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Do internet and mobile usage affect the Democracy-economic growth nexus in Africa?

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Toyo A. M. Dossou
Laboratory of Public Economics, University of Abomey-Calavi in Benin
Abomey-Calavi 02BP 2163, Gbégamey-Cotonou, Benin.
&
Université de Bourgogne, UFR Droit, sciences économique et politique, Site de Dijon
E-mail: dossoumarcel863@yahoo.fr

Kihumuro Jotham
Beijing Normal University
Email: jothamkihumuro25@gmail.com

Kouessi P. Dossou
Faculty of Economics and Management of the University of Abomey-Calavi in Benin
Abomey-Calavi 02BP 2163, Gbégamey-Cotonou, Benin
Email: pascalkouessidossou@gmail.com

Emmanuelle N. Kambaye
Schoolof International Business, Southwestern University of
Finance and Economics, No. 555 Liutai
Ave, Wenjiang District, Chengdu,
Sichuan 611130, China.
E-mail: nemmanuelle@yahoo.fr

Simplice A. Asongu
(Corresponding author)
School of Economics, University of Johannesburg,
Johannesburg, South Africa
E-mails: asongusimplice@yahoo.com, asongus@afridev.org

Alastaire S. Alinsato
Faculty of Economics and Management of the University of Abomey-Calavi in Benin
Abomey-Calavi 02BP 2163, Gbégamey-Cotonou, Benin
E-mail: alastaires@yahoo.fr

Research Department

Do internet and mobile usage affect the Democracy-economic growth nexus in Africa?

Toyo A. M. Dossou, Kihumuro Jotham, Kouessi P. Dossou, Emmanuelle N. Kambaye, **Simplice A. Asongu & Alastaire S. Alinsato**

Abstract

Recently, many studies have examined the ICT-economic growth relationship and the democracy-economic growth linkage with conflicting results. However, the study on the moderating effect of internet and mobile usage on the democracy-economic growth relationship is very scanty. This study, therefore, contributes to the economic development literature by examining the impact of internet and mobile usage on the democracy-economic growth relationship in 26African economies over the period 2000-2020. The panel corrected standard errors (PCSE) estimation technique has been applied. The results show that improving democratic system in Africa can foster economic growth. Moreover, the result reveals that increasing internet and mobile usage can boom economic growth in Africa. Furthermore, the results reveal that the interaction between internet and mobile usage and democracy can boost economic growth in Africa. Policy implications regarding the moderating effect of internet and mobile usage on the democracy-economic growth nexus are discussed.

Keyword: Democracy, internet and mobile usage, Economic growth, Africa

1. Introduction

Economic growth has been always viewed as the basic social progress and political stability, which have been found to play an important role in improving socio-economic outcome (Asongu & Odhiambo, 2019; Guo et al., 2022; Stawska & Jabłońska, 2022). Many benefits of economic growth has been identified by Stawska and Jabłońska (2022). First, according to Stawska and Jabłońska (2022), the rise of economic growth could improve socio-economic development. For example, it has been argued that economic growth could contribute to improve income distribution. As documented by Hjazeen et al.(2021), through the employment effects, economic growth has the power to lower unemployment rate. This has been corroborated by Xu et al. (2021) who used 38 African countries over the period 2000-2015 and found that economic growth reduces income inequality through creating jobs. Similarly, using 48 African countries over the period 1996-2020, Ofori et al.(2022) confirmed the findings of Xu et al. (2021). In recent years, economic growth has been argued to reduce poverty in developing countries, namely Africa, Asia and Latin America (Dossou et al., 2021; Folarin & Adeniyi, 2019; Zhao, 2020).Second, through the accelerator effect, economic growth is expected to stimulate investments which has the capacity to improve social welfare, income distribution and alleviate poverty. The underlying argument can be explained by the fact that economic growth could contribute to attracting international investments through infrastructural development, security and education improvement (Xu et al., 2022). Finally, through fiscal dividend, higher economic growth has been found to increase tax revenue, which by extension could contribute to reducing income inequality and poverty.

Over the last two decades, many studies have examined the determinants of economic growth (Asongu & Odhiambo, 2019). Among these determinants, democracy has been found to play a significant role in promoting economic growth. This has led to an investigation of the relationship between economic growth and democracy in recent years (Doucouliagos & Ulubas, 2008a; Kabir & Alam, 2021; Sirowy & Inkeles, 1990). According to the authors, the finding regarding the nexus between democracy and economic growth remains mixed. This argument has been supported by Sirowy and Inkeles (1990) who documented that the findings regarding the relationship between democracy and economic growth continue to be plagued by mixing results. One the one hand, economic growth has been appeared to be improved by democracy. For example,

democracy has been argued to promote economic growth through protecting property rights (Kabir & Alam, 2021).As a country is democratized, its resource allocation is efficiently used (Doucouliagos & Ulubas, 2008a). As such, it can contribute to promote economic growth. In more specific way, democracy has been documented to be successful in the distribution of wealth through collecting tax revenue and implementing social policies, which seem to play a crucial role in promoting economic growth (Gerring et al., 2005). Further, the authors argued that democracy has the power to open markets and improve institution in civil society, which by extension could contribute to promoting economic growth. On the other hand, democracy seems to undermine economic growth. For instance, the Kuznets theory developed by Kuznets (1955) posited that at the early stage of the process of economic development, democracy could contribute to crippling economic growth. The above mixing results regarding the impact of the political democracy on economic growth impelled us to re-examine the subject with new data.

Meanwhile the advent of information and communication technology has boosted every sector or factor (Ben Ali, 2020)that contributes to promote economic growth and improve development outcomes. According to Audi (1990), freedom of the press has been found to play a crucial role in enchanting the political democracy, which has been proven to promote economic growth. For example, a report released by Human Right Careers documented that freedom of the press and democracy are interrelated[1]. Further, the report documented that a free press has the power to uncover the truth. This view has been supported by Audi (1990), who posited that a free press has the power to protect people from governmental corruption. This argument has been recently supported by Dossou et al.(2021), Xu et al.(2022), Dossou (2023), Xu et al. (2021), Dossou et al. (2023) and Dossou et al. (2023), who argued that reducing corruption could contribute to promote economic growth through creating jobs, reducing income inequality and poverty. Similarly, a free press could hold those in political office accountable. In the same vein, abuses of power can be challenged by a free press. This argument is corroboratively supported by Ben Ali(2020) who argued that the power of people can be improved if ICT usage contributes to reporting administrative abuses and registering complaints. Nowadays, we have seen the usage of ICT during elections as it broadcasts information for voters (Ben Ali, 2020). Another angle has been revealed

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[1]https://www.humanrightscareers.com/issues/why-is-freedom-of-the-press-important-in-a-democracy/

by Ben Ali (2020) who argued that false statements and wrong information can be challenged by the use of ICT during political campaigns.In recent years, ICT has contributed to change the political landscape through revealing high corruption which has led to theArab Spring in North Africa (Ben Ali, 2020; Dossou et al., 2023). Doing so, will contribute to use efficiently national resource, which by extension could contribute to enhance development outcomes. However, the study regarding the moderation of ICT on the relationship bwteen democracy and economic growth is quite inexistent.

