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Economic Development Conference

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THEME: PERSPECTIVES ON DEVELOPING & SUSTAINING THE NIGERIAN ECONOMY

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14TH NATIONAL STRATEGIC RESEARCH AND ECONOMIC DEVELOPMENT CONFERENCE

VENUE - UNIVERSITY OF PORT HARCOURT

THEME
Perspectives on Developing & Sustaining the Nigerian Economy

DATE: Wednesday 30th - Thursday 31st July, 2025

TIME: 10:00am

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CONFERENCE PROGRAMME

DAY ONE – Wednesday 30th July, 2025
Arrival of Guest/Conferees/Delegates

DAY TWO – Thursday 31st July, 2025

OPENING SESSION/AWARD/PLENARY

Conference Registration	-	9:00am – 10:00am
Opening Prayer/Welcome Remark	-	10:00am – 10:15am
Institutional Brief/Chairman's Opening Remark	-	10:15am – 10:30am
Plenary Session	-	10:30am – 12noon
Launch Break/Group Photograph	-	12noon – 1:00pm
Plenary Session 2/Research Training	-	1:00pm – 4:00pm
Policy Review Session	-	4:00pm – 5:00pm

DAY THREE – Friday 1st August, 2025
Departure of Guest/Conferee/Delegates

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14TH NATIONAL STRATEGIC RESEARCH
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VENUE - UNIVERSITY OF PORT HARCOURT | WED. 30TH - THU. 31ST JULY, 2025

THE ROLE OF ICT IN PROVISION OF LIBRARY SERVICES IN POST-CONFLICT SOCIETY

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Abstract

This paper is an attempt to explore the crucial roles of Information and Communication Technology (ICT) in management and provision of library services, and its implication to sustainable development in Nigeria. Despite the availability of wide opportunities offered by the advent of ICT, it has been observed that application of ICT to library services in Nigeria seems inadequate probably due to variety of challenges. The paper aims to highlight the ICT based services in libraries, benefits of ICT and the role of library in sustainable development of Nigeria. The paper further identified the challenges of ICT application in libraries. It was recommended among others that; there should be improvement in the capacity and level of ICT adoption by libraries.

Keywords: *Information and Communication Technology (ICT), Libraries, ICT-based library services, Nigeria.*

Introduction

Information Communication Technology (ICT) has remained a catalyst in the issue of national advancement and development. Information, as power is effectively an infinite resource and a vital tool needed for the development of all sectors in any nation. It is therefore, imperative that application in libraries would go a long way in satisfying the information need of the citizens. It is worthy of note, that the emergence of ICT has impacted greatly on the quality of information provided through libraries, it also enables proper and adequate provision of library services to a library user from all disciplines. In this 21st century, the drastic role of ICT in library operations cannot be over emphasized. Many library routines and operations that were initially performed a manually are now being converted to computerized operations which means, applications of ICT techniques to providing better and faster services to the end users. A nation without functional libraries and information centres may lack access to information that would enable her sustainable development, in this era of globalization, in which the world is connected, information gains it's a power through permanent storage and wide distribution, which could be achieved through ICT.

According to Janakiraman and Subramaniah (2015), the world now experiences a digital scenario in which ICT has changed the possibilities of the library job promotions and has brought changes to expected library performances. ICT is a generic term that refers to the technologies that are used to collect, store, edit and communicate information in various format (Rau, 2018). The use of ICT improves access to digital information, narrows down the digital divide and also improves standard of living. Adoption of ICT in libraries is a way of improving on information services provided in libraries. This is an era, when people need to access timely information with ease, and this can only be done through the application of ICT to library services. It is also a way of contributing to sustainable development of the nation, since timely and effective provision of useful information can assist in building up a society ICT as an enabling tool, assist libraries in provision of information, which is very paramount to development of the various sectors in the nation. Libraries are playing a very important role facilitating access to global information and knowledge resources, using ICT.

Apparently, ICTs are indispensable tools needed for provision of value-added information that support the sustainable development. Although, many institutions and organizations including libraries face diverse challenges in the process of integrating ICTs to their services. Nevertheless, information provision is paramount to development and growth of any nation. It is therefore important that, effort is made to enable usability of JCTs in all sectors, of the nation ICT and library services. Information and communication technology are the application of technologies consisting of hardware, software, network and media for collection, storage processing transmission and presentation of information in vocal, textual, pictorial and multimedia formats, (Igwe, 2011). ICT is a term used in the library to refer to application of computers and other technologies to library practices such as acquisition, storage, organization and dissemination of information. The world has become a global village and with ICT, many library users now have access to vast sea of information, without necessarily investing much time or energy. The process of generally and distributing information is now being facilitated through the use of ICT.

Aina, Okunnu and Dapo-Asaju (2014) postulated that ICT is a term used to describe the ability to access information with the use of telecommunication-based internet resources. ICT provides the ability to create, organize, manipulate and access information from remote locations across the globe, within a short time. ICT involves incorporation of a range of technologies that are used to

support communication and information dissemination. Saidu, Tukur and Adamu (2014) described ICT as the use of computer-based technology and internet for making information and communication services available to a wide range of users. The term is broadly used to refer to a range of technologies including telephones, e-mail and so on. Central to the range of technologies is the internet, which provides the mechanism for transporting data in a number of formats such as text, images, sound and video. ICT is system that enables information to be collected, analyzed, processed and disseminated. Olise (2010) opined that information communication technologies (ICTs) are new technologies that cannot be ignored in Africa. He further identified that ICTs are significant tools that must be employed to achieve and sustain development.

The advent of ICT is indeed a boost to the library services as it now assists many librarians to use their ICT potentials to reach out to library users. Chisenga (2004) identified some of the ICT-based services that are provided by libraries as follows:

i. **Provision of web access to OPAC:** Libraries are providing access to web-based Online Public Access Catalogue (OPAC) interfaces. The OPAC makes it easier for users to access and use information resources. OPAC is the computer form of library catalogue, to access materials in the library (Afolabi and Abidoye, n.d.)
ii. **Electronic Document Delivery**: Libraries implement ICT-based interlibrary lending system, through the use of electronic networks for documents delivery. In essence, the Document Delivery Service (DDS) enables a library to use copies of research papers or other research document, from other libraries. These documents could be journal articles or other documents in digital format. They are mainly in portable document format (PDF) and they delivered to library users' desktops.
iii. **Online Instruction/User Education**: There is implementation of online based bibliographic or library user programmes such as online tutorials on searching online resources and virtual tours of library collections. Libraries can also use internet or CDRoms to educate users.
iv. **Online Readers Advisory Services**: Libraries now implement web-based versions of reader's advisory services to include informing users about new acquisitions, provide reviews and recommendations and so on in using the web.
v. **Networked Information Resources**: Libraries now provide users with access to networked information such as database, electronic scholarly journals and other publications from various publishers.

The services rendered in a library differ from one library to another, depending on the type of library, the type of patrons and the parent body's objectives. Other library services as highlighted by Idowu (2011) include:

i. Reference Service
ii. Current Awareness Services (CAS)
iii. Selective Dissemination of Information (SDI)
iv. Reprographies Service
v. Exhibition and Display
vi. Technical Services
vii. Serials Control
viii. Computerized Interactive Search
ix. Borrowing, Renewing and Reserving

Reprographies Technology: These are widely used in libraries globally. Reprographies machines are provided in libraries to ease photocopying of documents on demand.
Library Retrieval System: This involves the use of compact disc read only memory (CDROM), a technological mechanism for acquisition of specialized CD-ROM databases in various discipline such as law, sciences, medicine technology, agriculture, humanities and so on.
Indexing and Abstracting Services: It is a service that is carried out to provide summaries of documents and also to assign descriptors for referencing documents.
Institutional Repositories: It is an online archive for collection, preservation and dissemination of digital copies of the intellectual output of academic or research of institution, this could be journal articles as well as digital versions of theses and dissertations. This service is mostly provided in academic or research libraries.
Document Scanning Services: Scanner is important equipment in modernization of library. It is useful for scanning text, image and content page of books and providing great help for establishing digital and virtual library.

Benefits of ICT in Libraries
Globalization driven by ICT is presently having phenomenal impact on library practices TCTSs are significant and useful tools for sustainable development in all fields and all aspects of r our society. ICTs provide means to actualizing developmental goals in education, health, agriculture, business and commerce among others. According to Olise (2010), the introduction of ICTs in education had brought about computerization of traditional materials such as books, journals newspaper and other information resources in the library. This has also led to the existence of virtual library. Educational researchers, through the use of ICT can access current literature materials with ease. ICTs also encourage collaboration among researchers irrespective of their locations.

Internet provides up-to-date information on any subject. Likewise, earlier research findings can be easily accessed through the internet. In the area of agriculture, ICTs are being used to provide farmers with information as regards their plants and animals, which will eventually improve their productivity. On professional duties, computers are used to automate different manual functions. Acquisition, cataloguing of library materials, circulation, cataloguing of library materials, circulation and serials management are now automated in libraries, using available software in the r market. ICTs enable libraries to locate store, retrieve and disseminate information. ICT tools such as CD-ROM, e-mail are used in libraries for dissemination of information. In addition, digitization of information resources which involves converting print resources to electronic form is also carried out, using ICT.

Other benefits of ICT in libraries as stated by Ashikuzzaman (2014) include:
Provision of speedy and easy access to information.

i. Provision of remote and round the clock access to users.
ii. Provision of access to unlimited information from different sources.
iii. ICT enable easier, faster, cheaper and more effective library operations.
iv. ICT helps to manage information overload as information retrieval is made easier in computerized systems.
v. Computerization helps the library to save space and reduce paper.

There is no doubt that integration of ICT into provision of library services is able to bring great benefits to the entire community and nation. ICT which remains an enabling tool for provision of

timely and current library and information services is also indispensable to the sustainable development drive in Nigeria (Nwabueze and Ozioko, 2011) ICT can be applied to every aspects of human endeavor to achieve result-oriented service delivery. In his study, Olise (2010) found out that majority of the respondents see ICTs as significant tool for sustainable development in Africa. The respondents believed that ICTs improve education and other sectors' services. Using ICT tools, enable organizations and institutions to provide services more effectively.

ICT Resources in Libraries for Sustainable Development

ICT as aggregate of computers, telecommunication gadgets, multi-dimensional resources and other related technologies are applied and utilized in the total process of information management and dissemination. The various components of ICT have provided a facelift for the support of varying professional services. Nwabueze and Ozioko, (2011); Umana (2018) identified the following primary ICT resources as imperative in actualizing Nigeria's sustainable development goal. Likewise, the same ICT resources are paramount to effective delivery of library services. The ICT resources include:

i. **Computers;** These are essential management tools which can be used to handle different operations more efficiently. Computers can be used for various activities such as information generation, processing, storage, analyzing and information dissemination for sustainable development. The use of computers in the library is noted with great assets such as speedy information transmission, cost effectiveness and optimal utilization o available resources. Other computer accessories include CDs, Flash drive and so on. The computers are used to perform various library operations and routine such as ordering/acquisition, circulation e.t.c.
ii. **The Internet:** This ICT resources is a means to speedy flow of information. It is a network of computers, communicating with others, often via telephone line. The internet provides a worldwide platform for information sharing among individuals, institutions and organizations. The use of internet enables the provision of current and useful information to enhance productivity and good governance.
iii. **Electronic Mail (E-mail):** This is the most widely used resource of the internet. It is used for sending and receiving of messages otherwise known as mails. The messages are communicated through electronic device. E-mail enables faster and cheaper organizational communication
iv. **World Wide Web (WWW):** This is also an internet- based resource. Websites help individuals, organizations or institutions find products or information and transacts business. Relevant information is made available to members of the public through the websites of many organizations or institutions. Being on the web, places any nation or organization on the right cause of speedy and sustainable development in line with emergence of changes in technology, economic and political area.
v. **Video Confereneing:** This enables people at different locations to hold conferences by data communication network. It is convenient and less expensive for conducting a conference between two or more participants situated at different remote location (Mishra and Mishra, 2014).
vi. **Printing Technology**: A printer is a device that converts computer output into printed images, there are different kinds of printers used in library. They include Laser printer, Inkjet Dot-matrix printer and so on.
vii. **Online Public Access Catalogue (OPAC):** It is the computer form of library catalogue to access information materials in the library. It is an online database of materials held by a

library or group of libraries, It is a computerized library catalogue made available to the public. Most OPACs are accessible over the internet to users all over the world (Mislira and Mishra. 2014).

The Role of Library in the provision of Information for Sustainable Development

Information is a vital tool for development and there is no nation that can experience developmental sustainability without continuous flow of relevant information. Libraries are majorly concerned with the acquisition, organization. Dissemination and preservation of information to educate and enlighten the citizens. The development of any nation depends on provision of relevant, adequate and timely information on education, security, health and so on.

Access to such information are provided in various formats through the libraries. Library is a place where knowledge is created and shared. It is a storehouse where knowledge in various formats, be it print or electronic is preserved. There are different kinds of libraries which include academic, school, public, national and special library. The library, irrespective of its kind perform various roles. According to Afolabi and Abidoye (n.d) the primary role of the library is to provide information service to support the educational, recreation, cultural, economic and techno logical endeavours of members in their respective communities. It's no doubt that library is one of the organizations that can help the nation to achieve and sustain development. Library also, cannot fulfill this obligation if it continued to rely on the traditional methods of disseminating information. Therefore, there is need for libraries to employ reliable and potential tools like internet and other information and communication technologies (ICT5) to support, economic social and political sustainability.

Clise (2010) simply put sustainable development as developing for the present and future. It is the process of ensuring that the present development is sustained and maintained for the future. Sustainable development focuses on the need to build the nation for the future, through the process of improving the citizens' lives for the future. Adejumo and Adejumo (2014) viewed sustainable development as efficient management of resources for human survival taking into consideration both the present and future generation. To achieve sustainable development in a globalizing world, there is need for timely intonation that will leads to the right decision making and that will inform certain actions. The digital divide must be bridged to enable easy accessibility to intonation by the citizens. Bradley (2014) affirmed that libraries contribute to sustainable development. The libraries provide access to data and knowledge that support informed research which is instrumental to achieving sustainable development goals. ICT has paved ways for libraries to use ICT creatively in order to enhance service delivery to the users.

Challenges of Using ICT for Provision of Library Services

There is awareness that a lot of benefits are derived, through the adoption and use of Information and Communication Technologies (ICTs) in libraries, nevertheless, there are many challenges to be addressed. These include:

i. **Limited Financial Resources**: The acquisition and maintenance of the relevant equipment depends on the availability of fund. Mostly, there is paucity of funds in many libraries in Nigeria thereby, leading to inability to acquire, the necessary ICTs that would enable them connect to the internet, make subscription to various online database and obtain software licenses.
ii. **Shortage of ICT Facilities and ICT Skills:** The computers are used to receive and store large volumes of information. Likewise, the internet accessibility is made possible through

the use of computer, they are used to access Online Public Access Catalogue (OPAC) and also to perform many other routine activities in the library. Shortage of computers and other facilities remains a big challenge to many libraries. Many librarians also lack the ICT skills and this makes it difficult for them to embrace technological innovations. Lack of ICT skills places a serious restriction on the application of ICT to provision of library services.

Most African countries do not have workable ICT policies which are to act as guideline for implementation of development plans and strategies. When ICT policies are not available or adequately implemented, it can affect the sustainability of a nation's development.

i. **Lack of ICT Policies:** There is lack of systematic ICT policy in developing Countries and it impedes the deployment of ICTs (Afolabi and Abidoye, n.d).
ii. **Poor maintenance of ICT Equipment**: Many libraries do not have space and conducive environments for keeping ICT equipment. In addition, most of the ICT equipment are not adequately maintained in most libraries as a result of the maintenance cost which is usually very high. Also, as a result of lack of maintenance culture.
iii. **Erratic Power Supply**: In developing countries, large areas are still without a reliable supply of electricity (Said, Tukur and Adamu, 2014). Other challenges are;

i. Insufficient bandwidth.
ii. Lack of technical IT knowledge by library staff.
iii. Constant change of software and hardware.
iv. Copyright and intellectual property right management.

Conclusion

Application of ICT to provision of library services is a crucial effort towards sustainable development of Nigeria. Therefore, for libraries to remain agents that will facilitate sustainable development, efforts must be made to provide the right information at the right time. With the ICT in place, the objectives of libraries will not only be achieved but it will also help libraries to compete with their counterparts in the developed world. Developing countries like Nigeria must also recognize ICT as key strategic tool for sustainable development. Organizations, institutions including the library must be supported and encouraged to embrace and utilize ICT for efficient and effective delivery of service.

Recommendations

Based on the conclusions above, it is recommended that:

i. Fund should be provided to libraries on regular basis. All libraries, irrespective of the type need strong financial support from the parent organization.
ii. Provision of standards standby generator in libraries, to serve the computers and other ICT facilities in case of power outage. In addition to this, the Nigerian government in particular, should strive to permanently solve the challenges confronting the power sector.
iii. The librarians must become higher system thinkers and fully equip themselves to work in digital and computer environment.
iv. The Nigeria Library Association NLA) and National Library of Nigeria (NLN) must encourage and ensure that libraries acquire ICT tools for effective library operations and information disseminations.
v. Policies that would encourage the deployment and development of ICTs in all institution should be formulated and implemented for the nation's development to be sustained.

vi. The government of Nigeria should make library and information services, a part of national development initiatives and plans.
vii. Training and retraining of all category's library staff should be organized on regular basis. The ICT largely depends on ability of staff to operate ICT facilities. The training should include needed skills and techniques for data input into the computer, internet surfing and using different telecommunication facilities to exchange information.

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ANALYSIS OF AVEARGE SOLAR RADIATION IN KEBBI STATE: AN ARIMA APPROACH

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Abstract

*Electric power consumption has significantly increased in recent decades. Traditional energy sources such as oil, coal, and nuclear power have a negative impact on the environment. As a result, researchers have shifted attention toward renewable sources such as solar, wind, and marine energy. Solar energy production has grown significantly over the last decade, but power fluctuation driven by the variability of solar radiation remains a challenge. This study analyzes daily average solar radiation data for Kebbi State, Nigeria, using the ARIMA modeling approach, with data sourced from the Nigerian Meteorological Agency (NiMet), Birnin Kebbi for 34 weeks and 4 days (from **1st November 2024 to 30th June 2025**). After model identification and evaluation based on AIC and BIC criteria, ARIMA (1, 1, 2) was selected as the optimal model. The fitted model equation is:* $Y_t = 2.60346e\text{-}05 - 0.0424045_{t-1} - 1.90854_{t-1} + 0.908543_{t-2}$. *The model successfully captures short-term dynamics in the radiation pattern and was used to forecast solar radiation levels for 150 days ahead. This forecasting framework offers a valuable tool for energy planning and solar power deployment in semi-arid regions like Kebbi State.*

Keywords: *ARIMA, PACF, Solar Radiation, ACF, KPSS*

Introduction

In an era marked by climate volatility and the urgent need for sustainable energy, solar power has emerged as a cornerstone of global energy transitions, particularly in sun-drenched regions such as sub-Saharan Africa. With increasing solar irradiance levels and declining technology costs, solar energy offers a viable pathway to electrify underserved areas and reduce carbon dependency. This is especially relevant in Nigeria, where over 45% of the rural population remains off-grid, and power outages persist even in urban centers (International Energy Agency, 2023). One of the critical components of successful solar energy deployment is the accurate forecasting of solar radiation, which underpins decisions in photovoltaic (PV) system design, grid integration, and energy policy modeling. In regions like northern Nigeria, where resource availability is high but planning data is scarce, radiation forecasting becomes not just a technical necessity, but a developmental imperative (Addo et al., 2023).

Time series forecasting methods have gained prominence due to their ability to uncover trends, seasonality, and temporal correlations in historical solar data. Among these, the AutoRegressive Integrated Moving Average (ARIMA) model remains a widely applied tool because of its transparency, low computational burden, and effectiveness for linear short-term forecasting (Obiora, Adepoju, & Agbakwuru, 2023). ARIMA models also serve as effective benchmarks against which more complex machine learning models are compared. Nonetheless, ARIMA is limited in modeling the nonlinear characteristics common in meteorological datasets, especially under tropical conditions. As a result, researchers have begun exploring hybrid modeling frameworks that fuse ARIMA's linear pattern recognition with the nonlinear learning strengths of machine learning algorithms. Atiku and Oyedepo (2023) developed a hybrid ARIMA-LSTM model for solar prediction in West Africa, achieving significantly improved accuracy. Similarly, Zuma and Thwala (2024) implemented a SARIMA-ANN model under South Africa's fluctuating climatic regime, highlighting the benefits of model integration.

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Another complementary development is the adoption of decomposition-based models, such as Seasonal ARIMA (SARIMA) and Facebook Prophet, which are well suited for capturing complex seasonalities inherent in solar radiation data. In a comparative study in Ghana, Addo et al. (2023) showed that both SARIMA and Prophet could effectively model weekly and monthly irradiance cycles, outperforming traditional linear-only methods. Furthermore, Mubarak and Adebayo (2024) evaluated ARIMA, LSTM, and Prophet for radiation forecasting in Ibadan, Nigeria, concluding that model performance is highly data- and location-dependent.

Statement of the Problem

Electric power consumption has significantly increased in recent decades. Traditional energy, such as oil, coal and nuclear, has a negative impact on the environment. Despite Kebbi State's high solar energy potential, the region lacks localized solar radiation forecasting models grounded in real observational data. Most existing studies in Nigeria focus on southern or urban areas and rely on satellite-derived or monthly-averaged data, which fail to capture the short-term variability crucial for accurate energy planning in semi-arid zones. This study addresses this gap by applying an ARIMA model to daily solar radiation data in Kebbi State to support regional energy planning and provide a foundation for future hybrid modeling specifically for Kebbi State.

Aim and Objectives

The aim of this research is to analyze the data of **daily average solar radiation** for Kebbi State, an ARIMA approach using data sourced from the **Nigerian Meteorological Agency (NiMet)** Birnin Kebbi, Kebbi State, Nigeria. This can be achieved through the following formulated objectives:

i. To assess the stationarity of the time series using appropriate statistical tests such as the Augmented Dickey-Fuller (ADF) and KPSS tests.
ii. To identify and fit the optimal ARIMA model by analyzing autocorrelation and partial autocorrelation structures, and selecting based on AIC/BIC criteria.
iii. To generate short- to medium-term forecasts (e.g., 150 days ahead) of solar radiation using the fitted ARIMA model.

Existing Work

Atiku and Oyedepo (2023) developed a hybrid model integrating ARIMA and LSTM to forecast solar radiation in Nigeria. The training dataset consisted of daily solar irradiance from a 3-year period (2019-2022). The model architecture included an ARIMA component to capture linear patterns and an LSTM layer to model residuals. Forecast accuracy improved significantly, with RMSE reduced by over 20% compared to standalone models. Zuma and Thwala (2024) proposed a hybrid SARIMA-ANN model to forecast solar energy in South Africa. The dataset covered daily solar radiation across four climate zones over five years. SARIMA modeled seasonal linear trends, while an ANN component corrected non-linear deviations. The hybrid approach outperformed SARIMA alone, achieving a mean absolute percentage error (MAPE) of 7.2% in test scenarios.

Mubarak and Adebayo (2024) compared ARIMA, LSTM, and Prophet models using three years of solar radiation data collected in Ibadan, Nigeria. ARIMA performed better in terms of interpretability and speed but underperformed during high-variance seasonal transitions. Prophet achieved the best forecast accuracy (MAPE = 4.8%), especially during dry-season peaks, making it suitable for short-term solar deployment planning. Addo, Opoku, and Kyei (2023) conducted short-term solar radiation prediction using SARIMA and Prophet in Ghana. The dataset spanned four years, with a focus on the Harmattan season. Prophet models performed better under irregular seasonal events, while SARIMA struggled with sudden drops due to dust events. Prophet's built-in changepoint detection helped adapt forecasts to climate variability. Zerouali, Ennaji, and El Bouardi (2025) used ARIMA, SVM, and hybrid techniques to forecast pan evaporation in Morocco, a proxy for solar radiation modeling. A five-year dataset (2017-2021) was used. ARIMA alone showed good performance in stable months, but hybrid ARIMA-SVR achieved higher accuracy overall with RMSE reduction up to 35%, particularly during high solar months.

Study Area

This study focuses on Kebbi State, located in northwestern Nigeria, lies approximately between latitudes 10°N-13°N and longitudes 3°E-6°E. The region is characterized by a semi-arid Sahelian climate, marked by a long dry season (October to May) and a short-wet season (June to September). The annual solar irradiance levels are among the highest in Nigeria, with average daily solar radiation ranging from 4.8 to 6.1 kWh/m²/day, making it an ideal site for solar energy harvesting.

However, limited meteorological stations and poor energy infrastructure in the state create gaps in renewable energy planning. Therefore, building localized forecasting models can enhance

decision-making for solar farm siting, off-grid electrification, and agricultural scheduling. This study focuses on forecasting daily average global solar radiation (GSR), a critical input for photovoltaic and solar thermal system design.

Figure 1: Map of Nigeria showing Kebbi state

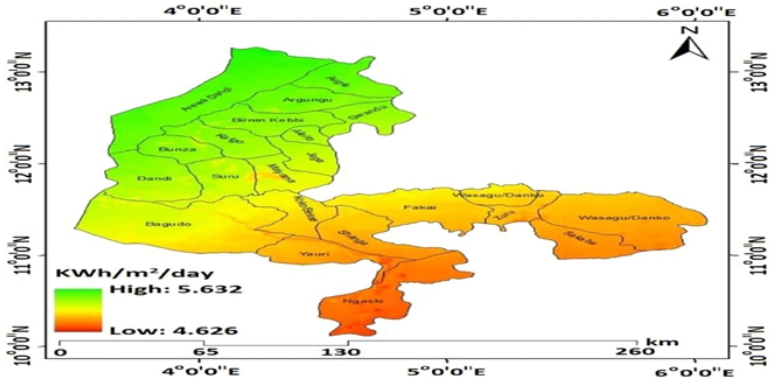

Figure 2: *Map of Kebbi State showing regions with high and low solar radiation*

Material and Methods

This study used daily average global solar radiation (GSR) data for Kebbi State, Nigeria, covering the period from 1st November 2024 to 30th June 2025. The dataset, comprising 242 daily observations, was sourced from the Nigerian Meteorological Agency (NiMet) at Birnin Kebbi. All measurements were recorded in kilowatt-hours per square meter per day (kWh/m²/day) and included minimum, average, and maximum values to capture natural variability in solar radiation.

To analyze the data, the ARIMA (Auto Regressive Integrated Moving Average) model was applied using the Box-Jenkins methodology. The procedure includes four primary stages: identification, estimation, diagnostic checking, and forecasting. Model implementation and statistical analysis were conducted using Gretl Statistical Software.

The ARIMA model is specified as ARIMA (p, d, q), where:
p is the order of the autoregressive part,
d is the number of differences required to make the series stationary,
q is the order of the moving average part.

The general structure form of an ARIMA model is expressed as follows:

$$X_t = C + \phi_1 \Delta^d X_{t-1} + \cdots + \phi_p \Delta^d X_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \cdots + \theta_q \varepsilon_{t-q}$$

Where, $\Delta = (1 - L)$

This can be written in the general form:

$$\Phi(L)(1-L)^d y_t = \Theta(L)\varepsilon_t \qquad \text{Where}$$

$$\Phi(L) = 1 - \phi_1 L - \phi_2 L^2 - \phi_3 L^3 - \cdots - \phi_p L^p$$

$$\Theta(L) = 1 + \theta_1 L + \theta_2 L^2 + \theta_3 L^3 + \cdots + \theta_q L^q$$

Where $\Phi(L)$ and $\Theta(L)$ are polynomials in the lag operator, and have no common root, L is defined such that $L^n X_t = X_{t-n}$ $(1-L)^d = \Delta^d$ =difference operator of order d ε_t = a white noise process. X_t = the observation under study (maternal mortality ratio)

AR = Autoregressive polynomial $\Phi(L)$.

MA = Moving average polynomial $\Theta(L)$.

Results

The dataset was analyzed to develop a suitable ARIMA (p, d, q) model. Below are time plots of minimum, maximum, and average solar radiation (Figures 3 and 4) show wave-like behavior, suggesting cyclical patterns and potential stationarity. Visual inspection indicated a relatively stable mean and variance, implying that the data may be stationary or near-stationary.

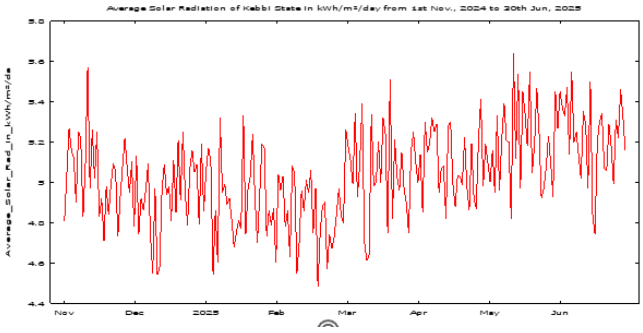

***Figure 3**: Time Plot of Daily average Solar Radiation in Kebbi state from 1st November, 2024 to 30th June, 2025*

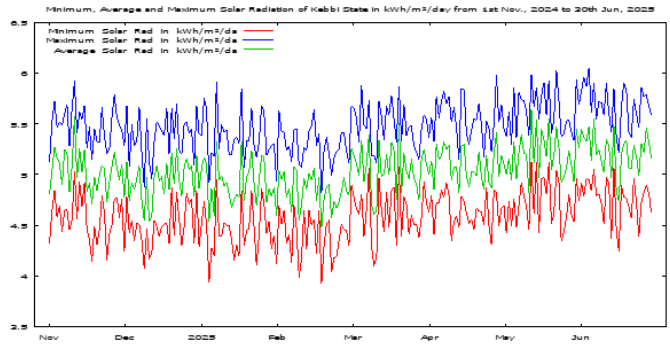

Figure 4: *Time Plot of Daily (Minimum, Average and Maximum) Solar Radiation in Kebbi state from 1st November, 2024 to 30th June, 2025*

Stationarity test

Initial visual inspection using time series plots of the original and differenced data suggested that the series may be stationary when differenced. The plots demonstrated a consistent mean and variance over time. To confirm stationarity, both graphical methods and statistical tests were employed. The autocorrelation function (ACF) exhibited a cyclical decay, while the partial autocorrelation function (PACF) showed a damped cutoff, indicating that the series is likely a mixed AR and MA process. Differencing was applied once to stabilize the series. The plot of ACF and PACF for before and after the first-differenced series (Figure 5 and 6) further confirmed the absence of a trend and variance instability, supporting the assumption of stationarity.

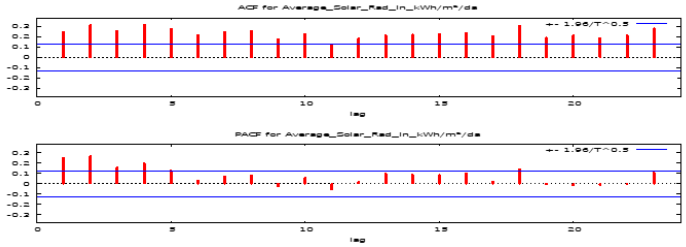

Figure 5: *ACF and PACF Plot of Daily average Solar Radiation in Kebbi state from 1st November, 2024 to 30th June, 2025*

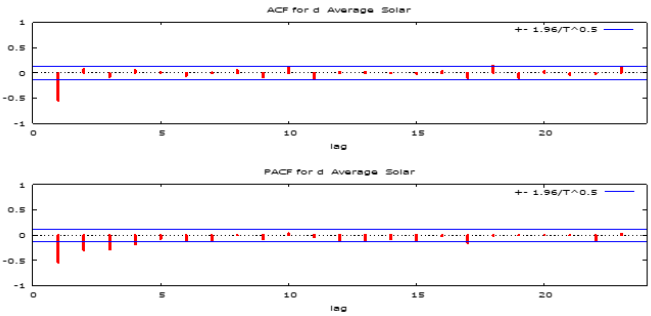

Figure 6: *ACF and PACF Plot of Daily average Solar Radiation in Kebbi state from 1st November, 2024 to 30th June, 2025 after first difference*

Unit Root Test

To statistically confirm the stationarity of the differenced series, the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests were conducted. The ADF test, applied with both constant and trend, rejected the null hypothesis of a unit root at the 5% significance level (test statistic: -18.6835, critical value: -3.41, p-value: < 0.0001). The KPSS test supported the ADF results by failing to reject the null hypothesis of stationarity (test statistic: 0.01297 < all critical values).These results confirm that the differenced series is stationary, justifying the use of ARIMA modeling with d = 1.

Table 1: Augmented Dickey-Fuller Test Results for d_Average_Solar

Series	Difference Order	Model Type	5% Critical Value	Test Statistic	Interpolated P value
d_Average_Solar	1st Difference	With Constant	-2.89 (approx.)	-18.7168	7.52E-45
d_Average_Solar	1st Difference	Constant & Trend	-3.41 (approx.)	-18.6835	6.39E-58

Table 2: Results of the KPSS Test at First Difference

Series	Test Statistic	10% Critical Value	5% Critical Value	1% Critical Value	Stationarity Decision
d_Average_Solar	0.01297	0.348	0.463	0.74	Stationary (since 0.01297 < 0.463, 0.348 and 0.74)

Model Fitting

Several ARIMA model configurations were tested to determine the best-fitting model based on Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). Candidate models included ARIMA (1,1,1), ARIMA(1,1,2), ARIMA(2,1,1), and ARIMA(2,1,2). As shown in Table 3, ARIMA (1,1,2) yielded the lowest AIC (-60.35) and BIC (-42.95) values, indicating the best fit. The model parameters were estimated as follows:

Constant: 2.60346e-05 (p = 0.167) AR(1): -0.0424045 (p = 0.575)
MA(1): -1.90854 (p < 0.00001) MA(2): 0.908543 (p < 0.00001)

The final model equation is: $\mathbf{Y_t = 2.60346e\text{-}05 - 0.0424045_{t-1} - 1.90854_{t-1} + 0.908543_{t-2}}$

Table 3: Results of ARIMA model identification for Daily average Solar Radiation

MODEL	Log-likelihood	Akaike Information Criterion	Bayesian Information Criterion
ARIMA (1, 1, 1)	1.996732	4.006536	17.92909
ARIMA (1, 1, 2)	35.17610	-60.35220	-42.94900
ARIMA (2, 1, 1)	13.96802	-17.93603	-0.532836
ARIMA (2, 1, 2)	35.62798	-59.25595	-38.37212

Analysis of Residual

Residual diagnostics were performed to validate the model adequacy. The ACF and PACF of residuals showed no significant autocorrelations, indicating that the residuals behaved as white noise. Additionally, plots comparing **fitted values vs actual values** (Figures 7 and 8) demonstrated a close alignment, suggesting a good model fit. Therefore, the ARIMA (1,1,2) model is considered statistically adequate for forecasting daily solar radiation in Kebbi State.

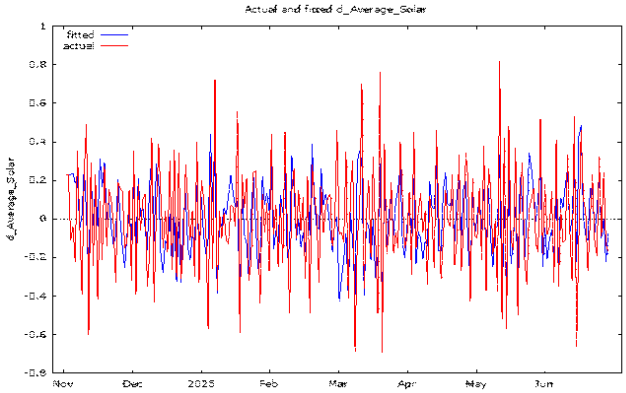

Figure 7: *Plot of Actual against fitted values of Daily average Solar Radiation*

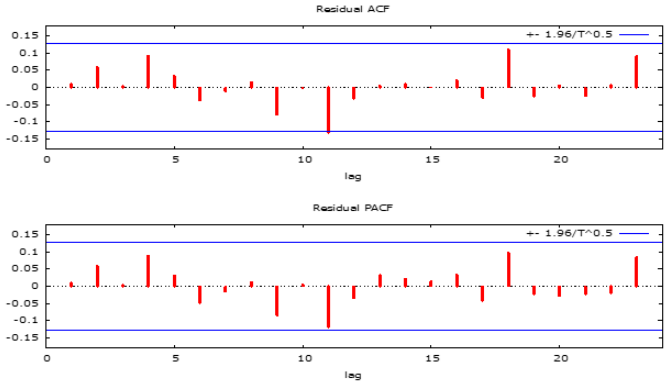

Figure 8: *Plot of residual for ACF and PACF for Daily average Solar Radiation*

Forecasting

To generate data on the expected daily record of solar radiation, the ARIMA model of the observed number of Daily average record of solar radiation to obtain forecast of the 150 days series is shown in the table below:

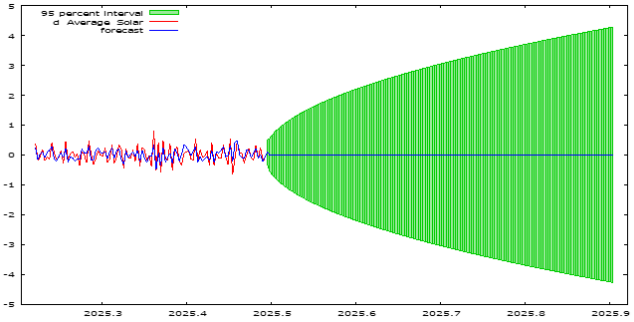

Figure 9: *Plot of Forecasting for Daily average Solar Radiation*

Conclusion

This study developed a time series forecasting model for daily average solar radiation in Kebbi State using the ARIMA (1, 1, 2) approach. Based on statistical evaluation criteria (AIC, BIC) and residual analysis, the ARIMA (1, 1, 2) model was identified as the best fit. The model equation: Y_t= 2.60346e-

$05 - 0.0424045_{t-1} - 1.90854_{t-1} + 0.908543_{t-2}$ effectively captured short-term trends and provided a reliable forecast for 150 days ahead. The results indicate that solar radiation levels are expected to **gradually increase**, offering positive implications for solar energy deployment in Kebbi State.

