INFORMATION AND COMMUNICATION TECHNOLOGY ADOPTION AND STOCK MARKET CAPITALIZATION IN SELECTED SUB-SAHARAN AFRICAN COUNTRIES

OKEREKE IKE GODSLOVE
Department of Economics
Babcock University, Ilishan Remo, Ogun State, Nigeria.
Email: okerekeikeg@gmail.com, Phone: +2348035384874

ONAKOYA ADEGBEMI BABATUNDE
Department of Economics
Babcock University, Ilishan Remo, Ogun State, Nigeria.
Email: gbemionakoya@gmail.com, Phone: +2348035550124

AMUSA BOLANLE OLUBUNMI
Department of Banking and Finance
Gateway ICT Polytechnic Saapade, Ogun State, Nigeria.
Email: bolabunmiakanni@gmail.com, Phone: +2348034698404

ABSTRACT
The literature on stock market performance have shown diverse channels through which stock performance can be enhanced, one of it is adoption of information communication technology. The effect of ICT adoption on the stock market capitalization has been one of the most commonly debated topics among economists and policy makers in African countries and the outcome has been controversial. The study empirically investigated the information communication technology adoption on stock market capitalization in selected sub-Saharan African countries. The ex-pos facto research design was employed in the study. Annual data from 2008 to 2022 for 8 selected countries in SSA sourced from World Bank's World Development Indicators and Internation Telecommunication Union Database were used for the study. Stationary tests were carried out to determine the stationarity and order of integration of the data values. Fixed Effect Estimation Technique was employed to evaluate the parameters in the model. The results showed that broadband users had insignificant negative effect on market capitalization ($\theta 1$ = -0.643, p-value = 0.781), mobile phone users had negative insignificant effect on the market capitalization ($\theta 2$ = -3.09, p-value = 0.584), internet users had positive significant effect in the market capitalization ($\theta 3$ = 0.53, p-value = 0.000) and Number of fixed telephone users had negative insignificant effect on the market capitalization ($\theta 4$ = 6.85, p-value = 0.125). The study concluded that ICT adoption had significantly affected market capitalization in the selected SSA. Based on the findings, the study recommended that telecommunication infrastructure be provided in the selected countries to enhance internet usage.

Keyword: ICT Adoption, Market Capitalization, Internet Users, Broadband Users, Mobile Phone Users.
JEL Classification: E, G, O.

1. INTRODUCTION
Africa is perceived to be a continent with significant prospects in terms of resources and tagged as a new developmental frontier. In the light of this perception, some African countries have commenced economic and structural reforms in the financial sectors to revive the so far subdued systems and, more essentially, to strengthen and develop their stock markets (Ngoa & Songs, 2021). The major reason that necessitated these reforms has been the need to strengthen

financial markets through stock markets development, in order to induce improved economic growth. Therefore, the development of stock markets in an emerging economy is seen as one of the major panaceas for achieving economic growth and lifting the standard of living. Arguably, a sound regulatory environment that supports the development of the stock markets is key to driving market confidence for both listed companies and investors.

Solarin, Shahbaz, Khan and Razali (2019) assert that stock markets are considered as one of the most crucial aspects of a market economy, in the sense that on the one hand they make it possible for firms to gain access to capital. On the other hand, stock markets enable investors to have a share of ownership in the listed firm, based on the firm's expected performance in the future. According to Adeleye, Adedoyin and Nathaniel (2021), the stock market is considered as one of the most crucial aspects of a financial system. This is in light of the fact that, through the stock market, listed firms can elicit capital by issuing their shares and at the same time bring about an environment through which the same issued shares can be freely traded by market participants. Hence, more recently, a growing strand of literature has focused on stock market development as the main factor for economic growth (Tsaurai, 2018; Bundoo, 2017 & Okwu, 2016). One of such determinants of stock market development has been argued by researchers to include the adoption of information and communication technology (ICT) (Tsaurai, 2018; Bundoo, 2017 & Okwu, 2016).

Information and Communication Technology (ICT) is the automation of processes, controls, and information production using computers, telecommunications, software's and other gadget that ensure smooth and efficient running of activities. It is a term that largely covers the coupling of electronic technology for the information needs of a business at all levels. ICT has surpassed the role of support services or only electronic data processing; its fields of applications are slightly global and unlimited. Its devices especially the Internet and modern computer email facilities have further strengthened early modernizations like the telephone and fax. Other ICT devices include data recognition equipment, factory automation hardware and services, tele-computing and teleconferences using real time and online system, Adeoti, (2020).

