Public Sector Digitalization Programmes in Ghana and Nigeria: Opportunities and Challenges

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ABSTRACT

Many developing countries have embarked on aggressive public sector digitalization programmes with financial and technical support from their bilateral and multinational donors. Citizens are often skeptical about their governments' digitalization agendas; and ask questions regarding opportunities for such projects and challenges that their implementations face; as well as their impacts on socio-economic variables. This paper examined pertinent literature on public sector digitalization programmes that were rolled out in Ghana and Nigeria over the last decade and identified opportunities that spurred such programmes as well as the challenges confronting their implementation. It also examined the impact of the digitalization programmes on productivity, accountability, service delivery, and macroeconomic variables (economic growth, poverty alleviation and unemployment). Thereafter, it proffered policy and strategy recommendations to guide the selection, design, development, implementation, and integration of digitalization programmes in developing countries like Ghana and Nigeria. Furthermore, it provided recommendations for governments, the African Union, and for future research.

Keywords: Digitalization programmes, digital economy, bureaucracy, developing countries, digital transformation, productivity, digitization, opportunities, challenges.

INTRODUCTION

The importance of digitalization in public sector organizations cannot be overstated. Many countries have embarked on digitalization efforts to increase effectiveness and efficiency of work, to increase accountability and transparency, and to reduce costs and bureaucracy in public sector organizations [1]-[7]. However, the digital divide between developing and developed countries, has over the last four decades, continued to widen. For instance, while 97.90% and 92.03% of the population in North America and Europe, respectively, had access to 4G network in 2020, only 52.16% of Africa's population had the 4G network coverage in 2020. Similarly, the deployment of 5G networks in North America (by percentage of population) was 63.75% in 2020; while that of Africa was 0.00% [8]. In the same vein, [9] concisely reveals, in Table 1, the prevalence of the digital divide between developing countries and developed countries in terms of likelihood of being an internet user, cost of internet, internet security, and mobile phone penetration. Table 1, therefore, shows that developing countries trail developed countries in all the above four dimensions/variables. Furthermore, [10] highlights the digital divide phenomenon in terms of broadband network speed; and Table 2 shows that the broadband network speed between Africa and USA is very slow compared with the other links on the table. Specifically, Table 2 reveals that the broadband network speed between USA and Europe is about 105 times faster than the link between USA and Africa, and about 47.35 times faster than the link between Europe and Africa.

Table 1. Comparison Of Measurements for Some Digitalization and Digital Divide Variables Between Developed and Developing Countries [9]

Variable	**Person in developed country compared with person in developing country**
Likelihood of being internet user	More than 22 times likely than in developing country

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Cost of internet access	150 times less than in developing country
Security of internet servers	More than 100 times than in a developing country
Mobile phone prevalence	29 times more than in a developing country

Table 2. Intercontinental Broadband Network Speeds [10] P.10

Network Link	**Broadband Speed**	**No. of times faster USA-Europe link is**
Between USA and Africa	8,504.5 Mbps	105.33
Between USA and Latin America	258,196 Mbps	3.47
Between USA and Asia	488,510 Mbps	1.83
Between USA and Europe	895,808 Mbps	-
Between Europe and Africa	18,918 Mbps	47.35
Between Asia and Europe	55,739 Mbps	16.07

Furthermore, Table 3 shows that the average broadband internet download speed in Western Europe is 118.69 Mbps, while it is 12.11 Mbps in Sub-Saharan Africa, and 9.81 Mbps in North Africa. This, thus, reveals that broadband network download speed in Western Europe is approximately 9.8 and 12.1 times faster than in Sub-Saharan Africa and North Africa, respectively.

Table 3. Worldwide Broadband Speed League 2023 [11]

Region	**Average download speed**	**No. of times faster Western Europe broadband speed is**
Western Europe	118.69 Mbps	-
North America	94.02 Mbps	1.26
Eastern Europe	67.92 Mbps	1.75
Asia	45.72 Mbps	2.60
South America	44.38 Mbps	2.67
Sub-Saharan Africa	12.11 Mbps	9.80
North Africa	9.81 Mbps	12.10

Reference [12] argues that technological, socio-economic, and linguistic factors account for the digital divide across nations/continents. Other major reasons that researchers attribute to this phenomenon include differences in telecommunications infrastructure, income levels, financial resources (for implementation and long-term support of digitalization efforts), affordability and availability of digital devices/services, digital literacy rates, and mobile phone penetration rates [13]-[16].

Problem Statement and Motivation for the Study

The digital divide between developing and developed countries continues to widen. Similarly, the digital divide within a country also continues to widen between urban dwellers and rural dwellers, and between digital literates and digital illiterates. Also, over the years, business executives and citizens in developing countries like Ghana and Nigeria have been subjected to bureaucracy when they go to receive services in public sector organizations. They had to wait for hours, days or weeks to receive needed services. Sometimes, their paper-based documents

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were misplaced and could not be traced. This invariably bred wanton corruption in the public sector, making governments to lose huge amounts of money annually through corrupt practices. For instance, the 2017 Auditor-General's report disclosed that Ghana lost over GH¢2 billion (about US$400 million) through revenue collection inefficiencies [17]. To forestall these and to meet UN's Sustainable Development Goals 1, 3-8, 11 and 17 relating to health, education, poverty eradication, environmental sustainability, gender equality, economic growth and global partnerships, governments have embarked on various robust digitalization programmes to increase efficiency and effectiveness of work, to increase transparency, to reduce costs and bureaucracy in public sector organizations and to increase national economic growth [3], [18].