The motivation of this study stems from the following paucity of empirical studies on the moderation effect of internet and mobiale usage on the democracy-economic growth nexus in Africa. Although some studies have examined the influence of democracy on economic growth and the influence on internet and mobile usage on economic growth in certain countries or regions (Adeleye & Eboagu, 2019; Narayan, Narayan, & Smyth, 2011), the moderating effect of internet and mobile usage on the democracy-economic growth nexus has not yet been empirically explored in Africa. It is fundemental to examine this linkages in Africa beacause of the high level of economic expansion, high level of internet and mobile usage and weak democracy system. Africa has been the focus of this study due to many reasons. First, Africa has experienced the expansion of mobile phone market in recent years. According to the World Bank (2012), the development landscape has been transformed by the internet and mobile phones, which have been implicated in many economic activies. ICT has been documented to positively affect Africa's growth in recent years (Dossou et al., 2023). Further, the World Bank (2012) has pointed several channels, namely financial sector, trade facilitation, climate change adaptation, health and argiculture that have been seen as a major contributor of economic growth in Africa. Despite the positive effect of ICT on economic growth, its development remains low compared to other developing countries (see Figure 1).
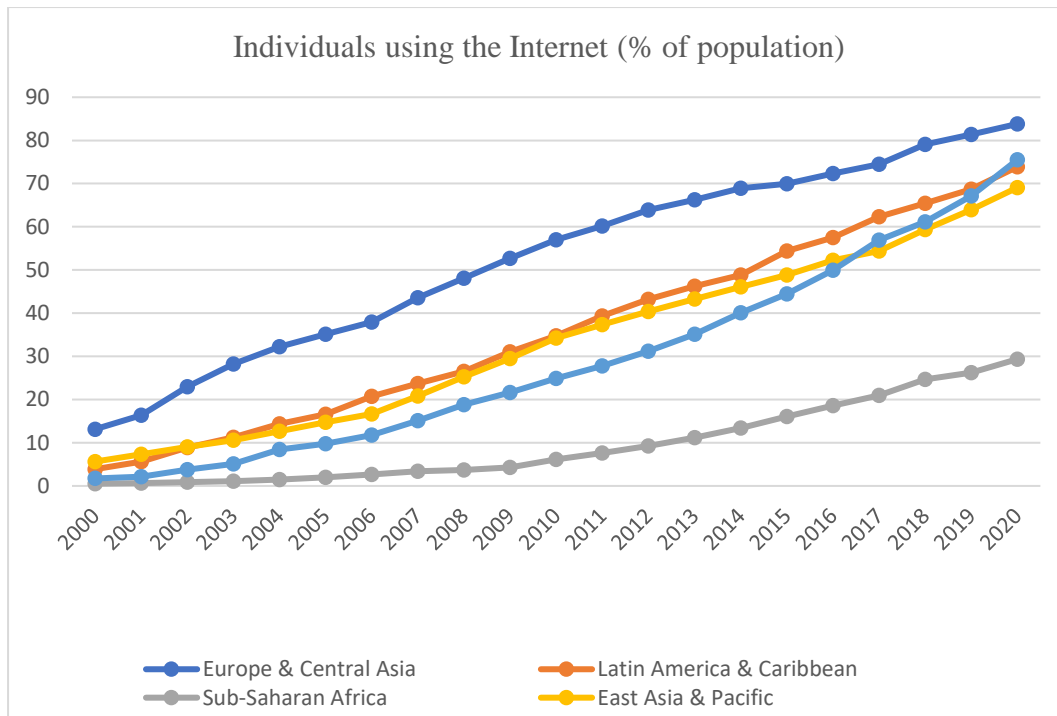
Figure 1. Trends of Individuals using the Internet (% of population.

Source. World Bank (2022)

Second, while democracy has been seen as a major factor that contributes to the enhancement of economic growth, African countries continue to deal with autocracy. For example, a finding revealed by the Brooking Institutions documented that 79% of sub-Saharan's population live in government that has been classified as electoral autocracies (Brooking Institutions, 2023). According to the explanation of the institutions, the organization of elections in those countries is closed to autocracies. This argument has been supported by the Ibrahim Index of African Governance which documented that political participation; right and inclusion are undermined in Africa and almost one-third of Africa population live under authoritarian regime. A shift toward autocracy regime can be shown in Burkina Faso, Mali and Guinea where a coup d'état has occurred without election in the year 2020, according to the report of Freedom House. Recently, democracy change has been observed in Tunisia where president Kais Saied has dissolved the country's democratic institutions such as the parliament and installed an authoritarian rule[2]. Moreover, presidents of some countries, namely Cameroon, Togo, Rwanda, Gabon and Uganda etc have maintained power

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[2]https://freedomhouse.org/country/tunisia

through rigging elections[3]. According to Fambeu (2021) and Fambeu and Yomi (2023), some countries have relied on anti-terrorism by reducing democracy space. Third, Xu et al. (2021) have pointed out the expansion of economic growth in Africa in recent years. Consequently, it is crucial to conduct an econometric analysis to determine the internet and mobile usage thresholds at which democracy can promote economic growth.

Thus, the specific objective of the present study is to examine the moderating effect of internet and mobile usage on the democracy-economic growth nexus in Africa. Essentially, some contributions have been made to the existing literature in the following areas. Firstly, it offers an original idea that focuses on the moderating effect of mobile and internet usage on the relationship between democracy and economic growth in a group of countries. Regarding the political economic and economic development literature in Africa, Fambeu (2021a) has for example, investigated the moderating effect of democracy on the relationship between trade and poverty reduction. In the same vein, Fambeu and Yomi (2023) assess the influence of democracy on poverty. Similarly, Acheampong et al.(2022) explored the impact of democracy on environmental quality. In the same account, the effect of corruption and democracy on foreign direct investment has been investigated by Zallé and Ouédraogo (2021) and Gossel (2018). However, the study regarding the relationship between democracy and economic growth is very scarce. A recent exception is Narayan et al. (2011) who examined the democracy-economic growth relationship. However, the study of Narayan et al. (2011) has used democracy proxies from the Freedom house. According to Acheampong and Opoku (2023), recent studies have criticised these proxies due to their inadequacies in terms of specificities. Accordingly, the definition of democracy has been criticised by these studies as it fails to encompass precision, coverage and sources, coding, aggregation, and validity and reliability tests. In essence, with respect to Acheampong and Opoku (2023), democracy should not only be viewed from election side since it is more than that. Therefore, unlike the study of Narayan et al. (2011) which only used the democracy proxies from the Freedom House, the present study has considered electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy which are collected from the Variety

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[3]https://freedomhouse.org/article/africa-contrasting-coups-and-elections-underscore-benefits-democracy

of Democracy (V-Dem) to proxy democracy. It is important to note that the current study uses these democracy indicators to comprehensively capture divers aspects of a democracy system. Moreover, the study of Narayan et al. (2011) has failed to examine the cross sectional dependence test as Africa has engaged in the process of the African Continental Free Trade Area. According to Xu et al.(2022), Xuanminget al.(2023) and Dossou et al. (2023), failing to examine the cross-sectional dependence test could lead to a bias result. Second, according to previous studies (Adeleye & Eboagu, 2019; Awad & Albaity, 2022; Fernández-Portillo, Almodóvar-González, & Hernández-Mogollón, 2020), the findings regarding the relationship between internet and mobile usage and economic growth are mixed. Following this remark, Kurniawati (2022) has encouraged future research to examine the relationship between internet and mobile usage and economic growth. Third, prior studies regarding the ICT, political economic and economic development literature have failed to examine the moderating effect of internet and mobile usage on the relationship between democracy and economic growth. Prior studies have either examined the influence of democracy on economic growth (Narayan et al., 2011) or the influence of internet and mobile usage on economic growth, whereas the moderating impact has been largely ignored. We therefore fill the gap in the economic development, political economy and ICT literature by investigating the moderating effect of internet and mobile usage on the relationship between democracy and economic growth. A favourable moderation insinuates that internet and mobile usage can promote the positive effect of democracy on economic growth while a deleterious moderation indicates otherwise.

2.0 Literature Review

This section provides an in-depth explanation of the theoretical background on the ICT-economic growth nexus, and the democracy-economic growth relationship. Several theoretical arguments through which democracy could impact economic growth are also highlighted. Empirical studies regarding the previous studies about the relationship between ICT and economic growth, and the most recent research concerning the relationship between democracy and economic growth are reported in this part. This section also consists of a formalized hypothesis that will enable the researcher to interpret the results. Lastly, a chronological flow of the summary of literature is provided in Tables 1 and 2 focusing on the relationship between ICT and economic

growth on the one hand and on the other, the nexus between democracy and economic growth.

2.1 Theoretical background

2.1.1 Theoretical background on the ICT-economic growth nexus

Overall factor efficiency, a gauge of increased outputs while retaining constant capital and labour inputs, is frequently used to study the impact of ICT on the growth of the economy. But more so, it has been determined that the neoclassical theory of economic growth is a suitable theory to explain the connection between ICT and economic growth (Awad, 2022). This idea contends that ICT could facilitate the equitable distribution of wealth. Awad and Albaity (2022) argue that ICT is considered to be able to improve inequality in income and economic growth through lowering corruption and encouraging freedom of economic activity. ICT can improve transparency, which appears to be essential for fostering economic growth and redistributing income (Dossou et al., 2023). Ibrahim et al. (2019) hold that another way that ICT might help enhance growth is through foreign direct investment which provides job opportunities and ultimately rise the GDP rate.

2.1.2 Theoretical background on the democracy-economic growth relationship

Several theoretical arguments through which democracy could impact economic growth are subdivided into two; Arguments for and against democracy. They can be further explained as seen below.

