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FROM THE EDITORIAL DESKS

The Journal of Information, Education, Science and Technology (JIEST) publish by School of Science and Technology Education, Federal University of Technology, Minna, Nigeria released volume 4, No. 1 (June, 2017 Edition).

JIEST is a multi-disciplinary Journal that contains research findings on diverse topics in Information, Education, Science and Technology. The Editorial Board receives articles throughout the year.

My unreserved appreciation goes to the Dean, School of Science and Technology Education of the above University for her tireless efforts in making sure that the demand of the Editorial Board are always met, I thank the University management for assisting in disseminating information regarding this Journal using the University website and Bulletin.

I thank the Editorial Board for their good work and for ensuring that articles are published twice in a year (June and December). The efforts of the contributors to this volume are commendable. It is not easy to conduct a research and have it published. The Editorial consultants and Reviewers made their inputs towards improving the work of contributors and I really appreciate their efforts.

Our readers comments, advice, suggestions are welcome for further improvement on the quality of the Journal.

Dr. Yaki A. A.
Managing Editor.

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JIEST is the journal of researches in information, Education, Science and Technology of the School of Technology Education, Federal University of Technology, Minna. The editorial board of the journal welcomes scholarly and original articles (Theoretical and Empirical) on current issues in the fields of information, education, science and technology that possess national and universal application. In addition, the Journal also publishes scholarly and original articles from allied disciplines that have education significance and values.

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Digital Technology and Sustainable Development: Prospects and Challenges

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Abstract

In an era marked by rapid technological advancements, the integration of digital technology into sustainable development initiatives presents both unprecedented opportunities and significant challenges. This paper discusses the dynamic interplay between digital technology and sustainable development, focusing on the prospects of leveraging innovations such as artificial intelligence, Internet of Things, big data, and blockchain to drive economic growth, environmental sustainability, and social inclusion. It highlights the potentials of digital technologies to enhance efficiency, innovation, and inclusivity while addressing challenges like the digital divide, cyber security, and environmental impacts. Therefore, this paper highlights the necessity of balancing the benefits of digital innovations with their associated risks, offering policy recommendations to foster an inclusive and sustainable digital future

Key Concepts: Digital technology; Sustainable Development;

Introduction

The integration of digital technology in driving sustainable development has become increasingly crucial in Nigeria. The digital transformation of various sectors offers promising prospects for advancing economic growth, social inclusion, and environmental sustainability. The Nigeria government's commitment to leveraging digital technology for sustainable development is evident in several policy initiatives and investments. For instance, the development of digital public infrastructure (DPI), which includes projects such as the expansion of fiber optic networks and the enhancement of digital identity systems like the National Identity Number (NIN). These initiatives aim to create a robust foundation for digital activities and transformations that can support the Sustainable Development Goals (SDGs).

Additionally, the COVID-19 pandemic has accelerated the adoption of digital technologies across various sectors in Nigeria, revealing both opportunities and challenges. The education sector, for example, saw a shift towards online learning platforms, while digital financial services expanded to enhance financial inclusion among the unbanked population. Despite these advancements, issues such as inadequate digital infrastructure, cybersecurity threats, and digital skills gap remain significant hurdles.

Studies have highlighted the impact of digital technology on specific SDGs in Nigeria. For instance, the research by Annan-Diab and Molinari (2017) on the interdisciplinary approaches essential for integrating digital technology into educational frameworks to achieve SDG 4

(Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure). Additionally, the International Monetary Fund (IMF) emphasizes the role of digital financial services in fostering financial inclusion, which is critical for reducing poverty and promoting economic growth.

The Nigerian government's digital economy blueprint, outlined by the Ministry of Communications, Innovation, and Digital Economy, underscores the need for comprehensive digital infrastructure and effective regulatory policies. This includes the planned execution of extensive fiber optic networks and the integration of digital government services into a unified platform, known as the 1gov.ng concept. However, while digital technology offers significant opportunities for sustainable development in Nigeria, realizing these benefits requires addressing infrastructural and policy challenges. Continued investments in digital infrastructure, coupled with efforts to enhance digital literacy and cybersecurity are essential for creating a resilient and inclusive digital economy that can drive sustainable development.