Both Ghana and Nigeria have embarked on many robust public sector digitalization efforts within the framework of Economic Community of West African States (ECOWAS) Digitalization Policy. Ghana has anchored its digitalization programmes on its Information and Communications Technology for Accelerated Development Strategy (ICT4AD) policy document [19]; while Nigeria is using its Digital Economy Policy and Strategy (DEPS) and National Information Technology Policy (NITP) documents to drive its current digitalization programmes [20]. Digitalization programmes in Ghana and Nigeria aim at creation of enabling ICT environments, reducing national digital divide, developing robust ICT infrastructure and digital economy, promoting socio-economic development, as well as fostering ICT access, adoption, and sustainability [19], [21]. The above objectives align with ECOWAS' legislative and regulatory ICT policy frameworks [22]. Both Ghana and Nigeria have chalked remarkable successes in their digitalization efforts so far. For instance, e-government programmes implementation has greatly improved public service delivery to citizens and businesses in Ghana and Nigeria [23]-[25]. However, citizens are skeptical about whether their government's digitalization agendas can effectually spur their socio-economic well-being, bolster national economies, and bridge the national digital divides between urban dwellers and rural dwellers on one hand, and between digital literates and digital illiterates on the other hand. Citizens are also skeptical about their government's ability to prudentially, and meaningfully, tackle challenges inherent in implementing their various digitalization programmes.

Though significant publications have been made on digitalization, a few research has concentrated on the impacts of digitalization on productivity, accountability, and macroeconomic variables in developing countries, including African countries [26], [27]. The researcher has not found any study that provides comprehensive listing, overview, and analysis of public sector digitalization programmes implemented in a country over a given period. Also, the researcher has not found any study that provides dual-country analysis of digitalization programmes. This study, therefore, performed a review of relevant literature on public sector digitalization programmes in Ghana and Nigeria from scholarly peer-reviewed journals, reports, and books in order fill these gaps; and to identify the opportunities and challenges related to those projects in the two countries.

The researcher is motivated to choose Ghana and Nigeria for this study because:

i. they are the two biggest economies in West Africa (in terms of GDP and economic growth); they have the most dominant, lucrative and fast-growing telecommunications network infrastructure and services; they are currently ready for the deployment of 5G technology for use; and they are well-positioned for a strong digital economic development [28]-[31].

ii. both countries have relatively stable political environments, and have been aggressively pursuing their robust digitalization agendas with similar goals and regulatory frameworks in line with ECOWAS' digital economy blueprint and African Union's all-inclusive Digital Economy for Africa (DE4A) initiative [30]-[32]; and

iii. both countries have placed high political premiums on their digitalization efforts by placing their respective digitalization agendas under the direct control of their Presidencies. Specifically, the Office of the Vice President of Ghana directly coordinates Ghana's digitalization programmes; while a 27-member Presidential Committee on E-government and Digital Economy steered Nigeria's digitalization agenda during the period 2019-2023 [33], [34].

Study Objectives and Research Questions

The objectives that drove this study were:

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i. To identify the key public sector digitalization programmes that were rolled out in Ghana and Nigeria in the last decade.

ii. To identify opportunities that spur the public sector digitalization programmes in Ghana and Nigeria.

iii. To determine the impact of the public sector digitalization programmes on productivity, accountability, service delivery, and macroeconomic variables (economic growth, poverty alleviation, and unemployment) in Ghana and Nigeria.

iv. To identify challenges to the public sector digitalization programmes that were rolled out in Ghana and Nigeria in the last decade.

The research questions for this study were:

RQ1. What key public sector digitalization programmes were rolled out in Ghana and Nigeria in the last decade?

RQ2. What opportunities drive the public sector digitalization programmes in Ghana and Nigeria in the last decade?

RQ3. What is the impact of the public sector digitalization programmes on macroeconomic variables (economic growth, poverty alleviation, and unemployment) in Ghana and Nigeria?

RQ4. What is the impact of the public sector digitalization programmes on productivity, accountability, and service delivery in Ghana and Nigeria?

RQ5. What are the challenges that face the public sector digitalization programmes that were rolled out in Ghana and Nigeria in the last decade?

The Concept of Digitalization

Digitalization refers to the automation of existing processes and structures by leveraging relevant digital channels and technologies to foster convenience, transparency, security, efficiency, innovation, customization, and delightful experiences for users [4], [35]-[37]. Also, [5] define digitalization as the transformations triggered by innovative digital technologies implementation to "create, process, share and transfer information" (p. 305) and to transform people's lives and empower a society. Reference [29] has identified five fundamental factors that steer a successful digitalization and digital economy; namely: "digital infrastructure, digital platforms, digital financial services, digital entrepreneurship, and digital skills" (p. 10). These factors are, therefore, incorporated into the frameworks and roadmaps of various ongoing World Bank-funded public sector digitalization and digital transformation programmes in many African countries (including Ghana and Nigeria).

Based on a seeming consistency of findings from studies conducted on 139 countries and 107 countries in 2000 and 2021, respectively, [8] postulates that countries should adopt 5 pillars for their digitalization programmes. These pillars are digital infrastructure (planning, affordability, and connectivity), digital human capital development, digital innovation schemes and systems, digital adoption (of devices, services, and platforms), and digital sector development (to produce digital services and products).

Overview of Public Sector Digitalization Programmes in Ghana and Nigeria

In this section of the paper, the researcher provides an overview of major digitalization programmes that were embarked on in Ghana and Nigeria over the last decade, in line with the Research Question #1 (RQ1).

RQ1. What key public sector digitalization programmes were rolled out in Ghana and Nigeria in the lastb decade?

Ghana's public sector digitalization efforts were hinged on its ICT for Accelerated Development (ICT4AD) Policy which spanned the period 2004-2022; and it was aimed at transforming Ghana into a digital society and

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economy through ICT leveraging. Table 4 shows key public sector digitalization programmes that Ghana has implemented over the last $7^{1}/_{2}$ years. Reference [21] conducted an analysis of Ghana's ICT4AD policy and revealed that wide gaps exist between the contents of the ICT4AD policy and what had been accomplished; and, therefore, suggested its holistic review.