The Channel of Property rights protection

North (1990) defines Property rights as those that have been given to a particular person and can be transferred as a substitute for equivalent rights over other properties. They specify how to use financial resources, exploit them for profit, and redistribute them in conformity with the legal requirements. Property rights are better protected by a democratic government's capacity to guarantee effective resolution of disputes brought on by the profits and losses that are associated with groups engaged in an economy that is evolving (Ghardallou & Sridi, 2020). Asoni (2008) argues that a stronger assurance of property rights results from a decrease in the threat of forfeiture by the government and individual agents. It ought to be highlighted that the political system's resilience

and viability also play a role in the beneficial impact of democracy on intellectual property (Baklouti & Boujelbene, 2020).

The Channel of Political Stability

A political system that is volatile discourages investment and slows growth (Alesina et al., 1996; Aisen, 2013). Also, political turmoil makes it difficult to make choices in the future, reduces transparency, and deters investors from committing to projects. Julio &Yook (2012) reckon that, a democratic administration would reduce the likelihood of political unpredictability, particularly during times when leadership shifts, instead lengthen the duration of the administration by bolstering confidence in the long-term viability of the democratic process. As a result, democracy could be associated with long-term goals and wise economic decisions, which would reassure investors both locally and globally and encourage the generation of tangible assets (Gupta, 1998)

The Channel of Human Capital Accumulation

For a variety of justifications, democracy promotes stronger human capital growth. Tavares & Wacziarg (2001) argue that endogenous growth model supports the earlier claim and demonstrates that allocation, in the context of public schooling, is governed by a political system in a state of equilibrium. The Saint-Paul and Verdier (1993) model indicates that; the equitable distribution of wealth throughout society influences the amount of public schooling generated through a democratic process: The median voter will be able to cast more ballots in a democratic regime to convey their opinions for education: a greater fiscal burden, as defined by the median voter, encourages the expansion of public education.

The Channel of Technological Innovations

The widespread adoption of cutting-edge technology and democracy has a favourable link, according to a range of reasons. According to Martinez & Wantchekon (2021), democracy fosters technological advancement by permitting both the entry and exit of new businesses within the market. Democratic societies are places where people learn by exchanging ideas, analysing them, adjusting their positions, and revising what they already know. In a democratic system, these many traits promote the widespread use of new technology (Halperin et al. 2005)

Theoretical Arguments against Democracy

There is some debate over democracy's effect on the fluidity of growth. In reality, a lot of academics focus more on the economic benefits of an oligarchy with reference to the operation of a democratic system, casting doubt on the beneficial association between both of these elements. Civil organization pressures have significantly less of an impact on dictatorships (Comeau, 2003). However, on the other hand, (Gao et al., 2017) argue that democracy has no discernible positive impact on innovation as measured by the quantity, quality, and originality of patents. Nevertheless, democratic administrations often make short-sighted policies in order to maximize their odds of being re-elected (Gupta et al., 1998). Democracy, particularly, results in an enormous transfer of wealth from the wealthy, property owners, and the other middle class in the direction of the vast poor majority (Acemoglu and Robinson, 2000). In view of the aforementioned limitations of democracy, certain critics contend that the most effective form of government would be a well-informed authoritarian rule that prioritizes respect for the economic liberties required for the free operation of market forces but that also upholds the rule of law.

2.2 Empirical studies

2.2.1 Empirical studies regarding the relationship between ICT and economic growth

The inaugural body of this research evaluates the potential association between ICT and GDP growth. Over the previous years, findings of several studies have been undertaken on the relationship between ICT and economic growth. The vast majority of research supported ICT's positive impact on economic growth (Appiah-Otoo & Song, 2021; Fernández-Portillo et al., 2020; Bilan et al., 2019; Niebel, 2018; Saidi et al., 2015; Erumban & Das, 2016; Nasab & Aghaei, 2009). Considering the effective and quick spread of ICT, emerging markets like China, Brazil, South Africa, Singapore, Thailand, and South Korea are increasingly catching-up to high-income industrialized nations, demonstrating the ever-changing and quickly expanding capabilities of ICT.

The positive linkage between ICT and economic growth can be explained using several channels. For example, ICT can help to attract foreign direct investment which by extension could contribute to boosting economic growth (Awad & Albaity, 2022). ICT can contribute to the betterment of horizontal and vertical integration through connecting local production and international network which play a significant role in

attracting foreign direct investment, and in turn can enhance economic growth (Dossou et al., 2023). Similarly, through ICT tools, namely internet and mobile penetration, can contribute to lowering obstacles to foreign direct investment which have the power to positively influence economic growth (Asongu & Odhiambo, 2020). Education is another channel via which ICT can boost economic growth (Chatterjee, 2020). ICT has a potential to reduce corruption, which can enhance the ability of governments to create a fair policy concerning the underprivileged. This assertion has been advocated by Xu et al. (2021), who concluded that decreasing corruption could help meet the Sustainable Development Goals (SDGs) by 2030 while minimizing disparities in wealth. ICT is crucial for advancing inventions, fostering entrepreneurship, and accelerating the global economy (Liu et al., 2021). Similarly, Ullah et al. (2021) argue that ICT is essential for facilitating trade and promoting regional cohesion. Implementing successful regional integration systems are made more accessible by ICT. This is because modern technologies are necessary for human development, enhanced wellness, and an aging population, which benefits the country. ICT also enhances workforce productivity and talents, which have a positive impact on scientific research and development, global trade, and revenue thus subsequently impacting economic growth (Nair et al., 2020). In addition, ICT plays an identical function in other significant economic areas like online business, and electronic banking services. ICT is a turning point for digital trading since it opens doors and improves cross-border trade, which in turn spurs economic growth (Tay, 2020; Xing, 2018). Similarly, Wang et al., (2022) argue that despite the fact that several recent studies are silent about the rise of ICT, by improving digital facilities, deepening the amalgamation of conventional sectors with internet connectivity, and developing targeted policies in light of variations by region, the expansion of the internet can affect green GDP growth and encourage urban technology innovation.

On the contrary, some research has yielded inconsistent and negative results on the impact of ICT on economic growth (Bahrini & Qaffas, 2019; Latif et al., 2018; Stanley, 2018; Raheem et al., 2020). An investigation carried out by Billon et al., (2023) to determine whether differences in education at the national level had an impact on ICT growth while using the internet. For the entire sample, they discovered that a link between access to the internet and educational inequality was negative. According to Maurseth (2018), there is a negative association that exists between access to the

internet and economic growth. Nie et al., (2017) examined the relationship between ICT adoption through internet use, and multiple indicators of personal happiness, employing data collected by the 2010 China Household Panel Surveys. Their outcomes suggest that Chinese Internet users may be psychologically vulnerable due to a potential cultural element.

Recent studies have shown that ICT has a negative impact on employment and the labour market because those who are poorer are less likely to adjust to modern information technology, a condition that worsens poverty and income disparity (Vassilakopoulou & Hustad, 2023). Latif et al., (2018) further suggest that in the domestic marketplace, ICT is more advantageous for industrialized nations than for emerging economies.

2.2.2 Empirical studies regarding the relationship between democracy and economic growth

There are numerous discussions about how democracy affects GDP growth, and it can be explained through a variety of mechanisms which include the following;

Acemoglu and Robinson (2012) emphasized that while economics had disregarded politics, doing so was essential to understanding how to articulate socio-economic disparities. Densumite (2023) explored the connection between democracy and economic growth in 33 nations from 2010 and 2020 employing the Panel Vector Correction Model for Errors, Panel Unit Root, and Cointegration Tests. According to early empirical findings, democracy promotes economic growth. Shabbir (2017) demonstrates the need of promoting democratic standards in order to reduce corruption and improve a country's GDP using panel data on D-81 economies from 1995 to 2013. Also, Salahodjaev (2015) experimentally examined the interaction impact of democracy and cognitive abilities on economic growth using data from 93 countries covering the years 1970–2013. The findings indicate that the correlation between democracy and growth in real gross domestic product changes depending on the degree of cognitive development of a country. According to Hussain and Haque (2016), there is overwhelming proof that the GDP growth rate and economic freedom are positively correlated. Research by Majeed et al. (2021) suggests that, a slight increase in economic freedom has a temporary negative correlation with GDP growth but an extended

positive correlation. Heterogeneous consequences are confirmed by the fact that the decline in economic freedom has a negative but negligible influence on growth. According to Acemoglu et al. (2019), democracy does contribute to the growth of the economy. In the opinion of Li and Kumbhakar (2022), growth exists prior to many of the accurate underlying elements of freedom as well as the standard of freedom in a country. Drury et al. (2006) argue that economic development can result in a beneficial outcome of reduced corruption, noting that highly corrupt countries become less corrosive as they grow increasingly democratic. This is because citizens will expect and demand that politicians be accountable during their time of service. However, Mauro (1995) discovered that corruption discourages investment, thus slowing down the rate of economic growth. In a study conducted by Haan and Siermann (1996), the link between democracy and GDP growth is not particularly significant. Since market failure frequently contributes to ecological problems in a contemporary democracy (Rapsikevicius et al., 2021), the destruction of the environment also happens when there is excessive economic freedom. A study conducted by Baklouti and Boujelbene (2020) revealed that democracy and GDP growth are causally related in both directions. Additionally, it was discovered that governance stability affects the impact of democracy on the economy.

