

ICT in Higher Education: A Tool for Sustainable Development in West Africa.

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ABSTRACT

ICT has been documented in literature to drive sustainable growth and development in many sectors as substantial growth may not be accounted for in isolation on the role of ICT. We looked at the role of ICT in higher education in West Africa region by examining two concepts of sustainable development goals (SDGs), the goal of quality education (goal 4) and the goal of industrial innovations and infrastructure (goal 9). Our idea is that ICT can be used as a tool in higher education to spread knowledge that could led to the attainment of sustainable development in the West Africa region. We examine the role of ICT in higher education on sustainable development by using cross sectional and ex post facto research design, purposive sampling was used to select five countries within the West Africa region based on the accessibility of data within the scope of 2013 and 2022. Active learning theory was used to underpinned the study while least square method of analysis was used as method of data analysis. The data were tested for linearity and the results of the study findings shows that the role of ICT in higher education positively affects sustainable development in the West Africa. The study recommends investment in ICT in higher education as an active learning tool to foster sustainable development as well as to optimally achieve sustainable development in West Africa.

Keywords: ICT, sustainable development, higher education, West Africa, least square method.

INTRODUCTION

The concept of ICT is complex as it affects majorly all branches of human activities on earth. Nothing tangible is achieved in isolation of the contribution of ICT in this 21st century. The continuous transformation and adoption of technologies in our world has impacted both positively and negatively but the positive impact outweigh the negative impact hence a call for the universal acceptance of ICT in the educational history of the West Africa region.

We identify that the concept of sustainable development became more pronounce when it was linked to the sustainable development goals initiated by the United Nations. The United Nations forecast challenges that may face the world in the long run if immediate actions are not taken to mitigate such challenges. Goals

were set and some of such goals includes the goal of quality education and industrial innovation and infrastructure. However, a major concept or tool needed to drive and sustain the achievement of the Sustainable Development Goals (SDGs) is the concept of Information Communication Technology (ICT). This is because the ICT stands as a tool or platform that integrate different technologies for monitoring and providing feedback on the progress of the attainment of each sustainable development goals.

In the 21st century, the way of life has been drastically improved making man to migrate from the traditional methods to the modern methods (ICT) of either doing things or way of modern life (Hannahkimmy, 2019). It is obvious as the world progress with its journey into the abyss of the digital age, countries across West Africa would not only experience the benefits that ICT brings but also the risks. That is while ICT contributes the exponential increase in human productivity, it also creates opportunity for exploitation. Nevertheless, researchers believe that the benefits of ICT outweigh the exploitation as education is a tool to minimize the risk of exploitation hence education bridges the gap between the role and the application of ICT and its quantifiable impact on sustainable development.

Despite the United Nations developmental goals 4 which talks about quality education, the amount of investment of West Africa countries investment in ICT is still low compared to advance countries. Distance learning education through ICT has bridged the gap of education service delivery. However, the concept of sustainable development has increasingly become of strategic positioning for developmental impact, creating room for ICT.

Funding sustainable development in West Africa requires huge resources for continuity and ICT through higher education is regarded as the core resource needed to accomplished this impact. The implication is that for concerned nation, party or institution with interest in sustainable development through modern technology would requires constant resources inflows to sustain continuity. The implication is that ICT is a core resource needed for the long run. Information and Communication Technology (ICT) includes computers, the Internet, and other electronic systems that are regarded as resources for growth and development in the modern educational system.

The current expectation on sustainable development by any stakeholder is that modern ICT in higher education would drive sustainable development (Nchofoung & Asongu 2022). Tezci (2011) stated that a nation or institution needs resources to dive sustainable development and economic growth, human capital development and the use of technologies are part of the resources needed to attain sustainable development and align with the sustainable developmental goals. Sustainability is seen as a paradigm for thinking about the future, in which environmental, societal, and economic considerations are balanced with the use of modern technologies in the pursuit of an improved quality of life for all persons.