Nigeria's public sector digitalization efforts were anchored on two main policy documents; namely: National Digital Economy Policy and Strategy (NDEPS), and National Information Technology Policy (NITP). Its NDEPS was launched in November 2019 while its NITP was launched in March 2001 [20], [38]. Its National Digital Economy Policy and Strategy (NDEPS) has 8 pillars for Nigeria's public sector digitalization roadmap; and its objectives are to:

i. promote digital innovation and entrepreneurship to stimulate growth in all economic sectors

ii. generate prosperity and value for Nigerians

iii. ensure security of digital activities and processes, reduce corruption, and expand GDP growth

iv. achieve 70% broadband penetration within 4 years

v. accelerate government services digitalization for improved transparency, service delivery, and accountability; and

vi. expand the educational curricula of primary, secondary and tertiary institutions in Nigeria to incorporate digital literacy knowledge and skills acquisition [20].

Figure 1 below shows the 8 pillars on which Nigeria's National Digital Economy Policy and Strategy (NDEPS) is anchored.

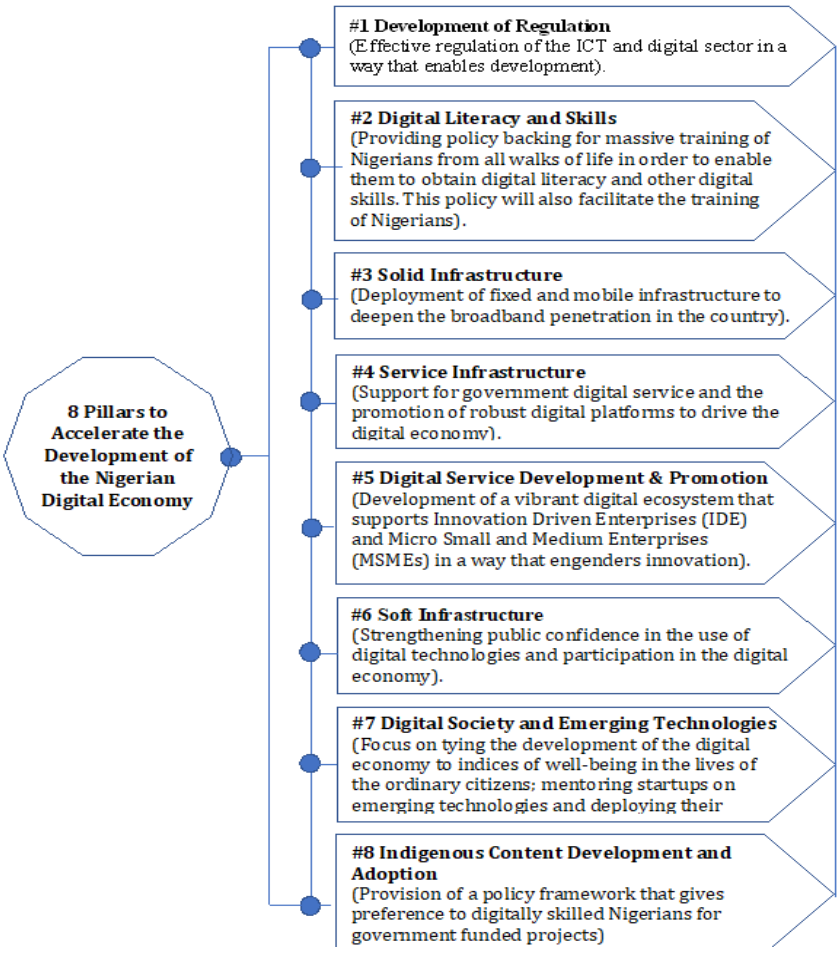

Figure 1. Pillars of the digitalization roadmap for Nigeria [20] p.1

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Nigeria's National Information Technology Policy (NITP), on the other hand, seeks to leverage ICTs to enhance transparency, foster public service delivery, and bring government closer to the citizens through virtual platforms [39].

Tables 4 and 5 show the key digitalization programmes that are embarked on in Ghana and Nigeria, respectively, over the last 7-8 years.

Table 4. Key Public Sector Digitalization Programmes in Ghana

Digitalization Program	**Implementing Government Agency**	**Purpose**
1. Government Integrated Financial Management Information System (GIFMIS)	Controller and Accountant General's Department (CAGD)	Budgeting and expenditure management platform for government ministries, departments, and agencies.
2. National digital property addressing system	Ghana Posts, in collaboration with Ministry of Finance	Property addressing system
3. Integrated Customs Management System (ICUM) dubbed Ports Digitalization System	Ghana Revenue Authority (GRA)	Paperless customs clearance at Ghana's ports
4. Driver and vehicle licensing automation	Driver and Vehicle Licensing Authority (DVLA)	Vehicle testing and registration, as well as issuance of drivers' licenses and roadworthy certificates
5. Passport office automation	Ministry of Foreign Affairs and Regional Integration	Online platform for passport application and processing
6. E-justice system (dubbed Fast-Track High Courts System)	Judicial Service of Ghana	Automation of high courts in Ghana
7. National Identification Cards system	National Identification Authority	Issuance of mandatory Ghana Cards to citizens and residents for use for subscriber identity module (SIM) card registrations and financial transactions in Ghana.
8. Mobile money payment services interoperability	Ghana Interbank Payment and Settlement Systems (GhIPSS).	Seamless and direct funds transference among mobile money wallets across telephone networks. Eliminates cross-network money transfer inconveniences and complexities.
9. Zipline drone services	Ministry of Health, in collaboration with the Office of the Vice President of Ghana	Medical-supplies delivery services to remote/rural areas in Ghana.
10. Ghana.gov platform	Office of the Vice President of Ghana	Government of Ghana's public sector single point-of-access platform for digital service, revenue collection and related workflow management.