Recent years have seen the remarkable growth and development of Information and Communication Technology (ICT), mostly in different countries, sectors and industries of the world, as a result of the transformational power of technology that favors efficiency and productivity. Dzidonu (2019) asserted that ICT can be termed as a collection of technologies that may consist of a microprocessor, computer, multimedia, broadcasting network telecommunication and internet technology. Further, he concluded that there has been a boost of service and operation as a result of these technologies at both individual and organization levels. Baro (2020) highlighted that the impact of ICT in the development of the global economy and life, in general, cannot be overstated. He further implied that the increase in the implementation of ICT projects and their usage over the last few decades in Africa has been phenomenal (Baro 2020). This can be attributed to the outstanding and efficient role ICT plays in both the public and the private sectors.

Developments in ICT have not only affected lives, but also various other areas of human activities in the last few years. Among the areas of social skills and activities that have been tremendously affected by ICT are developments in the global and, most especially, African stock markets. With respect to Bundoo's (2017) study of development of stock markets as well as its integration in the SADC, he concluded that SADC share issuing and trading should of necessity attain towards a greater integration in order to bring in more capital investment instead of relying on more volatile investment.

The nexus between Information Communication Technology and stock market development, particularly in recent years, has been mostly determined based on studies of industrialized economies, as well as the rising markets and high-income economies of the world. The study of the relationship of Information Communication Technology with the development of stock markets, especially in the past years, has focused mostly on the economies of developed countries and developing markets, including the economies of countries with a high interest rate (Okwu 2015).

Empirical studies on ICT adoption and stock market capitalization have not been conducted in sub-Saharan African region. For example the study of Okwu (2016) was limited to Nigeria and South Africa, Igwilo and Athenia (2021) examined ICT adoption and stock development in Africa in general, Vaumi, Leudjou and Faha (2021) examined the determinants of adoption and use of Information and Communication Technologies (ICT) in SSA firms, Sibindi, (2022) investigated whether information communication technology (ICT) adoption influences the development of SSA life insurance markets and Usman, Ozturk, Hassan, Maria, Zafar and Ullah (2021) examined how ICT affects the performance of emerging and frontier stock markets. Sub-Saharan African countries are enriched with significant prospects in terms of resources. Therefore, the development of stock market in terms of market capitalization in the region is seen as one of the panaceas for achieving economic growth and lifting the standard of living. To this end, this study examined the effect of ICFT adoption on the market capitalization in eight (8) Sub-African countries. The paper is structured into five sections which comprises the introduction, literature review, methodology, results and discussion of findings and conclusion and recommendation.

2. LITERATURE REVIEW

2.1 Theoretical Review

Innovation Diffusion Theory

Rogers (1983) explained the process of technological diffusion as one which is dictated by uncertainty reduction behavior amongst potential adapters during the introduction of technological innovations. Even though innovations typically offers its adopters novel ways of tackling day to day problems, the uncertainty as to whether the new ways will be superior to existing ones presents a considerable obstacle to the adoption process. To counter this uncertainty, potential adopters are motivated to seek additional information, particularly from their workplace peers.

Innovation diffusion theory consists of major components: innovation characteristic, individual user characteristic, adopter distribution overtime, diffusion networks, innovateness and adopter categories, and the individual adoption process. Arguably the most popular of the six components of IDT centers on the characteristics of the innovation itself. After analyzing a variety of previous innovation diffusion studies, Rogers (1983) singled out the following five characteristics of innovations that consistently influence the adoption of new technologies.

Technology Acceptance Model (TAM)

The Technology Acceptance Model, most known as technology acceptance model (TAM), was proposed by Davis (1989). The intention of the development of the model TAM resulted from an IBM Canada contract with the Massachusetts Institute of Technology - MIT, in the 80s to evaluate the market potential to new products of the brand and to make it possible an explanation of the determinants of computers use (Davis; Bagozzi; Warshaw, 1989). TAM

postulates that the acceptance of technology is predicted by the users' behavioural intention, which is, in turn, determined by the perception of technology usefulness in performing the task and perceived ease of its use. Davis (1989) proposed the TAM to focus in the reason the users accept or reject the information technology and how to improve the acceptance, offering, this way, a support to foresee and explain the acceptance. Davis (1989) conducted a *survey* in a group of 112 users at the Canada IBM and in 40 Master of Business Administration students of Boston University. The validation of the TAM model was based in the acceptance of a software text editor (Davis, 1989). Davis (1989) on this sample found out that the perceived use had higher impact in the behavior than the perceived facility.