Clarification of key concepts

In order to effectively prosecute the task of this paper, it would be necessary to clarify some very important concepts that will punctuate every page of this essay. These are Digital Transformation for Economic Growth; Environmental Sustainability through Digital Innovation: social inclusion and Digital Equity; Challenges of Digital Transformation; Development and Sustainable Development.

Digital Transformation for Economic Growth

Digital technology plays a crucial role in driving economic growth by enhancing productivity, fostering innovation, and creating new job opportunities. In Nigeria, the government's emphasis on digital public infrastructure aims to support economic diversification and reduce dependency on hydrocarbon revenues. Initiatives such as the expansion of fiber optic networks and the integration of digital services into a single platform (1gov.ng) are designed to boost the digital economy, thereby contributing to broader economic growth and stability.

Environmental Sustainability through Digital Innovation

Digital technologies like the Internet of Things (IoT), artificial intelligence (AI), and big data analytics can significantly enhance environmental sustainability. These technologies enable more efficient resource management, reduce waste, and mitigate environmental impacts. For instance, precision agriculture in Nigeria uses IoT and data analytics to optimize water and fertilizer use, improving crop yields while minimizing environmental harm. Similarly, smart city initiatives employ digital solutions to manage energy consumption and reduce carbon footprints.

Social Inclusion and Digital Equity

Digital technology has the potential to promote social inclusion by providing broader access to education, healthcare, and financial services. In Nigeria, digital financial services have been

instrumental in increasing financial inclusion among underserved populations. Efforts to expand digital literacy and skills are crucial for ensuring that all segments of society can benefit from digital advancements. Addressing the digital divide by improving access to technology in rural and underserved areas is a key challenge that must be tackled to achieve equitable social outcomes.

Development

The word development is multi-dimensional. It takes various forms and it is composed of diverse elements. Development could be seen as a social, economic, psychological and political phenomenon. Within this context, four major conceptions of development could be identified. The first is the modernization perspective which equates development with westernization. To the modernization theorists, a society is deemed as developing only when it is able to adopt western values, western socio-economic and political institutions as well as western pattern of consumption and standard of living (Stieglitz 1999 in Ogundiya, I.S.). This ideal has been heavily criticized on the grounds that it is Eurocentric, parochial and tautological

The second conception relates social and/or economic development to economic growth and the amount of wealth created in society. This measures development strictly in terms of Gross National Product (GNP). The major problem is that this conception pays little or no attention to the impact of the growth of the real situation of the people, in terms of how the GNP affects the actual quality and standards of life (Ekanola, 2007).

Sustainable Development

Having defined what development is, it will be pertinent to also say that sustainable Development is a development that meets the needs of the present generation without compromising the needs of the future ones (Ite, 2003).

It is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are made consistent with future as well as present needs. It is also an alternative development strategy for improving the living conditions of the human population without degrading the quality of the environment. The concept come into being following the realisation that economic development are closely linked, even though it was popularised by the report of the Brundt land Commission, which the United Nations General Assembly assigned to serve as long –term environmental strategies for achieving sustainable development (Boons, E.K (n.d))

Digital Technology, Crime, and Sustainable Development

The intersection of digital technology and crime presents multifaceted challenges to sustainable development efforts.

Opportunities

Enhanced Crime Detection and Prevention: Digital tools, such as predictive policing algorithms and surveillance technologies, aid law enforcement agencies in identifying and mitigating criminal activities. Real-time data analysis enables proactive interventions to enhance public safety (NIJ, (2013).

Transparency and Accountability: Blockchain technology offers immutable and transparent record-keeping mechanisms, fostering trust and accountability in governance, supply chains, and financial transactions. Decentralized platforms empower citizens to hold institutions accountable and combat corruption (Transparency International,(2019).