Recommendations

The following recommendations were made to enhance research for the benefit of the policy makers and researchers.

i. This study recommends for further study to explore the presence of seasonal effects within the solar radiation data to improve forecasting accuracy and model robustness.
ii. A comprehensive analysis of the relationship between meteorological variables (e.g., temperature, humidity, cloud cover) and solar radiation is recommended to enhance model inputs and predictive performance.
iii. Further studies should also consider inclined surface measurements to account for altitudinal and angular effects, enabling more accurate estimation of available solar insolation for photovoltaic system design.

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CHALLENGES AND PROSPECT OF OBTAINING BANK CREDIT BY SMALL AND MEDUIM SCALE ENTERPRISES (SMEs) IN DAMATURU METROPOLITAN YOBE STATE

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Abstract
The purpose of this paper is to examine the challenges and prospect of obtaining bank credits by small and medium scale enterprises (SMEs) in Nigeria. Nigeria's SMEs is one of the worst hit by the devastating impact of economic meltdown and other pandemic like covid-19 that affect many countries of the world and their economies growth. Drastic measures were taken within the country and global economic realities have led to faltering economic activities. As far as Nigerian economy is concern, the SMEs sector plays a very significant role in employment generation and in industrial production. Despite government support there still exist challenges in terms of financing, purchase of raw materials, lack of technological innovations, government policies among others. It was discovered that during the covid-19 many small and medium enterprises are lockdown, restricted of movement affect sales volume, and at such business tractions was bad and business was totally failure and loss. And there is no positive response by financial institution in granting loan to Small and medium Enterprises and usually demand for excessive collateral before granting loan request. It was recommend that The Central Bank of Nigeria should increase the credit facility embarked to empower the SME sector so that more SME in Nigeria can benefit as well as the study recommend financial institutions to provide credit facilities with a lower interest rate to the small enterprises and also the government can by ensuring that the Central Bank reduce the base rate for loans offered to SEs by providing subsidies to the financial institutions supporting the small business sector.

Keywords: *Bank credit, financial institutions, Subsidies, Economic meltdown, Pandemic*

Introduction

Nigeria's SMEs is one of the worst hit by the devastating impact of the economic meltdown currently ravaging countries of the world and their economies development. Drastic measures were taken within the country and global economic realities have led to faltering economic activities. The economic meltdown has posed a serious challenge to the world, necessitating countries around the world to adopt stringent measures such as complete or partial lockdowns in order to contain the spread of the disease and this has had great implications on national economies and rural development The Federal Government of Nigeria (FGN) had to close its land, sea and air borders and implemented a total lockdown in states and cities with very high infection rates across the country Onuoh et al (2020).In order to cushion the effect of the pandemic on the citizens, the federal government had announced a number of responses: N500 billion COVID-19 Crisis Intervention Fund, 50 billion Naira CBN intervention fund for households and MSMEs, 20,000 Naira four months conditional cash transfer to the country's poorest, reduction in price of fertilizers as subsidy to farmers etc. Onuoh et al (2020).

Furthermore, domestic demand and supply have fallen and micro, small and medium scale enterprises (MSMEs) are the worst hit as they rely on imports for their raw materials used in production. At the grassroots, the situation is aggravating experiences of marginalization, exclusion, deprivations, inequality and poverty (Okijie & Faminu 2020). However, on 16th March 2020, the apex bank (CBN) through a major policy, announced the creation of a NGN50 billion targeted credit facility to boost the economy amidst the growing economic devastation of coronavirus. The NGN50 credit facility will be implemented through the NIRSAL Microfinance Bank for households and SMEs that have been particularly hard hit by economic meltdown, including but not limited to hoteliers, airline service providers, health care merchants, etc. Onuoh et al (2020).

In Africa, the SMEs is the dominant sector and accounts for almost 90% of all the enterprises in rural and urban areas. SMEs are a major employment avenue to people and stimulate the development of the countries by promoting entrepreneurial and business skills amongst communities Musah et al (2018). As the world is struggling to fight off the economic meltdown, counties are witnessing unprecedented economic slowdowns and shutdowns. In Nigeria, the financial crisis is affecting the stability of small and medium scale enterprises (SMEs). As the pandemic continues to ravage the country, SMEs are struggling to survive due to the decline in the production volumes and harsh market conditions Musah et al (2018). However, the researchers intend to make an assessment of COVID-19 pandemic on small and medium scale enterprise. Economist's scholars are also very keen to point out that SMEs in Nigeria can do better, but are struggling due to weak economic growth and poor government policies. The Nigerian government had been coming to terms with oil price decline shock from 2014, with the GDP hovering around 2.3% in 2019 (Onyekwena and Ekeruche, 2020).

SMEs not only contribute to improved living standards, employment generation and poverty reduction but they also bring about substantial domestic capital and achieve high levels of productivity. From a planning point, SMEs are increasingly recognized as the principal means for achieving equitable and sustainable industrial diversification and growth. In most countries, including developed countries like Japan, USA, UK etc, SMEs account for well over half the total share of employment, sales and total contribution to GDP Musah et al (2018).

Objectives of the Study

The following are the objectives of the paper;

i. To assess economic meltdown on small and medium scale enterprise.
ii. To know government policy and Interventions on economic meltdown affecting Micro, Small and Medium Scale Enterprises (MSMEs).
iii. To identify the effect of economic meltdown on Medium Scale Enterprises operation

Literature Review

In Nigeria, Micro Small and Medium Enterprises (MSMEs) are generally referred to as enterprises with up to 250 employees. The micro enterprises employ between 1 and 9, while the small enterprises employ between 10 and 49 and medium enterprises employ between 50 and 249 employees respectively (OECD, 2005; Osunde, 2016). MSMEs play a big role in the Nigerian economy and economies around the globe. MSMEs outnumber large companies by a wide margin and also employ many more people. Nigeria has over 37.07 million MSMEs, and they account for more than 84 percent of total jobs in the country and about 48.5 percent of the gross domestic product, GDP, as well as about 7.27 percent of goods and services exported out of the country according to Ministry of Industry, Trade and Investment, (Premium Times, 2020). Based on the total numbers of MSMEs in Nigeria, Micro Enterprises account for the bulk with 36,994,578 enterprises (about 99.8 percent), while small enterprises took 68,168, and medium enterprises 4,670 (Premium Times, 2020). It is evident that Nigeria is overwhelmingly a country of small businesses, petty traders and micro-firms.

Several researchers have evaluated the role of MFIs in the development of SMEs. Oni, Paiko & Ormin, (2012) assessed the contribution of micro finance institutions (MFIs) to sustainable growth of small and medium scale enterprises (SMEs) in Nigeria. Their research revealed that MFIs does and could contribute to the sustainable growth of SMEs in the country. Nevertheless, the study also found among others that MFIs services outreach to SMEs at present is poor. Ojo (2014) examined the impact of microfinance on entrepreneurial development in Nigeria. The researcher concludes that microfinance institutions world over and especially in Nigeria are identified to be one of the key players in the financial industry that have positively affected individuals, business organizations, other financial institutions, the government and the economy at large through the services they offer and the functions they perform in the economy. Oni, & Daniya, (2012) accessed the development of Small and Medium Scale Enterprises and the role of Government and other Financial Institutions, they discovered that financial institutions provide the necessary financial lubricant that facilitate the development of Small and Medium Scale Enterprises, they stressed that, a lot still need to be done by the government in terms of policy formulation in order to complement the efforts of financial institutions. They finally recommend among other things that establishment of micro finance institutions to serve the grass root financial needs should be encouraged.

Sources of Financing Small Scale Business

Muktar (2014) Sahara (2020) and Umar (2006) provide following to be the major sources of financing small-scale business:

i. Personal contributions/savings
ii. Contributions from family, relatives, communities etc.

iii. Loans and advances (bank overdraft, commercial papers) from Commercial banks, Microfinance banks, Agriculture banks, Bank of Industry etc.
iv. Trade creditors: Trade credit represent the value of goods bought on credit by business. Trade credit is a flexible source of financing for any business venture.
v. Equipment leasing this is a financial arrangement to finance the purchase of assets through finance a company or leasing company or a bank.
vi. Sales and Lease Back this is a situation where an asset previously owned by a company is disposes off and immediately reposes through a leasing contract.
vii. Hire Purchase (Vendor Credit) this is an arrangement under which the hirer, in return for the use of an asset undertakes to make periodic payments to the owner of the assets he/she is expected to assume ownership of the asset after payment of the last instalment.
viii. Mortgage Financing: An alternative to sell and lease back is mortgaging. It may be possible for a company to arrange to borrow money by means of a mortgage on freehold property. Repayments of principal plus interest may be spread over a long a period of time.
ix. Central Bank of Nigeria Financing in form of financial social support in terms entrepreneurship development training for skills acquisition, You Win, N-Power, Covid-19 loan, agricultural financing for Irrigation Farming etc
x. Business angel financing: this is one the latest sources of finance of small-scale business
xi. Partners or Business Association, It is a common saying that" two good heads are better than one". Sometimes two or more individuals may decide to raise some amount of money in order to run a small-scale business.
xii. Financial/government agencies: These include organizations like the National Economic Reconstruction Fund (NERF), the World Bank, and SMEs manager by central bank of Nigeria and the African development bank. These organizations act as a source of capital for new businesses and export oriented small business activities.

Challenges Faced by Small and Medium Sized Enterprises'

Yadav and Vikas (2018), Cook (2000), BOI (2018), CBN (2020), Mulimani et tal (2012), Omeje (2018), Sahara (2020) and Umar (2006) in their various research provide the following challenges faced by Small and Medium Scale Business in developing countries Nigeria inclusive as follows:

Finance Related Challenges

I. lack of capital/non-availability of loan
II. Difficulties accessing financial resources
III. Lack of availability of adequate and timely credit.
IV. Limited access to equity capital.
V. Limited capital and knowledge.
VI. Difficulties in accessing capital.
VII. Lack of sufficient finance at affordable interest rates.
VIII. Highly inadequate credit flow.
IX. Diversion of working capital funds for acquisition of fixed assets.

Managerial/Marketing Related Challenged

i. Lack of entrepreneurial managerial and marketing skills
ii. Ineffective marketing strategy
iii. Identification of new market

iv. Challenges on modernization and expansion
v. Lack of facilities for market analysis
vi. Improper new product development
vii. No exposure to best management practices in manufacturing, marketing, distribution and branding
viii. Lack of sales promotion
ix. Lack of adequate information
x. Entry of many new manufacturers

Product Related Challenges

i. Poor quality of products.
ii. Product and service range and usage differences.
iii. Complexity of trade documentation including packaging and labelling.
iv. Problems of storage, designing, packaging and Product display/Lack access of packaging technologies.
v. Introduction of better substitutes.
vi. Removal of quantity restriction.

Technological / ICT Related Challenges

i. Limited communication networks.
ii. Low levels of technology.
iii. Lack of accessibility to information and knowledge.
iv. Lack of accessibility to investment technology equipment and know-how.
v. Low technology levels and lack of access to modern technology.
vi. Inadequate intellectual property protection.

Labour Related Challenges

i. Lack of skilled manpower for manufacturing, services, marketing, etc.
ii. Multiplicity of labour laws and complicated procedures associated with compliance of such laws.
iii. Non availability of highly skilled labour at affordable cost.
iv. Improper training and poor employee management.
v. Rigid labour markets.
vi. Absence of work force planning, poor industrial relations.

Material Related Challenges

i. Procurement of raw material at a competitive cost
ii. Shortage of raw material
iii. Non availability/difficulty of materials
iv. Non availability of raw material or increase in the price of raw material

Export Related Challenges

i. Language barriers and cultural differences
ii. Risks in selling abroad
iii. Competition of indigenous SMEs in foreign markets
iv. Inadequate behaviours of multinational companies against domestic SMEs

v. Lack of access to global markets
vi. Lack of government incentives for Internationalization of SMEs
vii. Improper regulatory policies at the entry and exit stages
viii. Infrastructure issues like power tariff and lack of export infrastructure

Empirical Studies

Access to external sources of finance may increase growth possibilities since it facilitates the development and improvement of firm's products and services or hire new employees. In transition economies, the development that financial markets experience may create barriers linked to the access to finance. Hence, academic research considers financial constraints as an important obstacle for entrepreneurship and firm growth. Empirical evidence supporting the importance of access to external finance for business growth can be found in Brown, Earlem & Lup,(2005), who examines firm growth determinants. Conversely, Johnson, McMillan and Woodruff (2000) evaluate institutional reforms in five Eastern European countries (including Romania), and they conclude that access to bank finance does not prevent business growth (Gichuki, Njeru and Tirimba (2014).

Mensah, Azinga, and Sodji (2015) in their work "Challenges faced by Small and Medium size Enterprises in Accessing Credit Facilities from Financial Institutions: An Empirical Assessment Incorporating the Perceptions of both Borrowers and Financiers", which was carried out to identified challenges faced by borrowers, precisely small and medium-size enterprises in accessing credit facilities from financial institutions. The study findings were presented using Pearson correlation test, simple linear regression analysis and the arithmetic mean. Findings of the study revealed several challenges, which were commonly perceived by bankers and borrowers. Some of these challenges are high inflation, lack of adequate capital, high interest rate in the capital market, and exchange rate fluctuation. The study also revealed that there was a strong positive relationship between challenges perceived by borrowers and challenges perceived by bankers.

Onugu (2005) in his work "Small and Medium Enterprises (SMEs) in Nigeria: Problems and Prospects" which was undertaken to find out if the SME sub-sector in Nigeria has performed its critical role of driving the country's industrial transformation and development as it has done in other developed countries; and if not, why, and also to identify remedial measures. The study thus investigated the performance of the Small and Medium Enterprises sub-sector of the Nigerian economy, its problems and prospects by selecting a total of 300 SMEs randomly from a cross section of a population of 1,500 SMEs spread among all the states of Nigeria including Abuja and covering virtually all forms (Sole Proprietorship, Partnership, Private and Public Limited Companies etc) and kinds (Services, Manufacturing, Processing, Oil & Gas, Educational etc). Also, eleven banks were selected using simple random sampling process. The major findings of the study include among others; SMEs have played and continue to play significant roles in the growth, development and industrialization of many economies the world over. In the case of Nigeria, SMEs have performed below expectation due to a combination of problems which ranges from attitude and habits of SMEs themselves through environmental related factors, instability of governments and frequent government policy changes and somersaults. The study also revealed that the "top ten" problem areas of SMEs in Nigeria in decreasing order of intensity include; management, access to finance, infrastructure,

government policy inconsistencies and bureaucracy, environmental factors, multiple taxes and levies, access to modern technology, unfair competition, marketing problems and non-availability of raw materials locally. Thus, the study pointed out that, managerial problems represent the greatest problem facing SMEs in Nigeria while non-availability of raw materials locally is the least problem.

Theoretical Framework

Credit Rationing Theory

One of the most important theories that focused on financing gap analysis is the Credit Rationing Theory by Stiglitz & Weiss (1981). In their formulation, Stiglitz and Weiss (1981) argued that agency problems (a conflict of interest between management (agents) and the shareholders (owners) of the organization) and information asymmetries are the major reason why SMEs have constrained access to finance. They argued that only SMEs know their real financial structure, the real strength of the investment project and the effective intention to repay the debt, that is, firms have superior private information (asymmetric information). Hence, the bank manager makes decisions under asymmetric information, and operates under a moral hazard and adverse selection risk.

Trovato, 2006). Constrained access to finance derived from financial institutions' credit rationing behaviour might not be efficient because managers work under conditions of asymmetric information. This may result in less profitable investments getting financed while more profitable investments are being left out and thus resulting in adverse selection and moral hazard risks. Therefore, asymmetric information can explain asymmetric of credit among firms with identical characteristics, the lenders not being aware of the exact bankruptcy likelihood for the firms, know only that this likelihood is positive and therefore choose to increase debts' cost. Start-up small firms are more likely to be affected by information asymmetry problems.

Deakins, North, Baldock and Whittam (2008) argued that those information asymmetries are more acute in new and technology-based propositions. They argued that, at an early stage, information is limited and not always transparent and assets are often knowledge based exclusive associated with the founding entrepreneur. Especially with manufacturing and technology-based firms, entrepreneurs may be reluctant to provide full information about the opportunity because of concerns that disclosure may make it easier for others to exploit. There are some categories of SMEs that will face additional problems due to lack of security, such as young entrepreneurs or those from deprived areas. In addition, there may be asymmetries arising from location as well as sector.

Data Presentation and Analysis

A total of fifty (50) copies of the questionnaires were administered to some selected Micro and Small Enterprises' (MSEs) in Damaturu metropolis. Fourty (40) copies of the questionnaires administered were completed and returned; as such, only fourty (40) questionnaires are presented and analysed.

Table 1: Distribution of Questionnaires to Fourty (40) MSE's in Damaturu Metropolis.

S/No	Name of MSE's	Number of Questionnaire(s) Administered	Number of Questionnaire(s) Returned
1	Shoe making Industry (6 in number)	06	06
2	Sachet Water Industry (8 in number)	08	08
3	Bread making Industry (4 in number)	04	04
4	Welding and Fabrication Industry (4)	04	04
5	Computer Institute (2 in number)	02	02
6	Super market (4 in number)	04	04
7	Restaurants and food catteen (6 in number)	06	06
8	Bumsa Carpet Store Enterprise	01	01
9	Hotel/Lodge (4 in number)	04	04
10	Goni Opera computer/GSM Repair	01	01
	Total	**40**	**40**

Source: Field Survey, 2025

Discuss of Findings

Based on the research carried out and data analysed, the result obtained from the survey conducted reveals the challenges faced by MSE's in accessing bank credit, in Nigeria.

i. There is no positive response by financial institution in granting loan to Micro and Small Enterprises and usually demand for excessive collateral before granting loan request during the covid-19
ii. If at all loan is to be granted to Micro and Small-Scale Enterprises, there is high interest rate charged on such loan by financial institutions.
iii. Repayment of loans granted at high interest is within a short period of time which results to un-fulfilment of the purpose of the loan during the covid-19.
iv. It is however noted that, for Micro and Small Enterprises to have unlimited access to bank credit, they must keep proper books of account and records in case it is demanded for in course of loan application, MSEs owners do not possess any concrete collateral during the covid-19.

Conclusion

It is an undeniable fact that MSMEs are the engines of every economy, especially in the developing world. They also form the foundation from which most of the big corporations of today were developed. Nigeria's SMEs is one of the worst hit by the devastating impact of the economic meltdown currently ravaging countries of the world and their economies. Drastic measures were taken within the country and global economic realities have led to faltering economic activities. As far as Nigerian economy is concern, the SMEs sector plays a very significant role in employment generation and in industrial production. Despite government support there still exist challenges in terms of financing, purchase of raw materials, lack of technological innovations, government policies among. The paper conclude that Nigerian government should adopt an effective economic strategy that will lead to economic growth and development.

Recommendations

Based on the findings made and conclusions drawn, the researcher recommends the following as the way forward to the problems facing Micro and Small Enterprises (MSE's) in Nigeria.

i. Diversification and consolidation of the economy: The Central Bank of Nigeria should increase the credit facility embarked to empower the MSME sector so that more MSME in Nigeria can benefit.
ii. MSE's should ensure proper keeping of books of account. Keeping up to date records of

business transactions enable the company to keep track of its operations because many of the financial institutions give priority to proper book keeping as a criterion for accessing funds and, hence, MSEs will be at advantage if they keep good business records. Maintaining a bank account with any of the financial institutions will also help the MSEs to have easy access to credit facilities and having a considerable amount in a bank account with a financial institution means the institution will have an idea of how much of capital the MSE operates with, thus serving as a guarantee that the MSE will be able to pay the credit back in time.

iii. Most of the owners/managers of MSEs in the country do not have the necessary training or education on how to manage their businesses profitably. Equipping the various MSEs owners with the necessary skills such as credit management, cash management, investment decision making and bookkeeping will help improve the returns on their investments.

iv. The research recommends financial institutions to provide credit facilities with a lower interest rate to the small enterprises and also the government can by ensuring that the Central Bank reduce the base rate for loans offered to MSEs by providing subsidies to the financial institutions supporting the small business sector.

v. Stimulation of MSMEs to improve local production and capacity: Efforts should be made to limit importation and to encourage local manufacturing of most of the medical supplies such as facemasks, hand sanitizers, ventilators etc. as to conserve our forex and stimulate our economy.

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EXAMINING SOCIO-CULTURAL PERSPECTIVES ON DEVELOPING AND SUSTAINING CREATIVE ECONOMY AMONG STUDENTS OF COLLEGES OF EDUCATION IN OGUN STATE

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Abstract

The study examined socio-cultural perspectives on developing and sustaining creative economy among students of Colleges of Education in Ogun State. The study adopted a descriptive survey research design. Population comprises all Colleges of Education in Ogun State. Simple random sampling technique was used to select two colleges of education in which one hundred (100) students were selected in Economics department from each of the chosen college to make a total of two hundred (200) respondents as sample for study. A self-developed questionnaire was used as instrument for data collection. It was developed in 2 Likert scale of Agreed and Disagreed. The instrument was moderated by experts who affirmed its validity. Reliability of the instrument was determined using Cronbach Alpha. Data collected were analyzed using simple percentage, mean and standard deviation statistical tools. Findings revealed that socio-cultural perspectives, which include traditions, values, norms, beliefs, and identity, play a crucial role in shaping individuals' attitudes and participation in creative activities among students of Colleges of Education in Ogun State. Findings also revealed that socio-cultural factors such as indigenous knowledge, cultural values, and traditions play a significant role in shaping students' creative expressions and entrepreneurial interests. Additionally, educational policies were found to support the integration of creative skills, promote cultural relevance in learning, and encourage sustainable practices within the creative industry. It was recommended that government and educational

authorities should revise and implement curricula that fully integrate creative and cultural education to equip students with practical skills relevant to the creative economy. Also, Colleges of Education should promote indigenous knowledge and cultural values through workshops, exhibitions, and student-led creative projects that foster local content and innovation.

Keywords: *Creative economy, Socio-cultural, Perspectives, Sustaining, Innovation*

Introduction

In the 21st century, the creative economy has emerged as a powerful driver of economic growth, cultural expression, and social inclusion. Creative economy refers to the sum of all economic activities that are directly or indirectly based on creative ideas, cultural expressions, and intellectual property. It includes sectors such as arts, media, design, fashion, film, music, publishing, and digital content, where creativity serves as the primary input for production and value creation (UNCTAD, 2010). This form of economy emphasizes the role of culture and innovation as drivers of economic growth and social development. According to Howkins (2011), the creative economy encompasses industries where the value of products and services lies in their imaginative or original content rather than traditional factors like capital or labor. It highlights creativity as an economic resource, and includes professions and businesses that leverage creative skills, talent, and intellectual capital to generate income and employment. The global rise of the creative economy has shown that investment in human imagination and innovation can lead to sustainable development, especially in nations with rich cultural heritage such as Nigeria.

Nigeria is home to diverse ethnic groups with vibrant cultural identities, artistic traditions, and a young, dynamic population. Socio-cultural refers to the interplay between social and cultural factors including norms, values, customs, traditions, language, and social structures that influence human behaviour, identity, and societal development. It emphasizes how people's interactions within their cultural and social environments shape their worldviews, practices, and learning experiences (Vygotsky, 2008). According to Rogoff (2013), the term socio-cultural describes the interdependent relationship between individual development and the cultural contexts in which individuals are embedded. It highlights the idea that cognition, behaviour, and creativity are not just individual processes but are deeply rooted in cultural practices and social interactions. Despite this rich socio-cultural base, the potential of the creative economy is yet to be fully harnessed, particularly in the education sector where students should be nurtured to contribute meaningfully to national development through creativity and cultural awareness (Okafor & Duru, 2018). While efforts have been made to promote creative industries nationally such as the success of Nollywood and Afrobeats on the global stage there remains a disconnect between education policies and the development of creative skills among students, especially in Colleges of Education which are pivotal in training future educators.

Socio-cultural perspectives, which include traditions, values, norms, beliefs, and identity, play a crucial role in shaping individuals' attitudes and participation in creative activities. Cultural values often influence what is considered meaningful art or innovation within a community and can either encourage or inhibit creative expression (Throsby, 2011). In Ogun State, known for its historical and cultural richness with cities like Abeokuta hosting cultural festivals, traditional artisans, and heritage sites there lies an opportunity to integrate these socio-cultural elements into

educational practices to develop students' creative competencies. However, there is a growing concern that formal education in Colleges of Education places limited emphasis on cultural knowledge and creative capacity-building (Adebayo & Alao, 2019). Students are often taught using rigid curricula with minimal opportunities to engage with their indigenous culture or creative industries. This disconnection not only stifles innovation but also undermines the sustainability of Nigeria's creative economy. Studies have shown that when students are exposed to their cultural heritage in learning environments, it enhances their sense of identity, motivates them to explore creative careers, and fosters innovation rooted in local content (Obaji, 2021).

Several studies have highlighted the pivotal role of socio-cultural factors in the development of the creative economy. Throsby (2011) emphasized that the creative economy is not merely an economic activity but is deeply embedded in cultural practices, identities, and values. According to Throsby, cultural diversity and creativity are essential drivers of the creative industries, and socio-cultural conditions play a critical role in shaping creative expressions. Similarly, Howkins (2011) argued that creative industries are fuelled by cultural capital, and the strength of cultural traditions, languages, and community norms influences the success and sustainability of these industries. In the Nigerian context, studies have shown that socio-cultural factors are vital in shaping students' engagement in the creative economy. For instance, Okafor & Duru (2018) noted that students' exposure to local cultural heritage and their ability to engage with traditional art forms directly impacts their creative skills and entrepreneurial activities. This suggests that Nigerian students in Colleges of Education, when nurtured in an environment that values their cultural heritage, are more likely to be innovative and contribute to the national creative economy.

Furthermore, the integration of indigenous knowledge into formal education systems enhances students' understanding of cultural identity, thereby fostering creativity (Obaji, 2021). Mnguni (2020), students who are exposed to their cultural heritage through educational curricula develop stronger ties to their communities and are more likely to engage in creative industries such as fashion, music, and performing arts. Mnguni's study suggests that students' sense of identity, grounded in socio-cultural contexts, enhances their creativity and participation in the creative economy. In a similar vein, Adebayo & Alao (2019) found that in Nigeria, students trained in an educational system that neglects cultural context often struggle to connect creatively with their communities. These students were less inclined to innovate within cultural industries, indicating a need for curriculum reforms that incorporate socio-cultural elements to foster creative skills. The integration of local culture into educational programs was found to have a positive impact on students' entrepreneurial ventures in the creative sector (Adebayo & Alao, 2019). Additionally, education that focuses on creative arts and indigenous knowledge enhances students' adaptability to the changing demands of the creative economy (Vygotsky, 2008).

In recent years, the integration of technology in the creative sector has opened up new avenues for student engagement. According to UNESCO (2021), digital platforms have revolutionized the creative economy, providing new opportunities for young creatives to showcase their talents globally. However, the adoption of digital tools in education remains limited in many parts of Nigeria. Studies such as those by Okeke and Nwaogu (2020) have shown that students in Colleges of Education in Ogun State are increasingly exposed to digital tools that enhance creative production, such as graphic design, digital music production, and video editing. These tools, when incorporated into the curriculum, can empower students to navigate the global creative economy while staying connected to their cultural roots.

Moreover, sustaining the creative economy among students requires more than just talent; it requires institutional support, socio-cultural awareness, and policies that link education with entrepreneurship and cultural industries. For instance, the creative economy can thrive when students are encouraged to draw from their cultural backgrounds, integrate them into modern creative practices, and receive support in terms of mentorship, funding, and digital tools (Howkins, 2011; UNESCO, 2021). Given these realities, it becomes essential to examine how socio-cultural factors influence students' involvement in creative activities, and how Colleges of Education in Ogun State can serve as a breeding ground for nurturing talents that contribute meaningfully to the creative economy.

Objective of the Study

The main objective of this paper is to examine socio-cultural perspectives on developing and sustaining creative economy among students of colleges of education in Ogun State. The specific objectives are to:

i. Examine the influence of socio-cultural factors on the development of creative skills and entrepreneurial activities among students of colleges of education in Ogun State.
ii. Assess the role of educational policies in promoting sustainability of the creative economy in Ogun State.

Research Questions

Based on the study, the research questions are;

I. What are the influence of socio-cultural factors on the development of creative skills and entrepreneurial activities among students of Colleges of Education in Ogun State?
ii. What are the roles of educational policies in promoting sustainability of the creative economy in Ogun State?

Methodology

The study adopted a descriptive survey research design. Population comprises all Colleges of Education in Ogun State. Simple random sampling technique was used to select two colleges of education in which one hundred (100) students were selected in Economics department from each of the chosen college to make a total of two hundred (200) respondents as sample for study. A self-developed questionnaire was used as instrument for data collection. It was developed in 2 Likert scale of Agreed and Disagreed. The instrument was moderated by experts who affirmed its validity. Reliability of the instrument was determined using Cronbach Alpha. Data collected were analyzed using simple percentage, mean and standard deviation statistical tools.

Presentation of Data Analysis and Results Discussion

Research Question one: What are the influence of socio-cultural factors on the development of creative skills and entrepreneurial activities among students of Colleges of Education in Ogun State?

S/N	ITEMS	AGREED		DISAGREED		Mean (x)	S.D
		Freq (N)	Percent %	Freq (N)	Percent %		
1.	My cultural background influences the type of creative or entrepreneurial activities I engage in.	156	78%	44	22%	3.78	.78
2.	Traditional values and practices in my community have helped shape my creative thinking.	128	64%	72	36%	3.68	.77
3.	Exposure to local arts, crafts, and music has enhanced my entrepreneurial interests.	154	77%	46	23%	3.76	.78
4.	Societal expectations discourage me from exploring certain creative or business ideas	152	76%	48	24%	3.75	.76
5.	My participation in cultural events or festivals has improved my creative skills	128	64%	72	36%	3.68	.77
Overall Total		**Mean (x) = 3.79 and STD = 0.78**					

The analysis of Research Question One reveals that socio-cultural factors significantly influence the development of creative skills and entrepreneurial activities among students of Colleges of Education in Ogun State. The overall mean score of 3.79 and a standard deviation of 0.78 indicate a strong agreement among respondents. A large percentage of students agreed that their cultural background (78%) and exposure to local arts, crafts, and music (77%) have enhanced their interest in entrepreneurship. Additionally, 76% acknowledged that societal expectations may discourage the pursuit of certain creative ventures, highlighting both supportive and restrictive aspects of socio-cultural influence. Similarly, 64% of the respondents affirmed that traditional values and participation in cultural events positively shaped their creativity. These findings underscore that students' engagement with their socio-cultural environment plays a vital role in nurturing their creative potentials and entrepreneurial mindset.

Research Question Two: What are the role of educational policies in promoting sustainability of the creative economy in Ogun State?

Table 2

S/N	ITEMS	AGREED		DISAGREED		Mean (x)	S.D
		Freq (N)	Percent %	Freq (N)	Percent %		
6.	Educational policies in Ogun State support the integration of creative skills into college curricula.	164	82%	16	8%	3.85	.79
7.	Government education policies encourage students to explore careers in the creative economy	162	81%	18	9%	3.85	.79
8.	There is a clear alignment between current educational policies and the promotion of indigenous cultural practices.	152	76%	48	24%	3.79	.78
9.	Policies in Colleges of Education provide adequate support for creative entrepreneurship initiatives	164	82%	16	8%	3.85	.79
10.	Existing educational policies promote the sustainability of local arts and creative industries in Ogun State	136	68%	64	32%	3.74	.78
Overall Total		**Mean (x) = 3.87 and STD = 0.79**					

The results presented in Table 2 provide a clear insight into the role of educational policies in promoting the sustainability of the creative economy in Ogun State. A significant majority of respondents agreed that educational policies support the integration of creative skills into college curricula (82%), encourage career exploration in the creative economy (81%), and provide adequate support for creative entrepreneurship (82%). Additionally, 76% of respondents believed that these policies align with the promotion of indigenous cultural practices, while 68% agreed that they promote sustainability of local arts and creative industries. The overall mean score of **3.87** and standard deviation of **0.79** further indicate a strong positive perception and consistency in responses. These findings suggest that educational policies in Ogun State are playing a supportive and strategic role in embedding creativity, cultural relevance, and entrepreneurship into the educational landscape of Colleges of Education.

Discussion of Findings

Results from research question 1 show the influence of socio-cultural factors on the development of creative skills and entrepreneurial activities among students of Colleges of Education in Ogun State. The findings affirm the study of Okafor and Duru (2018) who ascertained that cultural heritage and indigenous practices are instrumental in shaping entrepreneurial interest and innovation among Nigerian youths. Their study found that exposure to local traditions, arts, and festivals fosters a sense of identity and creativity that students often channel into business ventures. Similarly, Mnguni (2020) highlighted that education rooted in cultural context promotes the development of creative skills among learners by connecting them to their community values and artistic heritage. In addition, Obaji (2021) noted that students who actively participate in cultural events tend to develop a richer creative perspective, which in turn enhances their entrepreneurial engagement.

Findings from research question two shows the role of educational policies in promoting sustainability of the creative economy in Ogun State. This finding supported Adebayo and Alao (2019) who stated that the inclusion of creative and cultural education in formal policies significantly enhances students' readiness for entrepreneurship in Nigeria's creative sector. Similarly, Mnguni (2020) found that when educational policies are rooted in cultural and creative frameworks, they promote a deeper understanding of identity and innovation among students. Moreover, UNESCO (2021) emphasized that effective educational policy frameworks are critical to nurturing a sustainable creative economy, especially in developing nations, by aligning cultural heritage with modern educational goals.

Conclusion

Based on the findings, socio-cultural perspectives, which include traditions, values, norms, beliefs, and identity, play a crucial role in shaping individuals' attitudes and participation in creative activities among students of Colleges of Education in Ogun State. Findings revealed that socio-cultural factors such as indigenous knowledge, cultural values, and traditions play a significant role in shaping students' creative expressions and entrepreneurial interests. Additionally, educational policies were found to support the integration of creative skills, promote cultural relevance in learning, and encourage sustainable practices within the creative industry. It can be concluded that a well-structured blend of socio-cultural awareness and supportive educational frameworks is essential for nurturing a vibrant and sustainable creative economy among future educators in Ogun State. Therefore, sustained policy support, cultural integration,

and creative capacity building are key to unlocking the full potential of students in contributing to the creative sector.

Recommendations

Based on the findings of the study, it is recommended that;

i. Educational authorities should revise and implement curricula that fully integrate creative and cultural education to equip students with practical skills relevant to the creative economy.
ii. Colleges of Education should promote indigenous knowledge and cultural values through workshops, exhibitions, and student-led creative projects that foster local content and innovation.
iii. Policy makers should design and enforce educational policies that prioritize creative entrepreneurship, especially in teacher education institutions, to prepare students for self-employment and cultural preservation.
iv. Lecturers and educators should adopt culturally responsive teaching strategies that highlight the value of socio-cultural identity and creative expression in the learning process.
v. The government should provide funding and institutional support for creative hubs, talent incubation centers, and innovation labs within Colleges of Education to stimulate sustainable creative practices.
vi. Non-governmental organizations and private stakeholders should collaborate with educational institutions to sponsor creative economy initiatives and mentorship programs for students in the creative arts and cultural industries.

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APPLICATION OF VARIOUS TYPES OF CEMENT IN BUILDING CONSTRUCTION

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Abstract

Cement is simply referred to as a material with adhesive and cohesive properties which binds mineral particles together. Adhesive means it could be used to create a bond between two surfaces. Cement is extensively used in the construction of various buildings in our society. The common cement used in the construction industry includes; Ordinary Portland cement [o.p.c] white cement, Portland pozzolana cement [ppc], the hydrophobic Portland cement [Hpc] etc. However, a wrong application of these various types of cement has resulted to cracking or even the collapse of building, bridges, dams and reservoirs. At the end of this research work, we would understand the types of cement to use in low heat areas, chemical soils, high heat area, water or river line areas, and also the type of cement that can give color and aesthetics to our buildings hence ensuring a durable and aesthetically rich buildings in our society.