2.2 Empirical Review

Binuyo and Aregbeshola (2015) who examined the impact of information and communication technology (ICT) on output growth in Nigeria, South Africa, Egypt, Algeria, Morocco, Libya, Sudan, Kenya, and Ghana. They used annual data on GDP (PPP) to proxy economic growth whilst internet users, mobile phone users, telephone users, personal computers users, and school enrolment (tertiary) covering from 1990 – 2013 were used to proxy ICT. The data were analysed in a dynamic panel environment using the 2SLS method. The robustness of the 2SLS result was confirmed by the GMM regression. They found a positive relationship between ICT and economic growth in accord with earlier studies. The Granger causality test results indicate that only fixed wireless communication system Granger cause GDPPPP out of the five predictors suggesting that the other ICT predictors merely associate with GDP not necessarily Granger cause it as most of the earlier studies erroneously suggest. The study concluded that the affected countries had policy priority to development of ICT infrastructure with specific emphasis on the fixed wireless communication system as precursors for ensuring sustainable growth in the medium and long - term.

Okwu (2016) examined ICT in relation to stock market development, economic growth and development and other macroeconomic variables in Sub-Saharan Africa. His paper employed data on functional models adapted from Gompertz curve model for technology diffusion to investigate the effects of ICT on market outcomes of two leading stock exchange markets in Africa during the 1995-2015 periods. Results showed mixed effects of most ICT metrics and moderating variables in the study. Specifically, the effect of mobile telephone on all market indicators was positive and significant. Further, aggregate effect of the ICT proxies and moderating variables on all market indices was statistically significant. The ICT proxies accounted for positive dynamics in market outcomes, market operations and, thus, sine quo non to growth and development of the markets and financial sectors in the Continent. The study recommended that more investments in ICT wares and innovation by the stock exchanges and financial sectors in Africa were recommended. His finding is in agreement with the finding of Binuyo and Aregbeshola (2015).

Asongu and Nwachukwu (2017) investigated the role of internet and mobile phone penetration (ICT adoption measures) in complementing financial formalization and 'in-formalisation' (financial sector development) in improving financial access in Africa using evidence based on generalised method of moments with 53 African. The study pointed out some major issues. First, that Africa is experiencing an uneven asymmetric development in mobile phone (41 percent) and internet penetration (9.6 percent) as against the fact that developed economies had reached saturation levels as at 2010 in terms of their mobile phone and internet penetration which is consistent with the view that ICT market in Africa presents considerable opportunities for doing business compared to North America, Europe and Asia. Farid, (2018) ascertained whether African stock markets can improve their informational efficiency by formally

harmonising and integrating their operations on a common platform. The study showed that institutional deficiencies and openness to trade have a negative impact on economic growth. Further, the study documented that those African economies that were more open to international capital flows did not seem to grow faster than the rest. In a somewhat broader dimension to the study of ICT in relation to business and economic outcomes, Donwa and Odia (2019) determined the impact of the Nigeria stock market on socio-economic development for the 1981–2017 period. They found that the market indicators significantly enhanced economic growth.

Ezirim, Adebajo, Elike and Muoghalu (2019) examined the effects of information technology on the growth and development of the capital market in Nigeria for the period 1998–2017. They found that the level of ICT-facilitated interaction between stockbrokers and investors significantly affected the growth of market capitalisation and the volume and value of shares traded. It was found that information technology does not significantly affect a number of listings and government bonds. Owusu-Agyei, Okafor, Chijoke-Mgbam, Ohalehi and Hasan (2020) employed a panel of 42 sub-Saharan African (SSA) countries for the period 2000–2016 to investigate the relationship between ICT adoption, human capital development, economic freedom and financial development. They found that Internet use had a positive impact on different measures of financial development. Further, their results revealed that subsamples of SSA countries differ on their levels of human capital development and economic freedom.
Chien and Kurniawati (2020) investigated the effects of information and communication ICT diffusion on financial development for 81 countries over the period 1990–2018. They found that, comparing the different effects of ICT on financial development between the high-income group and the middle- and low-income groups, telephone and Internet positively influenced both groups' financial development, whereas mobile cellular caused a negative effect in high-income countries, but a positive effect in middle- and low-income countries. Secondly, they documented that the growth of the Internet and telephones raises the financial development in all regions, while mobile cellular growth positively affects financial development only in Africa. This study has partial agreement with the findings of Owusu-Agyei, etal (2020) be that at some point, the study supported that ICT adoption has a positive effect on financial development and in another point, the study found that some ICT parameters like mobile cellular has a negative effect.