Challenges

Cybersecurity Threats: Cybercrime, including ransomware attacks, data breaches, and online fraud, undermines economic stability and public trust in digital systems. Strengthening cybersecurity measures, regulatory frameworks, and international cooperation is essential to combat evolving cyber threats (EUC, (2020).

Ethical Dilemmas: Digital surveillance practices raise ethical concerns regarding privacy invasion, civil liberties, and government overreach. Balancing security imperatives with individual rights and freedoms requires robust legal frameworks and public oversight mechanisms (Whitman and Herbert, 2019).

Digital Technology and Socio-Economic Development

Digital technology has the potential to drive socio-economic development, particularly in emerging economies like Nigeria (McKinsey & Company, 2018). The burgeoning tech ecosystem in countries like Nigeria holds immense potential for job creation, economic diversification, and innovation-driven growth (African Development Bank, 2017). However, infrastructure deficits and regulatory barriers pose significant challenges to realizing this potential (Nigerian Communications Commission, 2020).

History of Digital Technology and Sustainable Development

The history of digital technology intertwines with the evolution of sustainable development goals. Digital technology, stemming from the invention of computers, has progressed from mainframes to ubiquitous personal devices connected through the internet. Sustainable development, propelled by landmark reports, such as the Brundtland Report in 1987, gained momentum in Nigeria, with a focus on environmental conservation, economic growth, and social

equity. Over time, the integration of digital technology into sustainable development practices has become increasingly prevalent.

Prospects and Challenges of Digital Technology

Prospects

Data-Driven Decision Making: Digital technologies enable the collection, analysis, and visualization of vast amounts of data, empowering policymakers and businesses to make informed decisions. For instance, predictive analytics can anticipate environmental trends, aiding in disaster preparedness and resource allocation.

Inclusive Access to Services: Digital platforms expand access to essential services such as healthcare, education, and finance, particularly in remote or underserved regions. Mobile health applications facilitate remote diagnosis and treatment, bridging healthcare gaps.

Green Technological Solutions: The convergence of digital technology and sustainability fosters innovation in renewable energy, smart infrastructure, and circular economy practices. Technologies like blockchain enhance transparency and traceability in supply chains, promoting sustainable consumption.

Challenges

Digital Divide: Disparities in internet access, digital literacy, and technological infrastructure perpetuate inequalities, hindering the equitable distribution of benefits. Rural communities and marginalized groups often face limited connectivity and exclusion from digital opportunities (Qiang and Doherty, 2008).

Privacy and Security Concerns: The proliferation of digital data raises privacy concerns and vulnerability to cyber threats. Safeguarding personal information and securing digital infrastructure against hacking, data breaches and surveillance are paramount.

Prospects of Digital Technology in Sustainable Development in Nigeria

Digital technology holds significant promise for advancing sustainable development in Nigeria. With a growing digital economy and increasing mobile connectivity, Nigeria stands at the cusp of a technological transformation that could drive substantial socio-economic progress. Here are several key areas where digital technology is poised to make a significant impact:

Economic Diversification and Growth:

The Nigerian government has actively promoted the use of digital technology to diversify its economy, traditionally reliant on oil revenues. Investments in ICT infrastructure, such as expanding 4G and the rollout of 5G, are facilitating economic diversification. The development

of the digital economy is expected to enhance business operations, improve service delivery, and create jobs, especially in the tech sector. According to the Oxford Business Group, the introduction of digital payment systems and the naira digital currency are pivotal in increasing transaction volumes and financial inclusion.

Financial Inclusion and Empowerment:

Mobile money services have revolutionized financial transactions in Nigeria, particularly benefiting the unbanked population. The Central Bank of Nigeria's licensing of payment service banks has significantly expanded access to financial services, fostering economic inclusion and resilience. With mobile money, financial transactions are more transparent and secure, which helps in economic formalization and security.