Keywords: *Strength, Adhesive, Purpose, Durability*

Introduction

Cement is a fine-gray powder that is blended in with water and different substances to make mortar or concrete. Cement is a critical part of the construction of buildings, streets, and other brick and motor manifestations. Assuming you thought that this material comes in a one-size-fits-all version, you are so off-base! Now is the right time to find out about the many kinds of cement accessible in the market to take special care of various construction purposes. Understanding the various properties of the many types of cement might assist you with pursuing an informed decision while choosing materials for your project. Cement is significant in light of the fact that it binds, or holds, the concrete mix together, giving it strength. These varieties of cement vary with quality, innovation, composition, and goals to accomplish in the building sites. While some are utilized for general masonry works, others are picked for decorative purposes.

Types of Cement Applications

Following are the various types of cement applications may vary with the types of cement so here are a few cements available in the market:

1. Portland Cements

i. Ordinary Portland Cement
ii. Modified Portland Cement
iii. Rapid hardening Portland Cement
iv. Extra Rapid hardening Cement
v. Low heat Portland Cement
vi. Sulphate resisting Portland cement
g. Water-repellent Portland Cement
h. Water-proof Portland Cement

2. Other Varieties of Cement

i. High Alumina Cement
ii. Quick-setting Cement
iii. Blast Furnace slag Cement
iv. White Cement.
v. Colored cement
vi. Acid resistance Cement
vii. Expanding Cement
viii. Hydrophobic cement
ix. Portland Pozzolana Cement
x. Supersulphated Cement
xi. Masonry Cement

a. Portland Cements

i. Ordinary Portland Cement

This is by far the most common cement in use.
It has a better rate of strength development and heat generation.
It has sufficient resistance to dry shrinkage and cracking but has less resistance to chemical attack.

Use

i. It is admirably suitable for use in general concrete construction when there is no exposure to sulphates in the soil or groundwater.
ii. It is used in small structures where the heat of hydration will not cause any defect.

ii. Modified Portland Cement

This cement, on the setting, develops less heat of hydration than ordinary Portland cement.

Uses

Due to the lower heat of hydration, it can be employed in hot climates and for the construction of heavy abutments, large piers, retaining walls, etc, where sulphate content is not high.

iii. Rapid Hardening Cement

i. It is also known as high early-strength cement.
ii. It has a huge proportion of lime and other components are the same as for Ordinary Portland Cement.
iii. It is prepared more carefully and burnt at a higher temperature than that of ordinary Portland Cement.
iv. The strength developed at the age of 3 days is of the same order as the 7 days strength of Ordinary Portland Cement with the same water-cement ratio.
v. The increased rate of gain of strength of this cement is achieved by a higher C_3S content and by finer grinding of the cement clinker.
vi. It is ground finer and has a specific surface not less than 3250 cm^2/g.
vii. It is lighter than Ordinary Portland Cement.
viii. The curing period is short; hence it is economical.

Uses

It is used here a rapid strength development is required.
Example: When the framework is to be removed quickly for re-use, or where sufficient strength for further construction is wanted as quickly as practicable.

iv. Extra Rapid Hardening Cement

This type of cement is obtained by inter-grinding calcium chloride with rapid hardening Portland cement. The quantity of calcium chloride should not exceed 3%.

Its strength is about 25% higher than that of rapid hardening cement at 1 or 2 days and 10 to 20 % higher at 7 days.

Uses

It is suitable for cold weather concreting, or when a very high early strength is required but when it is inadvisable to use aluminous cement.

v. Low Heat Portland Cement

i. It contains a low percentage (about 5%) of tricalcium silicate (C_3S) which hydrates quickly and a higher percentage (about 46%) of dicalcium silicate (C_2S) which hydrates slowly.

ii. It contains less time than ordinary cement; other materials remain the same as in the case of Ordinary Cement.
iii. It possesses low compressive strength.
iv. The initial setting time is about one hour and the final setting time is about 10 hours.

Uses
During the setting action of cement, a considerable amount of heat is produced, to reduce the amount of heat, this type of cement is used.
It is mainly used for mass concrete work.

vi. Sulphate Resisting Portland Cement
In this cement, the percentage of tricalcium aluminate (C_3A) is kept below **5 %** and it increases by resisting power against sulphates.

The heat formed by such type of cement is not much bigger than that of low-heat cement.
Theoretically, it is an ideal cement but because of the special requirement for the composition of the raw materials used in its manufacture, sulphate-resisting cement cannot be easily and cheaply made.

Uses
It is used in places where sulphate action is severe.
It is employed for structures that are likely to be damaged by severe alkaline conditions such as canal linings, culverts, siphons, etc.

vii. Water-repellent Portland Cement
It contains a small percentage of water-proofing materials uniformly mixed with cement and is manufactured under the name "**A quacrete**".
The cement is formed with ordinary or rapid hardening cement and white cement.
If such cement is used in concrete, considerable care is needed to avoid a reduction in strength.

Uses
It is chiefly used in water-tight concrete and water-tight renderings to check moisture penetration in basements etc and for colored rendering and stucco.

viii. Water-Proof Portland Cement
i. These types of cement are prepared by mixing with ordinary or rapid hardening cement, a small percentage of some metal stearate (Ca, Al, etc) at the time of grinding.
ii. Concrete made with such cement is more resistant to penetration by water and some oils than that made from ordinary cement.
iii. It is also adequately resistant to the corrosive action of acids and alkalies or other harmful salts usually present in industrial waters.

Uses
It is used for the construction of water-retaining structures like tanks, reservoirs, retaining walls, swimming pools, dams, bridges, piers, etc.

b. Others Varieties of Cement

i. High Alumina Cement

It is quick-setting cement of chocolate color.

It is manufactured from bauxite and limestone in special reverberatory furnaces.

It contains nearly 35 percent of alumina and the ratio of alumina to lime lies between 0.55 and 1.3.

Advantages

1. It resists the action of acid and high temperature and doesn't expand on the setting.
2. Its initial and final hardening times are 13/4 hours and 4 to 5 hours respectively. It, therefore, permits more time for mixing and placing operations.
3. It sets quickly and attains higher ultimate strength in a low period. Its strength after 1 day is about 40 N/mm^2 and after 3 days is about 50 N/mm^2.
4. It is completely resistant to the action of sulphates.
5. It offers excellent resistance to fire.
6. It is not affected by frost since it evolves great heat during the setting.
7. It is not necessary to grind it to fine powder since its setting action mainly depends on the chemical reactions.

Disadvantages

1. It is unsuitable for mass concrete construction as it develops considerable heat on the set.
2. It is much costlier than ordinary Portland cement.
3. Extreme care has to be taken to ensure that it doesn't come in contact with even traces of lime or ordinary cement.

Uses

1. Its field of application includes work in chemical plants and furnaces.
2. It is employed in colder regions having temperatures 18°C or below and during wartime emergencies.
3. It is used in underwater construction.

ii. Quick Setting Cement

It contains less percentage of gypsum and is ground much fine than ordinary Portland cement. The sitting action accelerated by adding a small percentage of aluminum sulphate, during grinding. It is very expensive compared to ordinary Portland cement.

Its initial and final hardening times are 5 minutes and 30 minutes respectively. The setting action of such a cement starts within 5 minutes and it becomes stone-hard in less than half an hour.

Uses

Due to its quick setting property, it is used in works where concrete is to be placed underwater or in running water.

iii. Blast Furnace Slag Cement

It is made by inter-grinding Portland cement clinker and granulated blast-furnace slag, the proportion of the latter not exceeding **65%** of the weight of the mixture.

It has lower evolution of heat.

It is more resistant to attacks by weathering agencies.

It is cheaper than ordinary portland Cement.
Its color is blackish grey.
Its initial setting time is not less than 30 minutes.
Its final setting time is not more than 10 hours.

Uses
It can be used in mass concrete structures (since its heat of hydration is lower than that of ordinary Portland cement).
However, in cold weather, the low heat of hydration of blast-furnace slag cement, coupled with moderately low rate strength development can lead to frost damage. This cement should not be used in thin RCC structures since its early strength is less. Because of its fairly high sulphate resistance, this type of cement is frequently used in seawater construction.

iv. White Cement
White Portland Cement is made from raw materials containing very little iron oxide, or magnesium oxide. China clay is normally utilized together with chalk or limestone free from impurities. Oil is utilized as a fuel in the kiln to neglect contamination by coal ash. Since iron acts as a flux in clinker, its absence necessitates high kiln temperatures but sometimes cryolite is added as a flux. Contamination of the cement with iron during grinding has also to be avoided. For this problem, rather inefficient pebble grinding is utilized in place of a usual ball mill, although nickel and molybdenum alloy balls have been considered. The cost of grinding is expensive and this, coupled with the huge expensive raw materials, makes white cement rather expensive.

Features
It dries quickly.
It owns high strength.
It contains superior aesthetic beauty.
It should not be set earlier than 30 minutes.
It should be carefully transported and stored in a closed container only.

Uses
1. It is used for floor finish, plasterwork, ornamental work, etc.
2. Miscellaneous applications of white cement include swimming pools (where it replaces the use of glazed tiles with colored shades usable underwater), molding sculptures and statues, painting garden furniture, etc.
3. It is also employed for ready-mixed concrete and precast concrete blocks.

v. Coloured Cement
Colored cement is prepared by adding **5 to 15%** of a suitable coloring pigment before the cement is finely ground.
I. Iron oxide is added to give red and yellow colors.
ii. Chromium oxides provide the green color.
iii. Cobalt oxide provides a blue color.

Colored cement is also known as "**Colourcrete**".
These are much costlier than ordinary cement.

Uses

These types of cement are widely used for finishing floors, external surfaces, artificial marble, stair treads, textured panel faces, window sill slabs, etc.

vi. Acid Resistance Cement

An acid resistance type of cement contains:

1. Acid-resistant aggregates such as quartz, quartzites, etc,
2. Additives such as sodium fluosilicate (Na_2SiF_6), and
3. The aqueous solution of sodium silicate or soluble glass.

– The addition of additive sodium fluosilicate accelerates the hardening process of soluble glass and also increases the resistance of cement to acid.

– The soluble glasswork as the binding material of acid-resistant cement.

It cannot resist the action of a water well.

Its water resistance can be increased by adding 0.5% of linseed oil or 2% of cresit and it is then known as acid and water-resistant cement

Uses

It is used for acid-resistant and heat-resistant coatings of installations of the chemical industry.

vii. Expanding Cement

It is formed by adding an expanding medium like sulpho-aluminate and a stabilizing agent to ordinary cement.

This cement expands whereas other types of cement shrink.

Uses

It is used for the construction of water-retaining structures.

It is also employed for repairing damaged concrete surfaces.

viii. Hydrophobic Cement

It contains admixtures (for example acidol, naphthene soap, oxidized petrolatum, etc.) that form a thin film around the cement grains and decrease the melting ability of cement grains. In this type of cement, in the initial stage, the gain in strength is less as hydrophobic films on cement grains prevent interaction with water. However, after 28 days, its strength is similar to that of ordinary Portland cement.

Uses

When this cement is used in the preparation of concrete, the fine pores in the concrete are uniformly distributed and thus the frost resistance and water resistance of such concrete are increased considerably.

ix. Portland Pozzolana Cement

It is an interground blended mixture of cement and pozzolana. Pozzolana is natural or artificial material containing silica and alumina in a reactive form. Pozzolanic materials most commonly met with are volcanic ash, pumic, opaline shales, and cherts, burnt clay, fly ash, etc. In the manufacture of cement, about 25% of pozzolanic material is added to the ordinary cement clinkers, and the mix is thoroughly ground.

Advantages

1. It owns higher tensile strength.
2. Evolves less heat during setting.
3. Attains compressive strength.
4. Offers great resistance to expansion.
5. Imparts a higher degree of water-tightness.
6. Imparts plasticity and workability to mortar and concrete prepared from this type of cement.
7. Offers higher resistance to chemical attack and the action of seawater.
8. Not costly

Disadvantages

1. Less compressive strength in early days.
2. Less resistance to erosion and weathering action

Uses

1. It is mainly used for hydraulic structures such as dams, weirs, etc.
2. It can also be used for sewage works and for laying concrete underwater.

x. Supersulphate Cement

It is made by intergrinding a mixture of 80 to 85 % of granulated slag with **10 to 15** % of calcium sulphate and about 5% Portland cement clinker and ground to a fineness of 4000 to 5000 cm^2/g. It is very much resistant to the seawater. It can resist the highest concentration of sulphates generally found in soil or groundwater. It also offers resistance to peaty acids and oils. The heat of hydration of this type of cement is low.

Its compressive strength should not be less than 15 N/mm^2, 22 N/mm^2, and 30 N/mm^2 after 3 days, 7 days, and 28 days respectively. This type of cement should not be mixed with other cement. It combines chemically with more water than is needed for the hydration of portland cement, so concrete with a water-cement ratio less than 0.5 should not be made, and mixes richer than 1:6 are not approved. It has been utilized for the undersides of bridges, over railway tracks, and for concrete sewers, carrying industrial effluents.

Uses

1. Supersulphated cement can be used in all cases where normal types of cement are used except in very hot weather.
2. It is used in a variety of aggressive conditions, for example, marine works, mass concrete jobs to resist the attack of aggressive water; reinforced concrete pipes in groundwater, and concrete construction in sulphate-bearing soils

xi. Masonry Cement

It is prepared by intergrinding a mixture of Portland cement clinkers with inert materials such as limestone, dolomite limestone, and dolomite gypsum and an air-entraining plasticizer in suitable proportion.

Its initial and final setting times are 90 minutes and 24 hours respectively.

Its compressive strength is 2.5 N/mm^2 for 7 days.

Because of its property of producing a smooth, plastic, cohesive, strong yet workable mortar when

mixed with fine aggregate, masonry cement is superior to lime mortar, Lime-cement mortar, and cement mortar.

Chemical Composition of Cement

i. **Lime (CaO):** If lime is provided in excess then the cement becomes unsound and if it is in deficiency then the strength is reduced therefore chances of quick setting will be enhanced.
ii. **Silica (SiO2**): It imparts strength to the cement due to the formation of di-calcium and tri-calcium silicates. If it is in excess then the strength of the cement would be enhanced therefore setting time gets prolonged, hence it prevents quick setting.
iii. **Alumina (Al2O3**): It imparts the quick setting property of cement. If it is in excess then the strength of cement is reduced and the chances of rapid hardening would be increased. It acts as a flux and it lowers the clinker temperature
iv. **Calcium Sulphate (CaSO4**): It is a retarder (admixture). If it is in excess then it slows down the quick setting which dominates to increase the strength. It is a gypsum form**.**
v. **Iron Oxide (Fe2SO4):** It imparts colour, hardness, and strength to the cement. If it is in excess, then it imparts more coloured to the cement (grey).
vi. **Magnesia (Mgo**): It imparts hardness and colour (yellow) to the cement, if it is in small quantity, and if it is in excess then it imparts unsoundness to the cement**.**
vii. **Sulphur (S**): If it is in reference quantity then it imparts strength to the cement and if it is in excess then the unsoundness is increased.
viii. **Alkalies** (Soda and Potash) (Na2O + K20): Most of the alkalies present in raw materials are carried away by the flue gases heating and the cement contents only a small amount of alkalies. If they are in excess in cement then they cause a number of troubles such as alkali-aggregate reaction, efflorescence and staining when used in concrete, brickwork or masonry mortar.

Properties of Cement

The physical properties are discussed in details in the following segment.

i. Fineness of Cement: The size of the particles of the cement is its fineness. The required fineness of good cement is achieved through grinding the clinker in the last step of cement production process. As hydration rate of cement is directly related to the cement particle size, fineness of cement is very important.
ii. Soundness of Cement: Soundness refers to the ability of cement to not shrink upon hardening. Good quality cement retains its volume after setting without delayed expansion, which is caused by excessive free lime and magnesia.
iii. Consistency of Cement: The ability of cement paste to flow is consistency.
iv. Strength of Cement: Three types of strength of cement are measured – compressive, tensile and flexural. Various factors affect the strength, such as water-cement ratio, cement-fine aggregate ratio, curing conditions, size and shape of a specimen, the manner of molding and mixing, loading conditions and age.
v. Compressive Strength: It is the most common strength test. A test specimen (50mm) is taken and subjected to a compressive load until failure. The loading sequence must be within 20 seconds and 80 seconds.
vi. Tensile strength: Though this test used to be common during the early years of cement production, now it does not offer any useful information about the properties of cement.

vii. Flexural strength: This is actually a measure of tensile strength in bending. The test is performed in a 40 x40 x 160 mm cement mortar beam, which is loaded at its centre point until failure.

viii. Setting Time of Cement: Cement sets and hardens when water is added. This setting time can vary depending on multiple factors, such as fineness of cement, cement-water ratio, chemical content, and admixtures. Cement used in construction should have an initial setting time that is not too low and a final setting time not too high. Hence, two setting times are measured:

ix. Heat of Hydration: When water is added to cement, the reaction that takes place is called hydration. Hydration generates heat, which can affect the quality of the cement and also be beneficial in maintaining curing temperature during cold weather. On the other hand, when heat generation is high, especially in large structures, it may cause undesired stress. The heat of hydration is affected most by C_3S and C_3A present in cement, and also by water-cement ratio, fineness and curing temperature. The heat of hydration of Portland cement is calculated by determining the difference between the dry and the partially hydrated cement (obtained by comparing these at 7th and 28th days).

Conclusion

In the above article we have study the physical and chemical properties of cement. In addition, we have also studied the types, uses, advantages and disadvantages of cement. We have discussed why cement is a vital building material. Cement has become the primary building material used for construction in the world today. Therefore, it is an essential component of the construction industry, and it provides a strong base for the concrete.

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EVALUATING ATMOSPHERIC VARIABILITY AND CLIMATE EFFECTS IN NAMTARI WARD YOLA SOUTH ADAMAWA STATE, NIGERIA: CONSEQUENCES FOR RURAL COMMUNITIES AMIDST SUSTAINABLE DEVELOPMENT AND AFRICA'S ECONOMIC TRANSITION.

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Abstract

This research examines atmospheric changes in Namtari Ward, Yola South LGA, Adamawa State, Nigeria, from 2013 to 2023, focusing on trends in temperature, rainfall variability, relative humidity, wind speed, and atmospheric pressure. Using a combination of trend analysis and field observations, the study assesses the impact of climate change on local communities that depend on agriculture and natural resources. Findings reveal a steady increase in average annual temperatures from 28.33°C in 2014 to 29.41°C in 2023, alongside erratic rainfall patterns that disrupt traditional planting and harvesting cycles. These climatic inconsistencies contribute to water shortages, crop failures, income losses, and heightened food insecurity, reducing community resilience. To address these challenges, the study recommends adaptive measures such as drought-resistant crops, improved water conservation techniques, and community-based climate awareness initiatives. Ultimately, the research highlights the urgent need for targeted policies and interventions to support rural communities in Namtari Ward, ensuring sustainable development amid ongoing climate change challenges.

Keywords: *Climate change, atmospheric changes, rural communities, Namtari Ward, Adamawa State*

Introduction

Climate change causes many environmental, social, and economic problems around the world, especially in rural places (IPCC, 2014). These areas often can't change well because their economies aren't strong enough, their infrastructure isn't good enough, and their main sources of income are climate-sensitive jobs like farming and herding. Changing patterns of precipitation, rising temperatures, and extreme weather events have all put agricultural output, water supply, and the overall stability of ecosystems in danger, making rural people around the world even more vulnerable. In Nigeria, changes in the weather have completely changed traditional farming cycles, making it harder to plan when to plant and how well to use farming methods. These changes have led to unpredictable rain patterns, longer droughts, and more floods, all of which threaten food security and the availability of water resources (Abiodun *et al.,* 2013; Akande, 2021). These changes in the weather are especially dangerous for rural areas that rely on rain-fed farming, like those in Namtari Ward, Yola South LGA. Namtari Ward is a good example of how changes in the climate are affecting agricultural output and community resilience because it depends on rain to grow crops and take care of animals (Amos *et al.,* 2015). There is a strong link between changing rainfall, rising temperatures, and lower food yields and soil quality in Nigeria's farming areas, according to research (Amadi *et al.,* 2019; Akamigbo & Nnaji, 2011). Plants experience water stress when it rains in unpredictable ways, which limits their ability to grow and produce crops. On the other hand, too much rain can wash away nutrients from the soil and cause it to become waterlogged. Similarly, higher temperatures speed up the loss of soil moisture and organic matter and raise the risk of desertification, all of which hurt farming production even more. The combined effects of these changes put food output at risk and make economic instability and poverty worse in rural households. Changes in the environment caused by temperature have effects on agriculture, but they also have social and political effects. Lack of important resources like water and farming land has made people in the area more competitive, which has sometimes led to fights between farmers and herders over grazing land and water access (Akinyemi, 2019).

Climate change influences atmospheric parameters, altering the composition and dynamics of the Earth's atmosphere. Shifts in temperature, precipitation patterns, and atmospheric circulation patterns have direct consequences for atmospheric conditions, such as air temperature, rainfall intensity, humidity, and air quality (Sauer and Rosenzweig, 2012; Rodrigues *et al.,* 2023; Ghosh *et al.,* 2018). These changes can impact human health, crop growth, water availability, and overall environmental quality. The existing body of literature has extensively examined the impacts of climate change on soil and atmospheric parameters. The Intergovernmental Panel on Climate Change [IPCC] has provided comprehensive assessments of climate change impacts, including the effects on soils and ecosystems (IPCC, 2014). Research studies have investigated the relationship between climate change and soil erosion, soil carbon sequestration, soil moisture dynamics, and crop productivity (Rees and Ball, 2015). Similarly, investigations have explored the influence of climate change on atmospheric parameters, such as precipitation patterns, temperature extremes, and air pollution (Rees and Ball, 2015).

However, while these studies have contributed significantly to understanding climate change impacts on soil and atmospheric parameters, there is still a need for regionally focused research that addresses the specific vulnerabilities and responses to climate change. Regional studies provide critical insights into the unique characteristics and sensitivities of ecosystems and communities within specific geographic regions. Thus, the study attempts to Evaluating

Atmospheric Variability and Climate Effects in Namtari Ward Yola South Adamawa State, Nigeria: Consequences for Rural Communities Amidst Sustainable Development and Africa's Economic Transition.

Statement of the Problem: Evaluating Atmospheric Variability and Climate Effects in Namtari Ward Yola South Adamawa State, Nigeria: Consequences for Rural Communities Amidst Sustainable Development and Africa's Economic Transition. Remains largely unexplored. Inadequate research on the particular vulnerabilities, transformations, and adaptation requirements of the region's atmospheric conditions. This knowledge gap hampers the development of effective strategies to mitigate the adverse effects of climate change which threatens the resilience and sustainability of ecosystems, Economic Transition, agricultural Productivity and human communities in Namtari Ward.

The objectives of this study were as follows: assess the variations in atmospheric parameters due to climate change and to determine the knowledge, attitude and practice (KAP) of people living in the communities on climate change.

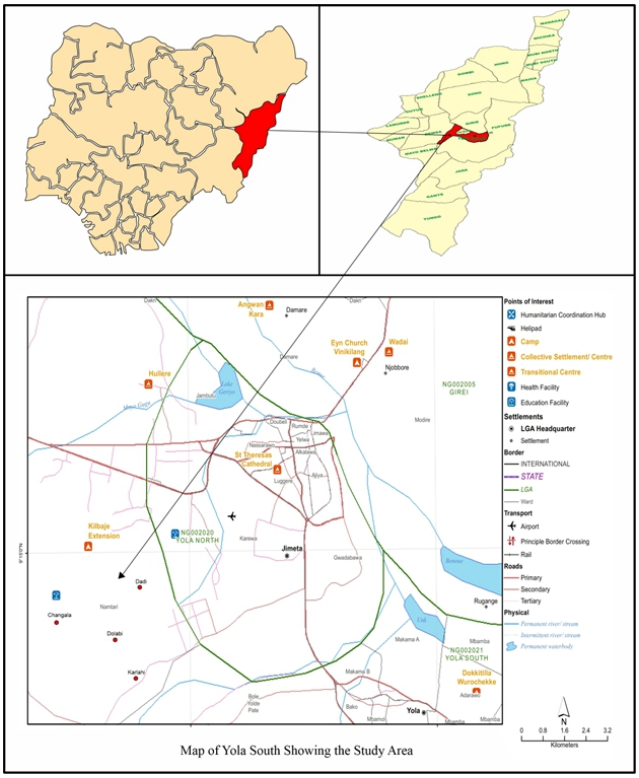
Significance of the Study: This study holds substantial significance to the field of Atmospheric Variability and Climate Effects in Namtari ward for local communities, policymakers, agricultural practitioners, and the scientific community. The findings and insights generated from this study can guide the achievement of Sustainable Development and Africa's Economic Transition, climate-resilient decision-making, enhance local livelihoods, and contribute to the overall understanding of climate change impacts and adaptation strategies. Ultimately, the research aims to contribute to the collective efforts in addressing the challenges posed by climate change and fostering sustainable development in the study area and beyond.

Scope of the Study: encompasses the Evaluation of Atmospheric Variability and Climate Effects in Namtari Ward Yola South Adamawa State, Nigeria: Consequences for Rural Communities Amidst Sustainable Development and Africa's Economic Transition. The scope of this study encompasses a multidimensional assessment of the impact of climate change on atmospheric parameters and evaluate their KAP in Namtari Ward. By investigating these interactions, the research aims to contribute valuable insights to the understanding climate change impacts at the local level and inform potential adaptation strategies for the study area.

These tensions show that climate change has many effects besides damaging the environment. It affects social cohesion, migration patterns, and the security of the area. The study's goal is to look into how changes in the atmosphere affect Namtari Ward and what those changes mean for people who live there. Through climate data analysis and community-based surveys, this project aims to find important climate trends, talk about the experiences of local farms, and look at the ways people have tried to deal with environmental problems. By combining scientific results with community opinions, the study will help people understand how changing weather affects the long-term viability of rural areas. The study results are very important for figuring out how to adapt and what policies should be put in place to lower climate risks in areas that are vulnerable. The goal of this work is to improve the resilience of rural communities in a world where climate change is becoming more uncertain by linking empirical climate science with real-world politics.

Methodology (Materials and Methods)

Study Area: Namtari Ward is situated in Yola South Local Government Area (LGA), Adamawa State, Nigeria. The area lies within the tropical climatic zone, characterized by distinct wet and dry seasons. The wet season typically spans from May to October, while the dry season lasts from November to April. Annual rainfall ranges between 800 and 1000 mm, supporting agricultural activities that are predominantly rain-fed. The average temperature varies between 25°C and 40°C throughout the year, with relative humidity peaking during the rainy season. Data Collection: Temperature, rainfall, relative humidity, wind speed, and atmospheric pressure data were sourced from the Nigerian Meteorological Agency (NiMet) for the period 2000–2023. This data was collected to analyze atmospheric variations and trends over the years. The collected meteorological data were validated through cross-referencing with regional weather monitoring records to ensure accuracy and reliability.



Map of Yola South Showing the Study Area

Data Analysis: Statistical tools were employed to evaluate the trends and variability of the meteorological parameters over the 10-year period (2014-2023). Descriptive statistics, including means, standard deviations, and percentages, were calculated to summarize the data. Time-series analysis and Analysis of Variance (ANOVA) were conducted to detect significant differences in atmospheric parameters across the years, with a significance threshold set at $P < 0.05$. Software such as Minitab 20 and Microsoft Excel were utilized for graphical representation and computational analysis of trends in temperature, rainfall, relative humidity, wind speed, and atmospheric pressure.

Results and Discussion: The atmospheric parameters for the study area from 2014 to 2023 are presented in Table 1. These parameters include temperature, rainfall pattern, relative humidity,

wind speed, and atmospheric pressure. The results provide insights into the climatic trends and variability in Namtari Ward, Yola South LGA, over the 10-year period.

Table 1: Summary of Atmospheric parameters of the study

Year	Temperature (°C)	Rainfall pattern (in mm)	Relative Humidity (%)	Wind Speed (km/h)	Air atmospheric Pressure (in millibars)
2014	28.33	60.4675	152.25	12.575	1009.79
2015	28.833	59.2675	131.25	13.125	1010.69
2016	28.75	61.5975	133.75	6.45	1010.53
2017	28.91	68.4525	124.75	6.06	1010.42
2018	29.66	59.375	123.5	6.258	1010.22
2019	29.75	78.185	140.75	7.016	1011.06
2020	28.75	44.785	141.75	7.475	1010.08
2021	29.33	57.0675	136.75	7.341	1009.33
2022	28.33	64.775	138.25	7.308	1009.71
2023	29.41	91.72	133.5	7.616	1009.23
Average	29.008	64.5693	135.65	8.123	1010.11

Source: Minitab 20 Computations; Parameter F (4,45) =37962.38; P=0.000 (p<0.05)

Temperature Trends*:* The average annual temperature over the study period was 29.008°C, with slight variations across the years. The highest annual average temperature (29.75°C) was recorded in 2019, while the lowest (28.33°C) occurred in both 2014 and 2022. The overall trend suggests a gradual increase in temperature over the years, aligning with global warming projections in tropical regions. These rising temperatures may have implications for crop growth, water resources, and local livelihoods.

Rainfall Patterns: Rainfall variability was evident, with the highest annual average rainfall (91.72 mm) recorded in 2023 and the lowest (44.785 mm) in 2020. The average rainfall for the 10 years was 64.5693 mm. A significant fluctuation in rainfall patterns suggests unpredictable wet and dry spells, which could challenge rain-fed agricultural practices predominant in the area.

Relative Humidity: The average relative humidity for the period was 135.65%, with the highest (152.25%) recorded in 2014 and the lowest (123.5%) in 2018. The observed decrease in relative humidity during certain years may exacerbate water stress for both crops and livestock. Conversely, periods of higher humidity may contribute to favorable growing conditions but could also increase the risk of plant diseases.

Wind Speed: Wind speed showed a relatively stable trend over the years, with an average value of 8.123 km/h. The lowest average wind speed (6.06 km/h) occurred in 2017, while the highest (13.125 km/h) was recorded in 2015. The moderate wind speeds observed are characteristic of tropical climates and play a role in influencing evapotranspiration rates and atmospheric pressure systems.

Atmospheric Pressure: The mean atmospheric pressure during the study period was 1010.11 millibars, with minor annual fluctuations. The highest pressure (1011.06 millibars) was recorded in

2019, and the lowest (1009.23 millibars) in 2023. These small variations in atmospheric pressure are consistent with typical weather changes in tropical environments and have minimal direct effects on local climate patterns. The ANOVA results revealed a statistically significant variation in the atmospheric parameters over the years ($F(4,45) = 37962.38$, $P = 0.000$), indicating notable climatic changes within the study period. This reinforces the need for adaptive strategies to mitigate the impact of such variability on agriculture and livelihoods.

Discussion: Trends, Variability, and Implications

The results of this study highlight significant trends and variability in atmospheric parameters, offering critical insights into the effects of climate change on Namtari Ward and similar rural communities in Nigeria. These findings are consistent with broader evidence from existing literature that examines the implications of climate change across sub-Saharan Africa (IPCC, 2021; Odjugo, 2010). Understanding these trends is essential for developing adaptive strategies that enhance resilience in vulnerable communities, particularly those reliant on climate-sensitive sectors such as agriculture and water resources.

Increasing Temperature Trends: One of the most prominent findings of this study is the steady rise in average temperature over the 10-year period analyzed. The mean temperature in Namtari Ward increased from 28.33°C in 2014 to 29.41°C in 2023, with minor fluctuations in between. While an increase of approximately 1.08°C over a decade may appear minimal, it aligns with global warming trends observed in other regions and has far-reaching consequences for environmental and socioeconomic systems (IPCC, 2021; Abiodun *et al.,* 2013). Higher temperatures contribute to increased evapotranspiration rates, leading to reduced soil moisture and placing significant stress on crops that depend on rain-fed agriculture. Research by Ebele and Emodi (2016) underscores that prolonged periods of elevated temperatures alter the phenological stages of crops, reducing agricultural yields and potentially leading to food insecurity. Similarly, livestock is adversely affected, as heat stress reduces animal productivity and increases susceptibility to diseases (Thornton *et al.,* 2018).

In rural communities such as Namtari Ward, where agriculture is the predominant livelihood, these temperature increases directly threaten food security. Traditional farming systems, which depend on predictable seasonal cycles, are disrupted, necessitating the adoption of adaptive strategies such as drought-resistant crop varieties, improved irrigation techniques, and agroforestry practices. Studies by Akinyemi *et al.,* (2020) and Jalloh *et al.,* (2012) suggest that integrating climate-smart agricultural practices could enhance resilience in such vulnerable communities.

Erratic Rainfall Patterns: Another critical finding of this study is the variability in rainfall patterns over the study period. Rainfall amounts fluctuated significantly, with annual averages ranging from a low of 44.785 mm in 2020 to a high of 91.72 mm in 2023. This unpredictability is a major challenge for farmers who rely on consistent rainfall for planting and harvesting cycles. The shift in rainfall patterns aligns with broader research findings indicating that climate change is increasing rainfall variability in Nigeria and across sub-Saharan Africa (Ebele & Emodi, 2016; Odekunle *et al.,* 2008). Irregular rainfall patterns not only disrupt agricultural calendars but also exacerbate the risk of extreme weather events. For instance, excessive rainfall in some years can lead to flooding, which damages crops, depletes soil nutrients, and increases the prevalence of waterborne diseases (Ajayi *et al.,* 2018). Conversely, years of low rainfall can result in prolonged

droughts, significantly reducing water availability for both irrigation and domestic use. Studies by Eze et al., (2019) emphasize that shifting precipitation patterns threaten not just food production but also overall water security in Nigeria. To mitigate these impacts, improved water resource management strategies must be adopted. Ajayi *et al.,* (2018) highlight the effectiveness of rainwater harvesting systems, small-scale reservoirs, and irrigation infrastructure in enhancing water availability during dry periods. Additionally, the implementation of climate-resilient agricultural practices, such as conservation agriculture and soil moisture retention techniques, could help farmers adapt to unpredictable rainfall patterns (FAO, 2020).

Conclusion

This study's findings validate the rising temperature trends and irregular rainfall patterns indicative of climate change effects in sub-Saharan Africa. These climate alterations present significant issues for rural populations such as Namtari Ward, impacting agriculture, water supplies, and general lives. Due to the escalating susceptibility of these communities, the necessity for proactive adaptation techniques is more pressing than ever. Temperature Trends and Rainfall Fluctuations: Increasing temperatures and erratic precipitation patterns have emerged as characteristic elements of climate change in sub-Saharan Africa. The research noted a steady rise in temperature over the last twenty years, alongside unpredictable precipitation patterns. These alterations negatively impact agricultural output, diminishing crop yields and exacerbating food insecurity (UNDP, 2021). Farmers in Namtari Ward, whose principal livelihood relies on rain-fed agriculture, are most impacted by these climate changes. Irregular precipitation results in extended droughts and, at times, extreme inundation, both of which reduce soil fertility and disrupt planting cycles. The research shows that it's very important to take action now by improving irrigation systems, using farming methods that can handle climate change, and upgrading water management systems. Policymakers and local stakeholders must emphasize sustainable development programs that strengthen community resilience to climate change. Investment in early warning systems, climate education, and financial assistance for smallholder farmers will be essential for enabling communities such as Namtari Ward to adapt to changing climate circumstances (UNDP, 2021). Subsequent study must concentrate on localized climate adaptation techniques customized for distinct environmental and socioeconomic conditions in Nigeria and elsewhere.

Fluctuations in Relative Humidity: The analysis indicated notable variations in relative humidity over the years, with a peak average of 152.25% in 2014 and a minimum of 123.5% in 2018. Variations in humidity levels impact local climatic conditions, altering crop viability and the incidence of pests and illnesses. Elevated humidity can promote fungal infections in crops, resulting in a rise in plant diseases such as powdery mildew and leaf blight. In contrast, reduced humidity levels exacerbate water stress, hindering crop growth during arid periods (Akinyemi *et al.,* 2020). These effects highlight the importance of using combined pest and disease management systems and flexible farming practices to deal with changing climate conditions.

Stability of Wind Speed and Its Consequences: The investigation recorded consistently constant wind speeds, averaging 8.123 km/h. While variations in wind speed exerted negligible direct effects on local climate, they significantly influenced evapotranspiration rates, soil moisture content, and the proliferation of crop diseases. Elevated wind speeds enhance soil moisture evaporation, intensifying dry conditions, while sluggish winds facilitate localized humidity accumulation, perhaps promoting disease spread in crops. Although this study did not concentrate on wind energy potential, it offers a prospect for renewable energy generation in the region. Utilizing wind

energy may facilitate sustainable development by diminishing reliance on fossil fuels and encouraging the use of clean energy in rural areas (Akinyemi *et al.*, 2020).