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11. GhanaPay platform	Ministry of Communications and Digitalization, in collaboration with the Office of the Vice President of Ghana	For mobile money wallet issuance and services by rural banks, universal commercial banks, and Savings and Loans companies in Ghana.
12. Lands registration system	Lands Commission of Ghana	Database system for Government-vested lands and stool lands registration
13. National health insurance system upgrade	National Health Insurance Authority	Database for national health insurance card issuance and workflows for health services delivery to subscribers
14. Digitalization of Electricity Metering and Payments	Electricity Company of Ghana (ECG)	Database for electricity metering, and for monitoring power consumption and equipment maintenance services
15. Biometric voters' registration and voting system	Electoral Commission of Ghana (EC)	Voters' registration and verification; and for electronic transmission of national election results to EC Head-Office.
16. SIM card registration and re-registration	Ministry of Communications and Digitalization	To curb personal and national security threats; and promote responsible mobile phones usage for social life and interactions.
17. E-VAT system	Ghana Revenue Authority	Platform for tax compliance, invoicing and revenue collection using QR codes
18. Myassembly.gov.gh : Unified Common Property Rate Platform	The Ghana Revenue Authority (GRA), in partnership with Ghana's Metropolitan, Municipal and District Assemblies (MMDAs).	A comprehensive, real-time, and self-service end-to-end property rates collection and administration portal that was rolled out across Ghana from 1st January 2023. It has a linkage to the Ghana, gov. gh payment platform; and it is aimed at eliminating cash payments to MMDAs, fostering full-automation of bills alerts, notifications and distribution to clients; and real-time property rate bills reporting.
19. e-Pharmacy platform	Ghana Pharmacy Council	A nationwide platform of registered pharmacies where residents can buy prescribed medicines online.

Table 5. Public Sector Digitalization Programmes in Nigeria.

Digitalization Program	**Implementing Government Agency**	**Purpose**
1. Bank Verification Number (BVN)	Central Bank of Nigeria (CBN)	Unique and secure banking transactions authentication system (comprising identification and verification) deployed throughout Nigeria.
2. Integrated Payroll and Personnel Information System (IPPIS)	Office of the Accountant General of the Federation (OAGF)	For effective and efficient storage of payroll data of public sector workers, and for cost-effective processing and payment of their salaries/emoluments.
3. Treasury Single Account (TSA)	Central Bank of Nigeria (CBN), in collaboration with Office of the Accountant	To consolidate all government revenues into a central bank account and seamlessly monitor flows of government expenditure processing to promote

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	General of the Federation (OAGF)	transparency and reduce bureaucracy and corruption
4. SIM card registration and re-registration	Federal Ministry of Communications and Digital Economy	To link citizens' and residents' national ID numbers to their SIM cards so as to curb personal and national security threats; and promote responsible mobile phones usage for social life and interactions.
5. Government Integrated Financial Management Information System (GIFMIS)	Office of the Accountant General of the Federation (OAGF)	Government and public service budgeting, processing of receipts and payments, and accounting/financial management
6. Treasury Single Account (TSA) using REMITA platform	Federal Inland Revenue Service (The system was adopted from System Specs Ltd.)	A treasury single account (TSA) platform for invoicing and payment for business and government services, money transfer services (involving bank accounts and mobile wallets), utility bills and taxes payment, and West African Examinations Council PIN purchase.
7. Government Services Portal www.services.gov.ng portal (dubbed 1-Gov).	Federal Ministry of Finance, Budget and National Planning	A one-stop portal for payments for government services, as well as for booking appointments, requesting for publications, and for verification of government-issued IDs, licenses and permits.
8. Enterprise architecture backbone and Nigerian e-Government Interoperability	Federal Ministry of Communications and Digital Economy	For seamless data exchange among MDAs and between government and citizens; to foster flexibility and efficiency of use, and security and integrity of shared public sector IT systems' processes and data.
9. Prepaid electricity meters	The Power Holding Company of Nigeria (PHCN).	Seamless monitoring of electricity credit purchase and usage in Nigeria.
10. Gov Tech platform 11. E-Passport platform 12. Government Service Portal (GSP) dubbed services.gov.ng	E-government Development and Regulation (e-GDR) Department of National Information Technology Development Agency (NITDA) Nigeria Immigration Service, in collaboration with the Federal Ministry of Foreign Affairs Federal Inland Revenue Service	Federal and state governments' holistic online platform for transparent public service delivery, inter-agency collaboration, and citizens' engagement/ participation. A government portal to facilitate electronic application and processing of Nigerian passports A portal to provide seamless electronic access to public/government services.

Since 2018, both Ghana and Nigeria have re-designated their Ministry of Communications to incorporate either Digital or Digitalization to show the level of importance both governments have placed on their digitalization efforts. While Ghana now has Ministry of Communications and Digitalization (MoCD), Nigeria has Federal Ministry of Communications, Innovation and Digital Economy (FMCIDE). Also, in line with Nigeria's public sector digital transformation agenda, an E-government Development and Regulation (e-GDR) Department was created under NITDA in 2017 to spearhead, coordinate and implement its public sector digitalization projects.

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Furthermore, the Office of the Vice President of Ghana is driving Ghana's digitalization agenda, while a 27-member Presidential Committee on E-government and Digital Economy steered Nigeria's digitalization agenda during the period 2019-2023.

In both Ghana and Nigeria, existing technology-sector friendly regulatory frameworks (notably: Cybercrime Act, e-Government Interoperability Framework, Data Protection Act, Online Content Regulation/Guidelines, and Consumer Protection Act) were adopted to guide their digitalization efforts [32]. For success and sustainability of the various digitalization and digital transformation programmes, both governments have made huge investments in the following areas:

i. providing ICT infrastructure (including digital centres and broadband access),

ii. strengthening data protection and cyber security, and

iii. providing digital entrepreneurship support programs for business startups (in blockchain, robotics, big data analytics, artificial intelligence, digital tools development, indigenous content development, and virtual reality).

Specifically, Ghana has provided free wi-fi to its public universities and senior high schools; and teachers in basic schools and senior high schools nationwide are being provided with laptops with relevant educational materials and software tools to enable their pupils and students acquire and/or hone digital skills. Both Ghana and Nigeria are aggressively providing specially tailored training and mentorship to their youth in digital tools usage and development. Also, they have established ICT hubs/parks, dubbed Digital Transformation Centres (with supports from the World Bank and the German Federal Ministry for Economic Cooperation and Development). These ICT hubs/parks are specifically aimed at "addressing social issues of digital transformation, facilitating access to and use of digital technologies for marginalized groups, and reducing digital divides" [40], p.1. Furthermore, both governments have established robust digital innovation and (digital) entrepreneurship schemes (such as You Start programme) to promote their digitalization and digital economy paradigms [29], [30], [40].