Furthermore, Asongu and Odhiambo (2020) examined the impact of ICT on both life- and non-life insurance industries by employing a panel study of 48 countries for the period 2004–2014. They documented a positive relationship between ICT adoption and life insurance consumption. The results of their study also established a positive relationship between ICT adoption (proxied by fixed broadband subscriptions) and non-life insurance penetration. Benlagha and Hemrit (2020) analysed the effect of internet use on insurance. They utilised OECD countries as a unit of analysis for the period 2007 to 2017 and employed panel data techniques in their analysis. They found that internet use was positively related to non-life insurance activities. Notwithstanding the results of their study documented no significant relationship between internet use and life insurance consumption. Asongu et al. (2020) explored the role of information and communication technology (ICT) in modulating the effect of governance on insurance penetration in 42 Sub-Saharan African countries. They found that, on the one hand, the internet penetration variable positively modulates the governance variables of political stability, government effectiveness, and rule of law to induce on life insurance. On the other hand, they established that the internet penetration variable had a positive modulating effect on the corruption–control for an overall positive effect on non-life insurance

Msuya, Mjema and Kundi (2020) established the status of ICTs adoption and use in Tanzania SMEs. The study employed multiple case studies and survey research strategies. Results show adoption of ICTs in SMEs had grown and had a positive effect on SMEs in Tanzania. As regards other factors that influence stock market performance other than ICT adoption, Igoni, Ogiri and Orlu (2020) examined the magnitude of relationships of the perceived macroeconomic factors and stock market performance during its interface. Results reported that GDP remains significant variable that respond to stock market performance positively, while inflation responded negatively, while interest rate and external reserves are shown to responding and adjusting to trends in Stock Market Capitalization. And market capitalization and exchange rate are operating independent of each other. Also, Olokoyo, Ibhagui and Babajide (2020) examined the long-run impact of macroeconomic indicators such as interest rate, foreign capital flows, exchange rate, GDP growth, inflation and trade on stock market performance (market capitalization) in Nigeria. Using data drawn from the World Development Indicators (WDI) and the Central Bank of Nigeria (CBN) Statistical Bulletin (2018), the study employed the VECM analysis. The results found suggest interest rate, inflation and trade bear a negative relationship with stock market performance. Their results show that when there is a deviation from the long-run relation between stock market performance and macroeconomic fundamentals.

Ejemeyovwi, Osabuohien and Bowale (2021) empirically investigated the interaction of ICT adoption and innovation, and the role of this digitalisation interaction on financial development in Africa and across the subregions. The results of their study documented that ICT–innovation interaction shock positively drives financial development. They reasoned that this implies that, for multinational corporations (MNCs) and other economic agents, the ICT–innovation interaction should be strongly applied across all sectors to drive financial development, since all sectors require finances to improve performance. Farhadi and Ismail (2020) employed a sample of industrialised countries for the period 1990–2018 to analyse the effects of ICT on economic growth and documented a positive significant relationship. The finding of these studies fully supported the finding of Owusu-Agyei, Okafor, Chijoke-Mgbam, Ohalehi and Hasan (2020) as the studies found positive effect of ICT adoption on performance regardless of the economy.

Igwilo and Athenia (2021) examined the causal relationship between ICT adoption and stock market development in Africa. The study examined a panel of 11 African stock exchanges for the period 2008–2017 and employed the panel ARDL bounds testing procedure to test for cointegration and examine the causal relationship between ICT adoption and stock market development. The results of the study documented a bi-directional causal relationship (complementarity) between ICT adoption and stock market development. In essence, ICT adoption and stock market development reinforce each other. Ejemeyovwi, Osabuohien and Bowale (2021) empirically investigated the interaction of information and communication technology (ICT) adoption and innovation, and the role of this digitalisation interaction on financial development in Africa, and across the sub-regions. It utilises the Bayesian Vector Auto-Regressive (BVAR) modelling to simulate the impulse response function and variance decomposition across Africa. The study finds that ICT innovation interaction shock positively drives financial development across all of 6 datasets. This implies that for multinational corporations (MNCs) and other economic agents, ICT – innovation interaction should be strongly applied across all sectors to drive financial development since all sectors require finances to improve performance.

Literature Gap

Empirical studies on ICT adoption and stock market capitalization have not been conducted in sub-Saharan African region. For example the study of Okwu (2016) was limited to Nigeria and South Africa, Igwilo and Athenia (2021) examined ICT adoption and stock development in Africa in general, Vaumi, Leudjou and Faha (2021) examined the determinants of adoption and use of Information and Communication Technologies (ICT) in SSA firms, Sibindi, (2022) investigated whether information communication technology (ICT) adoption influences the development of SSA life insurance markets and Phuong (2022) examined how ICT affects the performance of emerging and frontier stock markets. Sub-Saharan African countries are enriched with significant prospects in terms of resources. Therefore, the enhancing stock market capitalization in the region is seen as one of the panaceas for achieving economic growth and lifting the standard of living. To this end, this study filled the gap seen in the literature by examining the effect of ICT adoption on stock market capitalization in eight (8) Sub-African countries.