Given the arguments made above, the hypothesis of the study can be formulated as follows:

H_0 Consistent with the neoclassical theory of economic growth (Awad & Albaity, 2022), the effect of ICT on the Democracy-economic growth nexus in Africa is positive and significant.

H_1 ICT does not affect the democracy-economic growth nexus in Africa.

Based on the aforementioned prior literature, this study reveals mixed results concerning the contribution of ICT to Africa's economic growth between 2000 and 2020, which is consistent with the motivation underlying the study discussed in the introduction.

Table.1 Summary of literature focusing on the relationship between ICT and Economic growth

Author	Period	Region	Method	Key findings
De Clercq et al. (2023)	2011 - 2018	European Union	Dynamic fixed effects estimator.	Expansions in the provision of lower-speed broadband access accelerate annual per capita growth in both urban and rural regions
Khan & Haneklaus (2023)	2005 & 2019	93 Countries	Novel Bias-corrected method of moments estimators	Technology has both direct and indirect impacts on economic performance.
Wang et al. (2022)	2003 - 2018	China	SDM, DID	Internet development can significantly promote urban Green Innovation Efficiency
Abdulqadir&Asongu (2022)	2008 -2018	42 SSA Countries	Nonlinearity threshold model	There is a significant internet threshold effect of 3.55 percent for growth
Behera&Sahoo (2022)	1991 -2019	India	Non-linear NARD model	A positive (negative) change in globalization leads to a decline, (increase) in human development in the long run.
Appiah & Song (2021)	2002 - 2017	123 Countries	Aggregate Production Function (APF) following Solow (1956)	Poor countries tend to gain more from the ICT revolution.
Hussain et al. (2021)	1995 - 2016	4 South Asian economies	FMOLS technique and Panel VECM model	ICT penetration in both forms (ICT composite index & its individual form) have a long run positive relationship with the economic growth of South Asian economies
Adam (2020)	2016	Africa	PLS-SEM	a significant relationship exists between e-government development and ICT development.
Myovella et al. (2020)	2006 -2016	41 SSA Countries & 33 OECD Countries	OLS, FE & GMM	ICT increases growth.
Nguyen et al. (2020)	2000–2014	13 G-20 countries	FMOLS Quantile Regression	ICT increases growth

Table.2 Summary of literature focusing on the relationship between democracy and Economic growth

Author	Period	Region	Method	Key findings
Fambeu& Yomi (2023)	1999–2018	40 SSA countries	GMM	Democracy is not directly associated with poverty reduction in SSA
Opoku&Acheampong (2023)	2000 - 2020	47 SSA countries	GMM	Democracy variables are positively related to economic growth
Densumite (2023)	2010 - 2020	33 countries	VECM	Democracy has a positive effect on growth.
Nguema et al., 2023	1990 - 2014	40 African countries	GMM	Democracy enhances economic growth.
Li &Kumbhakar (2022)	1995 -2018	panel data set > 100 countries	GMM	When corruption and democracy are controlled at the same time, democracy has a positive effect on GDP per capita growth rate
Qasim (2022)	1984 - 2018	Pakistan	VECM	There exists a long-run relationship between democratic accountability and the economic growth of Pakistan.
Addi&Abubakar (2022)	2005 - 2018	27 SSA countries	fixed and random effect models	improvement in economic freedom stimulates economic growth
Gossel (2022)	1990 - 2018	38 SSA Countries	GMM	Democracy reduces inequality directly in both the short run and the long run
Kazerooni et al. (2020)	1986-2014	34 OIC Member countries	GMM	Political stability and democracy have a significant positive role in the economic growth.
Gill et al. (2019)	1980–2014	6 ASEAN	EKC hypothesis	Democracy measured by civil liberties increases the environmental cost of economic growth.

3.Model specification, data and methodology

3.1Model specification

To examine the moderation of information and communication technology on the nexus between democracy and economic growth, we follow a study that has examined the moderating effect in economic development by focusing on economic growth. For example, Malanski and Pontifícia(2021) who have investigated the moderation of economic freedom on the corruption-economic growth relationship. Moreover, Asongu and Odhiambo(2019) have investigated the moderating effect of ICT on the FDI-economic growth linkage. However, these studies have failed to examine the moderation of ICT on the relationship between democracy-economic growth. As the aim of this study is to fill this gap, our model can be written as follows:

$$Y_{it} = \beta_0 FD_{it} + \beta_1 FDI_{it} + \beta_2 TOP_{it} + \beta_3 Pop_{it} + \beta_4 Educa_{it} + \beta_5 Infl_{it} + \beta_6 ICT_{it} + \beta_7 Demo_{it} + \beta_8 (ICT \times Demo)_{it} + \varepsilon_{it} \ (1)$$

Where: Y_{it} is economic growth proxied by GDP growth and alternatively GDP per capita;$FD_{it}$is financial development which is domestic credit to private sector (% of GDP); FDI is foreign direct investment(% of GDP); TOP is trade openness (% of GDP); Pop is Population in millions; Educa is education which is School enrollment, secondary (gross), gender parity index (GPI); Infla is inflation which is consumer Price Index (annual %); ICT is information and communication technology which is internet penetration and mobile penetration; Demo is democracy which is electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy;ε_{it} is error term; t=2000-20202 (21); and i=26 African countries.

The net effect of democracy on economic growth can be deducted from equation1 as follows:

$$\frac{\partial Y_{it}}{\partial Demo_{it}} = \beta_7 + \beta_8 ICT_{it} \ (2)$$

3.2 Data

This study makes use of a panel of 26 African countries[4] over the period 2000-2020.The limited data on democracy has forced us to focus on 26 African economies. The sample

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[4]Benin, Botswana, Burkina Faso, Burundi, Central African Republic, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Guinea, Kenya, Lesotho, Liberia, Malawi, Mauritania, Morocco, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Sudan, Uganda, Zambia and Zimbabwe.

period has been chosen because of the remarkable expansion of economic growth over the last two decades as well as constraints in data availability at the time of the study. The data on inflation, economic growth, internet penetration, mobile penetration, financial development, foreign direct investment, trade openness, population and education were obtained from the World Bank of the World Development Indicators (WDIs). The data on democracy were emanated from the Varieties of Democracy (V-Dem).

Variable of our interest

Democracy indicators

Five democracy indicators, electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy have been used to proxy democracy in this study. In recent years, these indicators have been used in other fields of economic development. For example, Acheampong et al. (2022) have used these indicators to examine the impact of democracy on environmental degradation in Africa. Similarly, using these indicators, Acheampongand Opoku (2023) examined the moderating effect of democracy on the energy-economic growth nexus in Africa. In the same vein, Acheampong and Opoku(2023) used these five indicators to examine the moderation of democracy on the energy justice-deforestation relationship in Africa.

Economic growth

In accordance with the economic development literature (Asongu & Odhiambo, 2019), GDP growth and GDP per capita have been used to proxy economic growth. These indicators have recently been used by Asongu and Odhiambo (2019) to examine the moderation of ICT on the relationship between foreign direct investment and economic growth in sub-Saharan African countries.

Information and communication technology

Following a study by Adeleye et al.(2020), Dossou et al.(2023), Asongu and Le Roux (2017), Asongu and Odhiambo (2019) and Ofori and Asongu (2021), internet penetration and mobile penetration have been used to proxy information and communication technology. For example, using internet penetration and mobile penetration as a proxy of information and communication technology, Dzator et al. (2023) examine the influence of ICT on poverty reduction in Africa.

Control variable

Financial development

Theoretically, financial development can be recognised as an engine of economic growth. According to a report made by the World Bank, financial market development has the power to increase small and medium sized enterprises (SMEs) by providing finance service which plays a crucial role in development outcome[5]. Moreover, it contributes to economic development by reducing income inequality and poverty through providing access to finance to the vulnerable groups. It contributes also to the diversification of the economy(Abbas et al., 2022).