Both Ghana and Nigeria have, so far, chalked remarkable successes in areas of digital platforms interoperability, digital data protection, digital literacy and skills training and mentorship, and national digital radio and TV broadcasting. Furthermore, Ghana has successfully integrated the databases of National Identification Authority (NIA) with those of Social Security and National Insurance Trust (SSNIT), Ghana Revenue Authority (GRA), the banks, and the telecommunications companies to foster transparency, financial inclusion, electronic transactions security, and prudential tracking of tax and loan defaulters [41], [42]. Similarly, Nigeria has successfully linked its citizens' and residents' national ID numbers to their SIM cards to promote responsible mobile phones usage for social life and interactions, and to curb personal and national security threats [3], [43].

Opportunities for Public Sector Digitalization Programmes

In this section, the researcher provides a discussion of the opportunities that have driven the various digitalization and/or digital transformation programmes that were embarked on in Ghana and Nigeria within the last decade. This discussion is in line with the Research Question #2 (RQ2).

RQ2. What opportunities drive the public sector digitalization programmes in Ghana and Nigeria in the last decade?

Reference [44] assert that between 2010 and 2022, Africa experienced the fastest rate of digital infrastructural expansion (including internet bandwidth) in the world. Notably, they found that internet bandwidth usage in Africa grew at about 50% annually during that period. References [32] and [40], therefore, speculate that digitalization can create opportunities to bridge the digital divide between Africa and the developed world if the current tempo of digitalization efforts in African countries is sustained. The rapid ICT infrastructural development in Ghana and Nigeria and the many digitalization programmes rolled out over the last 7-8 years, put both countries in pole positions to reduce the digital divide between them and the developed countries, and

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between their digital literate citizens and digital illiterate citizens [32].

Digitalization appears to be a major way for a country to prepare itself for the 4th Industrial Revolution (dubbed Industry 4.0), which promises robust data and information-based economies hinged on ICT innovations such as artificial intelligence, robotics, machine learning, virtual reality, block-chain technology, and big data analytics [29]. The 5G network infrastructure that Ghana and Nigeria are about to deploy will propel them to realize the opportunities that Industry 4.0 promise.

Prior empirical studies have shown that opportunities that digitalization provides for a country include providing quick, efficient and cost-saving government services to citizens, businesses and residents; creating jobs and reducing unemployment in the areas of ICT infrastructure building, digital equipment manufacturing, data analytics and software development; increasing efficiency, productivity, transparency and accountability; fostering efficient revenue mobilization through taxes; promoting economic growth; improving the living standards of citizens; boosting educational and health services; boosting access to public (including welfare) services for businesses, citizens and residents through the use of ICT tools/applications; optimizing their budget efficiency; and increasing investment opportunities for businesses [2], [3], [6], [31], [34], [41], [43], [45]-[50]. The various digitalization programmes in Tables 4 and 5 provide citizen and residents to access government services quickly, efficiently, and cost-effectively. They also enable the opportunities enumerated earlier in this paragraph to be realized.

Digitalization programmes can also help Ghana and Nigeria to meet the 2030 deadline for UN's Sustainable Development Goals (SDGs) 1, 3-8, 11 and 17 relating to poverty eradication, education, health, global partnerships, gender equality, environmental sustainability, and economic growth. This is because digitalization programmes have the potential to increase efficiency and effectiveness of work, and also increase transparency, reduce costs and bureaucracy in public sector organizations and increase national economic growth in line with these SDGs. Furthermore, the digitalization programmes embarked on in Ghana and Nigeria have the potential to improve the quality and efficiency of public service delivery, promote socio-economic development by fostering financial inclusiveness for citizens and residents, as well as furthering ICT access, adoption, and sustainability [19], [21]. For instance, Ghana's Social Security and National Insurance Trust's digitalization and linkage to the National Identification Authority's system has led to the registration of 14,000 self-employed persons onto the Trust in 2023 alone; thus, giving a total of 101,028 self-employed persons enrolled in the period 2017-2024 [51].

Impact of Digitalization on Macroeconomic Variables (Economic Growth, Poverty Alleviation and Unemployment)

This section provides an analysis of the impact of public sector digitalization programmes in Ghana and Nigeria on economic growth, poverty alleviation and unemployment in line with the Research Question #3 (RQ3).

RQ3. What is the impact of public sector digitalization programmes on macroeconomic variables (economic growth, poverty alleviation and unemployment) in Ghana and Nigeria?

According to [45], a 10% rise in digitalization generates a 0.50% rise in Gross Domestic Product (GDP) per capita; and the same level of increase in digitalization produces a 1.02% reduction in unemployment rate. Similarly, in a study of 139 countries using data for the period 2007-2018, [52] reveals that ICT positively and significantly contribute to economic growth, employment levels and productivity. Specifically, it found that a 10% increase in digitalization yields the following impacts:

i. a 1.33% increase in GDP per capita globally, and

ii. a 1.04% increase in GDP in non-OECD countries.

In another study of 107 countries using data for the period 2010-2020 to gauge the impact of COVID-19 on their digitalization programmes, [8] used econometric data analysis; and found that a 10% increase in digitalization produces the following effects:

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i. a 1.35% increase in GDP per capita globally, and

ii. a 1.00% increase in GDP in non-OECD countries.

In their assessment of the digitalization stages/levels of 150 countries using 2010 data, [31] place Ghana and Nigeria in the 1st quartile with 36 other countries (in the band of 0-25 on a scale of 0-100, where 0 is the least digitalized). They also found that a 10% increase in digitalization in the 38 most digitalized countries (in the 1st quartile) produces the following significant impacts on GDP, unemployment, financial and social inclusion and transparency:

i. a 0.050% increase in GDP%,

ii. a 0.84% reduction in unemployment rate, and

iii. a 0.13% increase in financial/social inclusion and basic needs access (Human Development Index).