Education and Skill Development:

Digital technology is also transforming education in Nigeria. Initiatives like the ITU and UNICEF's Giga project aim to connect schools to the internet, thereby improving educational outcomes. Ericsson's mapping of over 109,000 schools for network coverage is a step towards bridging the digital divide in education. This connectivity is crucial for nurturing digital talent, which is vital for sustaining Nigeria's digital transformation.

Healthcare and Social Services:

Digital health solutions are enhancing the delivery of healthcare services in Nigeria. Telemedicine and mobile health applications are making healthcare more accessible, particularly in remote areas. These technologies improve patient care, facilitate remote diagnosis, and streamline healthcare management. The integration of ICT in health services supports the broader goal of achieving the Sustainable Development Goals (SDGs), especially in improving health outcomes and reducing mortality rate.

Environmental Sustainability:

ICT solutions are essential in addressing climate change and promoting environmental sustainability. Digital technologies can optimize energy use, reduce waste, and enhance resource management. According to Ericsson's research, ICT has the potential to reduce global greenhouse gas emissions significantly, contributing to Nigeria's efforts to build a low-carbon economy.

Agriculture and Food Security:

Digital technology is revolutionizing agriculture in Nigeria by providing farmers with access to information on weather patterns, market prices, and best farming practices through mobile applications. These innovations are improving crop yields, reducing losses, and ensuring food security. Digital platforms also enable better supply chain management, reducing inefficiencies and enhancing food distribution.

The prospects of digital technology in driving sustainable development in Nigeria are vast and multifaceted. By leveraging ICT, Nigeria can accelerate economic growth, improve public services, and foster inclusive development. Continued investment in digital infrastructure and policies that promote digital literacy and innovation will be crucial for realizing these benefits. With the right strategies, Nigeria can harness digital technology to build a sustainable and prosperous future for all its citizens.

Challenges of Implementing Digital Technology in Nigeria

Implementing digital technology in Nigeria presents several significant challenges, which must be addressed to fully harness the potential of digital transformation for sustainable development. These challenges span across infrastructure, regulatory frameworks, digital literacy, and socio-economic factors.

Infrastructure Deficiencies

One of the primary challenges is the inadequate digital infrastructure. Despite ongoing efforts to expand internet connectivity, significant gaps remain, particularly in rural areas. According to the Nigerian Communications Commission (NCC), broadband penetration is still below global standards, limiting access to digital services for a large portion of the population.

Electricity Supply: The inconsistency of electricity supply further exacerbates infrastructure challenges. Frequent power outages hinder the operation of digital technologies, impacting everything from internet connectivity to the functionality of tech-based services and businesses.

Regulatory and Policy Barriers

Regulatory and policy issues also pose significant challenges. The regulatory environment in Nigeria can be unpredictable, with policies often changing abruptly. This creates uncertainty for investors and businesses in the digital sector.

Data Privacy and Security: There are also concerns regarding data privacy and cybersecurity. While Nigeria has made strides with the Nigeria Data Protection Regulation (NDPR), enforcement remains weak. This lack of robust data protection frameworks can deter businesses and individuals from fully embracing digital technologies.

Digital Literacy and Skills Gap

Another major challenge is the low level of digital literacy among the population. Many Nigerians, particularly in rural areas, lack the necessary skills to effectively use digital technologies. This skills gap limits the adoption of digital tools and hinders the growth of the digital economy.

Education System: The education system has not fully integrated digital literacy into its curriculum, which means that new entrants into the workforce are often not adequately

prepared for the digital demands of modern jobs. Efforts to improve digital skills training and education are crucial to overcoming this barrier.

Socio-Economic Disparities

Socio-economic factors also play a significant role in the challenges faced. High levels of poverty and income inequality mean that many Nigerians cannot afford digital devices or internet services. This digital divide exacerbates existing socio-economic inequalities, as those who are digitally excluded are often also economically marginalized.

The integration of digital technology into sustainable development in Nigeria presents both promising opportunities and significant challenges. This discussion explores the interplay between these elements, drawing insights from recent studies and practical implementations.