Atmospheric Pressure and Regional Climate Dynamics: The study documented slight annual variations in air pressure, averaging 1010.11 millibars. These variations, characteristic of tropical climates, signify nuanced alterations in local meteorological systems. Atmospheric pressure affects meteorological patterns, encompassing storm development and fluctuations in precipitation. Understanding these factors can improve weather prediction models for the area, helping farmers plan better and lower the chances of losing crops due to unexpected weather events (Abiodun *et al.,* 2013). Precise meteorological predictions can enhance early warning systems, facilitating prompt reactions to unfavorable weather circumstances. Consequences and Adaptive Approaches: The results highlight the susceptibility of rural areas such as Namtari Ward to climatic fluctuations. The cumulative effects of increasing temperatures, unpredictable precipitation, and other climatic alterations present substantial threats to food security, water supplies, and livelihoods.

Recommendations

Effective Water Management Systems: The implementation of rainwater collection, small-scale irrigation, and community water reservoirs helps stabilize water supply during arid periods (Ajayi *et al.,* 2018). Enhanced Crop Varieties: The development and promotion of drought-resistant and heat-tolerant crops can bolster agricultural resilience and secure sustainable food production (Akinyemi *et al.,* 2020). Implementing sustainable land-use practices such as agroforestry, crop rotation, and soil conservation techniques might alleviate the negative impacts of climate change on agriculture (Ebele & Emodi, 2016). Climate-Smart Infrastructure: Investment in climate-resilient infrastructure, such as roads, storage facilities, and energy systems, can promote sustainable development and mitigate vulnerability to climate change effects (Akinyemi *et al.,* 2020). Community Engagement and Climate Education: It is imperative to raise awareness regarding the implications of climate change and the necessary adaptation actions. Local farmers and stakeholders must possess the requisite knowledge and skills to implement climate-smart practices effectively (UNDP, 2021).

Final Analysis: This study highlights the substantial effects of climate change in Namtari Ward, especially on increasing temperatures and unpredictable rainfall patterns that have disturbed conventional agriculture practices. The findings highlight the susceptibility of rural residents in the region to these atmospheric alterations, impacting their water supplies, food security, and livelihoods. To address these difficulties, it is essential to implement specific interventions, like increasing community understanding of climate change effects, advocating for climate-resilient agricultural methods, and boosting local water management systems. Enhancing resilience through these adaptive solutions is crucial for protecting the future of Namtari Ward and guaranteeing sustainable development amid climate uncertainty.

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YOUTH ENTREPRENEURSHIP: UNLOCKING NIGERIA'S JOB CREATION THROUGH AGRICULTURE: PAVING THE WAY FOR SUCCESS

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Abstract

This paper explores youth entrepreneurship unlocking Nigeria's job creation through agriculture: paving the way for success, agriculture should be handle as a business, because the current generations of farmers are aging rapidly. Globally, many young people and those from underprivileged background face significant challenges, including high unemployment and limited access to opportunities which hinder their potential for success. Absolutely with the changing technologies, demands for quality and standards, there is need to change the labour composition of agricultural sector of our country. The aim agricultural sector requires new skill, younger and more entrepreneurial farmers who will be able to run sound agribusiness that will make Nigerians agricultural modern, commercial and profitable. The sample size was 100 respondents, including teachers and agri-business students. Descriptive survey design was used, and data collected via structured questionnaires, and analysed using mean and standard deviation. The findings of this research are expected to contribute to policy discussion in unlocking Nigeria's job creation through agriculture in Nigeria. By providing empirical data on the role of the youth. This study offers practical recommendations such as our youths should be exposed to improved agricultural activities, because they have great potentials to exploit the windows of opportunities in agricultural sector. We need to urgently provide massive support for the youth's empowerment in Nigeria. It is necessary, to shape Nigeria's future and secure its destiny, through increasing the attractiveness of agriculture for young people.

Keywords: *Agriculture, Job Creation, Entrepreneurship.*

Introduction

Agriculture in Nigeria has remained unattractive to young people because of failure of government to mechanise the sector. "The exodus of rural youth means fewer small-scale farmers tomorrow, which will lead to drastically changing the profile of farming". Said a recent report by the International Institute for Environment and Development (IIED). Nigeria, with its vast agricultural potential and large youth population, stands at a critical juncture where youth entrepreneurship in agriculture can be a game-changer for the economy. By harnessing the energy, creativity, and innovation of its youth, Nigeria can unlock significant opportunities for job creation, economic growth, and sustainable development.

Moreover, Agriculture is the backbone of Nigeria's economy, contributing significantly to GDP, employing a large portion of the workforce, and providing food security. However, the sector's potential remains underexploited, particularly among the youth. By engaging youths in agricultural entrepreneurship, Nigeria can modernize its agricultural practices, increase productivity, and enhance the sector's contribution to the economy. Agriculture could be referred to as the production, processing, promotion and distribution of agricultural products. Agriculture is the backbone of economic system of a given country. And is important to human beings because it forms the basis for food security. It helps human beings grow the most ideal food crops and raise the right animals with accordance to environmental factors. Being able to grow the right crop and keep the right livestock ensures that human beings are able to eat healthy diets and form strong immune systems to fight against diseases and infections. Agricultural activities help human beings create job opportunities, which eventually helps build a strong and sustainable national economy. The main source livelihood of many people is agriculture. Approximately 70% of the people directly rely on agriculture as a mean of way to use land so as to avoid disasters like famines. (Nwogu 2013). Before industrial revolution, agriculture was the primary source of economy for most countries. Before the civil war in Nigeria, our country had more than enough food to take care of its citizen. Agriculture was booming before crude oil was discovered. However, upon the discovery of oil, much attention was shifted from agriculture. Over the years Nigeria has depended on crude oil exploration and exportation. Crude oil accounts for over 90 per cent of Nigeria's foreign exchange earnings, 35 per cent of gross domestic products (GDP), 75 per cent of government revenue. A failure to save for the rainy day as well as poor monetary and fiscal policies were party responsible for the country's current recession, according to the Central Bank of Nigeria (CBN).

Nigeria is blessed with a favourable soil and climate condition that can accommodate crops such as onion, carrot, cocoa yam, pear, potatoes, okra, vegetables, beans, and so much more. The country indeed has huge agricultural potentials. With over 84 million hectares of arable land, of which only 40 per cent is cultivated; a population of about 180 million people, making her Africa's largest market; 230 billion cubic meters of water; and abundant and reliable rainfall in over two thirds of its territory, the country has some of the richest natural resources for agricultural production in the world. Even though over 70% of our land is arable, Nigerian youths are encouraged to see farming as business. Instead, we all grew up and dream of working in a bank hall, factories, and the oil sector.

This situation of dominance of oil in the economy has led to a major decline in the agricultural sector, leading agriculture to be practiced and dominated by traditional smallholder farmers who raise subsistence crops such as maize, cassava, yams, rice of which up to 70% of the final produce is

for their own consumption. Most people will want to agree with me that, it will be difficult for government alone to provide jobs for all graduates. Even now that "good jobs" are dead, most people are still ignorant of the potential in agribusiness. Moreover, the agriculture sector requires new skill, younger and more entrepreneurial farmers who will be able to run sound agri-business, that will make Nigerians agricultural modern, commercial and profitable.

It must be recall that in 1960, 70s Nigeria was an agricultural power house that accounted for 42% of groundnut export globally, 29% of palm oil export, 18% of cocoa export and our farmers then, were the leading producers of Colton in West Africa. Agriculture as it where, was a job creation engine and era recorded low youth unemployment ratios of a mere 2%. Sadly, today Nigeria has lost that glory. We now, depend solely on food importation, even on the food items we had comparative advantage over other nations to produce. Nigeria food import has risen to alarming rate, as Nigeria spends over 3 Trillion annually. Also, it is my view, that this trend if checked will elusive effect on the nation economy, with resultant negative effects. Agriculture should be handle as a business, no longer as a development programme. We also need to look inwards and focus on private sector driven investment to unlock the potential of private sector driven investment to unlock the potential of the sector. All these initiatives are expected to serve as a platform to attract the younger people into agricultural business, as an occupation with new technology, agriculture is no longer about hoe and cutlass. (Ugochukwu 2010).

The vision of improved agriculture and indices of agricultural transformation agenda is to move Nigeria from small scale agricultural economy, to an agriculturally industrialized economy, towards wealth creation, jobs and market for farmers. Nigeria must also plan to grow the size of agricultural sector from the present level of $90 billion per year today, to $300 billion per year by 2030. There are lots of money to be made from Agriculture especially in investment in several agricultural value chains on tomatoes, cocoa, oil palm etc. Animal returns from these investment in each commodity value chains ranged from 19% to as high as 85% with investment payback period ranged from 3.5 to 4.5 years. (Nwankwo 2022). Consequently, in order to take advantage of this growth and rising profitability of the agricultural sector for the youth, some critical issues must be addressed. Rather than design solutions for the youth from Top-down approach, the bottom-Top approach, which carries participatory elements design, will convey solutions to youth unemployment issues in Nigeria.

The Role of Youth Entrepreneurship in Agriculture

Youth entrepreneurship in agriculture offers a promising pathway to address several challenges facing Nigeria, including:

i. Unemployment: By creating jobs in agriculture and related sectors, youth entrepreneurship can help reduce unemployment rates among Nigerian youths.
ii. Food Security: Entrepreneurial activities in agriculture can lead to increased food production, improving food availability and access, and enhancing food security.
iii. Economic Diversification: Agriculture-based entrepreneurship can contribute to diversifying Nigeria's economy, reducing dependence on oil, and building resilience against economic shocks.
iv. Rural Development: By stimulating economic activities in rural areas, youth entrepreneurship in agriculture can contribute to balanced regional development and reduce rural-urban migration.

Opportunities of Youth Entrepreneurship in Agriculture

i. Market Demand: Growing demand for food and agricultural products both domestically and internationally.
ii. Technological Advancements: Opportunities for adopting modern farming techniques and technologies.
iii. Government and Private Sector Support: Increasing support for agricultural development through policies, programs, and investments.

Challenges of Youth Entrepreneurship in Agriculture

i. Access to Finance: Limited access to capital and financial services for youth entrepreneurs.
ii. Lack of Skills and Training: Need for specialized training in agricultural entrepreneurship and business management.
iii. Infrastructure and Market Access: Challenges related to infrastructure, market access, and value chain development.

Importance of Youth Entrepreneurship in Agriculture

i. Job Creation: Entrepreneurship in agriculture can create direct and indirect jobs, reducing unemployment.
ii. Economic Growth: Agricultural entrepreneurship contributes to GDP growth, improving economic stability.
iii. Food Security: Enhancing agricultural productivity ensures food availability and security.
iv. Sustainable Development: Sustainable agricultural practices can promote environmental conservation.

Key Areas for Youth Entrepreneurship in Agriculture

i. Crop Production: Innovative farming techniques and technology can increase yield and efficiency.
ii. Livestock Production: Opportunities in poultry, fisheries, and animal husbandry.
iii. Agro-processing: Adding value to raw agricultural products through processing and packaging.
iv. Agricultural Technology: Development and application of tech solutions for farming and agricultural businesses.
v. Farm Management Services: Offering services like farm planning, management, and consultancy.

Benefits of Youth Entrepreneurship in Agriculture

i. Increased Productivity: Youth entrepreneurship in agriculture can lead to increased productivity and efficiency, contributing to food security and economic growth.
ii. Job Creation: Engaging young people in agricultural entrepreneurship can create employment opportunities, both directly and indirectly, contributing to poverty reduction and economic development.
iii. Innovation: Youth entrepreneurship in agriculture can also promote innovation, as young people bring new ideas and perspectives to agricultural production and marketing

Strategies to Support Youth Entrepreneurship in Agriculture

i. Training and Capacity Building: Programs focusing on business skills, agricultural practices, and technology use.
ii. Access to Finance: Initiatives like youth-focused funding schemes, grants, and low-interest loans.
iii. Infrastructure Development: Improving rural infrastructure to support agricultural activities.
iv. Market Linkages: Creating platforms for youth entrepreneurs to access markets and get better prices.
v. Policy Support: Government policies that encourage youth participation in agriculture, including incentives and protection.

Statement of Problem

The agricultural potential of Nigeria is barely being tapped and this explains the mobility of the country to meet the ever-increasing demand for agricultural produce Although the agricultural sector remains a dominant employer of labour serious investment is needed across the board to enhance production and increase the contribution of the country's GDP. Despite Nigeria's vast agricultural potential and large youth population, the country faces significant challenges in creating jobs and stimulating economic growth through agriculture. To answer this question, there is need for an empirical inquiry into the youth entrepreneurship: unlocking Nigeria's job creation through agriculture: paving the way for success.

Objective of the Study

i. To identify the factors influencing youth participation in agricultural entrepreneurship in Nigeria.
ii. To assess the impact of youth entrepreneurship in agriculture on job creation and economic growth in Nigeria.
iii. To explore the challenges faced by youth entrepreneurs in the agricultural sector in Nigeria.
iv. To develop strategies for supporting and enhancing youth entrepreneurship in agriculture for job creation in Nigeria.
v. To investigate the role of technology and innovation in promoting youth entrepreneurship in agriculture in Nigeria.

Research Questions

i. What are the key factors influencing youth participation in agricultural entrepreneurship in Nigeria?
ii. How does youth entrepreneurship in agriculture contribute to job creation and economic growth in Nigeria?
iii. What are the major challenges faced by youth entrepreneurs in the agricultural sector in Nigeria?
iv. What strategies can be implemented to support and enhance youth entrepreneurship in agriculture for job creation in Nigeria?
v. How can technology and innovation be leveraged to promote youth entrepreneurship in agriculture in Nigeria?

Methodology
A Descriptive field survey research methodology was adopted.

Population of the Study
The study population describes the entire people who are key informants to the findings of a study. Although the study focuses on youth entrepreneurship and agriculture, the population of the study include teachers and agri-business students from Abia State in South Eastern Nigeria respectively.

Sample and Sampling Technique
A total of 100 respondents were selected. A purposeful sampling technique was adopted as a sampling modality for the administration of the research instrument. Purposive sampling technique was referred because it involves selecting certain units or cases based on a definite purpose.

Table 1: Shows Youth Entrepreneurship in Agriculture

Variable	B	SEB	B	t	F	R2
BE	4.98	0.11	0.44	11.14	58.29 0.54	
EE	3.72	0.09	0.35	7.78	38.90. 0.31	
CE	2.02	0.10	0.22	3.25	18.14 0.16	

Note: BE Behavioural Engagement; EE = Emotional Engagement; CE Cognitive Engagement; B = Unstandardized regression coefficient; SEB = Standardized error of the Coefficient.

Conclusion
In conclusion we must create a future for Nigeria's agriculture it must be a future that will expand opportunities for millions of our youths. Therefore, our youths should be exposed to improved agricultural activities because they have great potentials to exploit the windows of opportunities in agricultural sector. We need to urgently provide massive support for the youths empowerment in Nigeria. It is necessary to shape Nigeria's future and secure its destiny. Though increasing the attractiveness of agriculture for young people.

In addition, youth entrepreneurship has the potential to significantly impact agricultural development, contributing to food security, economic growth, and poverty reduction. Addressing the challenges and constraints facing youth entrepreneurs in agriculture is crucial to unlocking their potential and promoting sustainable agricultural development. Furthermore, getting young Nigeria's in agriculture is a necessity since most of the country's subsistence farmers are elderly and dying off. If proper incentives are not available to the succeeding generation to engage in agriculture, it will leave a vacuum in the sector.

Recommendation
Government should set up agricultural mechanization centres to help young farmers without capital, who might need expensive tools such as tractors, which they may not be able to afford. Government at all levels (federal, state and local) needs to provide strategies and implement plan that can enhance employment opportunities. For example, government can partner with private and public agencies or set up business training centres and innovative programmes in different strategic location, in the country, that can widen the scope of horizon of nowadays Nigerians on the need to be self-employed.

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Challenges and Opportunities for Youth in Nigerian Agriculture" - Analyzes the challenges faced by youth in agriculture and identifies opportunities for growth and development.

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Youth Agriculture and Entrepreneurship in Nigeria" by Federal Ministry of Agriculture and Rural Development (FMARD) - Outlines government initiatives and strategies for promoting youth entrepreneurship in agriculture.

Youth Employment in Agriculture" by AfDB.

Youth Employment in Agriculture" by African Development Bank - Explores strategies for engaging youth in agriculture for job creation and economic growth.

Youth Employment in Agriculture Platform - An online platform sharing resources, best practices, and success stories on youth engagement in agriculture.

Youth Entrepreneurship in Agriculture: A Review of the Literature" in Journal of Agricultural Economics - Reviews existing literature on youth entrepreneurship in agriculture, highlighting challenges and opportunities

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CASE STUDY" A NECESSARY RESEARCH BEFORE A BUILDING DESIGN

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Abstract

A case study may be referred to as a research carried out as a detailed analysis, description and assessment of a specific person, group or situation over a period of time for the purpose of deriving or illustrating a principle. From the above definition it is obvious that an initial research is important to educate or insight the architect before ever embarking on any public or institutional building design. However, this research work is either neglected or underestimated by most architects in our society today due to various reasons like cost implication, distance, security and outright laziness. This research work is prepared to educate the society on the importance of case study in our everyday design and some easy ways of achieving a successful research before any design. At the end of this research work, we will understand the simple ways to overcome every limitation to a successful case study hence we will be able to produce better and more functional designs for the society.

Keywords: *Built Environment, information analysis, principle, Data.*

Introduction

A case study is an in-depth examination of a specific subject, such as a building, an individual, group, organization, or event, within its real-life context, and it is crucial for gaining detailed insights into complex phenomena. IT is a qualitative research method that involves a detailed and systematic investigation of a particular case or cases. A case study is an appropriate research design when you want to gain concrete, contextual, in-depth knowledge about a specific real-world subject. It allows you to explore the key characteristics, meanings, and implications of the case. Case studies are often a good choice in a thesis or dissertation. They keep your project focused and manageable when you don't have the time or resources to do large-scale research. A case study typically involves multiple data sources, including interviews, observations, documents, and other relevant materials. The findings of a case study can be used to generate insights, develop solutions, and inform decision-making processes.

Importance of Case Studies

i. In-Depth Understanding: Case studies provide a comprehensive understanding of the subject matter, capturing the intricacies and dynamics that might be overlooked in broader quantitative studies. This depth of analysis is particularly valuable when exploring new or complex phenomena.
ii. Contextual Insights: By examining cases within their real-life context, researchers can identify the factors and interactions that influence outcomes. This contextual understanding is essential for developing theories and practical applications.
iii. Exploratory Research: Case studies are particularly useful in the early stages of research when little is known about a topic. They help generate hypotheses and identify variables for further investigation.
iv. Theory Building: Analyzing multiple case studies can contribute to theory development by revealing patterns and relationships that inform existing theories or lead to the creation of new ones.
v. Practical Applications: In fields like business and education, case studies can inform best practices and strategies by providing real-world examples of success and failure.

In summary, case studies are vital research tools that enable a deeper understanding of complex issues, offering valuable insights that can inform both theory and practice across various fields.

Preparation for data collection in the Case Study Method

Because case-study research generates a large amount of data from multiple sources, systematic organization of data is important to prevent the researcher from becoming overwhelmed by the amount of data and to prevent the researcher from losing sight of the original goal and questions of the researcher. search. Prepaid preparation assists in the handling of large amounts of data in a documented and systematic manner. The researchers prepare databases to assist in the categorization, classification, storage and retrieval of data for analysis.

Collection of data in the field

The Case Study Method

I. The researcher must collect and store multiple sources of evidence comprehensively and systematically in formats that can be referenced and classified so that convergent lines of inquiry and patterns can be discovered. The researchers carefully observe the object of the case study and identify causal factors associated with the observed phenomenon.

ii. The renegotiation of the arrangements with the objects of the study or the addition of questions to the interviews may be necessary as the study progresses. Case study research is flexible, but when changes are made, they are documented systematically.

Evaluate and analyze data

The researcher examines the raw data using many interpretations to find links between the search object and the results with reference to the original search questions. Throughout the process of evaluation and analysis, the researcher remains open to new opportunities and insights. The case study method, using multiple methods of data collection and analysis techniques, offers researchers the opportunity to triangulate data to strengthen the findings and conclusions of the research. The tactics used in the analysis force researchers to go beyond initial impressions to improve the likelihood of accurate and reliable findings. Examples of case studies allow you to deliberately sort data in many different ways to expose or create new ideas and look for conflicting data to disallow the analysis. Researchers categorize, tabulate, and recombine data to address the initial propositions or purpose of the study, and perform cross-checks of facts and discrepancies in the accounts.

Prepare the report

How to start a case study essay

Examples of case studies report the data in a way that transforms a complex issue into one that can be understood, allowing the reader to question and examine the study and come to an independent understanding of the researcher.

The purpose of the written report is to portray a complex problem in a way that conveys an experience passed on to the reader. The studies present the data in a very accessible way to the public and can lead the reader to apply the experience to their own actual situation. Researchers pay close attention to sufficient evidence to gain the confidence of the reader that all routes have been explored, clearly communicating the boundaries of the case and giving special attention to conflicting propositions.

The introduction of the report includes acknowledging all participants, indicating the problem, listing the research questions, describing the methods used to conduct the research and any potential flaws in the method used, explaining the data collection and analysis techniques used and concluding with the answers to questions and suggestions for future research. Key features of the report include a feeling of specific stories related to the successes or losses experienced by organizations that were transmitted during data collection and responses or comments illuminating issues directly related to the research questions.

The researcher develops each question using quotes or other details of the data collected, and points to triangulation of data where applicable. The report also includes confirmation and departures from the conclusions of the literature used. The report's conclusion makes affirmations and suggestions for new research activities so that another researcher can apply these techniques to another community network and its participants to determine if similar findings are identifiable in other communities.

Key Characteristics of Case Studies:

i. Focus on a specific case, individual, or event.

ii. Provide in-depth analysis and contextual understanding.
iii. Useful for exploring new or complex phenomena.
iv. Generate rich qualitative data that contributes to theory building.

Types of Case Studies
Case studies can be classified into different types depending on their purpose and methodology. Common types include **exploratory**, descriptive, explanatory, intrinsic, and instrumental case studies.

1. **Exploratory Case Study**
Definition: An exploratory case study investigates an area where little is known. It helps to identify questions, variables, and hypotheses for future research.

Characteristics:
i. Often used in the early stages of research.
ii. Focuses on discovery and hypothesis generation.
iii. Helps clarify research questions.

Example: Examining how remote work affects team dynamics in an organization that has recently transitioned to a work-from-home model.

2. **Descriptive Case Study**
Definition: A descriptive case study provides a detailed account of a particular case, describing it within its context. The goal is to provide a complete and accurate depiction without necessarily exploring underlying causes.

Characteristics:
i. Focuses on describing the case in detail.
ii. Provides comprehensive data to paint a clear picture of the phenomenon.
iii. Helps understand "what" happened without delving into "why."

Example: Documenting the process and outcomes of a corporate restructuring within a company, describing the actions taken and their immediate effects.

3. **Explanatory Case Study**
Definition: An explanatory case study aims to explain the cause-and-effect relationships of a particular case. It focuses on understanding "how" or "why" something happened.

Characteristics:
i. Useful for causal analysis.
ii. Aims to provide insights into mechanisms and processes.
iii. Often used in social sciences and psychology to study behavior and interactions.

Example: Investigating why a school's test scores improved significantly after implementing a new teaching method.

4. **Intrinsic Case Study**

Definition: An intrinsic case study focuses on a unique or interesting case, not because of what it represents but because of its intrinsic value. The researcher's interest lies in understanding the case itself.

Characteristics:

i. Driven by the researcher's interest in the particular case.
ii. Not meant to generalize findings to broader contexts.
iii. Focuses on gaining a deep understanding of the specific case.

Example: Studying a particularly successful start-up to understand its founder's unique leadership style.

5. **Instrumental Case Study**

Definition: An instrumental case study examines a particular case to gain insights into a broader issue. The case serves as a tool for understanding something more general.

Characteristics:

i. The case itself is not the focus; rather, it is a vehicle for exploring broader principles or theories.
ii. Helps apply findings to similar situations or cases.
iii. Useful for theory testing or development.

Example: Studying a well-known patient's therapy process to understand the general principles of effective psychological treatment.

Methods of Conducting a Case Study

Case studies can involve various research methods to collect data and analyze the case comprehensively. The primary methods include **interviews**, **observations**, **document analysis**, and **surveys**.

1. **Interviews**

Definition: Interviews allow researchers to gather in-depth information from individuals involved in the case. These interviews can be structured, semi-structured, or unstructured, depending on the study's goals.

Steps:

i. Develop a list of open-ended questions aligned with the study's objectives.
ii. Conduct interviews with individuals directly or indirectly involved in the case.
iii. Record, transcribe, and analyze the responses to identify key themes.

Example: Interviewing employees, managers, and clients in a company to understand the effects of a new business strategy.

2. **Observations**

Definition: Observations involve watching and recording behaviors, actions, and events within the case's natural setting. This method provides first-hand data on interactions, routines, and environmental factors.

Steps:

i. Define the behaviors and interactions to observe.
ii. Conduct observations systematically, noting relevant details.
iii. Analyze patterns and connections in the observed data.

Example: Observing interactions between teachers and students in a classroom to evaluate the effectiveness of a teaching method.

Document Analysis

Definition: Document analysis involves reviewing existing documents related to the case, such as reports, emails, memos, policies, or archival records. This provides historical and contextual data that can complement other data sources.

Steps:

i. Identify relevant documents that offer insights into the case.
ii. Systematically review and code the documents for themes or categories.
iii. Compare document findings with data from interviews and observations.

Example: Analyzing company policies, performance reports, and emails to study the process of implementing a new organizational structure.

4. **Surveys**

Definition: Surveys are structured questionnaires administered to a group of people involved in the case. Surveys are especially useful for gathering quantitative data that supports or complements qualitative findings.

Steps:

i. Design survey questions that align with the research goals.
ii. Distribute the survey to a sample of participants.
iii. Analyze the survey responses, often using statistical methods.

Example: Conducting a survey among customers to measure satisfaction levels after a service redesign.

Case Study Guide: Step-by-Step Process

Step 1: **Define the Research Questions**

I. Defining the case. You should start by understanding the task at hand. This step requires you to read the assigned case to get a complete overview of what you should do before undertaking anything.
ii. Clearly outline what you aim to understand or explain.
iii. Define specific questions that the case study will answer, such as "What factors led to X outcome?"

Step 2: Select the Case(s)

i. Identifying the problem. Since every case study is a problem-solving tool, you should identify the problem that needs to be solved. Start by defining the central issue and identifying the main problems that necessitated this study.
ii. Choose a case (or cases) that are relevant to your research question.
iii. Ensure that the case is feasible to study, accessible, and likely to yield meaningful data.

Step 3: Determine the Data Collection Methods

I. Decide which methods (e.g., interviews, observations, document analysis) will best capture the information needed.

ii. Consider combining multiple methods to gather rich, well-rounded data.

Step 4: Collect Data

i. Gather data using your chosen methods, following ethical guidelines such as informed consent and confidentiality.

ii. Take comprehensive notes and record interviews or observations when possible.

Step 5: Analyze the Data

i. Analyzing the problem. After detecting the problem, it's time to analyze it. You should examine the issue carefully to understand its scope and cause.

ii. Organize the data into themes, patterns, or categories.

iii. Use qualitative or quantitative analysis methods, depending on the nature of the data.

iv. Compare findings across data sources to identify consistencies and discrepancies.

Step 6: Interpret Findings

i. Developing solutions. After unearthing the problem, it's time to brainstorm possible solutions to the identified issues. Consider several suitable solutions and select the best one/ones. Your recommendations should be implementable, realistic, and viable. Remember to share what you believe will be the outcomes of implementing each solution. You can base your evidence on personal experience, study materials, interviews, or collected data.

ii. Draw conclusions based on the analysis, relating the findings to your research questions.

iii. Consider alternative explanations and assess the generalizability of your findings.

Step 7: Report Results

i. Write a detailed report that presents your findings and explains their implications.

ii. Discuss the limitations of the case study and potential directions for future research.

iii. Making recommendations. Lastly, develop an implementation plan that details how your proposed solutions will be executed in practice. Remember to make recommendations for action

Examples of Case Study Applications

Business Case Study

i. Objective: To understand the success factors of a high-growth tech company.

ii. Methods: Interviews with key executives, analysis of internal reports, and customer satisfaction surveys.

iii. Outcome: Insights into unique management practices and customer engagement strategies.

Education Case Study

i. Objective: To examine the impact of project-based learning on student engagement.

ii. Methods: Observations in classrooms, interviews with teachers, and analysis of student performance data.

iii. Outcome: Evidence of increased engagement and enhanced critical thinking skills among students.

Healthcare Case Study

i. **Objective**: To explore the effectiveness of a new mental health intervention.
ii. **Methods**: Interviews with patients, assessment of clinical outcomes, and reviews of therapist notes.
iii. **Outcome**: Identification of factors that contribute to successful treatment outcomes.

Environmental Case Study

i. **Objective**: To assess the impact of urban development on local wildlife.
ii. **Methods**: Observations of wildlife, analysis of environmental data, and interviews with residents.
iii. **Outcome**: Findings showing the effects of urban sprawl on species distribution and biodiversity.

Advantages and Disadvantages of Case Study

Advantages

1. **In-depth analysis of complex phenomena**

Case study design allows researchers to delve deeply into intricate issues and situations.
"It allows that particular event to be studies in detail so that its unique qualities may be identified."
This depth of analysis can provide rich insights into the underlying factors and dynamics of the studied phenomenon.

2. **Holistic Understanding**

Building on the above point, case studies can help us to understand a topic holistically and from multiple angles.

3. **Examination of rare and Unusual Phenomena**

We need to use case study methods when we stumble upon "rare and unusual" phenomena that would tend to be seen as mere outliers in population studies.

4. **Helps Reveal the Experiences of Marginalzied Groups**

Just as rare and unsual cases can be overlooked in population studies, so too can the experiences, beliefs, and perspectives of marginalized groups.

5. **Supports the generation of new theories or hypotheses**

While large-scale quantitative studies such as cross-sectional designs and population surveys are excellent at testing theories and hypotheses on a large scale, they need a hypothesis to start off with!

6. **Reveals the Unexpected**

When a largescale quantitative research project has a clear hypothesis that it will test, it often becomes very rigid and has tunnel-vision on just exploring the hypothesis.

Disadvantages

1. **Not Usually Generalizable**

Case studies are not generalizable because they tend not to look at a broad enough corpus of data to be able to infer that there is a trend across a population.

2. **Subjectivity in interpretation**
Case studies usually (but not always) use qualitative data which helps to get deep into a topic and explain it in human terms, finding insights unattainable by quantitative data.
So, a criticism of case studies could be that they're more prone to subjectivity – and researchers need to take strides to address this in their studies.

3. **Difficulty in replicating results**
Case study research is often non-replicable because the study takes place in complex real-world settings where variables are not controlled

Conclusion
Case studies are valuable for in-depth exploration and understanding of complex phenomena within their real-life contexts. By using methods such as interviews, observations, document analysis, and surveys, researchers can obtain comprehensive data and generate insights that are specific to the case. Whether exploratory, descriptive, or explanatory, case studies offer unique opportunities for understanding and discovering practical applications for theories.

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THE IMPACT OF SOFTWARE APPLICATION PACKAGES AND ITS' CONTRIBUTION TO THE ACADEMIC PERFORMANCE OF OFFICE TECHNOLOGY AND MANAGEMENT STUDENTS. IN FEDERAL POLYTECHNIC DAMATURU, YOBE STATE

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Abstract

This research work is an attempt to view an analysis of the software application packages and its contribution to the achievement of academic performances of Office Technology and Management Department Students. The studies were guided by four research questions postulated i.e. how does utilization of spreadsheet, Microsoft Word, Webpage Design and Desktop Software application packages contribute to the OTM students' academic performance? The researcher adopted descriptive survey designed in the research work, the population of the study was sixty-four (64). The whole population of (64) students was used for the study. From the study, it was found that, the use of software application packages has brought better understanding of students' learning which makes their academic performance to be successful. Based on the findings, it is recommended that, the Department should improve the use of these software as it does not only increase students' performance but boost their learning effectively which is the main objective of any department. Department should also provide more opportunity for students to use the available resources to enable them perform effectively and efficiently.

Keyword: *Software application, Application packages, Technology and Learning.*

Introduction

Application package is a collection of files and configurations bundled together to make it easier to distribute, install, and manage software applications. It essentially packages everything needed for an application to run on a specific platform, including the executable files, libraries, and settings. This process simplifies deployment, reduces compatibility issues, and ensures a consistent installation experience. Bhat, (2022). Application Packages refer to a collection of files, resources, and metadata that are bundled together to install, run, or deploy a software application on a computing device. Kafka, (2024). These packages typically include the application code (executables), libraries, assets (like images or sounds), configuration files, and metadata such as version information, dependencies, and permissions.

The influence of technology in manufacturing, commerce, education, banking, home and especially industries and offices have fundamentally altered the nature of organizational work, its structures, systems and processes, how things are done, the expertise and competence required and the resources needed to carry out tasks. These changes in turn often result into the rethinking of many professions with a subsequent remaking of basic structure and processes. Three of the most popular types of computer software programmer are word processing, which help the user to write and edit memos, letters and reports, data management programmers or databases, which help the user-secretary to use long lists of data and spreadsheet programmers, which handle tables and numbers. Dris (2014). Computers enable time and cost saving, faster results, distance learning, assessment of student's achievement based on exam scores and monitoring of classroom progress, among other benefits (Witte and Rogger, 2014: Terzis and Economides, 2011). ICT can be used to bring training and learning opportunities within reach of a large number of people at a low marginal cost.

Application packaging has many benefits for application developers and users. Traditional or legacy software installations in the past were developed in a variety of ways. Setup developers designed their install programs to concentrate on their own products which often impacted on programs that were already installed on the computer, Kuricheti, Aparnaand Sandeep (2009). Application packaging is a process which customizes software as users or client's requirement. The word customize includes adding a new feature to it or deleting any unwanted feature from it. In this wrapping, the software installation, re-installation and removal are customized according to user's needs. Application packaging is viewed as a critical component for efficiently managing software on servers, desktops and notebook system. By streaming software install, uninstall, patching, upgrading and repairing, application packaging can help reduce costs associated with each phase of the application lifecycle (Application Packaging Developer 2009). In particular, application packaging is designed to reduce costs and improve efficiency during the deployment and post-deployment phases. Such benefits typically depend on having a stable environment in which packages are distributed automatically by enabling fast, standardized software. Business disruption caused by software failure are avoided: there by helping to reduce costs for IT support and business, respectively.

When implemented as on IT best practice, application packaging can help create a cost-effective software repository that is in line with overall business priorities. With application packaging strategy, organization can help reduce administrative costs while providing business benefits. This approach enables administrators to set and enforce corporate software configuration standards

(Kuricheti, Aparnaand Sandeep 2009). Application packages are one of the most important software management tasks IT department oversee in order to maintain a stable and productive end user environment. Desktop application must work as expected, be configured and updated to the required level and be available from different platform in a consistent, dependable manner. They have art of application packaging, allowing for significant cost saving and time reduction for both IT and business operation. Example of Software Application Packages is Excel Spreadsheet, Microsoft Power Point, Microsoft Office Word and Microsoft Access Database, e.t.c.

Statement of the Problem

The functions and effectiveness of the students in every institution, private or public, depends on the availability of technologies as well as the skills and competencies of the students to use the technological resources. As a result, one of the things that make students unique is the use of modern technological resources. The arrival of computer and its related application software's provide students with most advanced and revolutionary tools to perform in their academic. With the availability of computer and the ever-changing improved innovations in the application and use of computer application tools, higher institutions' efforts towards effective service delivery through general efficiency.

The following are some of the challenges faced by a student in their academic performance in respect of software application packages such as: spreadsheet (excel), word processors, database application, desktop publishing, multimedia software application, web page design. This has also created another impetus on the students, as there is an improvement in the way they study.
William and Tiffany (2007) submit that tertiary institutions face a growing gap between the level of services expected and the problem of office technology and management' inefficiency seems to delay the rate of operations and procedures needed for quality service delivery. Hence, it is important to determine the level of up-to-date knowledge of the OTM students and their use of software application packages in higher educational institutions in OTM Department and how these affect their performance.

Objectives of the Study

The main objective of this study is to study the impact of software application packages and its' contribution to the academic performance of OTM students in Federal Polytechnic Damaturu. However, the specific objectives are as follows:

i. To determine the impact of Database Application Package to OTM students' Academic Performance in Federal Polytechnic Damaturu.
ii. To determine the impact of Spreadsheet Application Packages to OTM student's academic performance in Federal Polytechnic Damaturu.
iii. To determine the utilization of Microsoft Word Application Package to OTM student's academic performance in Federal Polytechnic Damaturu.
iv. To determine the impact of Desktop Publishing Application Package to OTM students' academic performance in Federal Polytechnic Damaturu.