In the 21st century, the impact of ICT has been enormous but with low impact in West Africa and Africa in general. It is widely acknowledged that countries with modern technologies in education has higher chances in achieving and sustaining the development goals than countries with low ICT rating. Sang et al (2011) were of the opinion that the application of ICT in higher educational system would increase productivity.

The framework on ICT adoption in higher education in West Africa specifically in relation to sustainable development has not been adequately explored with obvious gaps. Therefore, the problem which this study focused to address is that despite the important of ICT, the short run effect of ICT in higher education in West Africa has not be measured on her sustainable development goals focusing on SDG 4 and 9. Hence this study contribute to the literature by using selected variables as proxies for ICT in higher education and sustainability using time series data across five countries in the West Africa Zone.

LITERATURE

Active learning is a potent resource to compare countries in educational delivery and the measure of long

run attainment of sustainable development goal. This study adopts the active learning theory to examine the role of ICT in higher education and sustainable development in the West Africa region.

Ofsted (2004) studied the impact of ICT and renewal energy on sustainable development, they used multiple regression as method of data analysis and time series data across 1990 to 2019 across selected countries across Europe and their findings shows that ICT positively affect sustainable development. Levin and Wadmany (2006) study the role of ICT for sustainable development using panel data across 80 countries. They used economic growth as a proxy for sustainable development while regression was used as the method of data analysis. The study found out that ICT has a positive significant impact on sustainable development in a country. Liu, Poulouva, Prazak, Ullah and Nathaniel (2023), examined infrastructural development and human capital development as a proxy sustainable development on CO2 emission using time series data regression as method of analysis in China and concluded that HCI affects the management of CO2 emission.

Lin, Wang and Lin (2012) studied information Technology impact on productivity using literature survey and the PRISMA flow diagram, the study findings show that European nations has contributed above 36% of ICT to productivity while Africa has contributed less than 9% of ICT to productivity hence making the impact of ICT less significant to productivity and sustainable development in Africa. Castro, Sánchez and Alemán (2011) used survey the impact of ICT on student's attendance and found out that ICT significantly impact on student's attendance and productivity. Coleman, (2021) and Kourgiozou et al., (2021) shows that the United Nations is a centre of attraction for ICT and thus several reports have emphasized the expanding use of information and communication technologies in UK educational institutions.

Wang (2021) reviewed the development of ICT in four countries and concluded based on its findings that the government of Great Britain has launched a number of programmes, such as the "Harnessing Technology" policy, to encourage the use of ICT in classrooms as ICT has a positive effect in boosting economic growth and development. The work of Van, Wong, Rubinić, O'Nuallain and Czabanowska (2022) stated that the government effort to increase the availability of information and communication technology (ICT) resources, infrastructure, and digital skills would increase UK schools productivity while the work of Mbunge (2020) shows that the application of a complete ICT integration is difficult to achieve due to inequalities in access and allocation of resources. However, Williams, Afolabi and Mojekwu (2023) stated other skills needed to boost sustainable development and industrialization apart from the use of ICT.

Bradley (2021) stated that there is sign to show that both student and teacher productivity may an advantage from the strategic use of ICT in the classroom while learning management systems, digital material, and interactive educational software are examples of ICT solutions that have been established to upsurge the learning results relating the ways in which students engagement are documented as well as teachers cooperation. Also, Bradley (2021) tried to explain that the use of ICT aids students' efficiency and effectiveness in the classroom and also that the use of ICT makes the teacher customised lessons for each student, conduct assessment and give feedback reports to students in real time.