According to [18], Nigeria's digitalization programmes are focused on increasing its economic growth through increased investments in digital infrastructure, increased digital entrepreneurship and ICT adoption, reduction in bureaucracy and corruption; and increased social/financial inclusion. In their study to determine the impact of digitalization/ICT on Nigeria's economic growth using data covering the period 1997-2016, [53] conclude that a long-term relationship exists between Nigeria's ICT adoption and its economic growth. Similarly, [54] assert from their research using data from 2001 that ICT investment and adoption in Nigeria impact its economic growth positively and significantly.

To achieve UN's Sustainable Development Goals 1, 3, 4, 5, and 8 relating to health, poverty eradication, education, gender equality, and economic growth, governments of Ghana and Nigeria have embarked on various robust digitalization programmes listed in Tables 4 and 5 to increase efficiency and effectiveness of work, to increase transparency, to reduce costs and bureaucracy in public sector organizations and to increase national economic growth [3], [18]. In Ghana, for instance, poor and marginalized citizens who are registered for the government's social intervention programs like Livelihood Empowerment Against Poverty (LEAP) scheme often receive notification alerts from the scheme using their mobile phones. Also, from the comfort of their homes, Ghanaians can apply for renewal of their National Health Insurance, apply for passports, pay taxes, property rates and water bills, and buy electricity credits using their mobile phones or computers [55].

A study by [56] found that during 2000-2016, adoption of the internet-of-things and mobile phones in 44 African countries has elevated the development of the informal sector; and generated financial inclusion for the poor in society. Similarly, [57] assert that digitalization plays a predominant role in poverty reduction in Sub-Saharan African countries. Furthermore, in their study to determine the impact of digitalization on poverty reduction in 35 countries covering the period 2005-2018, [58] found explicitly that digitalization has the tendency to reduce poverty rate.

Ongoing provisions of free wi-fi to Ghana's public universities and senior high schools; and laptops with relevant educational materials and software tools to teachers in basic schools and senior high schools nationwide will enable pupils and students to acquire and/or hone their digital skills. Similarly, both Ghana and Nigeria are aggressively providing training to their youth in digital tools usage and development. Also, the many ICT hubs/parks that were established in both countries, coupled with robust digital innovation and entrepreneurship schemes (such as You Start programme), help to promote digital literacy and inculcate digital employable skills as well as digital entrepreneurial skills in the youth. [29], [30], [40]. The You Start programme, for instance, provides participants/trainees with entrepreneurial support in the form of entrepreneurial mentorships/incubators, and provision of digital tools and financial start-up capital to participants to enable them establish their own enterprises and employ workers. These initiatives have the potential to reduce unemployment levels in both Ghana and Nigeria [30], [40].

Digitalization also creates avenues for venture capitalists and other local and foreign investors to increase investments in digital infrastructure and products, and this could lead to new digital entrepreneurial startups and

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expansion of existing digital firms and their attendant increase in employment levels; and this could lead to increased tax revenue to the government and thereby bolster GDP [44], [59]. Over the last 7-8 years, many new digital entrepreneurial firms have sprung up in Ghana and Nigeria and the existing ones have been expanding their operations; thus, helping to reduce unemployment levels in both countries.

The integration of databases of Ghana's National Identification Authority (NIA) with those of Social Security and National Insurance Trust (SSNIT), Ghana Revenue Authority (GRA), the banks, and the telecommunications companies tend to reduce bureaucracy, and foster transparency and prudential tracking of tax and loan defaulters in Ghana [41], [42]. Also, the implementation of Ghana's GIFMIS, ICUM, Ghana.gov, Ghana Pay, e-VAT, Myassembly.gov.gh and e-justice systems/platforms help to improve its gross domestic product. Similarly, Nigeria's Gov Tech, GIFMIS, 1-Gov, REMITA and IPPIS digital platforms help to improve its gross domestic product (GDP) [60]. This is because these programmes reduce corruption and boost tax/revenue mobilization.

According to [61], the value of Ghana's digital economy was about US$1.7 billion in 2020 (representing 3.3% of its GDP); and according to [62], that of Nigeria was US$9.7 billion in 2023 (representing 13.5% of its GDP). It is expected that the digital economies of Ghana and Nigeria will reach about US$5 billion and $19 billion, respectively, by 2030 [63]. The digital economies of both countries are driven mainly by the services sector, and minimally by the manufacturing and agricultural sectors. It is envisaged that the momentum of digitalization efforts in both countries will increase in the coming years and, thereby, boost their gross domestic products (GDP) further [28].

Impact of Digitalization on Productivity, Accountability and Service Delivery

In this section, the researcher provides an analysis of the impact of public sector digitalization programmes in Ghana and Nigeria on productivity, accountability, and service delivery in line with the Research Question #4 (RQ4).

RQ4. What is the impact of public sector digitalization programmes on productivity, accountability, and service delivery in Ghana and Nigeria?

From their study of the effects of digital transformation on innovation and productivity in organizations, [64] conclude that digitalization accelerates production processes and improves the quality of goods produced. Similarly, [65] argue that digitalization generates efficiencies in organizations, spurs innovation and improves their financial prospects. Also, [58] assert that digitalization is the linchpin for accelerating productivity in organizations; and stress digitalization's power in optimizing customer loyalty, revenue generation and profitability. In a similar vein, [66] argues that digitalization improves productivity of small-scale farmers through their access to vital digital information; and tends to increase their income levels. Furthermore, [44] postulates that intensive digitalization has the potential to make businesses more integrated in value chains, to increase their productivity by up to 32%, and bolster their profitability levels.