Research Questions

The following research questions guided the study:

i. How does Database Application Package contribute to OTM student's academic performance in Federal Polytechnic Damaturu?

ii. How does Spreadsheet Application Package contributed to OTM student's academic performance in Federal Polytechnic Damaturu?
iii. How does Microsoft Word Application Package contributed to OTM student's academic performance in Federal Polytechnic Damaturu?
iv. How does Desktop Publishing Application Package contributed to OTM student's academic performance in Federal Polytechnic Damaturu?

Significance of the Study

The study will be beneficial to the students in OTM department and the Polytechnic at large. This study will entail the impact of having skills in application package to students which will enable the students to boost their academic performance considering that ICT related course carried the highest mark in the department. The study will help students to widen their knowledge of the application of these software packages for their academic and business activities. It will also help to identify their loopholes in the use of the application packages which will motivated them to go extra classes to acquire this to enable them adequate prepared for the future endeavor. This research will serve as a guide to the lecturer in the department toward counseling and coordinating students toward application packages, because it will identify the area students are having problem in application packages this will enable affected lecturer to decide on how to address the problem militating the student's academic performance.

Scope of the study

The essence of the research work is to find the impact of software application packages and its contribution to the academic performance of students. The research work is however, limited to the study area, OTM Department Federal Polytechnic Damaturu. To identify the effect of application packages, use in the department, the impact of software application packages and it contribution to the academic performance.

Literature Review

This chapter reviewed related literatures on the following areas; Software application packages, Development of ICT in modern Office Technology and Management, the purpose of software application packages, Different types of software application packages, impact of software application packages to OTM students, etc.

Software application packages

Application packages software is a collection of software programs that have been developed for the purpose of being licensed to third-party organization. Application packages are generally designed tom support commonly performed business functions and appeal to multiple types of user organization. Although a package may be tailored to user's specific needs through parameters or tables, the software itself is not individualized to a given organization in the same way that custom-designed, custom-coded software would typically be tailored.

Application packages can be defined as the readymade software or program designed in a standardized form for solving various problems that are common to users. Mokolade (2015), opined that application packages are written by users themselves or acquired from manufactures as packages come in various format on compact disc (CD/DVD) or available on developer or manufacturers server on the internet that can be downloaded for usage at a cost or no cost. Busola

(2016) Opined That Computer Application packages is collection of programs that is directed at some generic application and can be tailored (perhaps with some additions) to the needs of a specific instance of that application. Application packages, within the context of this discussion, include all-purpose tools such as Excel, MS word, Database and word processing software are all-purpose tools that perform application functions in the hand of sophisticated users.

The potential is really boundless, and new software packages are being developed for solving different problems in new areas (education, inclusive) using computers. Software applications are commercially supplied products that typically provide solutions to a particular range of software development or application problems. Even so, five types of computerized applications are widely used in all professions and are generally identified by Agbo (2019) as: word processing, database management, spread sheets, graphics, and communications applications. Agbo further buttressed that when these software packages are sensibly integrated into the school and work environment by well- trained and experienced users, they tend to be powerful and productive tools.

Development of ICT in Modern Office

The secretary, due to the nature of their work has remained to be a key player in the success of achieving organizational goals and objectives. Many organizations relied on the secretary's abilities for the achievement of their organizational goals and objectives (Nwaokwa & Okoli, 2012). There are a lot of forces such as consumer behavior, market competition, efficient service delivery, technology and quality management, which are drivers to organizational changes in the present-day business world. Basically, it can be said that a software package is a program written to help a computer perform the required tasks. Software is a set of instructions to help a computer do its job. Application packages are software programs written to support tasks that a computer was originally allowed to do; they are developed according to the needs of computer users. Most of the times, the application software has to be installed by the user. This means that the application packages you may have on your computer will be different from what others may have on your system because each user has different needs or tasks to perform. In addition, application software is available in various versions and versions. And the system properties determine which packages will work on the computer depending on the system capacity.

However, development of office technologies which resulted in the creation and use of computers and software programmers has simplified the work of the secretary (Malavia & Gogia, 2010). The output of the present-day secretary is quite higher if compared with that of the old time secretary. This is evident if the benefits of using these technologies such as the printer, pen drive, hand phones, photo copier, e-mail, the zimbra and internet were viewed as factors maximizing the secretary's general output.

The Purpose of Software Application Packages

Every application software type is used for a particular purpose, such as:

i. Web browsers are used to search the internet, navigate multiple web pages and download and upload files to web-based solutions.
ii. Video, audio, and images files are viewed and edited with multimedia applications.
iii. Visual studio, PY-Charm, atom, and net-beans type of application software is preferred for writing code
iv. The solar-winds application is considered to monitor an enterprises network and it infrastructure.

v. Microsoft suite comprises word, excel, and PowerPoint for word processing, making spreadsheets, and creating presentations.

The main objective of opting for an application for completing a core operation is to save time, automate the task, and reduce the errors in the final output. In addition, organizations use enterprise management system to optimize collaboration between their internal and external departments. Furthermore, data security is maintained with application software due to embedded authentication, access control, and encryption mechanisms.

Different Types of Software Application Packages

i. Desktop publishing packages (e.g MS publisher, pagemaker, pageplus) are used to produce professional quality publishing such as posters, books, newsletters, newspapers and magazines.
ii. Graphics packages (e.g. paint, paintbrush, serif draw, corel draw) are used to produce and manipulate artwork
iii. Enterprise software is used for tasks of accounting, project management, risk management, decision-making, supply chain, and transaction management.
iv. Spreadsheet software Application (e.g. MS Excel, lotus 123) are used for tasks that involved a lot calculation or for production of graphs charts
v. Multimedia software is use for viewing and editing recorded videos.
vi. Word processors Application (e.g. MS word, word perfect) are used to produce text-based document such as letters, reports, and memos.
vii. Database software package (e.g. MS access, paraox) are used to store and retrieve information.
viii. Web page (e.g. MS frontpage, macromedia dreamweaver) are used to create web pages
ix. Presentation graphics packages (e.g. PowerPoint, lotus freelance) are used to create slide shows and presentation which can be viewed on screen or with a data or overhead projector.

Graphics packages

Computer graphics design skills in technology, business and art, using computer-generated images and words to create unique concepts and messages for publishing and advertising (edra 2022). Computer graphics is everywhere in the modern world, graphics designers use technology to manipulate and combine words, images, color, typography and sound in order to elicit emotions and deliver messages to viewers.

Enterprise software

Enterprise resource planning (ERP) is another business software application to link multiple departments and remote offices through a single dashboard. It can cover and automate the tasks of accounting, project management, risk management, decision-marking, supply chain, transaction management, and so forth. Customizing artificial intelligence according to business requirements streamlines workflows and decreases bottlenecks.

Spreadsheet software

This application software comprises rows and columns and helps store, process, and evaluate the data. The software flawlessly integrates with third-party tools to collect data from online forms. It can also be customized according to business requirement, enabling workflow streamlining and

reducing bottlenecks. It empowers the user to perform various arithmetic calculations quickly to large amount of data. Google sheets, Microsoft excel, and apple number are the standard applications easily accessible and integrated with cutting-edge APIs for better collaboration.

Multimedia Software
Software aiding the user to open, edit, and record image and video files are multimedia application. The entertainment and telecommunication sector mainly use it for viewing and editing recorded videos.

Word processor Software
Notepad is a common word-processing application software installed by default on every system. This kind of solution aids in inputting and editing files and adding tables, images, and link them. Also, in advanced word software, like Microsoft word, the user is provided with features to format text using different formats and put reference. Moreover, users can select multiple color, combinations page, boundaries page color, fort style, and size to make their text more appealing.

Database software
Video editing software is used in the entertainment and telecommunication sectors to view and edit recorded videos. These software applications development types integrate with various APIs, enabling organization to broadcast and share videos online effortlessly. Users also install gaming applications like steam and twitch to play and steam games on digital platforms allowing them to connect with friends and association. The list of application software mainly functions as a backend for other solutions and helps in data flow operations. For example, an E-commerce solution can embed it and store the username and password details of a new user in the database whenever they sign up.

Presentation (PowerPoint)
Microsoft PowerPoint is a Microsoft office suite program. The purpose of this program is to make electronic slide shows. According to Mahin, (2004), 1.25 million PowerPoint presentations take place in an organization. It was earlier found that 97% of visual aids in school today use presentation software for their assignment, project works, seminar presentation and, many among others. The benefits to slide shows is that it can incorporate sounds, music files, video files, images, graphs, data and generally appeals more to the human sense. On each slide a user can place text, graphics, movies, sound or other types of multimedia. The presentations can be printed or viewed on a computer PowerPoint application enables students to perform the following operations which are:

i. Inserting text
ii. Adding new slide to the presentation
iii. Deleting slides in a presentation
iv. Copying and moving text in a presentation
v. Inserting images
vi. Adding headers and footers
vii. Changing the slide background
viii. Using the slide master
ix. Using the zoom command
x. Using the spell check utility

Impact of software application packages to OTM students

Internet explorer

The software packages enable a user to easily and quickly view information and colorful graphics that may be stored on computer in many different countries. This is done with the aid of software known as the browser. Company and corporations no longer give out postal mail address. At every time, you meet people talking about the internet corporation includes those things they would want people on the public to know about them in the websites, the internet enables one to access or surf the net and share ideas, stories, data opinion and products.

Impact of Internet explorer to the students

With aid of the internet explorer, the students can surf the net and get to know about other school, department and have a wider knowledge about what goes on in school.

Microsoft outlook express

This is a communication software; it deals with electronic mail (e-mail) people compose documents using the Microsoft outlook express software. This software allows one sent and receives messages to and from any part of the world. Unlike the regular mail, e-mail often reaches its definition even in their counting in minutes or less.

Impact of Microsoft outlook express to the students

Instead of wasting time writing a letter and sending it through local post, the students can compose note and assignment, and then through internet via the Microsoft outlook express. The purpose of e-mail is to send data or messages electronically through the telephone network and through a central computer without posting such pieces of paper dispatched documents by countries.

Training and re-training

The advent of software activities has stimulated the need for training among students. This is because, the introduction of these software has necessitated the acquisition of knowledge to operate the computer software

Competition

Software application have brought competition between the OTM students and other profession such as the computer scientist, mass communication etc. in the school or workplace. OTM students are to work extra miles in order to be relevant in the accord of their profession.

Summary of the literature review

It is obvious that all the software application packages which were mentioned and reviewed in this chapter greatly facilitates the performance of the students. Both the spreadsheet (excel), desktop publishing, database, word processor which were all discussed and described above makes the study to be easier and faster to the students. The desktop publishing, spreadsheet, word processors, which were mentioned and also the importance of the application packages were included. This is why, is paramount importance for students to acquaint themselves with the operation of these application packages so as to ease the learning which often affects the student's academic performance.

Research Methodology

Design of the Study

The appropriate research design method used for this study is descriptive survey. It is a guide to show how the subject under research are brought into the scope of the research and how they are employed in the study setting to get the required result.

Population of the Study

The population for this study is made up of ND I, ND II, HND I, and HND II students of the Office Technology and Management Department. Based on the data obtained, the population of the students is sixty-four (64), as can be seen in the table below:

S/NO.	Number of Students	Population
1	ND I	8
2	ND II	20
3	HND I	19
4	HND II	17
Total		**64**

Sample and Sampling Technique

There was no sampling as the population is not large. This decision is in line with the Best (2011), who holds that whenever the population for the study is not large, a census survey should be conducted.

Instrument for Data Collection

The instrument that was used in the collection of data is the structured questionnaires. The self-structured questionnaires were designed in accordance with the research questions of chapter one. The questionnaire has twenty (20) research questions which were spread on equal basis of five to each research question. 5-Point Likert Scale rating was used, thus; SA = Strong Agreed (5 points), A = Agreed (4 points), U = Undecided (3 points), D = Disagreed (2 points) and SD = Strongly Disagreed (1 point).

Validity of the Instrument

In order to ensure the validity of the instrument, the questionnaire was subjected to face validation by the project supervisor in order to ensure the correctness of the content. Corrections were observed and effected accordingly before administering the questionnaire.

Method of Data Collection

The questionnaires were personally administered and recovered by the researcher. A total of sixty-four (64) questionnaires distributed to the OTM Department students during their lectures thereby getting 95% recovery.

Method of Data Analysis

After the collection, the researcher used the frequency distribution tables and mean deviation formula for the analysis.

The formula is presented as below: $X = \frac{\Sigma fx}{n}$

Where:

X=mean score

fX= frequency multiplied by score

n= number of responses

$$x = \frac{\sum fx}{n} = \frac{5+4+3+2+1}{5} e^{x} = \frac{15}{3} = 3.0$$

The cut-off points of 30 is obtained through the use of the formula. Therefore, any point above 30 is regarded as Agreed (Positive) while below 30 is regarded as Disagreed (Negative).

Presentation and Analysis of Data

This chapter provides a detailed analysis of data collected from field survey via the administration of the questionnaire. A total of 64 questionnaires were distributed to students of OTM Department, Federal Polytechnic Damaturu of which 61 (representing about 95.32% of the respondents) were retrieved, properly and adequately completed. The data collected from the respondents via questionnaire were classified and analyzed using frequency distribution tables.

Data Presentation, Analysis and Interpretation

Table 1: Personal Data

S/N	Variable	Number	Percentage
1	**SEX**		
a.	Male	32	52%
b.	Female	29	48%
	TOTAL	**61**	**100%**
2.	**PROGRAMME**		
a.	HND	36	59%
b.	ND	25	41%
	TOTAL	**61**	**100%**

Table 2: How does database application package contributed to OTM students' academic performance in Federal Polytechnic Damaturu?

S/N	Variables	SA	A	U	D	SD	Efx	x	Remark
1	Data storage contributes to the academic performance of OTM students.	29	24	3	3	2	258	4.22	Agreed
2	Data management contributes to the academic performance of the OTM students.	21	25	8	3	4	239	3.91	Agreed
3	Data manipulation contributes to the academic performance of OTM students.	19	27	10	3	2	241	3.95	Agreed
4	Data querying and reporting contributes to the academic performance of OTM students.	22	29	3	5	2	246	4.00	Agreed
5	Data security and access control contributes to the academic performance of OTM students.	33	24	3	1	0	272	4.45	Agreed
						Total Mean Score		**4.10**	

Source: Field Survey, 2024 **n=61**

Based on the above Table, it can be seen that, the mean scores of 2, 3.91, 3.95, 4.00, 4.45 respectively and with a total mean score of 4.10 shows that Data storage, Data management, Data

manipulation, Data querying and reporting and Data security and access control contributes to the academic performance of OTM students in Federal Polytechnic.

Findings

The Academic performance of OTM students in Federal Polytechnic Damaturu is greatly improved by the application of database application packages in the process of its manipulation through storage, management, manipulation, querying and reporting, security and access control of data

Table 3: How does spreadsheet (excel) application package contributed to OTM student's academic performance in Federal Polytechnic Damaturu?

S/N	Variables	SA	A	U	D	SD	efx	x	Remark
6	Data organization contributes to the academic performance of OTM students.	23	36	0	1	1	262	4.30	Agreed
7	Data calculation contributes to the academic performance of OTM students.	30	25	3	0	3	262	4.30	Agreed
8	Data analysis contributes to the academic performance of OTM students.	30	24	2	3	2	260	4.26	Agreed
9	Budgeting and forecasting contributes to the academic performance of OTM students.	23	22	8	4	4	239	3.91	Agreed
10	Automation contributes to the academic performance of OTM students.	28	28	3	2	0	265	4.34	Agreed
						Total Mean Score		**4.22**	

Source: Field Survey, 2024 n=61

Table 3 above shows that, questions 6-10 has means scores of 4.30, 4.30, 4.26, 3.91 and 4.34 respectively and with a total mean scores of 4.22 which is above the cut off points of 3.0. It revealed that data organization, calculation, analysis, budgeting and forecasting contributes greatly to the academic performance of OTM students in Federal Polytechnic Damaturu.

Findings

It was found that, the OTM students have the skills of spreadsheet application software through the manipulation of data organization, calculation, analysis, budgeting and forecasting and in turn contributes greatly to the academic performance of OTM students in Federal Polytechnic Damaturu.

Table 4: How does Microsoft word application package contributed to OTM student's academic performance in Federal Polytechnic Damaturu?

S/N	Variables	SA	A	U	D	SD	efx	X	Remark
16	Layout and design contributes to the academic performance of OTM students.	21	23	8	8	1	238	3.90	Agreed
17	Creation of image contributes to the academic performance of OTM students.	26	32	1	0	2	263	4.31	Agreed
18	Graphics integration contributes to the academic performance of OTM students.	24	26	5	4	2	249	4.08	Agreed
19	Templates creation contributes to the academic performance of OTM students.	23	30	3	3	2	252	4.13	Agreed
20	Creation of basic vector drawing contributes to the academic performance of OTM students.	21	30	6	2	0	247	4.04	Agreed
						Total Mean Score		**4.09**	

Source: Field Survey, 2024 n=61

The above table 5 shows that, questions 16-20 have means scores of 3.90, 4.31, 4.08, 4.13 and 4.04 respectively and with a total mean score of 4.09 which is above the cut off points of 3.0. It is revealed that students use desktop publishing in Layout and design of documents, creation of image graphics, integration of templates, creation of basic vector drawing, etc. All these applications contribute to the academic performance of OTM students.

Findings

It was found that, the OTM students have the skills of desktop publishing which enable them to Layout and design a document, creation of image graphics, integration of templates, creation of basic vector drawing, etc. This contributes greatly to their academic performance in Federal Polytechnic Damaturu.

Discussions of Findings

Based on the research curried out on the 'the impact of software application packages and its contribution on OTM students' academic performance of in Federal Polytechnic Damaturu, it was found that software application packages are in use in the training of students which make the to be more organized and efficient. The findings of this study show that the students' academic performance is greatly enhance by the use of Microsoft word. It enhances students' literacy in computer, desktop publishing result in students neglecting manual design skills, which are crucial for certain assignments. This can be supported by Rodriby (2021), who opined that Microsoft word is a great tool for creating business documents, as a student can design business and school documents from scratch. Word files help students to draft any form of correspondence whether formal or informal. Microsoft office contributes positively by aiding them to acquire skills on how to insert pictures, shape, graph, equation, and many more. Another affirmation can be justifying by the research conducted by Salehi et al (2019) that, the use of Microsoft word has many impacts on improving students' skills in English, especially writing skills. The benefit of this application is improving grammar and vocabulary acquisition. Another author to corroborate the findings is Yaser (2021) who opined that, students who are taught word processor method in the Microsoft word showed better writing skills.

Findings of the study showed that, the use and application of spreadsheet by students enhance their academic activities greatly and it is made easier for students to visualize and interpret statistical information. Akinniyi A.O (2001) supported and opined that, software application packages as a set of programme instruction that is used to aid classroom instructions. It teaches student participation and provides direct feedback to each student depending upon his or her individual responses. This has supported the above finding by identifying the impact of publisher packages to help students to create calendar and flyer, knowledge. The use of Corel draw also help students to known how to create organizational letter head paper, knowledge on how to use graphic software increase the ability of students to create logo and business card. As it was opined by Pedro (2022) who stated that software graphic design combines skills in technology, business and art, using computer-generated images and words to create unique concepts and messages for publishing and advertising.

Summary of major Findings

This research work was conducted to examine impact of software application packages on OTM students and academic performance in federal polytechnic Damaturu, Yobe state. The following were the major findings of the study:

i. The Academic performance of OTM students in Federal Polytechnic Damaturu is greatly improved by the application of database application packages in the process of its manipulation through storage, management, manipulation, querying and reporting, security and access control of data.
ii. It was found that, the OTM students have the skills of spreadsheet application software through the manipulation of data organization, calculation, analysis, budgeting and forecasting and in turn contributes greatly to the academic performance of OTM students in Federal Polytechnic Damaturu.
iii. It was found that, the OTM students have the skills of Microsoft word by creating, editing, reviewing and formatting of documents, and layout of page. This contributes greatly to their academic performance in Federal Polytechnic Damaturu.
iv. It was found that, the OTM students have the skills of desktop publishing which enable them to Layout and design a document, creation of image graphics, integration of templates, creation of basic vector drawing, etc. This contributes greatly to their academic performance in Federal Polytechnic Damaturu.

Conclusion

In conclusion, it is well established in this study that the software application packages such as MS word, Excel, desktop publishing, database etc. brings about efficiency to students' academic performance, in Federal Polytechnic study area. This finding could be relatively extended to other student of polytechnic in the country, as software application packages is everywhere.

Recommendations

Based on the finding in this research work and the analysis carried out, the researcher wishes to make the following recommendation.

i. OTM students in conjunction with the Lecturers should concentrate more on the practical than just going through the theoretical.
ii. OTM students should constantly put spreadsheet MS word, MS access, desktop publishing etc. into practical usage in other academic activities.

iii. The department should help anyway to put database, power point application into constant practice in order to prepare the students for their future career.
iv. The Lecturers teaching the ICT courses should give more adequate lectures on practical aspect of the ICT courses.
v. The Management of the Institution should ensure adequate supply of ICT facilities to the OTM Department e.g. internet, latest printers, etc.
vi. The Management should ensure regular maintenance of the computer systems.

Limitations of the Study

i. Small sample size (61 respondents).
ii. Limited geographical scope (OTM Department Federal Polytechnic Damaturu).
iii. Data collection method (questionnaire) may be subject to biases.
iv. Study focused on OTM students.

Suggestions for Further Studies

Investigate the impact of software application packages in other Departments of the Polytechnic. Explore the effectiveness of different software application packages in contributing to academic performance. To explore the benefits of acquiring knowledge and skills of other Software Application Packages apart from the Microsoft Office.

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POLICY REGARDING INFORMATION LIBRARIES' DECREASING ROLE

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Abstract

Because of its experience as an information provider, a library is an essential component in the construction of an information policy. As a result, industrialized countries always regard libraries as central and necessary counterparts in information policy because only libraries know and comprehend what information should be offered to suit the government's goals for national development. Given this, the library is always at the forefront of monitoring the direction of information policy. However, not all governments are able to see the importance of libraries. This paper reviews literature in information policy that seeks to indicate the relation between library and information policy in Nigeria. It is evident that the role of libraries in such an endeavor was crucial and remarkable in the past, but is gradually diminishing as information technology progresses. Since 2000, information technology has overshadowed and remarkably cast aside library significance. The role of the library should not be abandoned, but rather restored, in order to achieve a comprehensive, balanced, and intelligent information strategy.

Keywords: *Libraries, knowledge societies, Nigerian information policy, information providers, and information technology and communication.*

Introduction

Library is a distinct institution that plays prominent role in shaping the knowledge society closely driven and guided by information policy. The architecture of information provision stems out from this institution as it has the expertise in acquiring, disseminating, organising and administrating information. Thus, library is not only collector but also as stewards safeguarding the nation's heritage with in turn assure equality of access for the citizens (Cox, 2024). The impact of library to culture and civilization is tremendous and not deniable. In addition, library is also central in the creation and establishment of information society which sometimes called knowledge society. The development of the phenomenon demands in re-defining the position and objectives of institutions dealing information and knowledge (Aguilera, 2024). In light of this, library is identified as one of the key elements for open access to information without neglecting the basic role of library which concentrates in collecting and organising information and offering access needs to be maintained.

The significant role of library in information policy making has been asserted by scholars and researchers such as Lamberton way back (Yamagishi, 2024). Library and information service is not only fundamental but should also be the main player in information policy making. Only information professionals are capable to deliver their expertise in monitoring, regulating, shaping and implementing activities such as transborder data flow, national information system, information expert and profession, information skill, content dissemination, laws related to books, collection policy, data usage and distribution, reading campaign, information retention, public access center, knowledge sharing, national biblioghraphy, repository library, acquisition of foreign publications, availability of information and books access.

According to Sankaranarayanan, (2024). Suggests the development of information policy be coordinated by an advisory committee representative of private sector, local government, academicians and professionals related to library and information science. However, in some countries, the roles and works of library is often underestimated. Information possessed by the institution is not regarded as important as information technology (IT) which is only tool for organizing and managing the information. This paper highlights the role of libraries in Malaysia in connection with designing and developing information policy for the country or the so called the national information policy.

Information Policy

There is no single accepted definition for information policy (Steiner, 2023). The definition is subject to the researchers stand which perceives information policy from either limited or wider scope other than the dynamic and innovative nature of information. From the micro perspective, information policy is defined in general as a combination of legislation, procedure, guideline which regulate the production, management and use of information which shape the role of information in society. On the other hand, the macro perspective view information policy could not be separated from other fields such as education, science and technology culture, public administration transparency, information technology and health (Steiner, 2023). Information policy is a social political, regulation, economic and technological decision related to the role of information in society. (Zafarullah, 2021). on the other hand offers a broader definition by asserting that information policy is a guideline for planned actions to ascertain access to universal information to carry out social, economic and political activities in the course to achieve the nation development goal. Libraries play a vital role in society as enters for learning, research, and

community engagement. They provide access to information, foster literacy and education, and support cultural enrichment.

Culture of knowledge

Knowledge culture among the people to emphasize technologies for knowledge-related activities, such as acquiring, creating, sharing, and disseminating knowledge; and storing information. A knowledge-based culture is evidenced by:

i. People reading everywhere, such as on public transport or while waiting for a bus or train
ii. The large number of publications, such as books, journals, magazines and newspapers. The library's statistics in 2022 showed that China has published a total of 180,000 titles, the United Kingdom has published 116,000 titles, the United States has published 60,000 titles and India has produced 60,000 titles and published 45,000 titles.
iii. Documentation of comprehensive government information. It has been shown that a variety of educational activities benefit greatly from a culture and practice of good documentation, as evidenced in Europe (European Commission Directorate-General for Education and Culture, 2016).

The number of books read by students in higher education institutions is high. The total number of books read by students in Australia is 180 books. In Indonesia, it's 94. Students in India have read 130. (Abdullah, 2022) People clearly understand the role of technology in the following manner:

i. Publication of scholarly materials is not only in paper form, but also published online, and
ii. The production of films and documentaries, in terms of the amount produced and how interesting they are, using information technology. The opposite occurs in Malaysia

Salim (2011) implicitly indicates a culture of knowledge does not exist among the people. The absence of knowledge culture is reflected in the following areas:

i. The number of books read by people in a year is low. The average Malaysian reads two books a year, often through relaxed reading, in the form of comics, magazines and newspapers.
ii. Reading material and various entertainment types are light. Of the 10,310 registered titles in a year, only 1,273 (or 32%), is categorized as a scholarly book, which can improve the mind, innovation and knowledge of the reader. Sixty-eight percent is in the form of leisure reading materials, in addition to textbooks, academic resources and children's books.
iii. The number of books published by Malaysians is low. Statistics in 2005 showed that only 10,310 titles of books in various fields were registered during that year.
iv. The sharing of information is low, even among academics. The Mokmin study (2005) found that 67 percent of IPTS lecturers did not publish produced information on university websites.
v. Information technology in schools that is provided is motivated by profit. This was demonstrated by a number of computer failures of projects, particularly in state schools. Only two out of 300 schools in Sabah have computer laboratories
vi. Students go to schools and universities just to get a certificate, rather than from interest in sciences. This is reflected in the practice of reading among students in Malaysia, which is far behind other countries. Undergraduates in universities in the country read on average only 4 books a year.

As a result of using or providing information technology without a strong culture of knowledge among the people, the following conditions occur, namely:
Skilled people use technology but do not understand the role and use of technology;
Many technologies are used to disseminate and produce entertainment, gossip, pornography, defamation and non-scientific materials
The government website does not provide sufficient information, and information is out-dated and irrelevant. Technology is not fully utilized in rural internet centres, libraries and schools. Libraries in Malaysia have not risen to help shape the culture of knowledge among the people of this country.

This is due to the fact that national information policy development does not start with information and documentation, but instead starts with technology. While not likely to change, information should not be based solely on Information and Communication Technology (ICT). In other words, it should be extended far beyond basic information technology. Policies relating to acquiring, creating, sharing, disseminating and storing information should be clear and comprehensive. (Sayaf, 2021). Technology alone cannot create a culture of love of knowledge that forms the basis of a knowledge-driven society, but requires clear national information policies.

Library and information society
In the information age, citizens must be able to find and use information to meet their needs. Information is the key raw material but with no value if access to it is problematic. There is no other institutions carries out this long-term, systematic work except library (Cox,2021). Information is closely related to culture in a way that information yields knowledge which then contributes to people's creative power. It will be more systematic if the public can be offered accessed to knowledge and cultural treasures in the custody of library. The significant role of library should be depicted in the designing of information policy of the country. It is typical in many governments that information policy is designed as there is a requirement to develop information society. In this regard, the issues are largely related to the increasing pervasiveness of information technology (IT) as asserts by Cox, J. (2021).

The role of library is event pivotal in the development of information society. It acts as gateways to the information resources on the global superhighways. Library plays an important role as providers of electronic information and access points to informations in the efforts to bridge the gap between the information rich and poor. In fact, the stability of economy is also dependent on the access to information because national development is very much influenced by the amount of available information (Khalid, 2021). Apparently, this institution is also noted for its function as catalyst for human progress and aid in the development and transmission of knowledge and culture and innovation in society. Also, in a plural society like Malaysia, library ensures social inclusion and cohesion by providing access to information and knowledge to all the citizens.

Information society according to Hasan, (2022). is a society in which the quality of life, as well as prospects for social change and economic development, depends increasingly upon information and its exploitation? The living standards, patterns of work and leisure, the education system and the marketplace are influenced markedly by advances in information and knowledge. Knowledge-based activity particularly economy, is characterized by critical mass of knowledge workers, innovative and competitive service sectors, knowledge-induced poverty reduction, high value-added information-intensive commerce, high technology industries and inclusive participation in

economic activities. In the light of this, library is the only institution capable to shoulder information related responsibility, i.e by proving and ensuring quality information and services, digital and traditional content, knowledge and information networks and ICT facilities to facilitate life-long learning and communication. This will in turn nurture and culture the availability of diverse knowledge sources, foster free access to government information, encourage freedom of expression, tolerance of opposing political and public views, availability of diverse communication channels and defense of human rights.

Library's role in information policymaking

Enang, (2021). argues that matters relating to information policies should be the responsibility of the library. The library has a policy to select, organize and disseminate information, in addition to handling issues related to it. Information providers, libraries also need to be a developer. They play an instrumental role in the information policymaking, especially national information policies. These are public library access policies; the promotion of reading habits and control of books policy; science and technology policy; a policy regarding mapping and statistical information; a policy pertaining to the general public accessing to government information; a traditional information policy; communication technology-related policies; and societal information policy.

(Shuva, 2023). also established that the root of information is closely related to information and library science. From a total of 771 articles related to the root of information reviewed, a total of 540 articles were published in information and library studies journals, 92 were articles in legal journals, 32 in the field of public administration, 32 in political science, 26 in the field of communication studies, 24 in the social sciences, and 15 other articles were on management and business. Similarly, (Cannelli, 2022). insisted that the national information policy was originally made up of library, archives and documents. However, the basis of information evolved with the development of social media technology centres and access to more public and private information.

ICT policy scholars still insist that the information policy is not free from the influence and auspices of the library and information sciences. (Pohle, 2021). for example, found an information policy published before the 1980's which explains that the national information policy aims to regulate the "... creation, distribution, and use information." Meanwhile, (Cannelli, 2022). claims there are two alternative approaches for making or policy formulation, namely information, information policy based on the concept of "library," and the information policy based on the concept of "information." The NATIS program, launched by UNESCO in 1974, is an example of using the information policy development library approach. This approach has seen the development of policies regarding information and the scope of services provided by library information. The "information" approach, according to Gray, was built by experts who consider library information as only one component of information networks.

Recent claims, on scientific and technical information, were triggered by the urge of society to obtain information to meet the needs of the industrial revolution period ((Cannelli, 2022).). This is happening similarly to the increasing demand for printed books and newspapers triggered by the industrial revolution, thus facilitating the establishment of the first public libraries, particularly in England and the United States. The establishment of libraries allowed workers to read and learn; thus alleviating the fear that this group would be left behind and miss opportunities. The first

public library opened in the city of Boston in the United States in 1854, evidence of the importance of information resources to the community.

Though Siddique, etal, (2023)) report that though currently, the role of library and information professionals in the UK information policymaking is not distinct, but there is a strong suggestion that those working in knowledge and information stream are to be involved in information policymaking so as to make the policy more information content rather heavily on technical issues. But, the information professionals need to change their mindset in order to make their voice being heard by the government. Information professionals ought to be more interested in access rather than the control of information, a trait not traditionally associated with information professionals. In the midst of economic climate which exerts on efficiency savings, library and information professionals can show the good optimum use of information can save costs. Also, library and information professionals could articulate to the good value and benefit of information to government and the nation if they are made clear and understand of the value of information. This shows that the role of library and information professionals crucial. It is strongly felt that the content (information and knowledge) that should remain at the heart of consideration of national information policy. In fact, the closure of some government libraries, and the subsuming of others within IT-driven Information's Centers, provides evidence of the failure of this policy of reductionism.

Libraries in Nigeria

Library and information service have not been acknowledged as playing its role as central agency for providing and regulating information for the nation. The government of Nigeria is not paying serious attention to matters relating to library which finally impacted the information policy making. Public libraries are still without with the latest infrastructure to support their services to the people. It is timely to have high end facilities such as ubiquitous library (cross border information resource center that enable users to borrow and return materials from anywhere). Ісмайлов, (2022). reported that a survey on library development in Malaysia carried out by Ferguson in 1950 discovered that there was no planned library service and education for adults; library collections are poorly organized; lack of qualified and trained librarians; The role of library and information services depicted in the National Policy for the Library and Information Services 1990 are such as to be involved in the formulation of policy and decision-making process; involve in the planning of research and development activities; involve in educational process; and to be involved in the intellectual development of people, economic activities and fulfillment of their cultural and recreational needs (Ісмайлов, 2022).). But the strategies formulated were limited to providing appropriate library and information services, commensurate with needs of clientele; acquiring library materials within and from authorized the country; encouraging publishers to increase substantial publications in all fields of knowledge, sharing of resources to maximize benefits from the investment of public funds and act as repository for all library materials. Library concentrated on proving documentation of resources according to national standards; provide access to databases, provide facilities for lending, reference, referral, analysis of information, bibliographic control, and selective dissemination of information; and provide user education to create an information-consciousness society to derive benefit from the use of library materials. These strategies and efforts were limited to basic library activities. The National Policy for Library and Information Service did not reveal that library has important function in promoting the creation of information or knowledge society and one of the essential components in information policymaking.

In the 1980s, research on information policy in this country still revolved around the authority of the library and information services, with a focus on the development of national information systems. For example, (Gupta, 2024). discussed issues of accessing information, recognizing the importance of information to national development. Hence, the provision of information cannot be ad hoc and decadent, but instead should be coordinated and integrated.In 1982, the national information policy still focused on the scope of national information systems. At this point, the formation of a national information policy and the establishment of an organizational structure for the national information system were in line with developments at the international level, such as the General Information Programme (PGI), which was a combination of the existing programs of UNISIST and NATIS (Gupta, 2024).

In the early establishment of the National Library of Malaysia, the issue often focused on was the development of physical infrastructure, the construction of libraries, and reading material being provided, specific provisions of the Malaysia Plan (MP) as MP3 (1971-1980), MP4 (1981-1985) and MP5 (1986-1990). Starting with MP6 (1991- 1995) Saw wrote that government information technology, in the broad sense, refers to all elements of technology that enable the acquisition, storage, processing, transmission and delivery of information (the 6th Malaysia Plan, 1991). The Government should also pay attention to patents by creating Intellectual Property Policies for commercialization purposes. This policy aims at creating an environment that promotes trade potential of technology and economic activity and creates new employment opportunities through the formulation of policies and guidelines for intellectual property rights. Hence, universities and research institutions are more apt to create an environment that encourages innovation and invention (MP6, 1991).

The policies have managed to maximize use of resources in the country through an interlibrary loan system as well as served a platform for networking between libraries in the country. Basic research by Olubiyo, (2022) was conducted on the information base for developing countries. His research used Malaysia as a case study. The information sector is a rapidly evolving discipline, and the library is a small subset of the dynamic information. Rehman began an extensive research profile out of library authority, showing common information in 11 new categories. The categories are: environmental information, information needs, information systems, information policy issues (access, literacy, censorship, copyright, special needs groups and official information), provision of labour, the role and contribution of information agencies, legislation, technology and its impact, publishing and distribution of information, process development and implementation of policies, and international dimensions.

Libraries need to have clearly defined roles, as practiced in developed countries whereby the institution is shaped by the culture of knowledge. The culture of knowledge embraces all segments of society, either directly or indirectly involved with the addition of knowledge activities; where all actions of individuals or society are determined, decided and implemented based on this knowledge (Zaini, 2009). To understand the formation of knowledge culture, a comparison between the practices of developed countries, especially Western countries, and practices in Malaysia, needs to be made. This comparison provides an understanding of why the role of the library is central to information policies.