Foreign direct investment

Foreign direct investment has been found to play a crucial role in promoting economic growth (Toyo Amègnonna Marcel Dossou, Ndomandji Kambaye, et al., 2023; Xu et al., 2021). It has been believed that foreign direct investment has the power to increase foreign exchange, which by extension could contribute to promoting economic growth. According to Asafo-adjei et al.(2023), foreign direct investment can enhance economic growth through technological improvement and knowledge spillover. Moreover, foreign direct investment has been argued to increase tax revenue which in turn could promote economic growth. It is also argued that FDI can improve managerial skills. Considering these channels, a myriad of literature has assessed the FDI-economic growth nexus in both developed and developing nations (Asafo-adjei et al., 2023; Osei & Kim, 2020; Pegkas, 2015; Popescu, 2014). However, the findings regarding the FDI-economic growth nexus are mixed and inconclusive (Asafo-adjei et al., 2023). While a myriad of studies has found a positive contribution of FDI to economic growth, a few studies have shown no relationship between FDI and economic growth.

Trade openness

In accordance with the trade openness-economic growth literature, trade openness has been argued to promote innovation, increase productivity and promote economic growth(Fatima et al., 2020). Moreover, trade liberalization has the power to provide new market opportunities for local company which plays a significant role in economic performance. Furthermore, it can contribute to the promotion of economic integration

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[5]https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-development

which has been pointed out as a major contributor of economic growth[6]. Over the last two decades, the trade openness-economic growth nexus has been investigated by many scholars(Fatima et al., 2020).

Population

In accordance with Asongu and Odhiambo (2019) who have assessed the moderation of ICT on the FDI-economic growth nexus, we consider population in our model. The idea is divergent toward the effect of population growth on economic growth (Peterson, 2017).According to the author, population growth seems to retard economic growth, as the natural resources are very scarce. However, population growth has been shown to enhance economic growth. For example, population growth in the United States has led to more access to labor which has the power to increase the productivity[7].

Education

Education improvement seems to increase productivity and promote innovation (Marquez-Ramos & Mourelle, 2019). Moreover, it has been documented that the promotion of quality education can stimulate entrepreneurship which has been pointed out as a major driver of economic growth. Hence an increase in education improvement can lead to the promotion of economic growth.

3.3 Methodology

To assess the moderating impact of information and communication technology on the democracy-economic growth nexus, we have started by examining the preliminary test such as cross-sectional dependence test. In recent years, Africa has appeared to improve its economic integration by implementing the African Continental Free Trade Area (*AfCFTA*). As explained by Xu et al. (2022), in such case, it is important to look at the cross-sectional dependence test as it helps to prevent external shock. According to (Toyo Amegnonna Marcel Dossou et al., 2023), failing to address the issue of cross sectional dependence in the context where Africa has embarked in the process of the African Continental Free Trade Area could lead to a bias result (Dossou et al., 2023; Xu et al., 2022). Moreover, failing to address this issue could lead to a bias result,

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[6]https://blogs.worldbank.org/trade/growth-and-development-why-openness-trade-necessary-not-sufficient

[7]https://www.studysmarter.co.uk/explanations/macroeconomics/economic-performance/population-and-economic-growth/

according to the authors. Therefore, we recruit Pesaran(2004) to examine the of cross sectional dependence test. As revealed in Table 3, all variables are statistically significant, meaning that there is existence of the cross-sectional dependence. As argued by Xu et al. (2022), the presence of the cross-sectional dependence needs an appropriate estimation technique. Implying that, the panel corrected standard errors (PCSE) estimation technique developed by Jönsson (2005) has been applied to account for the cross-sectional dependence.

Table 3. Pesaran (2004) cross-sectional dependence test.

Variables	Statistic	p-value
GDP Growth	5.473***	0.000
GDP per capita (log)	46.066***	0.000
Electoral democracy	17.461***	0.000
Liberal democracy	14.534***	0.000
Participatory democracy	16.185***	0.000
Deliberative democracy	9.247***	0.000
Egalitarian democracy	15.366***	0.000
Mobile Penetration	56.170***	0.000
Internet penetration	49.523***	0.000
Financial development	26.834***	0.000
Foreign direct investment	9.557***	0.000
Trade openness (log)	15.852***	0.000

*** $p < 0.001$.

4. Results and discussion

4.1 Descriptive statistics and correlation matrix

The descriptive statistics and correlation matrix are disclosed in Table 3 and 4, respectively. As shown in Table 3, the mean values of GDP growth and GDP per capita (log) are 4.059 and 8.024, respectively. Moreover, the average values of internet and mobile penetration are 11.079 and 49.397, respectively. Further, the average values of democracy (electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy) are 0.498, 0.364, 0.306, 0.406 and 0.340, respectively. Figure 1 and 2 show the trend of the level of democracy in Africa

and the level of information penetration as well as the level of economy. Figure 3 shows the correlation between democracy and economic growth in Africa.

Table 4. Descriptive statistics

| Variable	Obs	Mean	Std. Dev.	Min	Max
GDP Growth	545	4.059	5.026	-36.391	26.417
GDP per capita (log)	546	8.024	0.8644	6.446	10.393
Electoral democracy	546	0.498	0.194	0.115	0.849
Liberal democracy	546	0.364	0.186	0.022	0.731
Participatory democracy	546	0.306	0.1269	0.058	0.585
Deliberative democracy	546	0.406	0.1853	0.052	0.77
Egalitarian democracy	546	0.340	0.1550	0.059	0.642
Mobile Penetration	539	49.397	43.158	0.018	165.59
Internet penetration	530	11.079	15.376	0.0152	84.120
Financial development	485	21.963	25.823	1.603	142.422
Foreign direct investment	546	4.101	8.613	-11.198	103.337
Trade openness (log)	485	3.956	0.604	-0.278	5.097
Population (log)	546	16.578	1.112	14.361	19.154
Education	330	0.865	0.185	0.382	1.388
Inflation	515	9.800	28.397	-9.616	557.201
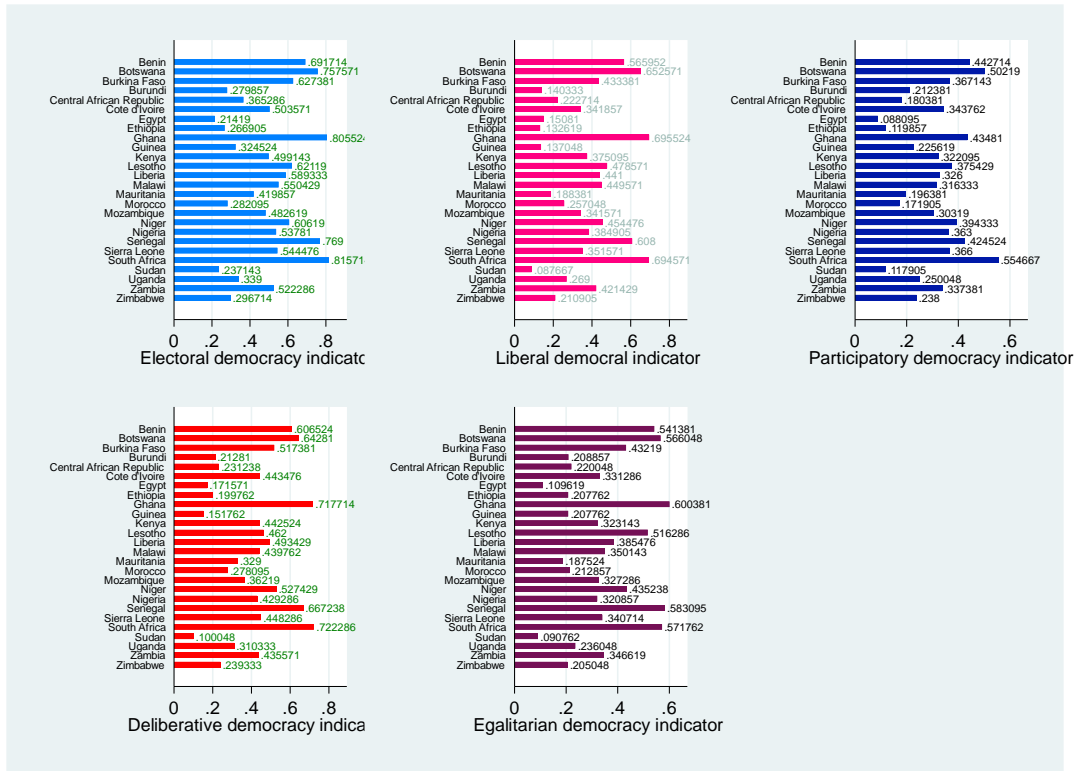
Figure 1. The trend of the level of democracy in Africa, 2000-2020