From their study of 139 countries using data for 2007-2018, [52] found statistically that a 10% rise in digitalization generates a 2.62% increase in labour productivity. Similarly, in their bid to gauge the impact of COVID-19 on digitalization programmes in 107 countries using data for the period 2010-2020, [8] found that a 10% increase in digitalization produces a 2.5% increase in labour productivity. Also, [31] found that a 10% increase in digitalization in the 38 most digitalized countries (including Ghana and Nigeria) produces a 1.17% increase in level of transparency or citizens' participation in government (e-Participation index).

Reference [32] argues that digitalization promotes quality healthcare services, digital educational/learning resources, efficient public service delivery, and citizens' active participation in decision-making regarding government policies and programmes through the use of e-Health, e-Learning, e-Service/e-Government, and e-Participation, respectively. Also, digitalization positively affects strategic direction, business model choice, productivity, and decision-making in organizations [49], [67]. For instance, Ghana's National Health Insurance system upgrade and e-Pharmacy platform have helped to boost the quality of healthcare services while the provision of free wi-fis and laptops in schools help to promote teaching and learning at all educational levels in Ghana.

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Digitalization has the potential to boost trust and accountability; and thereby reduce both bureaucracy and

corruption in public sector organizations. According to [68], the adoption of e-governance in Nigeria has increased efficiency in public sector data processing, improved government revenue mobilization, increased trust between the government and citizens, reduced corruption in the public sector, and improved the Nigerian economy. Similarly, from their assessment of digitization programmes, [7] postulate that leveraging and use of ICTs in a country have the potential to transform lives of citizens. They found that digitalization has reduced paperwork, increased productivity, reduced workload of public sector employees, improved citizens' access to government services, and reduced corruption.

Furthermore, [69] reveal that 12,486 ghost names were uncovered by Nigeria's Integrated Payroll and Personnel Information System (IPPIS) and duly purged from the payroll of 7 federal government Ministries, Departments and Agencies (MDAs) in Nigeria. Also, [18] discloses that "Nigeria saves a whopping sum of N4 billion daily (or at least N120 billion monthly) from the digitalization of the nation's Treasury Office" (p. 9). This is equivalent to US$285.49 million monthly i.e. US$3.43 billion annually. In addition, Nigeria government's REMITA platform helped to "recover N4.3 trillion of its cash assets lying idle in Deposit Money Banks (DMBs)"— this translates to US$10.23 billion [70].

Similar results were reported from Ghana's digitalization efforts. For instance, Ghana's Controller and Accountant General's Department has uncovered about 148,000 ghost workers on government's payroll when a biometric audit of Government Payroll was recently conducted with Ghana card. At Ghana's Social Security and National Insurance Trust (SSNIT), 27,000 ghost pensioners who were hitherto receiving GH¢327 million (US$40.37 million) annually were uncovered [24]; and at Ghana's National Service Secretariat (NSS), 14,000 ghost national service personnel who were hitherto receiving GHC112m (US$13.83 million) annually were uncovered. [71]. From these two government agencies (SSNIT and NSS), therefore, Ghana's digitalization efforts will be saving the Government of Ghana GH¢439 million (US$54.20 million) annually from the 41,000 uncovered and deleted ghost names.

The implementation of various e-government programmes has greatly improved public service delivery to citizens and businesses in Ghana and Nigeria [23], [24]. Implementations of Nigeria's Gov Tech, GIFMIS, 1-Gov, REMITA and IPPIS platforms, for instance, are pivotal to its government's fight against corruption and bureaucracy; and they also foster quality and effectiveness of public service delivery to its citizens, residents and businesses [28], [60]. Similarly, the implementations of Ghana's GIFMIS, ICUM, Ghana.gov, Ghana Pay, e-VAT, Myassembly.gov.gh and e-justice systems/platforms are helping to foster both trust and transparency, and also reduce corruption and bureaucracy in public sector service delivery.

In furtherance of Ghana's digitization drive, it has undertaken a 4-year Public Sector Reform for Results Project (PSRRP) spanning the period 2019-2023 to improve both accountability and efficiency of work and service delivery in 13 key public sector organizations. This project saw a 260% increase in vehicle licensing at Driver and Vehicle Licensing Authority (DVLA)'s 33 operational centres nationwide from 700 to 2500 [72]. It also witnessed about 700,000 passport applications processed during the period August 2023 - May 2024 at the Passport Office, coupled with a massive reduction in passport production backlog. Also, Ghana's Births and Deaths Registry recorded an increase in birth registration rates from 58% in 2015 to 93% in 2023 [72]. Furthermore, technology adoption and associated digitalization at Ghana's Public Services Commission (PSC), Office of Head of Civil Service (OHCS) and Commission for Human Rights and Administrative Justice (CHRAJ) witnessed enhancements in confidentiality and efficiency in their operations during the period 2019-2023 [72].

Digitalization drives in Ghana and Nigeria over the last 7-8 years have increased the awareness of citizens, residents and businesses for ubiquitous financial and social inclusions using mobile phones, computers, and other devices for social media, e-commerce and e-business, and e-government services. The flexibility and 24-hour facilities that these online/digitalized services offer make many people and businesses want to use them. Also, digitalization has reduced the cost of doing business, and makes life easier for citizens by solving problems using the various public digital platforms available [7].

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Challenges to Public Sector Digitalization Programmes in Ghana and Nigeria

This section identifies and discusses the challenges facing the digitalization programmes embarked on in Ghana and Nigeria in the last decade; and this is in line with the Research Question #5 (RQ5).

RQ5. What are the challenges that face the public sector digitalization programmes that were rolled out on in Ghana and Nigeria in the last decade?

Researchers have identified that the challenges to public sector digitalization programmes in developing countries (including Ghana and Nigeria) include inadequate ICT infrastructure to drive digitalization efforts [notably: "accessibility, connectivity, low bandwidth, and the high costs that are associated with implementation of ICT projects" [22] p.123, digital divide in a country, inadequate financial resources, inadequate ICT skills, lack of political will to promulgate appropriate investor-friendly and ICT-friendly legal frameworks, inadequate education and training for users, political interference in the operations of ICT regulatory authorities, intermittent power outages, lack of intergovernmental agencies' integration, bureaucracy and red tape, lack of prioritization of ICT (development, adoption and sustenance) in national budgetary allocations, and inadequate stakeholder engagements [8], [22], [35], [41], [73], [74]. Furthermore, [32] has identified other challenges as high illiteracy and unemployment rates among citizens, organizations' vulnerability to cyber-attacks, employees' resistance to change, as well as domestic economic and political uncertainties and disruptions.