Evenett, etal (2024). correlate information policy development with the need to provide scientific and technical information and the establishment of public libraries by the government. However,

Bustamante does not identify the need of scientific and technical information directly with the establishment of the national library. Studies on the source of information have begun to expand in scope, but are still cantered on the scope of library and information services. This clearly shows the library as an institution is managing information that is highly relevant to the development and formulation of policies for information. At the time of being formed, the policy was related to the affairs of the library and information managed, as enshrined in the National Library Act 1972 (Act 80), namely to:

i. Provide leadership and encourage partnership in library affairs;
ii. Assist the Government in promoting education in the use and development of the national language;
iii. Support research and investigations at the national level;
iv. Provide facilities for information, for both pleasure and life, in communities;
v. Contribute to the development of cultural relations with other communities; and
vi. Invent or promote any services or other activities relating to library matters as, directed by the minister. For this purpose, a set policy for the National Library covers Policy and Technology,

Digitization Policy, Policy for Malay Manuscripts, Gift and Exchange Policy, Policy Publication Delivery System (CMS), Media Resource Policy, the Policy Advisory and Consultancy Services, Classified Document Management Policy, Policy Disposal of Library Resources, Policy Monograph Acquisition and Material Documentation and Other Printed Materials, Library Resources Conservation Policy, and Human Resources Policy.

Change in elements of information policy

The approach used to develop the information policy in this country does not follow usual practices, like those of developed countries. Development of information policies in developed countries is based on the information needs of the library as the main player. Information and communication technologies are simply tools that serve as a catalyst for the prominent use of information. Malaysia only sees need for policies when it comes to making information and for communications technology, which dominates the way organizations operate. Thus, the basis of information developed has an emphasis on information and communication technology (ICT). The Government considers ICT a significant positive impact on society and the nation.

Conclusion

A clear national information policy for Malaysia cannot be traced. Initially, the country had only libraries to handle basic information. However, the scope of the library's role was confined to getting information, and managing, maintaining and disseminating information, appropriate to the roles outlined by UNESCO and enshrined in the Library. The policy does not cover information on socio-cultural and economic aspects, such as in the others outlined in the PGI. The limitations of the scope of the information policy for national information are not exhaustive. In fact, the national information policy should be cross-disciplinary. Although the country gives priority to ICT for increased development of the country, it sidesteps the role of the library. Information science is not appropriate for understanding the information needs of a nation. Even the role of the library needs to be strengthened in line with developments at the global level. Libraries are key players in the development of an informed and knowledgeable society, not just as providers, but also as storage and information retrieval centers. An informed and knowledgeable society cannot be established without a comprehensive.

integrated information policy. The library and information science remain a significant element of the source of information, even though the current focus is on information and communication technologies for transforming the economy for national development. Thus, the library must put forward the Library Association as the lead role in developing an informed society, such as that done by the American Library Association (ALA), the leading information policy, as played by the Canadian Library Association (CLA), and increased the social system, as recommended by Ashiq, (2022). As advocates by (Gupta, 2024). no other sector of the information industry has the professional skills or perception to recognized the value of information or to leverage it. But one distinct problem lies in the lack of champion within the profession who can influence at the highest level. Professional bodies in the area should take a wider approach to policy formulation, looking beyond the boundaries of institutions that provide and manage information.

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IMPACT OF OFFICE TECHNOLOGY AND MANAGEMENT SKILLS ON THE PRODUCTIVITY OF OFFICE MANAGERS IN FEDERAL POLYTECHNIC DAMATURU

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Abstract

This research work observed "Impact Of Office Technology And Management Skills On The Productivity of Office Managers In Federal Polytechnic Damaturu" The main objectives of this study is to examine how presentation skills affects Office Technology and Management on the Productivity of Office Managers, to determine the impact of word processing skills on the Productivity of Office Managers, to examine the use of Corel draw skills that affect Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu. The descriptive research design was employed to answer questions concerning the current status of the subject in the study. The Findings, revealed that poor presentation skills affect Computers presentation have made Managerial functions in office more effective, that office Technology and Management skills is very useful among office Managers in discharging their secretariat activities. And it was recommended that, the polytechnic should adopt more technologies skills to simplify and increase the productivity of office Managers, there is need for Office Managers to match the new challenges by acquiring new skills and competencies in the operation of these new technologies.

Keywords: *Technology, Productivity, Office Managers, Skills and Management.*

Introduction

Prior to the emergence of information technology, managerial duties were manually performed such as manual minute book keeping, storing of minutes books in book shelves, writing and taking records of discussion in meetings and other clerical functions perform by a manager. However, the emergence of information technology has drastically repositioned secretarial duties with the application of the various information technology equipment such as the computer, the electronic information transfer, electronic minute book that have facilitated the functions of the secretary in the office (Oluwalola 2020). Secretaries and administrative assistants perform a variety of administrative and clerical duties necessary to run an organization efficiently. They serve as information and communication managers for the office and plan as well as schedule meetings and appointments, organize and maintain documents and electronic files, manage projects, conduct research and disseminate information by using the telephone, mail services, web sites, and e-mail.

Office Technology is an aid to the secretary who makes constant use of the machines, hence the machines can carry out routine work or clerical jobs quickly, accurately and automatically more than the ordinary human being can do, thereby freeing the secretary in working out payroll, and other numerous letters and calculations which need an expert and excellent touch to be done correctly. Some of these machines have large storage facilities and can store information in their memory unit. Office Technology has created new job opportunities especially for the secretarial assistant. Office Technology refers to utilizing personal computers such as word processors and electronic intercom mail plus other technologies used to upgrade workers' productivity and efficiency, it is the technique of making a processor system automatic in the office (Hobday,2023).

As the reliance on technology continues to expand in offices, the role of the office professional has greatly evolved. Office automation and organizational restructuring have led secretaries and administrative assistants to increasingly assume responsibilities once reserved for managerial and professional staff (Akagha, 2023) Despite these changes however, the core responsibilities for secretaries and administrative assistants have remained much the same: performing and coordinating an office's administrative activities and storing, retrieving, and integrating information for dissemination to staff and clients. Secretaries and administrative assistants use a variety of office equipment, such as fax machines, photocopiers, scanners, and video-conferencing and telephone systems.

In addition, secretaries and administrative assistants often use computers to do tasks previously handled by managers and professionals; they create spreadsheets, compose correspondence, manage databases, and create presentations, reports, and documents using desktop publishing software and digital graphics. They may also negotiate with vendors, maintain and examine leased equipment, purchase supplies, manage areas such as stockrooms or corporate libraries, and retrieve data from various sources. At the same time, managers and professionals have assumed many tasks traditionally assigned to secretaries and administrative assistants, such as keyboarding and answering the telephone. Because secretaries and administrative assistants do less dictation and word processing, they now have time to support more members of the executive staff. In a number of organizations, secretaries and administrative assistants work in teams to work flexibly and share their expertise. It is therefore imperative to examine the relationship between office technology and secretarial productivity.

Statement of the Problems

The computerization of the office environment and the widespread use of information technology among managers and professional staffs have raised some questions about the future of the office Managers occupation. The emergence of information technology is a welcome development in the modern office environment and the Managerial function avail with some problems such as presentation skills, keyboarding with word processor, using Corel draw application in designing calendar and spread sheet application in calculating students grade etc. Information technology has contributed positively to reduce the huge volume of clerical work assigned to the secretary on daily basis Akagha, (2023). However, the application of these information technology devices can affect secretarial attitude positively or negatively. Addo, (2022). Studied information technology in Nigerian. Few organizations had Information Technology (IT) policy, for the main purpose of achieving full applications of Information Technology, in order to meet organizational goals, secure competitive advantage and to be up to date. The world is undergoing a rapid change due to innovations as seen in office technology, and as the new time and the evolution continue, for the relevance to the office work for which he/she is employed and moreover, the training which is to prepare secretaries to meet the challenges.

Objectives of the Study

The general purpose of the study on the impact of office Technology and Management skills on the productivity of office Managers in Federal Polytechnic Damaturu. Specifically, the study wanted to achieve the following:

i. To examine how poor presentation skills affects Office Technology and Management on the Productivity of Office Managers in federal Polytechnic Damaturu.
ii. To determine lack of keyboarding skills with word processing affects Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu.
iii. To examine lack of Corel Draw skills in production of calendar that affect Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu.
iv. To examine lack of desktop publishing skills in designing banner that affect office Technology and Management on the Productivity Office Managers in Federal Polytechnic Damaturu.

Research Questions

The following research questions were formulated for the study:

i. How does poor presentation skills affect Office Technology and Management on the Productivity of Office Managers in federal Polytechnic Damaturu.?
ii. How does lack of keyboarding skills with word processing affects Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu. ?
iii. How does lack of Corel draw skills in production of calendar affect Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu ?
iv. How does the impact of desktop publishing skills in designing banner affect office Technology and Management on the Productivity Office Managers in Federal Polytechnic Damaturu.

Significance of the Study

The findings of this study will be useful to the following:

Students
Students of the Department of Office Technology and Management who study various course within and outside the department. There by helping them to developed their skill on the utilization of office technology machines will know how to develop their potentials in any organization He/She found Himself/herself. This study also will help to enlighten OTM students on the need to develop more skills in their academic performance in order to achieve their desired goals and objectives.

Institution of learning
The study will be of enormous benefit to the institution of knowledge so that by using this study the polytechnic management to enforce on new employees to show their skills during recruitment excise.

Scope and Limitation of the Study
This research work is limited to Impact Office Technology and Management skills on the Productivity of Office managers in Federal Polytechnic Damaturu Yobe State.

Concept of Office Technology
Office automation refers to all processes that integrate computer and communication technology with the traditional manual processes. According to Dey, (2020). Office automation is a conglomerate of all the separate office information processing technologies which include: word processing, data processing, micrographics, reprographics and telecommunications. It also refers to the various automated electronic methods by which information is gathered, processed, reproduced, communicated, stored or protected and retrieved. This includes not only the methods through which office information is processed by the resources applied to capture, process, deliver and or store office information. Turner ,(2022). Reported that secretaries have vital roles to play in enhancing the attainment of organizational goals. Though secretaries of nowadays would not necessarily be expected to understand as much about the business in hand as their executives, they are increasingly being expected to have some understanding of the significance and effective management of the correspondence, reports and instructions which normally pass through their desks. The trained secretaries with state of the art materials and equipment are expected to be gainfully employed in the labour markets or even create jobs and become self-reliant despite the present hardship in the Nigerian economy. Office automation is a mechanism which aims to improve organization efficiency and productivity through use of effective and efficient management by utilizing electronic flow of correspondence in organization level , easy searching stored data, quick and timely response to client, removal of paper from administrative correspondence cycle, proper control over users, maintaining and recording data efficiently and improve communications within organization (Addo, 2022). increase non-productive activities like physical archiving of documents , maintaining records of operation in less volume, high safety and easy access, producing necessary report with different diagrams, decrease duties of office managers, typists and secretaries, possibility to telephone supervising on tasks and activities in any time, control over classified data, precision in doing operation and recording all affairs, removal of paper completely in performing work process, facility and speed in operation flow, high security in maintaining documents and possibility to rapid accessing them (Bajpai, 2024).

According to Esene (2012) the modern offices of today lay due emphasis on paperless office as a way of facilitating the process of correspondence handling and operations. For instance, AbdulKareem, (2020). stated that in offices computer, database management and other accessories

are increasingly being used to organize and control records. Secretaries are now being required to be able to operate computer using Dbase, Excel, Corel Draw and Word Processing packages such as Word Perfect, MS word, Power Point, Adobe Page Maker and in particular the dexterity to use most of the application packages contained in Windows 2000 to 2007 respectively. Munirathinam, (2020) Further stressed that; computer internet is now being used to send and retrieve information from any part of the world with relative ease. Office automation has taken over the entire activities of very many organizations with various electronic equipment such as computers, electronic typewriters, photocopiers, tele-printers, fax recorders, telephones with cellular, GSM/Mobile attachments, electronic switch boards, laminating machines, scanners, Dictaphones, magnetic and non-magnetic tapes. All this equipment, as a matter of fact are used to speed up the processing of correspondence, but not to replace the secretarial function of the secretaries (Koko, 2020).

Office Technology and the Managerial Functions

Information technology is the combination of computing, telecommunication and video techniques for the purpose of acquiring, processing, storing, and disseminating vocal, pictorial, textual and numerical information. However, Computer technology has undergone series of changes which reflect big size to miniature size of computers with their increasingly high processing speed of data into information for decision making Imene,(2020). Information technology according to Oliver, is a technology which supports activities involving the creation, storage, manipulation and communication of information (principally computing, electronics and electronic communications) together with their related methods, management and applications. It has also created countless opportunities and challenges for millions of individuals. In particular, the challenges of managers' responsible for introducing this technology have been exceptionally high in information and knowledge -based society. Management must attempt to capture the advantages offered by information technology, yet they must also avoid the pitfalls along the way toward increasing automation. As information has altered the way many people do their jobs and has changed the nature of work in industrialized nations, the practice of management has been greatly affected. The management of many firms and their managers must therefore understand the implications of this new information technology revolution which require substantial future readjustment and quickly learn how to benefit from it Imamov, (2021). The explosion in electronic commerce is just one example of the many way's information technology is influencing how people do business and how they account for business financial and economic events.

The blending of internet technologies and traditional business concerns is impacting all industries and is really the latest phase in the ongoing evolution of business infrastructure and change the way to respond more immediately to customer needs (Caliskan,2021). The audit objective which is to render an opinion on the “true and fair view” of a client's financial statement still holds, however, the technical expertise that the auditor must possess to evaluate computer-based accounting systems has undergone considerable changes and the change will ever continue to be more radical and rapid (Nychkalo, 2022). Information and communication technology are seen as a way to promote educational change, improve the skills of secretaries and prepare them for the global economy and information society. Information and communication technology are used to improve delivery of and access to effective and efficient management of office and the organization as a whole. Information and communication technology when focused on secretaries tends to improve the understanding of the secretarial practice and functions, increase quality of secretaries' work attitude thereby increase the impact of secretaries on the management of the office. While basically information and communication technology-based innovations can enhance in

secretarial functions, their linkage to office management is essential to achieve intended outcomes of an organization.

The Computer

Wickens, (2021), described the computer as a complex electronic machine used for all sorts of information processing. The information may be data, graphics, picture or audio. Computers are marked by accuracy of results, speed in operation and versatility in application. The use of computer system has brought about a lot of improvement and efficiency over the previous manual operations. Data processing skills will enable secretaries meet established performance criteria, maintain/update stored data base, and enable the secretary to interpret computer print outs.

Word Processing

According to de Lange, N. (2023). word processing is an electronically processing of alphabetic and alpha numeric information. A word processor consists of keyboard, electronic memory, a display unit and printer. Because word processors are versatile, they can be useful to any person who wants to produce documents such as advertising copy, novels, letters, term papers, scientific papers, legal briefs and any other type of word-based document. They went further to list the functions of word processor as follows: storing, editing information and retrieving text, insertion and deletion of text, underlining using various types of fonts, moving text page numbering and saving, storing or retrieving texts. However, the capability of a word processor is dependent upon the special features of the application software. Word processing skills have made the work of secretaries more interesting. Even the status and work environment of secretaries have witnessed tremendous changes. Today's secretaries require the knowledge, skills, attitude and aptitude of word processing to obtain good output in office operations. Word processing is beneficial to secretaries in the following ways: the success or failure, status or lack of status of a manager/boss will no longer determine the secretary's position. It relieves secretaries of the burden of repetitive typing thus making the production of documents less tedious. It enables secretaries to make additional and meaningful contributions to office tasks.

Data Processing

Sarker, (2021) describe He noted that business data processing functions include arranging, filing and sorting, editing, subtracting, recording and sorting alpha numeric data for future use. Alaimo, (2022) posited that data processing is the manipulation of all forms of data used in an organization into information in order to plan, control, manage and facilitate organizational activities. He noted that data processing can be done manually or automatically. Whichever method used, data processing consists of three steps: inputting, manipulating and outputting. Nwosu, Oluwalola, (2020), noted that the computer is used to process large volumes of accounting data relating to routine repetitive operations such as accounts receivable, accounts payable, inventories, payrolls and posting to large accounts. The nature of operations performed by an organization is dependent on the data processing skills used by that organization. They went further to list the following as data processing methods: batch processing, demand processes, interactive processing, real time processing, and time stating processing.

Telecommunications

Hobday, (2023). defined telecommunication as the technology of sending signals, images and messages over long distances by radio, telephone, television, satellite. B Paulse, (2021). opined that the merger of both technology and information technology have made telecommunication an indispensable component of office information systems. Pointed out that telecommunication is

about meeting or discussing with people from a distance. He listed some telecommunication equipment to include telephone and wireless phones, electronic mail, teleconferencing and video conferencing, word processors and telex, television, public address systems, internet and intranet services, satellite radio and satellite phones, electronic organizer, global positioning system and voice recognition by computer. They asserted that in this era of information explosion, where people are bombarded with data, getting the right information in the right amount and at the right time is not an easy task. It is only those organizations that have succeeded in managing information that will survive.

Reddy, (2021) Described telecommunication as all the methods of sending and or receiving messages by telephone or telegraph. Innovations in telecommunications have resulted in new technologies such as CD ROM, data broadcasting, small satellite antenna and remote data base access, etc. According to Ojochide, (2021), business organizations and secretaries need telecommunication skills to enable them to be up-to-date and be relevant in today's growing economy. Although telephone technique remains basically the same, new features are being introduced into the office at an alarming speed. This is because the electronic office relies on computer technology and telephone networks. Any secretary who is lacking telecommunication skills will find it very difficult to communicate effectively in an automated office.

Word processing Skills: Word Processing refers to the act of using a computer to create, edit, save and print documents. In order to perform word processing, specialized software (known as a Word Processor) is needed. One example of a Word Processor is Microsoft Word, but other word processing applications are also widely used Nnaji, (2023). Examples include: Microsoft Works Word Processor, Open Office Writer, Word Perfect and Google Drive Document. These programs allow users to create a wide variety of documents including (but certainly not limited to) reports, letters, memos, newsletters and brochures. In addition to typing text, the word processor allows you to add content such as pictures, tables, and charts to your documents as well as decorative items including borders and clipart.

Keyboarding: Keyboarding is the process of using a keyboard to input data, text, commands, or other information into a computer or other electronic device. It involves using a keyboard to type letters, numbers, symbols, and special characters in order to create documents, emails, messages, and other digital content Esther, (2020). Keyboarding skills are important in today's digital age, as they are essential for effective communication and productivity in many industries and professions. Keyboarding proficiency can be improved through practice and training, and there are many resources available to help individuals improve their typing speed and accuracy.

Graphic and Animation skills: Learning graphic design or 3D animation can be a rewarding career choice for those who are passionate about visual arts and design Borysova, (2022). Both fields require a combination of technical and creative skills, including proficiency in design software, an eye for aesthetics, and the ability to communicate ideas visually.

Presentation Skills such as Power Point: Presentation skills are the abilities and qualities necessary for creating and delivering a compelling presentation that effectively communicates information and ideas. They encompass what you say, how you structure it, and the materials you include to support what you say, such as slides, videos, or images.

Harware/Software maintenance skills: Hardware maintenance is the testing and cleaning of equipment. Software maintenance is the updating of operating systems and application programs in order to add new functions and change data formats. It also includes fixing bugs and adapting the software to new hardware devices.

Database skills: What are database skills? Database skills are soft and technical skills that computing professionals use to construct or administer complex digital databases. As a data administrator, you can use these skills to design the database structure, plan custom access permissions or write security code such as Ms access/Ms Excel.
Desktop Publishing Skills: Desktop publishers must have a good eye for how graphics and text will look. Murchie, (2020). that they can create pages that are visually appealing and legible. Communication skills. Desktop publishers must collaborate with others, such as writers, editors, and graphic designers, and communicate ideas effectively. Detail oriented such as Corel Draw,

Design of the Study

The descriptive research design was used to employ which is a process of collecting data in order to answer questions concerning the current status of the subject in the study.

Population of the study

The population of this study consists of thirty-two (33) Confidential Secretaries in the employment of Federal Polytechnic Damaturu Yobe State. The table below show the distribution of the population in the various Department and units in the institution.

S/N	Departments/Units	Number of Secretaries
1	RECTOTRY	1
2	DEPUTY RECTOR ADMIN	1
3	DEPUTY RECTOR ACADEMIC	1
4	REGISTRY	1
5	BURSARY	1
6	PROCUREMENT	1
7	ANTI CURRUPTION AND TRANSPARENCY	1
8	ACADEMIC AFFAIRS DIVISION	1
9	FEDPODAM NIGERIA LIMITED (COUSULT)	1
10	STUDENT AFFAIRS	1
11	WORKS	1
12	SPORT	1
13	POLYTECHNIC LIBRARY	1
14	SCHOOL OF SCIENCE AND TECHNOLOGY	4
15	SCHOOL OF MANAGEMENT STUDIES	6
16	SCHOOL OF ENGINEERING AND TECHNOLOGY	6
17	SCHOOL OF ENVIRONMENTAL STUDIES	1
18	SCHOOL OF GENERAL STUDIES	3
TOTAL NUMBER OF POPULATION		**33**

Sample Size and Sampling Techniques

Due to the fact that, the size of the population is not large, the study adopted the whole number of the population. Hence there is no sampling.

Instrument for Data Collection

The instruments use for this research work is a structured questionnaire which is formulated from the research questions of chapter one. Each research questions is expanded to have 5 question items, thus formed 20 questionnaire items in total. For the purpose of this research, the five (5) liker responses option used for collecting the questionnaire items are: Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD) questions and transmitted letter attached to it.

Validity of the Instrument
The questionnaires were designed based on the research question and presented to the supervisor for validation.

Method of Data Collection
The Researcher design and administered 33 copies of questionnaires with 20 questions and will be distributed to the respondents in their various units and departments who will be asked to tick the appropriate answer of their choices, which will be later retrieved, analyzed, and interpreted.

Method of Data Analysis
The researcher analyzes the data using the mean scale for score obtain from the five (5) points liker scale below:
Strongly Agree (SA) = 5
Agree (A) = 4
undecided (D) = 3
Disagree (D) =2
Strongly Disagree (SD) = 1

The cut-off point is obtained through the use of the following formula:

$$X = \frac{\sum FX}{N} = 5+\frac{4+3+2+1}{5} = \frac{15}{5} =$$ Therefore X=3.0

The cut-off point is therefore, 3.0 the mean score will now be calculated by multiplying each variable by the value allocated to each of the 5-point and sum up to get the summed frequency (EFX) which will be divided of the sample size (N) to get the mean score. Therefore, the cut-off point determines whether such variable is Agreed or Disagreed.

Presentation and Analysis of Data
Introduction
This chapter provides a detailed analysis of data collected from field survey via the administration of questionnaire. A total of 33 questionnaires were distributed to secretaries of Federal Polytechnic Damaturu of which 28 were retrieved, properly and adequately completed. Representing about 84.38% of the respondent. The data collected from the respondents via questionnaire were classified and analyzed using frequency distribution table.

Data Presentation, Analysis and Interpretation
Table 4.2.1: Age of Working Experience of Respondents

Gender	Frequency	Percentage
1 – 5 years	16	59.23%
5 – 10 years	4	11.12%
15 – Above	8	29.63%

Table 4.2.2: Highest Qualifications of Respondents

Level	Frequency	Percentage
OND/NCE	7	22.2%
HND/BSc.	19	70.4%
Others	2	7.4%
Total	28	100%

Table 4.2.3: Department/Unit of the Respondents

Department of the Respondents	Frequency	Percentage (%)
Rector office	1	3.70%
Deputy Rector Academic	1	3.70%
Registry	1	3.70%
Bursary	1	3.70%
Procurement unit	1	3.70%
School of management	4	18.52%
School of science	5	12.98%
General studies	1	3.70%
School of Environmental	4	18.52%
School of Engineering	5	12.98%
Fedpodam Library	1	3.70%
Students Affairs	1	3.70%
Deputy rector Admin	1	3.70%
Fedpodam Nig. Ltd. (Consult)	1	3.70%
TOTAL	28	100%

Table 4.2.4: How does poor presentation skills affects Office Technology and Management on the Productivity of Office Managers in federal Polytechnic Damaturu.?

s/n	Item	SA	A	U	D	SD	EFX	X	REMARK
1	Using Computers presentation have made Managerial functions in office more effective.	9	14	0	3	2	109	3.89	Agreed
2	The use of projector presentation has made work less cumbersome.	11	13	2	2	0	117	4.17	Agreed
3	Heavy files are no longer being carried regularly because of the acceptance of computer presentation.	15	12	1	0	0	126	4.5	Agreed
4	Documents can easily be retrieved when presentation.	12	16	0	0	0	124	4.42	Agreed
5	Multi-tasking can be effectively done because of the availability of the presentation skill with computer .	17	6	5	0	0	124	4.42	Agreed

Source: Field Survey 2024 n=28

Table 4.2.4 Interpretation
Based on the Table 4 above, Question 1 with a mean score of 3.89 indicated that Using Computers presentation have made Managerial functions in office more effective. Question 2 with a mean score of 4.17 point out that Using the use of projector presentation has made work less cumbersome. Question 3 with a mean score of 4.5 indicated that Heavy files are no longer being carried regularly because of the acceptance of computer presentation. Question 4 with a mean score of 4.42 point out that Documents can easily be retrieved when presentation. Question 5 with a mean score of 4.42 indicated that Multi-tasking can be effectively done because of the availability of the presentation skill with computer.

Findings
Base on the above Findings, revealed that poor presentation skills affect Computers presentation have made Managerial functions in office more effective, affect the use of projector presentation has made work less cumbersome, affect Heavy files are no longer being carried regularly because of the acceptance of computer presentation, affect Documents can easily be retrieved when presentation, affect Multi-tasking can be effectively done because of the availability of the presentation skill with computer.

Table 4.2.5: How does lack of keyboarding skills with word processing affect Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu ?

s/n	Item	SA	A	U	D	SD	EFX	X	REMARK
6	With word files are easily stored and retrieve.	17	8	0	0	3	120	4.28	Agreed
7	Files and documents can be filed, sorted and retrieved swiftly when using word.	9	17	2	0	0	119	4.25	Agreed
8	Data processing procedures aid speed and efficiency within the institution.	16	9	3	0	0	125	4.46	Agreed
9	Inputting numbers are done with ease.	4	19	5	0	0	111	3.96	Agreed
10	Sorting of all data are done effectively	7	18	2	1	0	115	4.10	Agreed
Total Mean Score:		**4.21**							

Source: Field Survey 2024 **n=28**

Table 4.2.5 Interpretation:
Based on the Table 5 above, Question 6 with a mean score of 4.28 indicated that With word files are easily stored and retrieve., Question 7 with a mean score of 4.25 point out that Files and documents can be filed, sorted and retrieved swiftly when using word, Question 8 with a mean score of 4.46 indicated that Data processing procedures aid speed and efficiency within the institution, Question 9 with a mean score of 3.96 point that Inputting numbers are done with ease., Question 10 with a mean score of 4.10 indicated that Sorting of all data are done effectively

Findings
Base on the above findings it revealed that lack of typing skills with word processing affect Microsoft word files are easily stored and retrieve, Files and documents can be filed, sorted and retrieved swiftly, Data processing procedures aid speed and efficiency within the institution, Inputting numbers are done with ease and Sorting of all data are done effectively.

Table 4.2.6: How does lack of Corel draw skills in production of calendar affect Office Technology and Management on the Productivity of Office Managers in Federal Polytechnic Damaturu ?

s/n	Item	SA	A	U	D	SD	EFX	X	REMARK
11	Corel draw helps office manager effectively by designing office Calendar .	11	12	2	1	2	113	4..03	Agreed
12	With Corel draw application you can easily design poster for office activities .	6	18	3	1	0	113	4.03	Agreed
13	Corel draw makes it easier for office managers to vis ualize and interpret information on bill board.	11	16	0	1	0	121	4.32	Agreed
14	Corel draw contributes to office managers in achieving their target.	8	15	5	0	0	115	4.10	Agreed
15	Office managers who frequently use Corel draw tasks can achieved job productivity.	9	14	3	1	1	113	4.03	Agreed
Total Mean Score:				**4.10**					

Source: Field Survey 2024 **n=28**

Table 4.2.6 Interpretation:

Based on the Table 6 above, Question 11 with a mean score of 4.03 indicated that Corel draw helps office manager effectively by designing office Calendar, Question 12 with a mean score of 4.03 point out that With Corel draw application you can easily design poster for office activities., Question 13 with a mean score of 4.32 indicated that Corel draw makes it easier for office managers to visualize and interpret information on bill board, Question 14 with a mean score of 4.10 point out that Corel draw contributes to office managers in achieving their target, Question 15 with a mean score of 4.03 indicated that Office managers who frequently use Corel draw tasks can achieved job productivity.

Findings

Base on the Findings above revealed that, Corel draw helps office manager effectively by designing office Calendar, With Corel draw application you can easily design poster for office activities, Corel draw makes it easier for office managers to visualize and interpret information on bill board, Corel draw contributes to office managers in achieving their target, Office managers who frequently use Corel draw tasks can achieved job productivity.

Table 4.2.7: How does the impact of desktop publishing skills in designing banner affect office Technology and Management on the Productivity Office Managers in Federal Polytechnic Damaturu?

s/n	Item	SA	A	U	D	SD	EFX	X	REMARK
16	Desktop publishing applications are too complex for office managers to design banners.	11	9	2	2	4	105	3.75	Agreed
17	Office managers without desktop publishing software cannot design complimentary card.	7	14	1	3	3	103	3.67	Agreed
18	Using desktop publishing applications office managers can design invitation card.	8	12	2	3	3	103	3.67	Agreed
19	Overuse of desktop publishing applications can make office managers not to perform task effectively.	4	2	1	8	13	60	2.14	Disagreed
20	Office managers often struggle to integrate desktop publishing applications with other skills, lead to inefficiency in their job performance.	10	8	3	2	5	102	3.64	Agreed
Total Mean Score:				**3.42**					

Source: Field Survey 2024 **n=28**

Table 4.2.7 Interpretation
Based on the Table 7 above, Question 16 with a mean score of 3.75 indicated that Desktop publishing applications are too complex for office managers to design banners, Question 17 with a mean score of 3.67 indicate that Office managers without desktop publishing software cannot complimentary card, Question 18 with a mean score of 3.67 indicated that Using desktop publishing applications office managers can design invitation card, Question 19 with a mean score of 2.14 point out that Overuse of desktop publishing applications can make office managers not to perform task effectively, Question 20 with a mean score of 3.64 indicated that Office managers often struggle to integrate desktop publishing applications with other skills, lead to inefficiency in their job performance.

Findings
Findings revealed that, Desktop publishing applications are too complex for office managers to design banners, Office managers without desktop publishing software cannot complimentary card, Using desktop publishing applications office managers can design invitation card, Overuse of desktop publishing applications can make office managers not to perform task effectively, Office managers often struggle to integrate desktop publishing applications with other skills, lead to inefficiency in their job performance.

Discussions of Findings
This research which determines on the Impact of Office Technology and Management Skills on the Productivity Office Managers in Federal Polytechnic Damaturu, after data analysis, it was found out that, computer has significant impact in Managerial skill in federal polytechnic Damaturu. The results indicated that Computers have made functions in office more effective, use of computers has made work less cumbersome, Heavy files are no longer being carried regularly because of the acceptance and the use of the computer, Documents can easily be retrieved, and Multi-tasking can be effectively done because of the availability of the computer. These findings emphasize that Multi-tasking can be done effectively on the availability of computer skills on productivity of secretaries in federal polytechnic Damaturu.

The study reveals that With Microsoft word files are easily stored and retrieve, Files and documents can be filed, sorted and retrieved swiftly, Data processing procedures aid speed and efficiency within the institution, Inputting numbers are done with ease, and Sorting of all data are done effectively. These results highlight the importance of Microsoft word in secretarial skill in federal polytechnic Damaturu. The findings indicated that excel helps secretaries manage time more effectively by automating calculations, With Microsoft excel you can easily calculate Students Grade point Average, excel makes it easier for secretaries to visualize and interpret statistical information, excel contributes to secretaries inachieving higher grades in subjects involving data management, Secretaries who frequently use Excel are more prepared for data-related tasks in their job productivity. These results emphasize the need for effective use of excel in productivity of secretarial skills in federal polytechnic Damaturu.

The study reveals that lack of desktop publishing skills, Desktop publishing applications are too complex for secretaries to use effectively in their academic productivity, Secretaries without access to desktop publishing software are at a disadvantage in creating visually appealing projects, Using desktop publishing applications can result in formatting errors that affect the quality of secretaries

in academic submissions, Overuse of desktop publishing applications may result in secretaries neglecting manual machine skills, which are crucial for certain assignments and Secretaries often struggle to integrate desktop publishing applications with other academic tools, leading to inefficiency in their secretarial productivity. Therefore, this study enumerates the importance of desktop publishing skill to the secretaries in Federal Polytechnic, Damaturu.

This research results settle with other studies which have been undertaken on closely related variables. In a study, Wickens, (2021). described the computer as a complex electronic machine used for all sorts of information processing. The information may be data, graphics, picture or audio. Computers are marked by accuracy of results, speed in operation and versatility in application. The use of computer system has brought about a lot of improvement and efficiency over the previous manual operations, Lesi, (2020). Data processing skills will enable secretaries meet established performance criteria, maintain/update stored data base, and enable the secretary to interpret computer print outs.

Word Processing refers to the act of using a computer to create, edit, save and print documents. In order to perform word processing, specialized software (known as a Word Processor) is needed. One example of a Word Processor is Microsoft Word, but other word processing applications are also widely used. Examples include: Microsoft Works Word Processor, Open Office Writer, Word Perfect and Google Drive Document Nnaji, (2023). These programs allow users to create a wide variety of documents including (but certainly not limited to) reports, letters, memos, newsletters and brochures.

Desktop publishers must have a good eye for how graphics and text will look, so that they can create pages that are visually appealing and legible Murchie, (2020). Communication skills. Desktop publishers must collaborate with others, such as writers, editors, and graphic designers, and communicate ideas effectively. Detail oriented such as Corel Draw.

Summary, Conclusion and Recommendation

This chapter discuss on the summary of the major findings from the responses gathered through the questionnaires. The formulated questionnaire has been analyzed and conclusion was drawn from the overall findings. In the conclusive part, recommendations were offered to the bodies concerned, which if considered will solve the problem associated with the study as aforementioned.

Summary of Major Findings

Base on the above Findings, revealed that poor presentation skills affect Computers presentation have made Managerial functions in office more effective, affect the use of projector presentation has made work less cumbersome, affect Heavy files are no longer being carried regularly because of the acceptance of computer presentation, affect Documents can easily be retrieved when presentation, affect Multi-tasking can be effectively done because of the availability of the presentation skill with computer.

Base on the above findings it revealed that lack of keyboarding skills with word processing affect Microsoft word files are easily stored and retrieve, Files and documents can be filed, sorted and retrieved swiftly, Data processing procedures aid speed and efficiency within the institution,

Inputting numbers are done with ease and Sorting of all data are done effectively. Base on the Findings above revealed that, Corel draw helps office manager effectively by designing office Calendar, With Corel draw application you can easily design poster for office activities, Corel draw makes it easier for office managers to visualize and interpret information on bill board, Corel draw contributes to office managers in achieving their target, Office managers who frequently use Corel draw tasks can achieved job productivity.

Findings revealed that, Desktop publishing applications are too complex for office managers to design banners, Office managers without desktop publishing software cannot complimentary card, Using desktop publishing applications office managers can design invitation card, Overuse of desktop publishing applications can make office managers not to perform task effectively, Office managers often struggle to integrate desktop publishing applications with other skills, lead to inefficiency in their job performance.

Conclusion

In conclusion the study found out that office Technology and Management skills is very useful among office Managers in discharging their secretariat activities in Federal Polytechnic Damaturu. It has also found out that Heavy files are no longer being carried regularly because of the acceptance and the use of the computer, makes Office Managers to developed and increased their skills productivity and Documents can easily be retrieved. It also found that Data processing procedures aid speed and efficiency within the institution found useful among Office Managers in Federal Polytechnic Damaturu. Finally, the study found out that Excel makes it easier for office managers to visualize and interpret statistical information and Overuse of desktop publishing applications may result in secretaries neglecting manual machine skills, which are crucial for certain assignments of Office Managers in Federal Polytechnic Damaturu.

Recommendations

Based on the findings of the study, the following recommendations were made:

i. The polytechnic should adopt more technologies skills to simplify and increase the productivity of Office Managers.
ii. There is need for office managers to match the new challenges by acquiring new skills and competencies in the operation of these new technologies.
iii. The Polytechnic should organize on-the-job and off-the-job training of secretaries to be up-to date on new skills and information technology training to simplify the training of Office Managers.
iv. The office technology skills should be redefined to fit the office managers effective managerial functions, and there should be policies in the institution for managerial training for better performance of Office Managers in the Polytechnic.

Limitations of the Study

i. Small sample size (28 respondents).
ii. Limited geographical scope (Federal Polytechnic Damaturu Secretaries (Non-Academic Staff).
iii. Data collection method (questionnaire) may be subject to partialities.
iv. Study focused on Office Managers of the federal Polytechnic Damaturu.