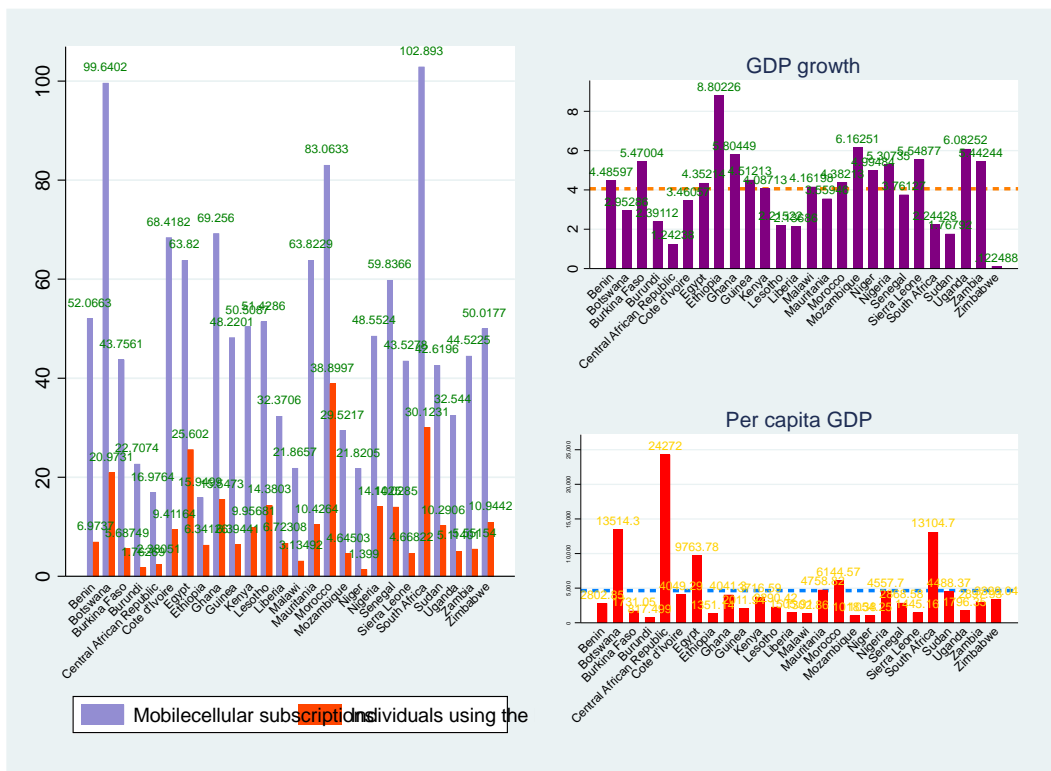Source: Authors' computation based on the data set of V-Dem

Figure 2.The trend of the level of economy as well as the level of information penetration in Africa, 2000-2020
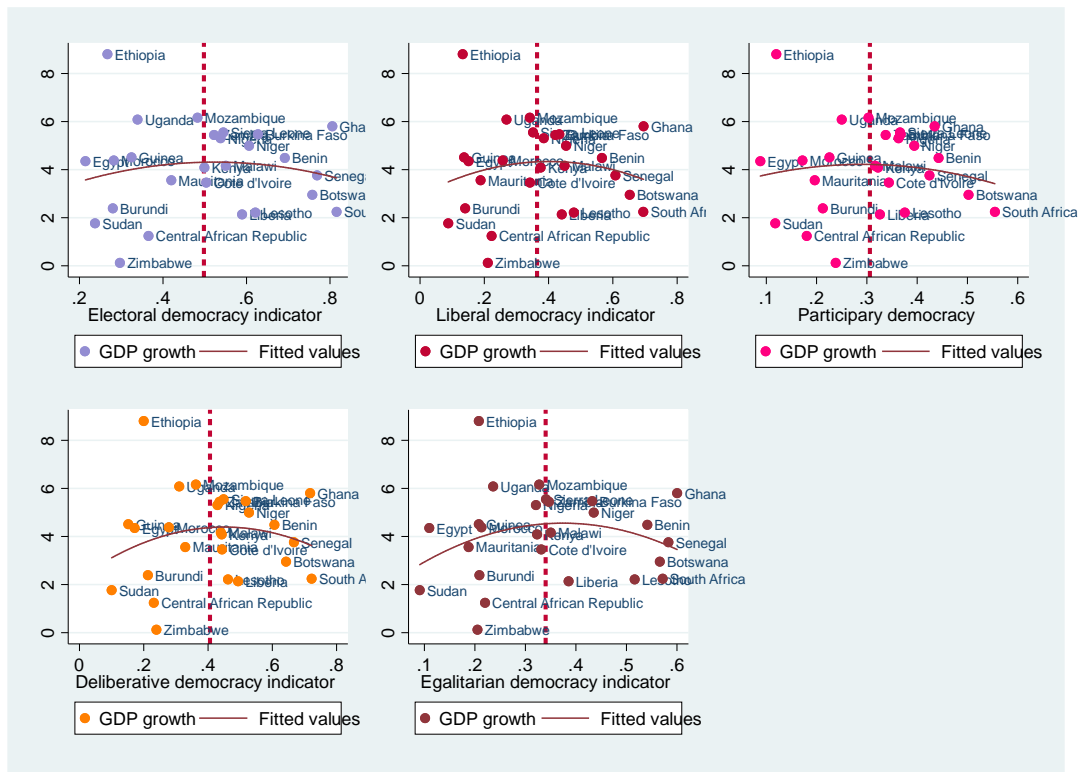
Figure 3. The relationship between democracy and economic growth in Africa, 2000-2020.

Table 5. Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1)GDPGrowth	1														
(2)GDP per capita (log)	-0.0609	1													
(3)Electoral democracy	0.0232	0.102	1												
(4)Liberal democracy	0.00656	0.184**	0.964***	1											
(5)Participatory democracy	0.0178	0.0641	0.938***	0.923***	1										
(6)Deliberative democracy	0.0307	0.131*	0.972***	0.973***	0.923***	1									
(7)Egalitarian democracy	-0.00365	0.0329	0.964***	0.972***	0.925***	0.953***	1								
(8)Mobile Penetration	-0.157*	0.414***	0.146*	0.169**	0.133*	0.158*	0.123	1							
(9)Internet penetration	-0.219***	0.454***	-0.0103	0.0698	-0.0164	0.0282	-0.00480	0.814***	1						
(10)Financial development	-0.197**	0.515***	0.204**	0.296***	0.294***	0.263***	0.188**	0.425***	0.491***	1					
(11)Foreign direct investment	0.209**	-0.171**	-0.0216	-0.0572	-0.0426	-0.0585	-0.0503	0.0392	-0.0986	-0.107	1				
(12)Trade openness (log)	0.134*	0.0514	0.327***	0.330***	0.299***	0.336***	0.353***	0.163*	0.0506	0.0862	0.295***	1			
(13)Population (log)	0.0446	0.207**	-0.124	-0.0332	-0.0817	-0.0549	-0.174**	0.155*	0.309***	0.324***	-0.121	-0.390***	1		
(14)Education	-0.198**	0.332***	0.129*	0.168**	0.148*	0.0901	0.144*	0.461***	0.378***	0.378***	0.0218	0.269***	-0.0344	1	
(15)Inflation	-0.0524	0.0688	-0.124	-0.0986	-0.167**	-0.153*	-0.149*	-0.124	-0.0569	-0.152*	0.0416	-0.235***	0.203**	0.0873	1

*** p<0.01, ** p<0.05, * p<0.1

4.2 Effects of ICT and democracy on economic growth

Table 6 discloses the influence of ICT and democracy on economic growth. Considering the first aim of this study, we find that ICT enhances economic growth in Africa. Our finding is in line with Abendin et al. (2022) who argued that ICT has the potential to reduce tariff barriers via promoting E-commerce which has been pointed as the main propeller of economic growth. Moreover, Asongu and Le Roux(2017) supported our finding by pointing the positive and significant effect of information and communication technology on inclusive human development which has been pointed as the main driver of economic growth. Our finding is consistent with the argument of Dossou et al.(2023) who documented that ICT has a profound effect on entrepreneurship which has been found as a major propeller of economic growth. In the same vein, our results have been supported by the argument of Nchofoung and Asongu (2022) who documented that the advent of technology has propelled economic growth through promoting financial development and educational outcomes. Further, the authors pointed out structural transformation which needs the aid of ICT as a major driver of economic growth. In the same account, Cheng et al. (2021) explained our results by arguing that ICT can enhance economic growth through increasing productivity. Moreover, our results align with the argument of Nchofoung and Asongu (2022) who argued that ICT can boost globalization, which by extension can propel economic growth due to the improvement of economies of scale. However, our results have been disagreed by the findings of Mohammed and Sulong (2017)who hold that ICT can harm economic growth due the absence of economic transformation.