Opportunities and Benefits

Digital technology is pivotal in diversifying Nigeria's economy beyond its heavy reliance on oil. The expansion of the digital economy, facilitated by increasing broadband penetration and mobile connectivity, supports new business models and entrepreneurial ventures. Digital platforms like e-commerce and fintech are driving economic growth by creating new markets and improving access to financial services.

Enhancing Public Services

Digital technologies have the potential to revolutionize public services in Nigeria. Smart city initiatives in Lagos demonstrate how digital tools can improve urban management, reduce traffic congestion, and enhance public safety. Moreover, digital health solutions are making healthcare more accessible, particularly in remote areas, through telemedicine and mobile health applications.

Agricultural Productivity

In the agricultural sector, digital technology is addressing critical issues related to productivity and sustainability. Precision agriculture, which employs IoT and data analytics, helps farmers optimize resource use, improve crop yields, and enhance food security. Digital platforms that connect farmers with markets and investors also facilitate better access to capital and fairer prices.

Educational Access and Digital Literacy

Educational initiatives, such as the Giga project by ITU and UNICEF, aim to connect schools to the internet, thus bridging the educational digital divide. These efforts enhance learning outcomes and prepare students for a digital future by integrating technology into the educational framework.

Challenges and Barriers

Infrastructure Deficiencies

Despite the progress, significant infrastructure gaps persist. Inadequate broadband coverage, particularly in rural areas, and unreliable electricity supply hinder the widespread adoption of digital technologies. Addressing these infrastructure challenges is critical for enabling digital transformation across Nigeria.

Regulatory and Policy Hurdles

The regulatory environment in Nigeria can be complex and unpredictable, posing challenges for digital technology implementation. Issues such as data privacy, cybersecurity, and the enforcement of regulations like the Nigeria Data Protection Regulation (NDPR) need more robust frameworks and consistent application to build trust and security in digital platform.

Digital Literacy and Skills Gap

A substantial portion of the Nigerian population lacks the digital skills necessary to effectively use advanced technologies. This skills gap limits the potential of digital initiatives and exacerbates inequalities. Investments in digital literacy programs and the integration of digital skills training into the education system are essential to overcoming this barrier.

Socio-Economic Inequalities

High levels of poverty and income inequality mean that many Nigerians cannot afford digital devices or internet services. This digital divide not only limits individual opportunities but also hampers broader socio-economic development. Ensuring affordable access to digital technologies is crucial for inclusive growth.

Cultural Resistance

Cultural factors and resistance to change can impede the adoption of digital technologies. Overcoming this resistance requires community engagement and education to demonstrate the benefits and safety of digital tools. Such efforts can build trust and encourage wider acceptance and use of digital innovations.

The prospects of digital technology in advancing sustainable development in Nigeria are substantial. However, realizing these prospects requires addressing significant challenges, including infrastructure deficiencies, regulatory hurdles, digital literacy gaps, socio-economic inequalities, and cultural resistance. A concerted effort from the government, private sector, and civil society is essential to create an enabling environment for digital transformation. By tackling these challenges, Nigeria can harness the power of digital technology to drive sustainable development and improve the quality of life for its citizens.

Conclusion

In conclusion, the intersection of digital technology and sustainable development presents both opportunities and challenges in navigating the complexities of a changing world. The evolution of digital innovation, from its inception to its pervasive presence in contemporary society, intertwines with the narrative of sustainable development goals. As globalization redefines economic interconnectivity, climate change poses existential threats, and urbanization reshapes human habitats, the role of digital technology becomes increasingly critical in addressing pressing global challenges. Through an exploration of the prospects and challenges of digital technology, this paper has highlighted the transformative potential of data-driven decision-making, inclusive access to services, and green technological solutions in fostering sustainable development practices. However, it has also underscored the need to address challenges such as the digital divide, privacy concerns, cyber security threats, and the environmental footprint of digital technology.

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