3. METHODOLOGY

This study is on ICT adoption and stock market performance in selected SSA, for the period from 2008 to 2022 being a 15 (fifteen)-year period. There are 49 sub-Saharan African countries and of these countries, only 24 countries have stock exchange markets. Of the 24 countries, Angola, Cape Verde, Gabon, Lesotho and Mozambique have no listed firms in their stock exchange markets. Furthermore, there are no available data at World Development Indicators (WDI) for Cameroon, Malawi, Rwanda, Seychelles, Somalia, Sudan, Eswatini, Tanzania, Uganda, Zambia and Zimbabwe. Therefore, this study was conducted in 8 Sub-Saharan African countries and they are Botswana, Ghana, Ivory Coast, Kenya, Mauritius, Namibia, Nigeria and South Africa. The study is static panel data as both the time and number of observations are less than 25. Hausman test was conducted and the result showed that the p-value is less than 0.05 and this led to the use of Fixed Effect estimate in testing the hypothesis.

3.1Theoretical Framework

The theoretical framework of the study lies on technology diffusion model modified by Rogers (2003). Several studies have anchored their research on Roger's (2003) model of innovation diffusion. Specifically, Okwu (2015) and Jayson (2009) empirically examined the effect of ICT adoption on stock market performance in developing countries using the Rogers (2003) theory of diffusion. Rogers (2003) explained that diffusion is the process by which communication is passed through several channels over time among the members of a social system. Innovation is defined as an idea, construct or practice that is perceived and developed by an individual, group of individuals or unit of adoption. To this, adoption is the use of the idea which is the innovative outcome in its full action. So, innovation diffusion is now the process by which the ideas are communicated and adopted by members of a giving setting.

Rogers (2003) further noted that after innovation, several adopters would emerge with certain attribute of adoption. This study therefore sees stock market operators as among the several adopters that would emerge in adopting ICT innovation. It should also be noted that every innovation aims at improving a giving system. Adoption of ICT by stock market operators is to enhance the performance of stock exchange. It has become a vital tool not only for industrial and marketing advantages, but also for effective policy measures to overcome existing and even increasing digital inequalities. To corroborate this, Parida et al. (2009) see ICT as an effective tool improved external communications and quality service delivery to customers.

Based on the assumption that technology usage tends to an equilibrium level over time along an S-shaped path, the model is specified as:

$\log h_{i,t} - \log h_{i,t-1} = q_i [\log h^*_i - \log h_{i,t-1}]$ ……. (3.1)

where $h_{i,t}$ is ICT use in country (stock market exchange) in period t,

$h_{i,t-1}$ is ICT use in country (stock market exchange) i in the preceding period

t-1, h^*_i is post-diffusion (adoption) equilibrium level in country (stock market exchange)

I, and q_i is the speed of adjustment in country (stock market exchange) i.

In the model, ICT is the explained variable and factors that cause changes in ICT level are the explanatory variables. Thus, the model considers ICT usage in relation to the determinants of extent of usage.

But the model is modified in this study by using ICT adoption as the explanatory variable while the determinants of stock exchange performance constitute the explained variable. This necessitated the need to adapt or modify the model in line with the data sets and study thrust. For convenience, h and q are substituted with X and Y respectively. Thus, the model becomes:

$\log X_{i,t} - \log X_{i,t-1} = Y_i [\log X^*_i - \log X_{i,t-1}]$……(3.2)

where X_i is ICT adoption in stock market exchange i in time period t,

$X_{i,t-1}$ is ICT adoption in stock market exchange i in the preceding time period, t-1,

X^*_i is post-ICT adoption optimal stock performance for stock exchange i

Y_i is the speed of adjustment to optimal stock performance in stock exchange i.

The metrics of ICT adoption and stock exchange transaction capacity stand as the explanatory and explained variables respectively. Whereas an autonomous component, $\Phi 0$, and a stochastic term, μ, are introduced into the model as

$\log MC_{i,t} - \log STDEX_{i,t-1} = \Phi 0 + \Phi 1 ICTAdPt + \mu$……(3.3)

where $\log MC_{i,t} - \log TC_{i,t-1}$ depicts of transaction capacities dynamics responding to ICT adoption.

ICTAdp encompasses the metrics of ICT adoption in the exchanges.

$\Phi 0$, autonomous component, is extent of stock capitalization without ICT adoption.

$\Phi 1$ implies the interactions (effects) of ICT adoption on stock capitalization. It measures the magnitude and direction of the effects of ICT adoption on stock capitalization of the stock exchanges. Thus, it shows the measure of responsiveness or sensitivity coefficient of stock capitalization to a given change in ICT innovations and adoption in the exchanges.

μ, the stochastic variable, which is the unexplained factors the affect stock capitalization but were not captured by the model.