Table 6. Effects of ICT and democracy on economic growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Financial development	-0.0240***	-0.0182***	-0.0261***	-0.0268***	-0.0276***	-0.0271***	-0.0255***	-0.0189***	-0.0192**	-0.0197***	-0.0195***	-0.0183***
	(0.00612)	(0.00528)	(0.00601)	(0.00624)	(0.00678)	(0.00603)	(0.00618)	(0.00558)	(0.00585)	(0.00665)	(0.00568)	(0.00566)
Foreign direct investment	0.0776**	0.0727***	0.0840**	0.0863*	0.0849*	0.0873***	0.0841***	0.0737**	0.0757*	0.0758*	0.0760**	0.0717**
	(0.0326)	(0.0223)	(0.0438)	(0.0338)	(0.0442)	(0.0242)	(0.0237)	(0.0340)	(0.0437)	(0.0446)	(0.0343)	(0.0338)
Trade openness	0.0411***	0.0390***	0.0370***	0.0361***	0.0368***	0.0355***	0.0377***	0.0385***	0.0374***	0.0374***	0.0373***	0.0395***
	(0.0115)	(0.00929)	(0.0120)	(0.0118)	(0.0119)	(0.0121)	(0.0117)	(0.0106)	(0.0104)	(0.0106)	(0.0106)	(0.0103)
Population	0.995***	1.135***	0.990***	0.967***	0.996***	0.968***	0.997***	1.138***	1.122***	1.127***	1.124***	1.141***
	(0.210)	(0.199)	(0.213)	(0.216)	(0.211)	(0.218)	(0.211)	(0.203)	(0.204)	(0.203)	(0.210)	(0.199)
Education	-4.846***	-3.612**	-4.617***	-4.582***	-4.586***	-4.428***	-4.670***	-3.646***	-3.555***	-3.566***	-3.525***	-3.674***
	(1.317)	(1.233)	(1.313)	(1.298)	(1.328)	(1.304)	(1.302)	(1.187)	(1.199)	(1.214)	(1.212)	(1.189)
Inflation	-0.0958**	-0.0759***	-0.0917**	-0.0920***	-0.0895**	-0.0891***	-0.0920***	-0.0748***	-0.0747***	-0.0736***	-0.0736***	-0.0758***
	(0.0328)	(0.0218)	(0.0340)	(0.0333)	(0.0336)	(0.0342)	(0.0337)	(0.0224)	(0.0222)	(0.0227)	(0.0229)	(0.0223)
Internet penetration		0.0425***						0.0478***	0.0414***	0.0395***	0.0439***	0.0480**
		(0.0150)						(0.0046)	(0.0132)	(0.0137)	(0.0131)	(0.0238)
Electoral democracy			1.324***					0.234*				
			(0.380)					(0.122)				
Liberal democracy				1.442***					0.488*			
				(0.509)					(0.257)			
Participatory democracy					2.555**					1.035*		
					(1.268)					(0.618)		
Deliberative democracy						1.643**					0.548**	
						(0.804)					(0.257)	
Egalitarian democracy							1.243***					0.173
							(0.357)					(0.153)
Internet penetration×Electoral democracy								0.0121***				
								(0.0012)				
Internet penetration× Liberal democracy									0.0476***			
									(0.0147)			
Internet penetration× Participatory democracy										0.0333**		
										(0.0166)		
Internet penetration× Deliberative democracy											0.00686*	
											(0.0040)	
Internet penetration× Egalitarian democracy												0.0156***
												(0.0026)
Constant	-9.349**	-12.30***	-9.946**	-9.379**	-10.16**	-9.665**	-9.808**	-12.42***	-12.24***	-12.46***	-12.35***	-12.31***
	(3.445)	(3.290)	(3.388)	(3.502)	(3.383)	(3.428)	(3.434)	(3.275)	(3.344)	(3.274)	(3.321)	(3.290)
Observations	255	245	255	255	255	255	255	245	245	245	245	245
R^2	0.160	0.179	0.164	0.165	0.167	0.166	0.163	0.179	0.179	0.180	0.180	0.179
Mean level	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.37	1.01	1.4	0.624	N/A

Standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1

The estimated coefficient of democracy indicators, namely electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy is positively and statistically significant. The implication is that the improvement of democracy in Africa can foster economic growth. Economic growth can be promoted or enhanced through the improvement of democratic regime. This finding is consistent with the argument of De Haan and Siermann (1996) who posited that the government or private sector might be exposed to free press and open public debate which appear to propel economic growth. Moreover, the authors continue to explain our result by saying that political and civil freedom might control government action in order to implement a policy that could contribute to promote sustainable economic growth. Our result is aligned with the argument of Doucouliagos and Ulubas (2008) who documented that pro-growth governmental policy can be supported by democratic regime. Further, our result has been explained by Bardhan (1993) who showed that the enhancement of economic growth can be done through a sound leadership which might be contributed to improve technical change and market condition. Our results have been supported by the argument of Weekly(2016) who documented that electoral democracy has the power to force governments to improve the living condition of the marginalized people.

As disclosed from Column 8 to Column 12, the results unveil that the interaction between ICT and democracy indicators (electoral democracy, liberal democracy, participatory democracy, deliberative democracy and egalitarian democracy) has a positive and significant effect on economic growth. This implies that the advancement of technology can help to improve electoral process through increasing transparency which has been pointed as important for pro-growth policy. Further, Ben Ali (2020) gives credit to our result by documenting that ICT usage has the potential to report and reduce administrative abuses as it occur from an autocratic regime. Moreover, the authors said that ICT has the power to provide information for voters in order to avoid corrupt politician who did not care about the pro-growth policy (Bhattacherjee & Shrivastava, 2018). Making a compelling case, Ben Ali (2020) support our finding by positing that the use of ICT can help to improve freedom of speech, the free flow of information and the promotion of human rights. Further, a recent report supports our finding by documenting that ICT has the potential to improve transparency in governance structures and brings governments accountable to their respective

mandates.[8] Our finding is consistent with Kabir and Alam(2021) who argued that the choice of investment and financial destiny can be controlled by people who feel free democratically. According to the authors, these investments and financial destiny can help to propel economic growth. Similarly, our results support the argument of Kabir and Alam (2021) who argued that improving the quality of democratic institutions can contribute to the improvement of economic freedom and financial system which can foster economic growth in both developed and developing countries.

We find that financial underdevelopment undermines economic growth. This means that as financial underdevelopment increases, economic growth slows. This finding is not surprising given the fact that Africa continues to deal with financial barriers (Tchamyou et al., 2019). Our finding is not consistent with the argument of Bloch and Tang (2003) who noticed that the development of banks can facilitate technological innovation which has the capacity to enhance economic growth. Moreover, the authors documented that improving financial system can lead to the improvement of productivity growth which plays a vital role in economic growth. Our finding disagreed with Guru and Yadav (2019) who indicated that the improvement of financial system could provide social gain through promoting innovation in the entire economy. The authors have further documented that a well financial market could increase the level of entrepreneurship. Our finding has been disagreed with the theory of Levine (1997) who document that financial development can improve the diversification of the economy. Our findings subscribe to those of Roubini and Sala-i-Martin (1992) who argued that a financial repression can contribute to lowering productivity, which by extension can hamper economic growth.

We also find a positive and significant association between foreign direct investment and economic growth. Our finding aligns with Xu et al. (2021)who posited that the promotion of economic growth through attracting foreign direct investment can be done if the host requires a minimum threshold in human development capital. It has been also argued that foreign direct investment can propel economic growth through economic stability and liberalized markets. Due to its linking to the world market, Ozawa (2015) argued that foreign direct investment has the power to generate and transplant a technology and skills which seem to drive economic growth. Further, the

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[8]https://www.apc.org/en/pubs/books/icts-democracy-information-and-communication-techn

authors argued that foreign direct investment could contribute to economic growth through facilitating structural upgrading. As it contributes to increasing investment, Dinh et al.(2019) posited that foreign direct investment has the power to reduce the gap between saving and investment which could contribute to enhance positively economic growth. However, our finding contradicts the argument of Ayenew (2022) who said that foreign direct investment can undermine economic growth if the profits emanated from the sector are repatriated to the origin countries. Further, foreign direct investment can hurt economic growth due to some global events. For example, Koçak and Barış-Tüzemen (2022) argued that the ongoing COVID-19 pandemic has negatively affected foreign direct investment, which by extension, has lowered economic growth in recent years.