Chatterjee and Chakraborty (2021) shows that ICT enables educators to improve their practices by providing a window in which they could access quality learning materials that could improve their professional growth and create room for possible collaboration. Ovcharuk et al. (2020) studied ICT and its impact UK educational system and found out that the use of ICT in the educational sector is important in solving problem relating to the environment and helps all stakeholders within the environment with interest in education to be informed so as to make decisions in the digital world. This implies that, within the environment, online education can take place, distant learning and all chance for lifelong learning. Ferri et al (2020) also support stated that the growth of ICT would bring more contributions to accessible schooling in

the long run while Casado-Aranda et al. (2021) were of the opinion that educational institutions in this 21st century has cutdown the cost on paper usage and digitalizing training and learning materials to facilitating online and research collaboration.

Olusola et al (2011) itemized some of the challenges faced in the process of implementing and adopting full ICT in UK educational system, them itemized the complexity in managing data privacy, huge amount of funds, a lack of suitable infrastructure to match the project on ground as at the start as well as digitally savvy are the documented problems. Henning-Smith, (2020) supported the work of Olusola et al (2011) by stating that internet connection are not adequately available in such nation especially in rural and economically disadvantaged regions may truncate the successful implementation of ICT while Latchem, (2018) stated that teachers attitude to embrace change may slow down the application of ICT in educational sector which may indirectly affect productivity and development.

The review of the literature pointed that West African countries are lacking behind in the use of ICT in education to drive her sustainable development goals. Also, in as much as ICT in higher education is a potent resource for growth, West African countries are yet to tap into this window by investing huge resources.

METHODOLOGY

Least square method was used as method of analysis while two research design was adopted in the study, the cross-sectional research and ex post facto research design. Purposive sampling method was used to select five West African countries based on the criterial of accessibility of data that are within the scope of 2013 to 2022. The countries selected are Nigeria, Ghana, Gambia, Mali and Senegal. However, there exist a limitation to the study as a result of incomplete data from some of the selected countries accessible online within the scope of the study.

Table 1: Variables, Description, Measurement and Sources

Variables	Description	Measurement	Data Source(s)
Sustainable Development (SD)	This is represented as independent variable and it measures with the use of economic growth, human capital development index and infrastructural development.	economic growth, human capital development index, infrastructural development	available in public domain/online and literature in the selected countries.
ICT Development Index (ICTDI)	This is described as an index that shows the level of ICT sector development.	It measures the rate of growth of ICT	available in public domain/online and literature selected countries.

Source: Authors compilation, 2023

METHOD OF DATA ANALYSIS

In order to quantitatively analyze the role of ICT in education and its impact on sustainable development in the West Africa region, we developed two linear models. The first model was used to captured sustainable development while the second model was used to examine the effect of the role of ICT in higher education on sustainable development.

$$SD=f (GDP +HCD + INFD)..... (1)$$

The Model is hereby written in Mathematical Form

$$SD_t = \beta_0 + \beta_1 ICTDI_t + \mu_t \quad (2)$$

Model 2 was regarded as the functional model for the study and it is thus explained as follow.

ICT in higher Education is the independent variable and is proxy with:

ICTDI= ICT Developmental Index

Sustainable Development (SD) is the dependent variable and is proxy with:

GDP= Gross Domestic Product

HCD= Human Capital Development

INFD= Infrastructural Development

To remove the possibility of spurious regression results, the model 2 is hereby written as:

$$LOGSD_t = \beta_0 + \beta_1 LOGICTDI_t + \mu_t \quad (3)$$

Table 2: Summary of the Least Square Result

Model 3	Prob.	Standard Coefficient	t-statistics	F-statistics	R ²	Durbin-Watson stat.
	0.000	0.269147	6.414316	8.880646	76.1%	1.2

Source: Extracted from the least square result, 2023.

From the model 3, the SD represent the dependent variable (sustainable development) while the ICTDI represent the independent variable (the role of ICT in higher education).