Access to sensitive information through hacking and digital related crimes (like identity theft, and advance fee fraud) are major threats and concerns for individuals, businesses and governments in Ghana and Nigeria. This, therefore, calls for more investment in cyber security [75], [76]. Also, insecurity in several parts of Nigeria caused delays for MTN to eventually kickstart its pilot testing of 5G network installations in Lagos, Ibadan, Maiduguri, Abuja, Kano, Port Harcourt, and Owerri [77]. Deployment of 5G networks is envisioned to propel the country's digitalization and digital transformation drives [78].

High costs of digital infrastructure and digital products in Ghana and Nigeria pose severe challenges to their digitalization efforts. Reference [44] argues that software and digital device are more costly in Sub-Saharan Africa (in US dollar terms) than in other regions of the world. This issue is compounded by the high import duties that are paid on digital equipment and goods. Therefore, [44] concludes that this high cost tends to deter firms from adopting digitalization. These have invariably led to inadequate ICT infrastructure to support the execution of digitalization projects in Ghana and Nigeria. For instance, internet penetrations in both countries are still low. This, therefore, calls for concerted efforts to be made to strengthen their telecommunications infrastructure and ICT adoption initiatives so as to propel their digitalization drives and digital transformations.

Public sector organizations in Ghana and Nigeria are often plagued with financial constraints due to inadequate budgetary allocations to support their digitalization operations. Compounding this issue, therefore, is improper procurement procedures that are often used which are at variance with the tenets of Public Procurement Acts in both countries. Also, there is prevalence of red tape, bureaucracy, and inadequate access to information, despite the enactment of Right to Information (RTI) Acts in Ghana and Nigeria. In addition, politicians in both countries often interfere with the operations of ICT-related regulatory authorities. Moreso, over the years, governments in both countries had not prioritized ICT (adoption and sustenance) in their national budgetary allocations.

Absence of national discourse on governments' digitalization efforts and activities is another challenge. Both Ghana and Nigeria do not have any legally binding national digitalization policy direction which any ruling government should adopt; rather various political parties have their own policy directions enshrined in their manifestos for implementation when they win an election. Thus, there is the likelihood that a new government may abandon some of the ongoing digitalization projects embarked on by the previous government. Furthermore, governments of both Ghana and Nigeria lack the political willpower to formulate and implement appropriate investor-and-ICT friendly legal frameworks to underscore their digitalization efforts to ensure system quality and improvements in the quality of socio-economic life of citizens and residents.

There is also inadequacy of personnel assigned to digitalization projects; and some of those assigned lack the requisite expertise (in terms of skills, technical knowhow, and experience). Also, in some public sector

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organizations in both countries, some employees make unethical and irresponsible use of information resources and systems (for example, downloading illicit or unauthorized software on office computers, not making regular backups of data, and improper care of data storage resources).

RECOMMENDATIONS

This section provides policy and strategy recommendations for digitalization projects' selection, design, development, implementation and integration in developing countries like Ghana and Nigeria. It also provides recommendations for governments, the African Union, and for future research.

A. Digitalization projects' selection, planning and design

i. The scope, objectives and deliverables of each digitalization project should be clearly provided in the project's terms of reference; and members of the Project Team should be selected based solely on their expertise (skills, knowledge and experience).

ii. Resources for each digitalization project (budget, personnel and computer resources) should be carefully budgeted for with focus on value-for money, project quality and timely delivery.

iii. Project planning/scheduling tools such as Work breakdown structure, Gantt chart or Microsoft Project, should be used to plan each digitalization project with its milestone deliverables clearly stated. Appropriate tools such as UML tools (use-case, dataflow diagrams, sequence diagrams, activity diagrams, and class diagrams), should be used to design the projects.

B. Digitalization projects development, implementation and integration

i. Appropriate system development and project management methodologies should be used for the digitalization projects so as to ensure good project quality. Also, appropriate implementation and performance measurement metrics should be used to evaluate the digitalization projects.

ii. Related digitalization projects should be seamlessly integrated to promote interoperability and user experience.

iii. Adequate documentation should be prepared for each digitalization project covering its entire life-cycle (from inception, through planning, design, development, implementation, integration and maintenance).

C. Recommendations for governments

i. Governments of Ghana and Nigeria should incentivize local and foreign digital entrepreneurs to complement them in digital infrastructure and services provision. Such public-private partnerships, (for instance, through build-operate-transfer [BOT] agreements), will bolster trust, and accelerate the development of digital economies of Ghana and Nigeria.

ii. Governments of Ghana and Nigeria should diligently and conscientiously source various budding ICT products, services and tools from Africa to promote the African Continental Free Trade Area (AfCFTA) initiatives.

D. Recommendations for the African Union

i. The African Union (AU) may consider instituting a peer-review mechanism for periodic assessment of the quality and impacts of public sector digitalization programmes in its 54-member countries, by using appropriate key performance indicators. This should be done in support of the African Union's Digital Economy for Africa (DE4A) initiative.

ii. The African Union (AU) may consider spearheading the conceptualization, design, development, and hosting of a real-time Continental Mobile Money (CMoMo) application/platform for people and businesses

to use for e-commerce and e-business transactions across Africa, using a common currency. This requires AU's active collaboration with the governments of member states, and development of the necessary policy/legislative framework(s) to guide the CMoMo initiative.

E. Recommendations for future research

Future research may consider performing comparative analysis of citizens' perceptions of public sector digitalization programmes in Ghana and Nigeria (-- the two biggest economies in West Africa in terms of economic growth and telecommunications network infrastructure development).

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