The coefficient of trade openness is positive and significant, meaning trade openness enhances economic growth. This implies that an increase in trade policies such as reducing import and export tariffs and non-tariff barriers can enhance economic growth in Africa(Fatima et al., 2020; Keho, 2017). The implication of this result can be explained by the fact that trade liberalization can promote economic growth through improving total factor productivity which is related to technology diffusion (Barro & Sala-i-Martin, 1997; Rivera-Batiz & Romer, 1991). Moreover, the authors continue to support our finding by arguing that trade openness can propel economic growth through providing access to goods and services and achieving efficiency in the allocation of resources.

The impact of education on economic growth is negative and statistically significant. These findings suggest that school exclusion could retard economic growth in Africa. Our finding is not in line with Marquez-Ramos and Mourelle (2019) who have pointed education as a major driver of economic well-being. Further, our finding contradicts the findings of Coman (Nuţă), Lupu, and Nuţă(2022) who stated that the quality of skill matters for the promotion of economic growth.

The results unveil that inflation has a negative and significant effect on economic growth. This suggests that an increase in the level of inflation could lead to a decrease in economic growth[9]. This finding corroborates the postulation that an increase in inflation could lead to an increase in nominal mortgage interest rate. Similarly, our

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[9]https://www.frbsf.org/education/publications/doctor-econ/1998/june/inflation-economic-growth/

finding is confirmed by Doan Van (2020) who argued that high inflation is always associated with uncertainty which by extension can hinder economic growth.

Moreover, the results show that population growth promotes economic growth. This means that as population growth increases, the growth rate also increases. This finding aligns with the findings of Peterson (2017) who postulated that high population growth could undermine socio-economic development and thereby retarding economic growth.

5. Robustness check

5.1 Robustness check1

A sensitivity analysis has been performed by using internet penetration as a proxy of information and communication technology. The results disclosed in Table 6 are similar to the early results.

5.2 Robustness check2

In accordance with the economic development literature (Asongu & Odhiambo, 2019), the robustness has been examined by using GDP growth as a proxy of economic growth. The results are very similar those disclosed in Tables 6 and 7. However, these results are not reported but are available on request.

Table 7. Robustness check

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Financial development	-0.0240***	-0.0198**	-0.0261***	-0.0268***	-0.0276***	-0.0271***	-0.0255***	-0.0224***	-0.0241***	-0.0245***	-0.0245***	-0.0216***
	(0.00612)	(0.00652)	(0.00601)	(0.00624)	(0.00678)	(0.00603)	(0.00618)	(0.00628)	(0.00668)	(0.00722)	(0.00626)	(0.00649)
Foreign direct investment	0.0776	0.0806	0.0840**	0.0863**	0.0849**	0.0873***	0.0841***	0.0790	0.0806	0.0844	0.0818	0.0772
	(0.0626)	(0.0615)	(0.0438)	(0.0338)	(0.0442)	(0.0242)	(0.0237)	(0.0617)	(0.0612)	(0.0623)	(0.0616)	(0.0611)
Trade openness	0.0411***	0.0433***	0.0370***	0.0361***	0.0368***	0.0355***	0.0377***	0.0433***	0.0429***	0.0419***	0.0420***	0.0446***
	(0.0115)	(0.0111)	(0.0120)	(0.0118)	(0.0119)	(0.0121)	(0.0117)	(0.0119)	(0.0119)	(0.0115)	(0.0118)	(0.0118)
Population	0.995***	1.070***	0.990***	0.967***	0.996***	0.968***	0.997***	1.102***	1.075***	1.092***	1.080***	1.084***
	(0.210)	(0.214)	(0.213)	(0.216)	(0.211)	(0.218)	(0.211)	(0.216)	(0.217)	(0.214)	(0.220)	(0.214)
Education	-4.846***	-3.993**	-4.617***	-4.582***	-4.586***	-4.428***	-4.670***	-4.120***	-4.073***	-3.937***	-3.853***	-4.351***
	(1.317)	(1.449)	(1.313)	(1.298)	(1.328)	(1.304)	(1.302)	(1.337)	(1.336)	(1.370)	(1.325)	(1.325)
Inflation	-0.0958***	-0.0992***	-0.0917***	-0.0920***	-0.0895***	-0.0891***	-0.0920***	-0.0945***	-0.0946***	-0.0918***	-0.0903**	-0.0939***
	(0.0328)	(0.0350)	(0.0340)	(0.0333)	(0.0336)	(0.0342)	(0.0337)	(0.0356)	(0.0348)	(0.0355)	(0.0355)	(0.0353)
Internet penetration		0.0125*						0.0318**	0.0286**	0.0270**	0.0348**	0.0315**
		(0.00587)						(0.0125)	(0.0114)	(0.0124)	(0.0123)	(0.0122)
Electoral democracy			1.324***					-0.776				
			(0.380)					(1.604)				
Liberal democracy				1.442***					-0.961			
				(0.509)					(1.594)			
Participatory democracy					2.555**					-0.253		
					(1.268)					(2.412)		
Deliberative democracy						1.643**					-0.963	
						(0.804)					(1.667)	
Egalitarian democracy							1.243***					-1.965
							(0.357)					(2.135)
Mobile penetration×Electoral democracy								0.0336**				
								(0.0170)				
Mobile penetration× Liberal democracy									0.0381**			
									(0.0190)			
Mobile penetration × Participatory democracy										0.0428		
										(0.0274)		
Mobile penetration× Deliberative democracy											0.0458**	
											(0.0189)	
Mobile penetration× Egalitarian democracy												0.0492**
												(0.0237)
Constant	-9.349***	-10.88***	-9.946***	-9.379***	-10.16***	-9.665***	-9.808***	-10.83***	-10.40***	-11.09***	-10.58***	-10.13***
	(3.445)	(3.621)	(3.388)	(3.502)	(3.383)	(3.428)	(3.434)	(3.567)	(3.592)	(3.589)	(3.543)	(3.649)
Observations	255	254	255	255	255	255	255	254	254	254	254	254
R^2	0.160	0.174	0.164	0.165	0.167	0.166	0.163	0.184	0.186	0.184	0.190	0.185

Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

6. Conclusion and policy recommendations

The main purpose of economic growth is improving the economic well-being of a nation. According to many studies (Asongu & Odhiambo, 2019; Tchamyou, Asongu, & Odhiambo, 2019), the economic well-being of a nation can be improved by providing job creation, improving quality of life, increasing tax revenue, reducing poverty and income inequality. In order to provide more policies to achieve these goals, many scholars have investigated the determinants of economic growth in both developed and developing countries. Among these drivers, democracy has been found to affect economic growth. This has led to an extensive investigation of the relationship between economic growth and democracy However, regarding the findings of the relationship between democracy and economic growth, the literature has presented a mixed and inconclusive results. Such an inconclusive result has compelled us to re-investigate the relationship between democracy and economic growth using 26 African countries over the period 2000-2020. As ICT has been involved in many economic activities, we think that its involvement in democratic system can contribute to propelling economic growth. Therefore, this study adds to the literature by assessing the moderating effect of ICT on the linkage between democracy and economic growth. To achieve these goals, the two-panel corrected standard errors (PCSE) estimation technique has been applied. The results show that improving democratic system in Africa can foster economic growth. Moreover, the result reveals that increasing ICT infrastructure can boom economic growth in Africa. Furthermore, the results reveal that the interaction between ICT and democracy can boost economic growth in Africa.

Regarding to the findings of this study, we recommend that African leader should promote a digitalized democracy in order to promote economic growth. Moreover, African leader should involve digital infrastructure in their democratic system in order to improve a living condition of the marginalized people. Moreover, African governments should ensure freedom of rights and equality which remain important in the process of economic development.

The current study has succeeded in investigating the moderation of mobile and internet usages on the democracy-economic growth nexus. As there is huge difference between developed and developing countries in terms of the level of democracy, it suggests that future research should consider the same issue using developed countries as a case study. Since our paper fails to consider the issue of endogeneity, it suggests that future research

should use the GMM to investigate the same issue as well as consider both short-run and long-term effects with the relevant estimation techniques.

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