Given a dynamic environment such that changes in ICT adoption and the control variables bring changes in stock market capitalization, equation (2) becomes:

$\Delta MC_{k,jt} = \Delta [\Phi 0 + \Phi 1_{k,jt} \sum_{j=1}^{n=4} ICTadp_{k,jt} + \alpha 1_{k,jt} \sum_{j=1}^{m=2} Z_{k,jt} + u_{,}]$.....(3.4)

3.2 Model Specification

This study adopted the model of Okwu (2015), on ICT adoption and stock markets, that is the independent variables, which is the subset (division) of ICT network as acknowledged by Perin and Poullot (2013). The following general empirical research model was developed in the form of Panel data regression equation:

From equation 3.3

$MC = f(ICTadp, Z_k)$……3.5

ICTadpt = NBU, NMU, IU, FTU

MC = market capitalization

Z_k = GDP

$MC_{it} = \theta 0 + \theta 1 \ln NBU_{it} + \theta 2 \ln NMU_{it} + \theta 3 IUs_{it} + \theta 4 \ln NFTU_{it} + \theta 5 \ln GDP_{it} + \mu_{it}$ 3.6

Where :

NBU = Number of Broadband user

NMU = Number of Mobile phones Users

IU = Number of Internet Users

NFTU = Number of Fixed Telephone Users

MC = Stock Market Capitalisation as a % of GDP, that is $Market\ CapitalisationGDP\%$

GDP = Gross Domestic Product

$\theta 0$ = Model intercept

$\theta 1 - \theta 5$ represent the coefficients of the model explanatory variables.

Table 3.1 Variables, Description, Measurement and Sources

Variables	**Abbreviation**	**Sources**
ICT Adoption Variables		
Number of Broadband Users	NBU	International Telecommunication Union database
Number of Fix Telephone Users	NFTU	International Telecommunication Union database
Internet Users	IU	International Telecommunication Union database
Number of Mobile phone Users	NMU	International Telecommunication Union database
Stock Market Capitalization Variable		
Stock Market Capitalisation to GDP (%)	MC	World Bank Global Financial Development database
Control Variable		
Gross Domestic Product	GDP	World Bank Global Financial Development database

Source: Authors' computation (2025)

4. RESULTS AND DISCUSSION OF FINDINGS

Descriptive Statistics

Table 4.1: Tabular Representation of Descriptive Statistics

	GDP	IU	MC	NBU	NFTU	NMU
Mean	1.29	31.97	53.46	288416.5	699684.5	45056764
Median	4.63	28.01	23.15	91618.0	272072.5	2353673
Maximum	5.74	78.30	322.71	1946551.	4875000.	6.57
Minimum	8.61	1.90	0.01	320.00	61100.00	1033300.
Std. Dev.	1.67	22.17	77.31	428702.7	1245259.	75044466
Skewness	1.21	0.5	2.19	2.03	2.61	4.98
Kurtosis	2.76	2.0	6.54	6.37	8.38	38.41
Jarque-Bera	29.64	9.52	158.37	139.48	280.70	6763.74
Probability	0.00	0.01	0.00	0.00	0.00	0.00
Sum	1.55	3836.38	6415.24	34609986	83962146	5.41
Sum Sq. Dev.	3.30	58498.37	711278.3	2.1	1.85	6.7
Observations	120	120	120	120	120	120

Source: Authors' computation (2025) using E-views 10

Correlation Test

This test is carried out to ensure that the explanatory variables are not highly correlated. High correlation among explanatory variables leads to the problem of multicollinearity.

	MC	NBU	NFTU	IU	NMU	GDP
MC	1.0000					
NBU	0.7973	1.0000				
NFTU	0.8195	0.6285	1.0000			
IU	0.4199	0.4560	0.1424	1.0000		
NMU	0.1073	0.4651	0.1171	0.0814	1.0000	
GDP	0.4765	0.6168	0.5501	0.0587	0.5803	1.0000

Source: Authors' computation using STATS 15 (2025)

Result from table 4.2 shows that number of broadband users (NBU), number of fixed telephone users (NFTU) and number of mobile phone users (NMU), internet users (IU) and gross domestic product (GDP) had positive correlation with market capitalization (MC). This implies market capitalization change in the same direction with ICT adoption. From the result also, all the correlation coefficients among the explanatory variables are all below 0.8 tolerate limits.

This implies that there is no potential multicollinearity problem among the explanatory variables in all the models used for the study.

Cross Sectional Dependency

This refers to the correlation or interdependence between the values of the variables across countries used in this study. Checking for cross sectional dependency of the variables is important because it measures how much the value of a variable for a country is related to the values of the same variable for other countries.