Suggestions for Further Studies

To Analyze the role of workers training in enhancing the Productivity of Office Managers in Federal Polytechnic Damaturu.

i. Conduct a comparative study on different Office Technology and Management Skills like Webpage Design in some selected Nigerian institutions.
ii. Explore the effectiveness of different OTM skills for the productivity of Office Managers in educational institutions.
iii. Investigate the impact of Software Application on the productivity of Office Managers in Nigerian polytechnics.
iv. Develop a framework for implementing Desktop Publishing in OTM Skills.

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THIRD-PARTY LOGISTICS AND MATERIALS DISTRIBUTION EFFICIENCY IN NATIONAL PRIMARY HEALTH CARE DEVELOPMENT AGENCY (NPHCDA), NIGERIA

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Abstract

The National Primary Health Care Development Agency (NPHCDA) plays a vital role in ensuring equitable distribution of essential health commodities across Nigeria. However, logistical challenges continue to undermine the efficiency of its distribution system. This study examined the effect of Third-Party Logistics (3PL) dimensions—Delivery Timeliness (DLT), Cost Effectiveness (CE), and Cold Chain Management (CCM)—on Materials Distribution Efficiency (MDE) within NPHCDA. A quantitative approach was adopted, using structured questionnaires administered to 242 staff across selected NPHCDA offices. Multiple regression analysis was conducted using SPSS to assess the influence of the three 3PL components. Results showed that all three variables had significant positive effects on MDE. Delivery timeliness emerged as the strongest predictor, indicating that improved delivery schedules and responsiveness significantly enhance distribution performance. Cost effectiveness also had a substantial impact, showing that efficient cost control and resource optimisation contribute meaningfully to distribution efficiency. Additionally, cold chain management practices—such as temperature control and product integrity—were found to play a crucial role in ensuring reliable and safe delivery of health commodities. The model explained approximately 45.7% of the variance in materials distribution efficiency (R^2 = 0.457), demonstrating the collective relevance of the 3PL variables. The findings highlight the importance of leveraging external logistics capabilities to improve the reliability, affordability, and integrity of public health supply chains. It is recommended that NPHCDA strengthen its collaboration with 3PL providers by

investing in delivery scheduling, cost management systems, and robust cold chain infrastructure.

Keywords: *Third-Party Logistics (3PL); Materials Distribution Efficiency; NPHCDA; Delivery Timeliness; Cost Effectiveness; Cold Chain Management.*

Introduction

Efficient distribution of materials, particularly vaccines and essential medical supplies, is vital for effective healthcare delivery systems worldwide. Across the globe, third-party logistics (3PL) has emerged as a strategic solution for improving materials distribution by outsourcing warehousing, transportation, and cold chain management to specialised logistics service providers. Christopher (2016) highlights that integrating 3PL into supply chains enhances operational responsiveness, reduces delays, and ensures better utilisation of resources. Countries such as the United States, United Kingdom, and Germany have successfully adopted 3PL to strengthen their public health supply chains, ensuring timely delivery of temperature-sensitive medical products to health facilities.

Within Africa, the use of third-party logistics in health programmes is growing steadily. Countries like South Africa, Ghana, and Egypt have engaged 3PL providers to overcome distribution challenges. In South Africa, private logistics companies work with the National Department of Health to deliver vaccines and antiretroviral drugs efficiently, improving stock availability (Mashamaite & Mbohwa, 2017). In Ghana, Boateng and Asante (2018) reported that outsourcing logistics under the Expanded Programme on Immunisation enhanced delivery timeliness and reduced wastage. Likewise, Egypt has used third-party cold chain logistics to distribute insulin and vaccines nationwide, addressing storage and transport barriers (WHO, 2019).

In Nigeria, the National Primary Health Care Development Agency (NPHCDA) coordinates vaccine and medical consumable distribution to over 30,000 health facilities nationwide. Despite this extensive mandate, challenges such as poor road infrastructure, limited cold chain equipment, and funding constraints have hindered timely and efficient distribution (NPHCDA, 2022). In response, NPHCDA engages third-party logistics providers under Gavi-supported immunisation programmes to strengthen warehousing, cold chain management, and last-mile delivery. These partnerships are intended to address inefficiencies and ensure vaccines and supplies reach facilities safely and promptly. However, without effective third-party logistics proxies, distribution efficiency remains inadequate. Delivery delays lead to vaccine stockouts and missed immunisation sessions. Cost management is inefficient due to underutilised internal fleets and high maintenance expenses, while cold chain integrity is often compromised by inadequate infrastructure and limited technical expertise in public sector logistics units. Such inefficiencies weaken immunisation programmes, lowering coverage rates and increasing vulnerability to preventable disease outbreaks.

This study therefore focuses on three key proxies of third-party logistics: delivery timeliness, cost effectiveness, and cold chain management, as critical determinants of materials distribution efficiency within NPHCDA. Delivery timeliness refers to how well 3PL providers adhere to agreed delivery schedules without delays. Timely delivery is essential to prevent vaccine expiry and maintain uninterrupted services (Onuoha, 2020). Cost effectiveness refers to the ability of 3PL

services to reduce distribution costs while maintaining high quality and reliability. Studies by Musa (2019) and Okeke (2017) show that outsourcing logistics functions often leads to significant cost savings through economies of scale and route optimisation. Cold chain management involves maintaining proper temperature controls for vaccines and temperature-sensitive medical supplies throughout distribution. Adewumi et al. (2019) emphasise that effective cold chain management by specialised 3PL providers reduces wastage and preserves product potency. These proxies are expected to enhance materials distribution efficiency within NPHCDA by ensuring vaccines are delivered on time, costs are optimised, and temperature integrity is maintained. This study seeks to provide empirical insights into how 3PL utilisation influences distribution performance in public health programmes, informing policy decisions on logistics outsourcing in Nigeria's health sector.

Despite NPHCDA's efforts to improve its distribution systems through third-party logistics engagements, inefficiencies persist, especially in last-mile delivery and cold chain management. While studies in other African countries have shown the benefits of 3PL, there is limited empirical evidence on its effectiveness within Nigeria's immunisation programme. Uncertainty remains as to whether 3PL providers significantly improve delivery timeliness, reduce costs, and maintain cold chain integrity. Without clear evidence, decisions on scaling up or optimising 3PL engagements remain speculative. This gap forms the problem this study seeks to address by examining the effect of third-party logistics on materials distribution efficiency within the National Primary Health Care Development Agency, Nigeria.

Thus, the specific objectives include the following:

i. To examine the effect of delivery timeliness by third-party logistics providers on materials distribution efficiency within the National Primary Health Care Development Agency (NPHCDA), Nigeria.
ii. To determine the effect of cost effectiveness of third-party logistics services on materials distribution efficiency within NPHCDA.
iii. To assess the effect of third-party cold chain management practices on materials distribution efficiency within NPHCDA.

Hypotheses of the Study

The study tested the following null hypotheses:

H01: Delivery timeliness by third-party logistics providers has no significant effect on materials distribution efficiency within NPHCDA.
H02: Cost effectiveness of third-party logistics services has no significant effect on materials distribution efficiency within NPHCDA.
H03: Cold chain management by third-party logistics providers has no significant effect on materials distribution efficiency within NPHCDA.

Conceptualisation

Delivery Timeliness

Delivery timeliness refers to the ability of a logistics system to deliver materials to intended destinations at the right time without delays or disruptions. Christopher (2016) describes it as ensuring that goods reach recipients exactly when needed to support operational continuity. Onuoha (2020) argues that timely delivery is essential in healthcare logistics, particularly for

vaccines and critical drugs, to prevent stockouts and service disruptions. Musa (2019) views delivery timeliness as a key performance metric in evaluating third-party logistics providers in the health sector. Okeke (2017) emphasises that timely deliveries reduce emergency procurement, which often incurs higher costs and logistical stress. Boateng and Asante (2018) contend that while timeliness enhances efficiency, it should also be accompanied by delivery accuracy to avoid operational setbacks. Mashamaite and Mbohwa (2017) stress that delivery timeliness improves service levels and enhances health facility preparedness. Adewumi et al. (2019) observe that delivery delays contribute significantly to vaccine wastage and reduced immunisation coverage. In contrast, Ugochukwu, Engström, and Langstrand (2018) caution that focusing solely on timeliness without strategic planning may lead to unsustainable logistics expenses. Fagade and Ajayi (2021) argue that delivery timeliness is critical for meeting national immunisation targets, especially in rural health programmes. Similarly, Ekezie et al. (2020) highlight that prompt delivery strengthens public trust in immunisation and other health interventions. Thus, in this study, delivery timeliness refers to the extent to which third-party logistics providers deliver vaccines and medical materials to NPHCDA facilities within the required timeframe without delays.

Cost Effectiveness

Cost effectiveness in logistics refers to achieving desired operational outcomes at the lowest possible cost without compromising quality or service standards. Musa (2019) defines it as optimising cost inputs relative to logistics outputs in healthcare distribution. Okeke (2017) asserts that outsourcing logistics functions to third-party providers often leads to cost reductions through operational specialisation and route consolidation. Onuoha (2020) agrees that cost effectiveness is necessary for the financial sustainability of public health supply chains. Boateng and Asante (2018) caution that outsourcing contracts must be thoroughly reviewed to avoid hidden costs that could offset projected savings. Mashamaite and Mbohwa (2017) observe that cost-effective logistics systems release funds for other priority health interventions such as training and cold chain expansion. Adewumi et al. (2019) note that effective cold chain management by third-party providers reduces wastage costs, enhancing overall cost efficiency. Ekezie et al. (2020) emphasise that cost effectiveness in vaccine logistics directly influences the number of outreach campaigns feasible within budget cycles. Fagade and Ajayi (2021) argue that when third-party logistics services optimise operational costs, public health agencies can invest in staff capacity development. Ugochukwu et al. (2018) add that digitalisation in 3PL operations further enhances cost effectiveness by reducing manual processing delays and errors. Therefore, in this study, cost effectiveness refers to the ability of third-party logistics services to achieve efficient distribution of materials at reduced costs while maintaining service quality within NPHCDA operations.

Cold Chain Management

Cold chain management involves planning, implementing, and controlling processes that maintain temperature-sensitive products within required temperature ranges during storage and distribution. The World Health Organization (2019) defines it as ensuring that vaccines and other temperature-sensitive health commodities remain potent from manufacturer to administration points. Adewumi et al. (2019) note that effective cold chain management prevents spoilage and maintains vaccine potency, thus protecting public health investments. Mashamaite and Mbohwa (2017) emphasise that third-party logistics providers invest significantly in modern cold chain infrastructure to guarantee temperature integrity throughout distribution. Boateng and Asante (2018) observe that inadequate cold chain systems result in frequent stockouts and wastage due to

damaged vaccines. Onuoha (2020) highlights the importance of trained cold chain technicians to maintain standards and ensure proper handling. Okeke (2017) notes that outsourcing cold chain logistics reduces public sector capital expenditure on infrastructure acquisition and maintenance. Ekezie et al. (2020) assert that effective cold chain management is linked to higher immunisation coverage, especially in remote areas with challenging climates. Fagade and Ajayi (2021) argue that investment in cold chain logistics improves programme credibility and donor confidence. Ugochukwu et al. (2018) add that digital temperature monitoring tools used by modern 3PL firms significantly reduce cold chain breach incidents. Thus, in this study, cold chain management refers to the processes by which third-party logistics providers maintain appropriate temperature controls for vaccines and medical supplies distributed by NPHCDA to health facilities nationwide.

Empirical Review

Delivery Timeliness and Materials Distribution Efficiency

Onuoha (2020) investigated the role of delivery timeliness on vaccine distribution efficiency in South-East Nigeria. The study population comprised health facility managers across five states, with a sample of 250 respondents selected through stratified sampling. Using a survey research design, data were analysed with descriptive statistics and multiple regression. Findings revealed that adherence to delivery schedules significantly reduced stockout rates and improved immunisation coverage. The author concluded that timely deliveries are crucial to maintaining public trust in immunisation programmes and recommended strengthening logistics contract monitoring to ensure delivery adherence. However, a major limitation was reliance on descriptive analysis without robust causal inference, limiting generalisability.

Musa (2019) assessed third-party logistics performance in Kano State with a population of public health officials and third-party providers, sampling 200 respondents via purposive sampling. Employing a cross-sectional survey and analysing data using SPSS regression analysis, the study found that prompt deliveries improved distribution coverage and reduced emergency procurement. Musa concluded that timeliness enhances operational efficiency and recommended integrating electronic tracking for delivery monitoring. However, the study focused predominantly on urban centres, neglecting rural distribution realities where timeliness challenges are often more severe. Mashamaite and Mbohwa (2017) examined delivery timeliness within South Africa's Expanded Programme on Immunisation. The study used a mixed-methods approach, with interviews and survey questionnaires administered to 150 logistics managers and health officers. Statistical analysis included thematic coding and descriptive statistics. Results showed that partnering with private logistics firms significantly improved last-mile delivery performance. The authors concluded that public–private partnerships enhance health distribution networks and recommended scaling such models nationally. Nonetheless, their study lacked cost implication analyses, omitting potential trade-offs between timeliness and operational budgets.

Boateng and Asante (2018) assessed Ghana's immunisation logistics outsourcing programme, targeting national immunisation programme staff and third-party providers, with 220 respondents sampled purposively. Employing a quantitative survey and analysing with regression models, they found that timeliness improvements enhanced facility-level readiness and vaccine availability. The authors concluded that outsourcing logistics strengthens immunisation coverage and recommended continued investment in third-party logistics frameworks. However, the study

failed to analyse other logistics dimensions such as cold chain integrity, limiting holistic applicability.

Cost Effectiveness and Materials Distribution Efficiency

Musa (2019) evaluated the cost benefits of outsourcing logistics services in Kano State, targeting public health administrators and logistics contractors, with 200 respondents sampled purposively. The study adopted a cross-sectional design and regression analysis in SPSS. Findings indicated that 3PL engagements reduced distribution costs by up to 18%. Musa concluded that cost effectiveness justifies outsourcing decisions and recommended routine cost-benefit reviews for contract renewals. A limitation was its reliance on self-reported provider data without triangulating with government expenditure records.

Boateng and Asante (2018) assessed Ghana's Expanded Programme on Immunisation, targeting logistics managers and third-party providers, with 220 respondents selected purposively. Using regression analysis, the study found that cost savings were achieved through route optimisation and vehicle pooling. They concluded that outsourcing increases efficiency and recommended structured contracts to ensure accountability. However, the study lacked statistical control for confounding operational variables that could influence cost effectiveness outcomes.

Okeke (2017) studied third-party logistics outsourcing in Anambra State, Nigeria, focusing on state immunisation officers and supply chain managers, sampling 150 respondents through purposive sampling. Using descriptive survey design and t-test analysis, findings revealed significant reductions in distribution costs alongside increased immunisation coverage. The study concluded that outsourcing enhances cost efficiency and recommended expanding third-party engagements. However, the cross-sectional design made it difficult to assess long-term sustainability of cost savings.

Mashamaite and Mbohwa (2017) studied cost implications of public–private logistics partnerships in South Africa's vaccine distribution, targeting health department officials and private providers, sampling 160 respondents using purposive sampling. Using qualitative thematic analysis supported by descriptive statistics, they reported operational cost reductions following outsourcing. Their conclusion was that such partnerships optimise health budgets, recommending broader rollout. Nonetheless, the study did not examine whether cost savings translated into improved health outcomes.

Cold Chain Management and Materials Distribution Efficiency

Fagade and Ajayi (2021) assessed cold chain practices in Lagos State, Nigeria, targeting immunisation officers and cold chain managers, sampling 190 respondents randomly. Using regression analysis, they found that third-party providers with digital monitoring systems reported minimal temperature breaches. The study concluded that digital technologies enhance cold chain reliability and recommended nationwide deployment. However, user satisfaction outcomes were not examined alongside technical performance.

Onuoha (2020) evaluated cold chain integrity in Enugu State, Nigeria, with a sample of 160 respondents comprising cold chain technicians and facility managers selected through random sampling. Using descriptive and inferential analysis, results showed that third-party providers-

maintained temperature standards more reliably than government-run systems. The author concluded that outsourcing enhances cold chain efficiency and recommended its institutionalisation. However, the small sample size limits generalisability. Ekezie et al. (2020) studied cold chain management within Gavi-supported immunisation programmes in Northern Nigeria, with a sample of 200 logistics officers selected through cluster sampling. Using regression analysis, results showed that third-party providers reduced cold chain breach incidents by 30%. The authors concluded that outsourcing enhances temperature control and recommended integrating digital monitoring tools. However, interactions between cold chain management and other logistics dimensions such as timeliness were not analysed.

Adewumi et al. (2019) studied cold chain management effectiveness by third-party providers in South-West Nigeria, targeting cold chain technicians and immunisation officers, sampling 180 respondents via purposive sampling. Using a cross-sectional survey with chi-square tests, they found significant reductions in vaccine wastage due to effective temperature control. They concluded that outsourcing cold chain management enhances efficiency and recommended scaling up third-party contracts. However, the study did not analyse the cost implications of such outsourcing.

Theoretical Framework

This study was guided by the Resource-Based View (RBV) and Transaction Cost Economics (TCE) theories to explain how third-party logistics (3PL) enhanced materials distribution efficiency in NPHCDA. The RBV emphasises the strategic value of leveraging external logistics expertise, while TCE highlights cost reductions through outsourcing. Together, these theories support the use of 3PL as a performance-driven and cost-effective approach. Each theory was further explained in the subsequent sections.

Resource-Based View (RBV) Theory

The Resource-Based View (RBV), popularised by Barney (1991) in the United States, emphasises that an organisation's competitive advantage and performance depend on its ability to acquire and utilise valuable, rare, inimitable, and non-substitutable resources. RBV suggests that internal resources and capabilities such as logistics infrastructure, fleet assets, and cold chain technologies are strategic tools for operational efficiency. Scholars have applied RBV in logistics research. Ugochukwu, Engström, and Langstrand (2018) analysed third-party logistics integration in Nigerian FMCG firms, arguing that outsourcing enables firms to access specialised capabilities too costly to develop internally. Similarly, Boateng and Asante (2018) examined immunisation logistics outsourcing in Ghana, asserting that contracting 3PL providers allows health agencies to leverage external expertise and infrastructure as strategic resources.

RBV's strength lies in explaining why organisations engage third-party providers to access resources and expertise lacking internally, thus enhancing operational performance. Its weakness, however, is its inward-focused assumption that overlooks external market uncertainties and regulatory barriers affecting public health logistics systems. The theory is justified in this study as NPHCDA's reliance on third-party providers represents a strategic resource decision to overcome internal logistical constraints. However, a critique is that RBV fails to incorporate relational and transactional dynamics, such as power imbalances and accountability issues in outsourcing contracts. Despite this, RBV underpins this study as it highlights how delivery timeliness, cost effectiveness, and cold chain management enhance materials distribution efficiency.

Transaction Cost Economics (TCE) Theory

Transaction Cost Economics (TCE), advanced by Williamson (1979) in the United States, underpins this study by explaining how organisations decide between internal operations and outsourcing to minimise transaction costs such as negotiation, monitoring, and enforcement expenses. In logistics, TCE suggests that firms or agencies outsource to third-party providers when market transaction costs are lower than the cost of performing services internally. Musa (2019) applied TCE to logistics outsourcing in Kano State's health sector, finding that engaging 3PL providers reduced operational and maintenance costs compared to using internal fleets. Similarly, Okeke (2017) used TCE in Anambra State, concluding that outsourcing logistics services reduced total distribution costs and enabled health agencies to focus on their core health service mandates.

The strength of TCE lies in its practicality for explaining outsourcing decisions, showing how public agencies engage third-party logistics to reduce inefficiencies and optimise distribution costs. However, its weakness is its narrow focus on cost minimisation, often neglecting strategic considerations such as service quality, innovation, and relational trust, which are crucial in health supply chains. The theory is justified in this study as NPHCDA uses third-party logistics to minimise distribution costs while improving delivery timeliness and cold chain management. A critique remains that TCE does not adequately account for service quality and relational governance challenges essential for vaccine distribution in Nigeria's complex health environment.

Methodology

This study employed a quantitative descriptive survey design to examine the relationship between Third-Party Logistics (3PL) factors—Delivery Timeliness, Cost Effectiveness, and Cold Chain Management—and materials distribution efficiency within NPHCDA. The research covered the agency's headquarters, zonal offices, and selected state immunisation offices. Abuja was included for its national coordination role, while zonal and state offices were chosen for their relevance to vaccine distribution. The study focused on 575 staff members directly involved in logistics, procurement, immunisation, and cold chain operations. This design enabled the collection of measurable data aligned with the study objectives and ensured relevant representation across operational tiers within NPHCDA.

Sample Size Determination

To determine the sample size from this population of 575, the Taro Yamane (1967) formula, which calculates the minimum required sample size n was applied. The formula is expressed as:

$$n = \frac{N}{1+Ne^2}$$

where: n = required sample size; N = total population (575, from Table 1); e = level of precision (0.05 or 5%). Therefore, by substituting the values, we have:

$$n = \frac{575}{1+575\,(0.05)^2} = \frac{575}{1+1.4375} = \frac{575}{2.4375} \approx 236$$

Table 1: Corrected Sample Size Distribution to each NPHCDA Office (n = 260)

SN	Office Location	Staff Population	Proportion (%)	Sample Size
1	National Headquarters, Abuja	220	38.3%	100
2	North Central Zonal Office – Minna	60	10.4%	27
3	North East Zonal Office – Bauchi	45	7.8%	20
4	North West Zonal Office – Kaduna	45	7.8%	20
5	South East Zonal Office – Enugu	35	6.1%	16
6	South South Zonal Office – Benin City	30	5.2%	14
7	South West Zonal Office – Ibadan	40	7.0%	18
8	State Immunisation Offices	100	17.4%	45
Total		**575**	**100%**	**260**

Source: *Field Survey, 2025*

Data Collection

Data for the study were obtained through a structured questionnaire comprising five sections. The first section covered demographic information, while the remaining sections addressed the key variables: Delivery Timeliness (DLT), Cost Effectiveness (CE), Cold Chain Management (CCM), and Materials Distribution Efficiency (MDE). A five-point Likert scale ranging from 'Strongly Disagree' (1) to 'Strongly Agree' (5) captured respondent perceptions. To ensure broad coverage and efficiency, the questionnaire was disseminated electronically via Google Forms across selected NPHCDA offices nationwide.

Instrument Quality

The instrument underwent expert review for content validity, while a pilot test involving ten staff members from non-sampled NPHCDA units refined its clarity and structure. Internal consistency reliability was assessed using Cronbach's Alpha, with all constructs yielding values above 0.70, confirming the questionnaire's reliability.

Model Specification

This study used a quantitative design and applied Multiple Linear Regression in SPSS to analyse the impact of Delivery Timeliness, Cost Effectiveness, and Cold Chain Management on Materials Distribution Efficiency within Nigeria's NPHCDA. The method provided clear insight into how key 3PL elements affect distribution performance in public health logistics. The model assumed linearity, normality of residuals, homoscedasticity, and absence of multicollinearity. This approach enabled objective assessment of relationships among variables. The multiple regression function is MDE = f(DLT, CE, CCM), mathematically specified as:

$$MDE = \beta_0 + \beta_1 DLT + \beta_2 CE + \beta_3 CCM + \gamma.$$

Where: β_0 = Constant (intercept); β_1, β_2, β_3 = Regression coefficients for each predictor variable, and γ = Error term accounting for unexplained variance.

Data were analysed using SPSS Version 26. Descriptive statistics (mean, standard deviation) summarised the data, while inferential statistics, including Pearson correlation and multiple linear regression, tested the strength and direction of relationships between independent variables (DLT, CE, CCM) and the dependent variable (MDE). The ANOVA test assessed the overall significance of the regression model, adopting a significance level of 0.05 for hypothesis testing.

Data Presentation, Analysis, and Results

Demographic Analysis

Out of 260 questionnaires distributed, 242 valid responses were retrieved, yielding a response rate of approximately 93.1%, thus enhancing the study's credibility and representativeness. Table 2 presents the demographic characteristics of respondents. The majority of respondents fall within the 31–40 age group (36.2%), followed by those aged 18–30 (29.8%). This youthful distribution suggests that most participants are in their early to mid-career stages and are likely to be familiar with current logistics systems, including the use of digital tools for tracking delivery timeliness and maintaining cold chains.

Educationally, over 80% of respondents possess tertiary-level qualifications, with 51.2% holding HND/B.Sc. and 29.8% having higher degrees. This reflects a workforce that is likely to understand the technicalities of logistics operations, cost control, and temperature-sensitive distribution — key areas in assessing 3PL efficiency. Work experience is also well distributed, with 43.8% having over five years of experience and 32.2% between three and five years. This means a large proportion of respondents have significant operational exposure, which enhances the depth and reliability of the feedback gathered. Their familiarity with logistics practices supports informed evaluations of 3PL performance.

Table 2: Demographic Characteristics of Respondents

Characteristic	Category	Frequency (n)	Percentage (%)
Age	18–30	72	29.8%
	31–40	88	36.2%
	41–50	53	21.9%
	51 and above	29	12.0%
	Total	242	100%
Educational Level	ND/NCE	46	19.0%
	HND/B.Sc.	124	51.2%
	Higher Degrees	72	29.8%
	Total	242	100%
Work Experience	Less than 3 years	58	24.0%
	3–5 years	78	32.2%
	Over 5 years	106	43.8%
	Total	242	100%
Department/Unit	Logistics	65	26.9%
	Immunisation	58	24.0%
	Administration	49	20.2%
	Procurement	42	17.4%
	Others	28	11.5%
	Total	242	100%

Source: *Researcher's Computation, 2025*

Departmental representation shows that 26.9% of respondents work in logistics, 24.0% in immunisation, and 17.4% in procurement. This composition ensures that insights are drawn from those most directly involved in distribution activities, such as delivery scheduling, vendor coordination, and cold chain oversight. Input from administration and other units adds a broader organisational view.

Missing Data Check: Before regression analysis, missing data were checked using SPSS *Descriptive Statistics > Frequencies*. Results confirmed that all 242 responses were complete, with no missing values across variables, thus eliminating the need for case deletion or imputation.

Descriptive Statistics of Variables

Descriptive analysis was conducted to summarise the central tendencies and spread of the key variables. Table 3 presents the mean, standard deviation, minimum, and maximum values for each construct. Results show that respondents generally agreed on the positive influence of the 3PL proxies on Materials Distribution Efficiency. Cold Chain Management had the highest mean (M = 3.92), suggesting it was viewed as the strongest contributor, while Cost Effectiveness recorded the lowest mean (M = 3.79), though still positive. Standard deviations ranged from 0.68 to 0.81, indicating moderate response variability across the 242 participants.

Table 3: Descriptive Statistics of Variables (n = 242)

Variable	Mean	Std. Deviation	Minimum	Maximum
DLT	3.86	0.75	2.00	5.00
CE	3.79	0.81	1.90	5.00
CCM	3.92	0.68	2.20	5.00
MDE	3.88	0.74	2.00	5.00

Source: *SPSS output, 2025*

Normality Test: Data normality was tested in SPSS using *Explore > Plots > Normality plots with tests*. Both Shapiro-Wilk and Kolmogorov-Smirnov tests showed p-values above 0.05 (Table 4), indicating no violation of normality. Thus, the data are suitable for parametric analysis, including multiple regression. This approach follows Field (2018) and Hair et al. (2020), who emphasise that normality enhances the validity of regression-based inferences.

Table 4: Tests of Normality

Variable	Kolmogorov-Smirnov (p-value)	Shapiro-Wilk (p-value)
DLT	0.071	0.068
CE	0.062	0.074
CCM	0.054	0.079
MDE	0.066	0.065

Source: *SPSS Output, 2025*

Next, the multicollinearity test was conducted**.** Multicollinearity occurs when two or more independent variables in a regression model are highly correlated; this can undermine the accuracy of regression estimates. It was assessed by examining Variance Inflation Factor (VIF) and Tolerance values in SPSS (*Analyze > Regression > Linear > Statistics > Collinearity Diagnostics*). Results (Table 5) showed all VIFs were well below the threshold of 10, with Tolerance values above 0.10, indicating no multicollinearity concerns. This affirms the stability and validity of the regression coefficients, in line with Hair et al. (2020) and Field (2018) guidelines.

Table 5: Multicollinearity Statistics

Predictor Variable	Tolerance	VIF
DLT	0.728	1.373
CE	0.785	1.274
CCM	0.764	1.309

Source: *SPSS Output, 2025*

Homoscedasticity Test: The assumption of homoscedasticity (constant variance of residuals) was checked using a scatterplot of ZPRED vs ZRESID (obtained via *Regression > Plots*). Residuals were randomly scattered around zero, confirming homoscedasticity and constant variance, as recommended by Tabachnick and Fidell (2019).

Outliers and Influential Points: To detect outliers and influential cases, Cook's Distance and Leverage Values were generated in SPSS (*Regression > Save > Cook's Distance*). No individual case exceeded the recommended threshold of 1.00 for Cook's Distance.

Table 6: Summary of Outlier and Influence Diagnostics

Diagnostic Statistic	Min.	Max.	Mean	Rule of Thumb
Cook's Distance	0.002	0.275	0.063	< 1.00
Leverage Values	0.009	0.122	0.035	< 0.20

Source: *SPSS Output, 2025*

These results confirm that no single data point disproportionately influenced the regression model, reinforcing its robustness (Stevens, 2009).

Regression Analysis and Hypothesis Testing

Multiple regression results in Table 7 showed significant positive effects of Delivery Timeliness ($\beta = 0.401$, $p < 0.001$), Cost Effectiveness ($\beta = 0.358$, $p < 0.01$), and Cold Chain Management ($\beta = 0.319$, $p < 0.001$) on Materials Distribution Efficiency. ANOVA confirmed overall model significance ($F(3,238) = 29.67$, $p < 0.001$)

Table 7: Regression Coefficients Table

Dependent Variable: MDE

Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	2.012	0.301	–	6.683	0.000	–	–
DLT	0.401	0.073	0.452	5.493	0.000	0.728	1.373
CE	0.358	0.081	0.407	4.420	0.001	0.785	1.274
CCM	0.319	0.068	0.371	4.691	0.000	0.764	1.309

a. Dependent Variable: MDE

Source: *SPSS Output, 2025*

Hypotheses Testing

Hypothesis One (H_{01}): Delivery Timeliness (DLT) has no significant effect on Materials *Distribution Efficiency (MDE).*

The regression coefficient for DLT is B = 0.401, with a standardised Beta of 0.452 and a t-value of 5.493 (p = 0.000). This indicates a strong and statistically significant effect of DLT on MDE. Hence, H_{01} is rejected. This suggests that improvements in delivery schedules, lead-time reduction, and timely responsiveness significantly enhance materials distribution efficiency within NPHCDA.

Hypothesis Two (H_{02}): *Cost Effectiveness (CE) has no significant effect on Materials Distribution Efficiency (MDE).*

The regression results show that CE has B = 0.358, Beta = 0.407, and a t-value of 4.420 (p = 0.001). Thus, H_{02} is rejected. This finding implies that effective cost management, resource optimisation, and financial prudence within logistics operations positively influence materials distribution outcomes in NPHCDA.

Hypothesis Three (H_{03}): *Cold Chain Management (CCM) has no significant effect on Materials Distribution Efficiency (MDE).*

CCM recorded B = 0.319, Beta = 0.371, and a t-value of 4.691 (p = 0.000), indicating a significant positive effect. Therefore, H_{03} is rejected. This means that robust cold chain processes, including temperature control and product integrity maintenance, significantly enhance the efficiency of materials distribution within the agency.

Model Fit Statistics

The model fit statistics indicate the degree to which the independent variables (DLT, CE, CCM) jointly explain the variance in the dependent variable, MDE.

Table 8: Model Fit Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.676[a]	.457	.444	.590	1.8217

a. Predictors: (Constant), DLT, CE, CCM
b. Dependent Variable: MDE
Source: *SPSS Output, 2025.*

The multiple correlation (R = 0.676) shows a moderately strong link between predicted and actual MDE values. The R^2 value of 0.457 means 45.7% of the variation in distribution efficiency is explained by DLT, CE, and CCM. Adjusted R^2 (0.444) confirms the model's reliability, accounting for predictor count. These statistics indicate a good model fit, showing that delivery timeliness, cost effectiveness, and cold chain management significantly influence materials distribution efficiency within NPHCDA.

Analysis of Variance: To test the statistical significance of the overall model, an ANOVA (Analysis of Variance) test was performed. The results are shown below:

Table 9 : ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Registration	38.275	3	12.758	36.842	.0000[b]
	Residual	45.715	131	0.349		
	Total	83.990	134			

a. Dependent Variable: MDE
b. Predictors: (Constant), DLT, IAC, LCE
Source: *SPSS Output, 2023.*

The F-statistic of 36.842 and the associated p-value of 0.000 indicate that the regression model is statistically significant at the 5% level. This means that at least one of the independent variables significantly predicts the dependent variable (MDE), thereby rejecting the null hypothesis that the model has no explanatory power.

Discussion of Findings

This study examined the effect of third-party logistics (3PL) factors—Delivery Timeliness, Cost Effectiveness, and Cold Chain Management—on Materials Distribution Efficiency (MDE) within the National Primary Health Care Development Agency (NPHCDA), Nigeria. The findings show that Delivery Timeliness significantly influences distribution efficiency ($B = 0.401$, $\beta = 0.452$, $t = 5.493$, $p < 0.05$), leading to the rejection of H_{01}. This suggests that timely deliveries improve supply chain performance by reducing lead times and delays. This supports Arvis et al. (2018), who argued that logistics timeliness is crucial in achieving delivery reliability in public health systems. Likewise, Christopher (2016) emphasized that timeliness improves customer satisfaction and operational effectiveness in supply networks.

Cost Effectiveness also significantly impacts MDE ($B = 0.358$, $\beta = 0.407$, $t = 4.420$, $p < 0.05$), leading to rejection of H_{02}. Efficient cost management, such as minimising transport and handling costs, contributes to effective logistics performance. This aligns with Langley et al. (2020), who noted that reducing logistics costs enhances system responsiveness. Similarly, Zhang et al. (2019) found that effective cost strategies support resource optimisation in healthcare supply chains. Cold Chain Management had a statistically significant effect on distribution efficiency ($B = 0.319$, $\beta = 0.371$, $t = 4.691$, $p < 0.05$), prompting the rejection of H_{03}. This means that maintaining optimal temperature and safe handling of medical supplies boosts distribution performance. Duijzer et al. (2018) highlighted that cold chain integrity minimises vaccine spoilage. Ashok et al. (2017) also observed that strong cold chain systems are critical for maintaining vaccine efficacy in developing countries.

The model showed strong explanatory power ($R^2 = 0.457$; adjusted $R^2 = 0.444$), meaning that 45.7% of the variation in MDE is explained by the three independent variables. The model's F-statistic ($F = 36.842$, $p = 0.000$) further confirms that the predictors significantly affect MDE. Overall, the findings demonstrate that integrating 3PL services—focusing on timeliness, cost control, and temperature-sensitive handling—can significantly enhance logistics outcomes in the public healthcare sector. These results highlight the need for the NPHCDA to improve logistics partnerships and infrastructure to ensure efficient and equitable material distribution nationwide.

Conclusion and Recommendations

Based on the key findings, this study concludes that strategically engaging third-party logistics (3PL) providers can greatly enhance materials distribution efficiency within the NPHCDA. To maximise these benefits, the agency should implement clear contractual agreements, maintain robust performance monitoring systems, and foster strong partnerships with logistics firms. These measures will support timely deliveries, cost-effective operations, and the safe handling of temperature-sensitive medical supplies such as vaccines, thereby strengthening the overall logistics framework and improving public health outcomes.

Recommendations

To improve materials distribution efficiency within the NPHCDA, especially in vaccine logistics, the following recommendations are made based on the study's findings:

i. The agency should enhance delivery timeliness by adopting performance-based service level agreements (SLAs) with 3PL providers. These should define strict delivery timelines, incorporate penalties for delays, and incentives for timely service. GPS-enabled tracking and digital fleet systems will improve coordination and ensure prompt delivery, even in hard-to-reach areas.
ii. To boost cost effectiveness, the NPHCDA should perform regular logistics cost reviews and use data-driven route optimisation tools. These can highlight the most efficient delivery paths, reducing fuel consumption, vehicle strain, and delays. Coordinating regional shipments and consolidating deliveries will further cut costs without lowering service quality.
iii. Maintaining a strong cold chain system is essential for safeguarding vaccine quality. Investment in smart temperature monitoring with real-time alerts will help detect and respond to cold chain breaches. Regular training and certification of 3PL staff, along with support from global health partners, will improve infrastructure and operational reliability.

