TO, GOV, MOB, and BB increased economic growth by .2%, .9%, 2.2%, and 1.3%, respectively. The broadband and mobile variables are also significant in the fixed effect, and the GMM model shows the significance of digitalisation for economic growth. Governance is crucial for economic growth as it improves contracting, consumer, and investor trust and reduces transaction costs, though it is not significant in the fixed effect model. The panel fixed effects model controls for unobserved heterogeneity across countries. The results from this model were consistent with those of the OLS model, showing that TO, internet usage, and broadband subscriptions positively and significantly impacted GDPPG. GMM models use lagged variables as instruments to control for endogeneity. Diagnostic statistics indicated the non-presence of first or second-order serial correlation, validating the instruments' appropriateness. The GMM results highlighted that mobile and broadband subscriptions, governance, and trade openness all significantly and positively impact the economic growth of African economies.

Table 4: Effects of Digitalisation on AFRICAN Economies

Variables	OLS	Fixed Effects	GMM
L.GDPPG			0.60**
TO	0.002**	0.12**	0.09***
INF	.081	.134*	.02
GFCF	-0.09	0.141	0.05*
GOV	0.009**	0.035	0.001***
MOB	0.022**	0.011**	0.012**
BB	0.013**	0.021**	0.010*
Constant	0.44	0.033	-2.29**
No of Observations	700	700	647
R-Squared	0.43	0.29	
No of Countries	30	30	30
AR (1) p-value			0.121
AR (2) p-value			0.25
Sargan p-value			0.385

*Note: The p-values are reported in parentheses, and significance levels are denoted with asterisks for ***p < 0.01, **p < 0.05, and * $p < 0.1$.

5. Conclusion

This section discusses the findings of the study and the related policy implications. In this study, we investigated the role of digitalisation in driving economic growth in African countries. Our analysis employed three empirical models—OLS, fixed effects, and GMM—to assess the impact of digitalisation proxies' impact on GDP per capita growth (GDPPG), including mobile subscriptions and broadband subscriptions. We have also included governance to consider the institutional quality and standard independent variables for economic growth. The results consistently indicated that mobile phone and broadband subscriptions positively, significantly, and robustly impact economic growth. Along with digitalisation, governance quality and trade openness are key drivers of economic growth. Inflation and gross fixed capital formation are not robustly affecting economic growth. Overall, our findings underscore the crucial role of digitalisation, particularly mobile and broadband subscriptions, in fostering economic growth in African countries. Policymakers should focus on improving digitalisation, governance quality, and trade openness by allocating resources and government spending and taking stakeholders along for sustainable growth. This area of research can be further expanded by incorporating digitalisation in the financial industry and sample splitting to see the impact of COVID-19 and business cycles. Future studies may divide the sample period into certain different market conditions (see Shahid & Sattar, 2017).

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