Table 4.3: Cross-Sectional Dependency Result

Variables	CD- test	P-Value	Decision
MC	-0.22	0.826	Absence of CD
NBU	16.26	0.000	Presence of CD
NFTU	0.27	0.788	Absence of CD
IU	18.29	0.000	Presence of CD
NMU	14.90	0.000	Presence of CD
GDP	11.88	0.000	Presence of CD

Source: Authors' computation using STATS 15 (2025)

Result at table 4.3 shows that there is cross sectional dependency in gross domestic product (GDP), number of broadband users (NBU), internet users (IU) and number of mobile phone users (NMU). The implication is that these variables dependent on another across the eight (8) selected sub-Saharan African countries used for this study. It also shows that the variables are correlated across the countries under study within the stated time period. However, there is no cross-sectional dependency in market capitalization (MC) and number of fixed telephone users. This implies that there is no similarity in these variables across the eight (8) selected African countries. In order to account for the presence of cross-sectional dependency, second generation unit root test was conducted in these variables.

Unit Root Test

First Generation Unit Root Test

Table 4.4: IPS (with assumptions of heterogeneous slopes)

IPS											
AT LEVELS						AT FIRST DIFFERENCE					
Constant			Constant and Trend		Remarks	Constant			Constant and Trend		Remarks
Variables	IPS statistics	P-value	IPS statistics	P-value	Remarks	Variables	IPS statistics	P-value	IPS statistics	P-value	Remarks
MC	-0.6285	0.2648	-0.1086	0.4568	not stationary	MC	-3.9707	0.0000	-2.3321	0.0098	Stationary
LnNBU	4.9542	1.0000	2.8747	0.9980	not stationary	NBU	-10.6061	0.0000	-4.2993	0.0000	Stationary
lnNFTU	-5.6298	0.0000	-2.2624	0.0118	Stationary	NFTU	-	-	-	-	

IU	1.8003	0.9641	-1.5292	0.0631	not stationary	IU	-4.0470	0.0000	-2.5755	0.0050	Stationary
NMU	-1.6304	0.0515	0.8721	0.8084	not stationary	NMU	-2.3787	0.0087	-2.4644	0.0069	Stationary
LnGDP	-1.4392	0.0751	-3.3325	0.0004	not stationary	LnGDP	-5.2952	0.0000	-	-	Stationary

Source: Authors' computation using STATS 15 (2025)

Table 4.5: LLC (with assumptions of homogenous slopes)

LLC											
AT LEVELS						AT FIRST DIFFERENCE					
Constant			Constant and Trend		Remarks	Constant			Constant and Trend		Remarks
Variables	LLC statistics	P-value	LLC statistics	P-value		Variables	LLC statistics	P-value	LLC statistics	P-value	
MC	-0.6229	0.2667	-1.3987	0.0810	not stationary	MC	-4.8575	0.00	-4.2649	0.0000	Stationary
lnNBU	-8.1012	0.0000	-13.290	0.0000	Stationary	lnNBU	-	-	-	-	
LnNFTU	-2.8902	0.0019	0.3825	0.6489	not stationary	lnNFTU	-	-	-3.7573	0.0001	Stationary
IU	-2.4878	0.0064	-4.6507	0.0000	Stationary	IU	-	-	-	-	
LnNMU	-5.1277	0.0000	-2.4129	0.0079	Stationary	lnNMU	-	-	-	-	
LnGDP	-3.5272	0.0002	-6.4326	0.0000	Stationary	LnGDP	-	-	-	-	

Source: Authors' computation using STATA 15 (2025)

Result presented in table 4.5 shows that both IPS and LLC tests, the variables are stationary at levels 1(0) and firs difference I(1). This implies that there is no unit root among the variables.

4.4.2 Second Generation Unit Root Test

Pesaran's CADF (cross-sectionally Augmented Dickey Fuller) is used for this test. The result is presented in the table below:

Table 4.6: CADF Unit Root Test

AT LEVELS				AT FIRST DIFFERENCE			
Variables	CADF Statistics	P-value	Remark	Variables	CADF Statistics	P-value	Remark
lnNBU	-2.861	0.060	Not stationary	NBU	-2.427	0.031	Stationary
IU	-1.512	0.970	Not stationary	IU	-2.921	0.044	Stationary
lnNMU	-2.118	0.632	Not stationary	lnNMU	-2.899	0.049	Stationary
lnGDP	-2.821	0.073	Not stationary	lnGDP	-2.906	0.047	Stationary

Source: Authors' computation using STATA 15 (2025)

The result at table 4.6 shows that the all variables are stationary at first difference. This implies that with the presence of cross-sectional dependency, there is no unit root in the variables.