The prob. value shows that the role of ICT in higher education is statistically significant to increased sustainable development in the West Africa Region. The positive value of the standard coefficient corroborates the active learning theory and that as institutions within the West Africa region used ICT in higher education, students and professionals in the learning curve within the region would connects new ideas that would drive sustainable development and growth. The positive value of 0.269147 implies that the role of ICT in higher education drive sustainable development. The implication is that for every one unit increased in the role of ICT in higher education, there is a corresponding increase of 0.269147 increase in increased on sustainable development in the West Africa region. The coefficient of determination of 76.1% shows that that 76.1% of the explanatory variable (the role of ICT in education) is explained by sustainable development in the West Africa region while the Durbin-Watson statistics shows a positive autocorrelation of 1.2 between the role of ICT and sustainable development.

DISCUSSION OF FINDINGS

From the findings of the study, we looked at variables used as proxy for the role of ICT in education and sustainable development and we found out that the variables are statistically significant. The work of Lei et

al (2022) examined the effect of ICT on sustainable development using multiple regression and time series data and concluded that ICT positively affect sustainable development, the implication is that this study supports the work of Lei et al (2022) by unveiling that there is a positive relationship between the role of ICT in higher education and sustainable development in the West Africa region and with the passage of time, the positive impact of ICT on the sustainable development would be more visible and pronounce. Levin and Wadmany (2006) used economic growth as a proxy for sustainable development and panel data to examine the role of ICT across 80 countries across the globe and concluded that ICT positively affect economic growth. The findings of the study align with the conclusion of Levin and Wadmany (2006).

Liu *et al* (2023) were of the opinion that in as much as sustainable development is fundamental for growth, many variables has been used as proxy for sustainable development hence variables such as infrastructural development and human capital development when used as a proxy sustainable development would positively affect CO2 emission, hence this study partially supports the work of Liu et al (2023). Peter *et al* (2018) were of the opinion that the best method of examining the role of ICT on any substantial variable is the application of qualitative approach as any data used that is distinct from qualitative approach may not give the true picture of the effect of the role of ICT on such variable, they adopts PRISMA flow diagram and found out that ICT contribute a positive impact to sustainable development and that the role played by independent nations are substantially important, hence this study support the work of Peter *et al* (2018). This study supports the work of Coleman (2021) and Kourgiouzou *et al.*, (2021), while Coleman looks at ICT investment impact on increased productivity in Africa, Kourgiouzou *et al.*, (2021) concluded that countries in the United Kingdom became a centre of attraction for higher education for students across the globe hence making ICT investment in educational institutions paramount for the growth and sustainability of higher educational system.

Wang (2021) stated that the lunch of the “Harnessing Technology” is an important message that the role of ICT is fundamental in all levels of the educational system hence this study finding support the view of Wang (2021) while Van et al (2022) agreed to research findings that states that government commitment to the growth of ICT through substantial investment is essential for the growth of ICT towards sustainable development. The implication is the role of ICT in this 21st century is fundamental for growth and thus with the use of the medium of education the relative impact of ICT on increased productivity and sustainable development would be felt.

This study does not support the work of Mbunge (2020) because Mbunge (2020) concluded that financial resources is a barrier to the growth and application of ICT. This study supports the work of Bradley (2021) that with the use of ICT, a gap has been bridged that link teachers and students together. The study supports the findings of Chatterjee and Chakraborty (2021), Ovcharuk et al. (2020) and Latchem (2018), that with the passage of time, sustainable development cannot exist in isolation of the role of ICT in higher education within the West Africa region.

CONCLUSION

We conclude by using various statistical analysis to provide support in investigating the subject matter. That is all analysis done in this study are used to generalized the findings and answer the research question on the role of ICT in higher education and sustainable development in the West Africa region. This study concluded that based on the active learning theory, ICT knowledge are crucial for the growth and sustainable development of the West Africa region in both the short and long run. Similarly, the study established the fact that a significant relationship exists between the role played by ICT in higher education in fostering economic growth or industrial sector development in the 21st century. Since all sectors are dependent on the role of ICT in attaining optimal productivity and sustainable development, the need for potential investment in ICT is mandatory to drive sustainable development goals in West Africa, hence this

study supports the existing evidence that the role of ICT in higher education impact positively on sustainable development.

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