Test of hypothesis

Table 4.6: The Effect of ICT Adoption on Market Capitalization in Selected SSA Stock Exchange Markets

Variables	Pooled OLS	FE	RE
LnNBU	11.219***	-0.643	-0.277
	(3.619)	(2.309)	(2.452)
LNNMU	-13.192*	-3.093	-1.023
	(6.968)	(5.638)	(5.856)
IU	0.650***	0.530***	0.406***
	(0.222)	(0.144)	(0.145)
LNNFTU	42.189***	-6.85	0.334
	(4.534)	(4.438)	(4.511)
LNGDP	15.837*	-26.195**	-4.349
	(9.297)	(11.385)	(10.125)
CONSTANT	802.789	828.197***	163.694
	(98.805)	(281.54)	(224.931)
Hausman Test	23.44		
	(0.0003)		
f-statistics = 49.91 p value = 0.000			
Serial Correlation Test Pesaran's CD = 1.758 p-value = 0.0787			
Heteroskedasticity Test	2.03		
	(0.0918)		

Source: Authors' computation using STATA 15 (2025)

*****, ** and * represent significant at 1%, 5% and 10% respectively.**

The dependent variable is market capitalization (MC) while the independent variable is ICT adoption which is measured using Number of Broadband user (lnNBU), Number of Mobile phones Users (lnNMU), Number of Internet Users (IU) and Number of Fixed Telephone Users (lnNFTU) and the control variable is gross domestic product (lnGDP)

Estimated equation: $MC_{it} = \theta 0 + \theta 1 \ln NBU_{it} + \theta 2 \ln NMU_{it} + \theta 3 IUs_{it} + \theta 4 \ln NFTU_{it} + \theta 5 \ln GDP_{it} + \mu_{it}$

Regression output: $MC_{it} = 828.197 - 0.643 \ln NBU_{it} - 3.093 \ln NMU + 0.530 IU - 6.85 \ln NFTU - 26.195 \ln GDP_{it}$

The study found that number of internet users had significant positive effect on market capitalization in the selected SSA countries. This implies that more internet users meant a large investors base for stock exchange markets in SSA. The rise of online trading platforms has empowered retail investors, allowing them to buy and sell stock easily. Also, the internet enabled international investors to have access on local markets.

The value for f-statistics which is significant at 5% significant value shows that ICT adoption had significant effect on market capitalization of the SSA stock exchanges. This implies that ICT adoption facilitated automation in business operations which transcends to a reduced labor costs and increased production efficiency. The findings conform to the view of Usman, etal

(2021) who examined the mediating relationship between ICT expansions and economic development by investigating specifically how expansions of ICT such as broadband internet services and mobile telephony have affected a country's market capitalization. Their results indicated that the number of mobile cell subscriptions, internet users, and fixed broadband subscriptions per 100 people each have a positive and statistically strong effect on market capitalization. Furthermore, the finding allies with that of Ezirim, Adebajo, Elike and Muoghalu (2019) who examined the effects of information technology on the growth and development of the capital market in Nigeria for the period 1998–2017 and found that the level of ICT-facilitated interaction between stockbrokers and investors significantly affected the growth of market capitalization and the volume and value of shares traded. It was also recorded that internet usage had positive significant effect on market capitalization. This shows that as internet usage is a significant factor that influences market capitalization.

However, the findings of this study do not conform to the view of Vaumi, Leudjou and Faha (2021), where they studied the effects of information communication technology on stock market capitalization, using panel data analysis. Their findings shows that ICT expansion are positively associated with stock market capitalization. However, this finding supports the view in another study that stock markets are neither a necessary nor sufficient condition for promoting the performance of ICT (Owusu-Agyei, etal, 2020).

5. CONCLUSION AND RECOMMENDATIONS

Stock markets are not merely casinos where players come to place bets. Stock markets provide services to the non-financial economy that are crucial for long-term economic development. The ability to trade securities easily may facilitate investment, promote the efficient allocation of capital, and stimulate long-term economic growth. The study found that ICT adoption had significant effect on market capitalization in the selected SSA countries. Generally, the results are consistent with the majority of theoretical and empirical studies conducted on both developed and developing economies. As a new contribution to the established body of literature, the researcher has attempted to provide an analysis of the effect of ICT adoption on market capitalization. Based on the findings we conclude that ICT adoption is a significant tool that has enhanced the stock market capitalization in the selected SSA countries.

i. The study recommends that telecommunication infrastructure be provided in the selected countries to enhance internet usage. This is indispensable, given that internet usage demonstrated a significant positive effect on stock market capitalization.
ii. The study observed that broadband usage had a significant effect on market capitalization. Broadband access in SSA has been a major challenge for many years. The lack of broadband access has resulted in limited access to information, slow economic growth, and limited investment opportunities. Economies in SSA should invest in building fiber optic networks, expanding wireless coverage, and improving the capacity of existing networks to handle more traffic.

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