Contribution to Knowledge

This study contributes to knowledge by empirically showing that Delivery Timeliness, Cost Effectiveness, and Cold Chain Management play crucial roles in improving Materials Distribution Efficiency in public health systems, with NPHCDA as a reference. It fills a key gap in literature regarding the role of 3PL in Nigeria's public healthcare sector. Moreover, it introduces a tested framework for using 3PL to improve distribution efficiency. These findings provide useful data for refining logistics strategies, policy decisions, and planning in government-led health supply chains.

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APPENDIX: THE QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DATA

Please tick (✔) the option that best applies to you.

1. **Respondent's Age Range:** 18–30 [ ] 31–40 [ ] 41–50 [ ] 51 and above [ ]
2. **Highest Educational Level:** ND/NCE [ ] HND/B.Sc. [ ] Higher Degrees [ ]
3. **Years of Work Experience:** Less than 3 years [ ] 3–5years [ ] Over 5 years [ ]
4. **Department/Unit:**
   Logistics [ ] Immunisation [ ]Administration [ ] Procurement [ ] Others (specify):

INDICATOR-CONSTRUCT QUESTIONNAIRE

Instruction: Please indicate the extent to which you agree with each of the following statements by selecting one of the options: Strongly Agree (5), Agree (4), Undecided (3), Disagree (2), Strongly Disagree (1)

SECTION B1: DELIVERY TIMELINESS (DLT)

S/N	Items	5	4	3	2	1
DLT1	Logistics providers meet agreed delivery timelines consistently.					
DLT2	There are penalties for late deliveries in our logistics contracts.					
DLT3	GPS-enabled tracking improves our delivery coordination.					
DLT4	Logistics operations support prompt delivery even in remote areas.					
DLT5	Timely deliveries enhance material availability at service points.					

SECTION B2: COST EFFECTIVENESS (CE)

S/N	Items	5	4	3	2	1
CE1	3PL providers help reduce overall distribution costs.					
CE2	Route optimisation tools reduce fuel and time wastage.					
CE3	Our agency regularly conducts logistics cost audits.					
CE4	Coordinated regional shipments help lower expenses.					
CE5	Cost savings are achieved without compromising delivery quality.					

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IMPACT OF GOVERNMENT SPENDING AND TAXATION ON ECONOMIC GROWTH IN NIGERIA

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Abstract

Nigeria's economy has experienced fluctuations in growth rates over the years, prompting concerns about the effectiveness of government fiscal policies. This study investigates the impact of government spending and taxation on economic growth in Nigeria. The objectives of the study are to (i) examine the relationship between government spending and economic growth, (ii) analyze the impact of taxation on economic growth, and (iii) investigate the combined effects of government spending and taxation on economic growth. The study employs the Autoregressive Distributed Lag (ARDL) model to examine the long-run and short-run relationships between government spending, taxation, and economic growth in Nigeria. The data used in this study were obtained from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). The study's findings reveal that government spending positively and significantly impacts economic growth in the long run. In addition, the impact of taxation on economic growth is positive and significant. The study also finds that the combined effects of government spending and taxation on economic growth are positive, but with diminishing returns. The study concludes that government spending is an effective tool for promoting economic growth in Nigeria. However, taxation hurts economic growth, suggesting that the government should adopt a tax policy that minimizes the burden on taxpayers. Based on the findings, the study recommends that the government should (1) increase its spending on infrastructure and human capital development, (2) adopt a tax policy that promotes economic growth, and (3) ensure that tax revenues are efficiently utilized to promote economic growth and development.

Keywords: *ARDL, Economic Growth, Government Spending, Taxation.*
JEL Classification: H50, O40, O23

Introduction

Economic growth is a fundamental objective for every nation, and fiscal policy, comprising government spending and taxation, is a critical tool in achieving this goal. In Nigeria, government expenditure has historically been geared toward infrastructure development, social services, and economic stimulation (Akpan, 2022). Similarly, taxation plays a crucial role in generating revenue to finance these expenditures (Babalola, 2015). However, the actual effectiveness of fiscal policy in driving economic growth remains a subject of ongoing debate among economists, policymakers, and citizens. While government spending has the potential to enhance productivity and improve standards of living, inefficiencies in fiscal allocation often diminish its impact (Udoh, 2022). Likewise, taxation, when poorly structured, may stifle investment and entrepreneurship, consequently hindering economic expansion (Akpan, 2022).

Government expenditure encompasses public investments in areas such as education, healthcare, transportation, and security. These sectors are vital for fostering economic development, as they contribute to human capital formation, facilitate business activities, and enhance overall productivity (Babalola, 2015). For instance, when the government invests in improved road networks, businesses benefit from reduced transportation costs, enabling more efficient distribution of goods and services (Udoh, 2022). Similarly, investments in healthcare result in a healthier workforce, leading to higher labor productivity (Akpan, 2022). However, despite increased spending on public projects, Nigeria has often faced challenges such as corruption, financial mismanagement, and bureaucratic inefficiencies, which limit the effectiveness of government spending (Babalola, 2015). Large portions of the national budget are often allocated to recurrent expenditures, such as salaries and administrative costs, leaving inadequate funds for capital projects that directly stimulate growth (Udoh, 2022).

On the other hand, taxation serves as the government's primary source of revenue, funding essential public goods and services (Akpan, 2022). An effective tax policy ensures fairness, encourages compliance, and supports economic growth without placing excessive burdens on individuals and businesses (Babalola, 2015). In Nigeria, tax revenue is derived from various sources, including corporate taxes, value-added tax (VAT), personal income taxes, and excise duties (Udoh, 2022). While taxation is necessary to sustain government functions, overly high tax rates can discourage business activity, reduce disposable income, and deter investments (Akpan, 2022). Entrepreneurs and investors often seek environments where tax policies are favorable, and excessively burdensome tax regimes can lead to capital flight, where businesses relocate to countries with lower tax rates (Babalola, 2015). Additionally, tax evasion and avoidance remain prevalent issues, undermining revenue generation efforts (Udoh, 2022). Weak enforcement mechanisms and loopholes in tax laws enable individuals and corporations to exploit the system, reducing government revenue and its ability to finance growth initiatives (Akpan, 2022).

Despite the challenges posed by inefficient spending and taxation policies, fiscal measures have the potential to significantly impact Nigeria's economic trajectory (Babalola, 2015). This study seeks to evaluate the relationship between government spending and economic growth, analyze the effects of taxation on investment and productivity, and assess the overall effectiveness of fiscal policies in fostering sustainable development (Udoh, 2022). Key research questions guiding this inquiry include: How does government expenditure influence Nigeria's GDP growth rate? What impact does taxation have on investment and overall economic performance? To what extent does

fiscal policy contribute to macroeconomic stability? These questions serve as a foundation for understanding the intricate dynamics between fiscal policy and economic progress (Akpan, 2022). Fiscal policy effectiveness depends not only on the volume of government spending and tax rates but also on the efficiency of policy implementation (Babalola, 2015). For example, infrastructure projects that suffer from delays and cost overruns diminish the potential benefits that such investments could have on economic growth (Udoh, 2022). Similarly, if tax policies disproportionately burden small businesses while providing excessive incentives to large corporations, economic expansion may be skewed in favor of a few rather than fostering broad-based growth (Akpan, 2022). Therefore, how fiscal policies are designed and executed plays a crucial role in determining their impact on economic development (Babalola, 2015).

The scope of this research focuses on Nigeria's fiscal policies over the past two decades, analyzing government spending patterns, taxation structures, and their respective impacts on economic growth (Udoh, 2022). The study considers macroeconomic indicators such as GDP growth rates, inflation levels, investment inflows, and employment figures to evaluate the effectiveness of fiscal measures (Akpan, 2022). Additionally, sector-specific data will be examined to identify which industries have benefited most from government spending and which have suffered the adverse effects of taxation (Babalola, 2015).

Literature Review

Fiscal policy, comprising government spending and taxation, is crucial in shaping economic development. Nations worldwide rely on these financial mechanisms to regulate economic activity, promote stability, and drive growth. In Nigeria, the relationship between fiscal policy and economic expansion has sparked extensive debate among economists, policymakers, and researchers. While government spending fosters infrastructural development and social welfare, taxation serves as a vital revenue source for financing such expenditures. This section explores the theoretical foundations, empirical evidence, and key models used in analyzing the impact of fiscal policy on Nigeria's economic trajectory.

Theoretical Framework on Government Spending and Taxation

Economic theories provide a foundation for understanding the role of fiscal policy in driving national development. Several perspectives have emerged, each offering unique insights into how government spending and taxation shape economic performance.

Keynesian Economics and Fiscal Stimulus

The Keynesian economic framework emphasizes the significance of government intervention in stimulating demand, particularly during economic downturns. According to Keynesian theory, public spending boosts aggregate demand, thereby enhancing productivity and employment levels (Alqadi, 2020). During recessions, governments can mitigate economic slowdowns by increasing expenditures or reducing tax burdens to encourage consumer and business activity.

Wagner's Law of Expanding Government Expenditure

Wagner's Law asserts that as a country experiences economic growth, public expenditure naturally rises due to increasing demand for essential services such as education, healthcare, and infrastructure (Adegboyo, Keji, & Fasina, 2021). This perspective suggests a positive correlation between national prosperity and government involvement in economic affairs.

Ricardian Equivalence Hypothesis and Fiscal Neutrality
The Ricardian Equivalence Hypothesis argues that deficit-financed government spending does not necessarily enhance economic output, as rational consumers anticipate future taxation and adjust their savings accordingly (Felix, 2024). This theory challenges the effectiveness of expansionary fiscal policy, suggesting that government borrowing may not significantly boost economic demand.

Endogenous Growth Theory and Fiscal Policy Efficiency
Endogenous growth models highlight the importance of strategic government spending in fostering long-term development. Investments in infrastructure, technological innovation, and human capital are essential drivers of productivity and sustained growth (Efe & Obriki, 2023). From this perspective, efficient fiscal policies contribute to economic resilience by enhancing key sectors that influence industrialization and innovation.

Empirical Studies on Fiscal Policy and Economic Growth in Nigeria
Numerous empirical investigations have assessed the relationship between fiscal policy and economic growth in Nigeria. These studies evaluate the impact of government spending and taxation on macroeconomic indicators such as GDP, investment rates, and employment levels.

Impact of Government Expenditure on Economic Growth
Several scholars have explored the effects of public spending on Nigeria's economic development. Felix (2024) found that government investments in education and agriculture positively influence national productivity, whereas spending in healthcare and environmental sectors has demonstrated varied impacts. Similarly, Ejinkonye, Nwankwo, & Mazeli (2023) observed that recurrent expenditure contributes significantly to economic stability, while capital expenditures have yielded inconsistent results.

Taxation and Its Effects on Economic Performance
Taxation plays a fundamental role in revenue generation, yet its impact on economic growth depends on factors such as tax rates and administrative efficiency. Nsonwu (2021) discovered that excessively high tax burdens discourage investment, reduce household disposable income, and hinder entrepreneurial activity. Conversely, Adegboyo et al. (2021) argue that well-structured tax policies provide financial resources for development while maintaining a stable economic environment.

Fiscal Policy Efficiency and Challenges
Studies assessing the effectiveness of Nigeria's fiscal policies emphasize the need for prudent financial management and improved tax administration. Efe & Obriki (2023) concluded that fiscal measures significantly affect economic growth and recommended diversification of revenue sources alongside enhanced budgetary transparency.

Methodology
The study of fiscal policy and its relationship with economic growth has evolved significantly over time, leading to the development of various analytical models. These models provide frameworks for assessing how government spending and taxation influence national economies, helping

policymakers craft effective strategies. In Nigeria, several models have been employed to understand the complexities of fiscal policy and its long-term effects on economic performance.

Dynamic Stochastic General Equilibrium (DSGE) Models

Dynamic Stochastic General Equilibrium (DSGE) models have become a widely accepted tool for analyzing macroeconomic trends. These models integrate various economic variables to assess the impact of fiscal policy on stability, inflation, employment, and GDP growth (Le, Meenagh, & Minford, 2024). By incorporating stochastic elements, DSGE models account for uncertainties and external shocks that may affect Nigeria's economic trajectory. In the Nigerian context, researchers have used DSGE frameworks to evaluate fiscal sustainability, estimating how tax revenues and government spending interact with economic cycles.

Error Correction Model (ECM)

The Error Correction Model (ECM) is another analytical approach frequently used in Nigerian fiscal policy research. ECM is particularly beneficial in examining long-term relationships between government spending, taxation, and economic growth (Ejinkonye, Nwankwo, & Mazeli, 2023). Unlike traditional regression models, ECM accounts for short-term deviations while ensuring long-run equilibrium between dependent and independent variables. Studies in Nigeria have employed ECM to evaluate how changes in tax rates and government spending influence GDP growth over extended periods.

Computable General Equilibrium (CGE) Models

Computable General Equilibrium (CGE) models are another essential tool for assessing fiscal policy's impact on economic growth. These models simulate economic interactions among different sectors to evaluate policy changes, tax reforms, and expenditure adjustments (Aktug, Polat, & Basoglu, 2025). CGE models enable researchers to quantify the potential effects of fiscal policy on production, consumption, employment, and investment. In Nigeria, CGE simulations have been applied to predict the consequences of tax incentives and subsidies, highlighting their impact on economic sectors such as agriculture, manufacturing, and services.

Autoregressive Distributed
Lag (ARDL) Models.

Autoregressive Distributed Lag (ARDL) models have been instrumental in analyzing fiscal policy dynamics in Nigeria. These models offer insights into how fiscal policies influence economic growth over different time horizons (Adegboyo, Keji, & Fasina, 2021). ARDL techniques are particularly useful for examining both short-term and long-term fiscal interactions, enabling researchers to determine the lagged effects of taxation and government expenditure on macroeconomic indicators. Nigerian studies using ARDL models have demonstrated how shifts in fiscal policy influence variables such as inflation rates, exchange rates, and investment flows. By capturing the temporal effects of fiscal changes, ARDL. Based on the aforementioned methodology, this study align with ARDL.

ARDL Model Specification

The ARDL framework allows us to explore both short-run and long-run relationships between fiscal policy indicators and economic growth. The general equation is expressed as:

$$lngdppc_t = \beta_0 + \beta_1 lnGS_t + \beta_2 TR_t + \beta_3 FDI_t + \beta_4 GCF_t + \mu_t \quad 1$$

Based on the principle of economic theory, the expected relationship of the parameter$\beta 1 - \beta 4, >$ 0.

Equation 1 is specified in ARDL form. Thus,

$$\Delta GDPPC_{it} = a_i + \sum_{j=1}^{p} \lambda_{ij} \Delta GDPPC_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta GS_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta TR_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta FDI_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} \Delta GCF_{i,t-j} + +ECM_{it} \quad 2$$

Where:

i. GDPPC = Gross Domestic Product per Capita at time *t* (dependent variable)
ii. GS = Government Spending at time *t-j* (lagged independent variable)
iii. TR = Tax Revenue at time *t-k* (lagged independent variable)
iv. FDI = Foreign Direct Investment at time *t-m* (lagged independent variable)
v. GCF = Gross Capital Formation at time *t-n* (lagged independent variable)
vi. β_0 = Intercept term
vii. $\beta 1$-$\beta 4$ = Coefficients to be estimated
viii. μ_t= Error term
ix. ECM_{it} = Error Correction Model

Estimation Procedure

i. Check Stationarity**:** Use the Augmented Dickey-Fuller (ADF) test or the Phillips-Perron (PP) test to determine whether variables are I (0) or I(1).
ii. Lag Selection: Determine the optimal lag length using AIC or SBC.
iii. Bounds Testing for Cointegration: Apply the Pesaran et al. (2001) ARDL bounds test to assess long-run relationships.
iv. Estimate the ARDL Model: Conduct Ordinary Least Squares (OLS) regression to estimate short-run and long-run coefficients.
v. Error Correction Representation: Formulate the ECM to measure the speed of adjustment to long-term equilibrium.

Presentation and Discussion of Results

Descriptive Statistics

Descriptive statistics provide a comprehensive quantitative summary, elucidating the behavior and distribution patterns of the variables within the model. Table 4.1 systematically presents these statistics for all the variables utilized in the study, offering insights into central tendencies, dispersion, and the overall data structure. This preliminary analysis is crucial as it highlights the disparity and variability among the variables, which can significantly impact the subsequent regression estimations. By meticulously analyzing these descriptive statistics, the researcher ensures a robust foundation for the model estimation, paving the way for more accurate and reliable analytical outcomes.

Table 4.1: Descriptive Statistics Results

	LNGDPPC	LNGS	LNTR	FDI	LNGCF	TROP	TR_FDI
Mean	7.692892	9.75E-10	23.87415	1.432442	24.48244	0.424770	4.47E+09
Median	7.782913	6.05E-10	14.50231	1.571199	24.80805	0.415123	3.63E+09
Maximum	7.893406	2.31E-09	111.5949	2.900249	25.12169	0.536989	1.03E+10
Minimum	7.287927	4.43E-10	7.881350	0.183821	23.39397	0.349164	8.11E+08
Std. Dev.	0.179936	6.27E-10	22.06304	0.776847	0.616620	0.051705	2.94E+09
Skewness	-0.876505	0.919708	2.762481	0.197403	-0.622448	0.417150	0.562870
Kurtosis	2.630279	2.250562	11.48606	2.008674	1.725848	2.114252	2.070946
Jarque-Bera	3.209740	3.945109	102.5384	1.138600	3.173229	1.480605	2.130432
Probability	0.200916	0.139101	0.000000	0.565922	0.204617	0.476970	0.344653
Sum	184.6294	2.34E-08	572.9795	34.37860	587.5785	10.19449	1.07E+11
Sum Sq. Dev.	0.744667	9.03E-18	11195.88	13.88029	8.745071	0.061488	1.99E+20
Observations	24	24	24	24	24	24	24

Source: E-Views Output, 2025.

Table 4.1 reveals that Gross Domestic Product per Capita (GDP per Capita) shows a stable trend with an average of 7.69, suggesting a relatively balanced income distribution. The negative skewness implies that higher-income levels are more common than lower ones. Similarly, Gross Capital Formation (LNGCF) remains steady at 24.48, indicating consistent investment in productive assets. Government spending (LNGS) follows a moderate pattern, though scientific notation makes direct interpretation challenging. Meanwhile, FDI remains relatively low, with a mean of 1.43, reflecting a controlled investment inflow. The trade openness index (TROP) suggests balanced international trade participation, with slight fluctuations.

Among the most striking observations is the extreme variation in tax revenue (LNTR). With a mean of 23.87 and a maximum of 111.59, tax contributions vary significantly across different entities. A skewness value of 2.76 confirms the presence of extreme cases, where a few entities contribute disproportionately to national tax collections. The Jarque-Bera test further supports the irregularity (p-value = 0.000), proving that tax revenue is highly non-normally distributed.

GDP per capita and gross capital formation show stable distributions, indicating economic consistency. Foreign direct investment (FDI) is relatively low but stable, suggesting controlled investment inflows. Tax revenue (LNTR) is highly skewed, meaning a few entities contribute disproportionately, which can indicate structural inefficiencies in tax collection. The Jarque-Bera test confirms that tax revenue distribution is irregular, requiring policy attention to ensure fairness. Trade openness (TROP) reflects moderate variation, showing balanced international trade engagement.

Correlation Matrix Analysis

To explore the relationship between the dependent variable and the explanatory variables used in the study, a correlation analysis was conducted using Pearson Product-Moment Correlation (PPMC). The correlation analysis provides insights into the strength and direction of linear relationships between pairs of variables.

Table 4.2: Correlation Matrix Results

	LNGDPPC	LNGS	LNTR	FDI	LNGCF	TROP	TR_FDI
LNGDPPC	1.000000	-0.916119	0.443250	-0.505848	0.929198	-0.063038	0.419447
LNGS	-0.916119	1.000000	-0.448946	0.501262	-0.986527	-0.098034	-0.435227
LNTR	0.443250	-0.448946	1.000000	-0.744150	0.511426	0.105267	-0.382064
FDI	-0.505848	0.501262	-0.744150	1.000000	-0.590532	-0.104858	0.451757
LNGCF	0.929198	-0.986527	0.511426	-0.590532	1.000000	0.139415	0.363620
TROP	-0.063038	-0.098034	0.105267	-0.104858	0.139415	1.000000	0.116696
TR_FDI	0.419447	-0.435227	-0.382064	0.451757	0.363620	0.116696	1.000000

Source: E-Views Output, 2025.

The correlation analysis in Table 4.2 shows that GDP per capita is strongly linked to investment, while higher government spending tends to reduce private sector investment. Tax revenue shows extreme variations and is negatively correlated with foreign direct investment, indicating that high taxes may discourage international investors. Trade openness has weak correlations with other variables, meaning it does not significantly affect GDP or investment trends. Policymakers should focus on tax reforms, balanced government spending, and investment-friendly strategies to ensure sustainable economic growth.

Unit Root Tests

The Augmented Dickey-Fuller (ADF) unit root test is a widely used statistical test for assessing the stationarity of a time series. The ADF test is an extension of the Dickey-Fuller test and accounts for higher-order autoregressive processes by including lagged differences of the series in the test equation. This helps to address potential autocorrelation issues in the residuals, enhancing the robustness of the test results.

Table 4.3: Stationarity Test Results

Variables	**Levels**		**First** Diff.		**Order of Int.**
	ADF Stat.	Prob.	ADF Stat.	Prob.	
LNGDPPC	-5.658	0.000	-8.215	0.000	I(0)
LNGS	-2.116	0.240	-5.967	0.000	I(1)
LNTR	-2.666	0.096	-3.528	0.001	I(1)
FDI	-0.489	0.876	-8.119	0.000	I(1)
LNGCF	-1.852	0.346	-3.404	0.001	I(1)
TROP	-2.526	0.122	-5.267	0.000	I(1)

Source: E-Views Output, 2025.

Bounds Test for Cointegration

The ARDL Bounds test for cointegration approach is a robust method employed in this study due to its ability to handle variables that are integrated of order one and zero. The flexibility of the ARDL approach makes it suitable for small sample sizes and can be used irrespective of whether the underlying regressors are purely I(0) 0, purely 1 I 1), or a mixture of both.

Table 4.4 displays the findings of the ARDL Bounds cointegration test. The test involves computing the F-statistic for the joint significance of the coefficients of the lagged levels in an ARDL model. The critical bounds values are then compared to determine the presence of a long-run relationship among the variables.

Table 4.4: ARDL Bounds Cointegration Test Results

F-Bounds Test		Null Hypothesis: No level relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.948245	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: E-Views Output, 2025.

The ARDL Bounds Cointegration Test is used to check if a group of variables is linked over the long run, even if they may move separately in the short run. In the case presented in Table 4.4, the test result shows an F-statistic of 4.948245 with six independent variables (k = 6). This value is higher than all the upper critical bounds (I(1)) at the 10%, 5%, and 1% significance levels. That means the test gives us strong evidence to reject the idea that there's no connection among the variables. In other words, there is a meaningful and stable long-run relationship between them. This outcome is very useful, especially when creating an Error Correction Model (ECM), which lets researchers explore how the system adjusts in the short run to return to its long-term balance after disruptions. Essentially, this result gives confidence in the model's ability to describe both immediate and persistent trends.

4.5 ARDL Regression Results

Table 4.5: Long-run and Short-run ARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.755387	3.484949	-0.503705	0.6218
LNGDPPC(-1)*	-0.788122	0.161745	-4.872625	0.0002
LNGS**	1.56E+08	1.20E+08	0.000000	0.0000
LNTR**	0.000849	0.000688	1.234602	0.2360
FDI**	-0.023915	0.035262	-0.678198	0.5080
LNGCF**	0.323842	0.144466	2.241649	0.0405
TROP**	-0.805724	0.198461	-4.059858	0.0010
TR_FDI**	2.04E-11	8.22E-12	2.487468	0.0251
ECM	-0.788122	0.103432	-7.619673	0.0000
Short-Run				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGS	1.98E+08	1.56E+08	1.270171	0.2234
LNTR	0.001077	0.000890	1.210259	0.2449
FDI	-0.030344	0.044118	-0.687797	0.5021
LNGCF	0.410904	0.176970	2.321889	0.0347
TROP	-1.022334	0.277307	-3.686650	0.0022
TR_FDI	2.59E-11	1.09E-11	2.382939	0.0308
C	-2.227304	4.470028	-0.498275	0.6255

Source: E-Views Output, 2025.

Table 4.5 presents the outcomes of this model, with separate coefficients reported for long-run and short-run relationships.

Long-Run Dynamics

In the long-run component of the model, the lag of the dependent variable, LNGDPPC(-1), has a significant negative coefficient of -0.788, indicating a strong adjustment effect over time. This suggests that when GDP per capita was higher in the previous period, it has a dampening effect in the long run, consistent with economic convergence behavior. The associated p-value (0.0002) confirms this result is statistically significant.

Government spending (LNGS) shows a large positive coefficient and is highly significant (p = 0.0000), pointing to its strong, positive influence on GDP per capita over the long term. Gross capital formation (LNGCF) and Tax revenue (TR_FDI) also exhibit statistically significant and positive effects, emphasizing their importance in promoting economic growth. TROP, potentially representing trade restrictions or openness proxies, shows a significantly negative influence (p = 0.0010), implying that restrictive trade policies hinder long-run growth. Other variables like interest rate (LNTR) and foreign direct investment (FDI) show no statistically significant effect in the long run, based on their high p-values.

Short-Run Dynamics

The short-run coefficients shed light on how variables influence GDP per capita in the immediate term: Gross capital formation (LNGCF) and TR_FDI retain their significance in the short run, mirroring their long-run impact and reinforcing the urgency of investment and trade-related inflows. TROP again shows a negative and significant short-run effect, highlighting the adverse impact of trade barriers even in the near term. Other variables, such as government spending, interest rates, and FDI, are not significant in the short run, suggesting their impact may materialize more gradually. The Error Correction Term (ECM) is a central feature of the ARDL model, indicating how quickly deviations from the long-run path are corrected. The ECM coefficient of -0.788 is negative and highly significant (p = 0.0000), confirming the presence of a stable long-run relationship and showing that about **78.8% of disequilibrium is corrected within one period a strong and rapid adjustment speed.

Discussion of Findings

The Autoregressive Distributed Lag (ARDL) model serves as a robust econometric tool for analyzing how various macroeconomic variables influence economic growth across time horizons. Table 4.5 provides both the long-run and short-run ARDL regression results, which offer a deep insight into the behavioral patterns of these variables in shaping GDP per capita. This discussion explains the findings, relates them to relevant economic theories, and draws out practical policy implications.

At the heart of the long-run results lies the coefficient of the lagged dependent variable, LNGDPPC(-1), which is negative and statistically significant. This supports the *neoclassical growth theory*, particularly the idea of convergence, which suggests that economies tend to return to a long-term equilibrium after short-term deviations. The implication is that past economic performance influences current outcomes, but only to a point, highlighting the need for continual innovation and policy evolution to sustain growth. Government spending (LNGS) shows a strong, positive, and statistically significant effect on GDP per capita in the long run. This finding aligns with *Keynesian economic theory*, which posits that public expenditure, especially on infrastructure and public goods, can stimulate overall economic activity. Policy-wise, this means that governments should allocate spending toward sectors that enhance productivity, such as education, health, and infrastructure development.

Gross capital formation (LNGCF) also emerges as a key growth driver, reinforcing ideas from *Solow's growth model* and *endogenous growth theory*, which emphasize the role of investment in expanding an economy's productive capacity. Encouraging public and private investment—through incentives, financial access, or stable regulatory frameworks—can therefore yield meaningful dividends. Tax revenue interacted with the foreign direct investment (TR_FDI)

variable, also has a positive and significant effect in the long term. This result supports *comparative advantage theory* and modern trade theories, which suggest that open economies benefit from increased market access, innovation spillovers, and resource efficiency. Consequently, governments are encouraged to pursue open trade regimes, dismantle excessive barriers, and promote exports to maximize their growth potential.

Conversely, the TROP variable, possibly reflecting trade restrictions, shows a significant negative influence on long-run growth. This provides empirical backing to arguments against *protectionism*, implying that restrictive trade policies may stifle competition, raise input costs, and hinder productivity. Policymakers should therefore prioritize competitive domestic industries over shielding them from global markets. Interestingly, foreign direct investment (FDI) and interest rate (LNTR) fail to exhibit statistically significant long-run effects. This suggests that simply attracting capital inflows may not be sufficient to spur long-run growth unless the domestic economy is equipped to absorb and utilize these investments productively. It also raises questions about the efficiency of financial intermediation and the responsiveness of investment to interest rate changes.

Furthermore, in the short run, gross capital formation (LNGCF) and TR_FDI maintain their significance, echoing their long-run impact. This underscores the immediate importance of investment and trade-related capital flows in influencing economic outcomes. TROP continues to exert a negative effect, indicating that restrictive trade policies are detrimental not only in the long term but also in the short-run adjustment period. Other variables such as government spending, interest rates, and FDI appear statistically insignificant in the short run, suggesting that their effects, if any, are more structural and gradual. A particularly noteworthy result is the significant and negative Error Correction Term (ECM), which confirms the existence of a stable long-term relationship among the variables. The coefficient indicates that approximately 78.8% of any disequilibrium from the long-run path is corrected within a single period. This swift adjustment affirms the strength of the long-run model and suggests that the economy is resilient in returning to equilibrium following short-run shocks.

Conclusion and Recommendations

The ARDL model confirms a stable long-run relationship between economic growth and variables like government spending, capital formation, and trade openness. Trade openness has a consistently negative effect, while foreign direct investment (FDI) and interest rates show no significant impact, suggesting limitations in their effectiveness within the current economic structure. The strong error correction mechanism indicates that the economy returns quickly to equilibrium after short-term fluctuations.

Policy implications include:

i. Increase productive government spending on infrastructure, health, and education.
ii. Encourage investment by offering incentives and improving access to finance.
iii. Promote trade liberalization and reduce regulatory bottlenecks.
iv. Reform trade policy by phasing out protectionism and boosting competitiveness.
v. Enhance the impact of FDI by strengthening domestic absorptive capacity and ensuring technology spillovers.
vi. Reform financial systems to make interest rates more effective as a policy tool.

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AGRICULTURAL PERSPECTIVE ON SUSTAINABLE ECONOMIC DEVELOPMENT IN NIGERIA

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Abstract

Agriculture is pivotal to Nigeria's economy, yet its potential for driving sustainable economic development remains underutilized. The paper examines the critical role of agriculture in achieving a sustainable economic development in Nigeria. Having reviewed current and related literature, it was, however, noticed that the agricultural sector's contributions to food security, environmental sustainability, and economic diversification cannot be overemphasized. It was therefore, concluded that despite its significance to the national economic development, still the sector faces some perennial challenges like inadequate funding, corruption, climate related issues, people's perception etc. The paper offers insights and recommendations for strengthening the agricultural sector's role in achieving long-term, sustainable economic growth in Nigeria through adequate funding, youth engagement/empowerment in agriculture, technology transfer, public-private partnerships, research and development among others.

Keywords: *Agriculture, Perspective, Sustainable, Economic Development, Nigeria.*

Introduction

In Nigeria, agricultural sector has contributed to the nation's economy through the export of it outputs for foreign exchange earning which contributed about 24.17% to nominal GDP in 2021. According to the data, crop production remained the major driver of the sector that accounts for 90.54% of overall nominal growth in the first quarter of 2020. The distribution of GDP across economic sector in 2022, agriculture contributed about 23.69% to Nigeria GDP with about 30.70% from industry and 44.04% came from services sector in January 2024 (CBN, 2024). It is certainly true that the current global economic crisis has forced many nations, including Nigeria, to consider unconventional approaches to economic diversification. Population growth, climate change, the COVID-19 pandemic, and violent conflicts are some of the main causes of this economic crisis (Iwuagwu, 2021). Because the world is committed to achieving the Sustainable Development Goals (SDGs) of the United Nations by 2030, especially goals 1 and 2 (reducing poverty and hunger) and the eighth goal, which points to sustainable economic development and this coincides with the conference's theme. The trend of economic diversification has therefore been a major source of concern among the member countries of the United Nations. Nigeria, one of the most troubled economies in the world, has been rocked by its over-reliance on oil as a mono economy; therefore, a strong economic diversification plan is essential (Donatus *et al*., 2019). The ecology in the northern part of the country make it famous for livestock keeping in addition to small and large ruminants, poultry population stands at 180 million poultry (FMARD), 2017). According to Isukul *et al*. (2019), human capital development is crucial for substantial economic diversification in a country like Nigeria. Thus, as the conference's title encapsulates, the aforementioned may play a major role in achieving sustainable economic development in our beloved Nigeria, particularly in the areas of agriculture having being a sector with a high percentage of youth employment (Adeyanju, 2017).

Nigeria's economy hinges on agriculture even prior to independence with a strong GDP and foreign exchange, being the most populous Black country in the world and the most densely populated country in Africa. When oil was discovered in the early 1970s, however, the nation ignored its thriving agricultural industry because of some political machinations (Onuka, 2017). In spite of the growing importance of oil, Nigeria has remained essentially an agrarian economy, with agriculture still accounting for significant shares in Gross Domestic Product (GDP). According to Adeyanju (2017), the sector has also been reported by various researchers to hold high employment potentials (70%) for the populace, provided that it is supported by adequate investments and a conducive legal environment with appropriate policy framework. However, on the basis of the forgone, one will note that, agriculture possess all it takes particularly if given sufficient consideration, to derive the Nigerian economy into a sustainable one which free from on oil whose prices keeps fluctuating in the global market. Therefore, this paper aims to review the impeccable roles of agriculture in Nigeria particularly in the face of the country's economic growth and sustainability putting into consideration the challenges faced by the sector of the economy.

Agriculture and Nigeria's Economic Development

However, sustainable economic, social and political development cannot be achieved without a functional economic growth. Thus, economic growth is necessary for sustainable economic development (Odetola & Etumnu, 2013). Agriculture has played a significant role in Nigeria's economic development, contributing substantially to its GDP despite the growing importance of oil (Kanayo & Maurice, 2013). However, the sector's potential has varied over time, influenced by

political and economic regimes. Studies have shown a positive relationship between agricultural output and economic growth, with factors such as domestic savings, government expenditure, and foreign direct investment impacting GDP (Izuchukwu, 2011). Therefore, going by this it will be understood that, agriculture can be so impactful on the economic advancement of the developing nations like Nigeria and this can be achieved in the areas of food security, job availability, domestic savings and equally foreign exchange.

According to Irz et al. and Thirtle et al. as cited in Kabiru *et al*. (2021) who stated that, most of the direct contributions of agriculture to economic growth, is increase in incomes of farmers and their purchasing power. Also, studies have shown that, an increase in the agricultural growth can lead to an increase in incomes of the poorest population and this thereby, affects the economic growth of a country positively. Likewise, agriculture according Munonye & Esiobu, (2017) has the potential to provide employment, reduce poverty, and ensure food security.

Contributions of Agriculture to Nigeria's Economic Development

I. **Employment Opportunity:** Agriculture is one of the largest employers in Nigeria providing jobs for the teaming populations among the youth which is served as the key source of livelihood particularly in rural areas. It contributed for about 34.31% in 2023 (FMARD, 2023).
ii. **Value Chain Development:** Agriculture promotes the development of various value chain that include production, processing, distribution and marketing. This leads to increased jobs opportunities and economic generation to individual and the nation as a whole.
iii. **Food Security:** With a large growing population, agriculture is essential for ensuring food security in Nigeria as it provides the necessary food to meet the dietary needs of the population and reduces resilience on food importation.
iv. **Rural development:** Agricultural activities stimulate economic growth in rural areas through infrastructure development and the creation of related businesses such as processing and transportation.
v. **Foreign Exchange Earning:** Agricultural exportation such as cocoa, rubber, palm oil and cashew nuts contribute to foreign exchange earnings while oil is the dominant sector. Hence, agriculture remain the vital source of foreign earnings to the nation.
vi. **Economic diversifications:** Agriculture is a key role to diversifying Nigeria's economy reducing its dependence on oil and gas. This is particularly in times of oil price fluctuations when the crude oil prices is unstable in the global markets

Challenges facing Agriculture in Nigeria

However, despite the numerous opportunities hold by agriculture in Nigeria as agrarian nation, yet, the sector faces some challenges which may be internal or external hindering its success for a meaningful economic development. As such, they often find it difficult to effectively participate in the programs designed and implemented by both the government and non-governmental organizations with the sole aim of making them productive hence, accelerating the country's food production capacities for sustainable economic development. According to Ouko *et al*. (2022) these challenges include; negative perception of agricultural activities, lack or inadequate skills, limited access to infrastructure, lack of access to land, finance, and information, networking and mentoring, insufficient market information, negative effects of climate change, low levels of value-addition, inadequate policies supporting youth Agripreneurship, and poor markets.

One of the foremost challenges is the negative perception of agricultural activities among the said youth. This is seen as one of the most difficult challenges in Nigeria, where the youth particularly those in the urban areas perceived agriculture as a venture for the less privileged individuals (Ajekwe & Ibiamke, 2020). Rural residents, who make up a greater portion of the nation's youth, frequently migrate to cities in search of better opportunities, if applicable. According to Okello (2014), in the majority of Sub-Saharan African nations, schools penalize students with agricultural tasks, which exacerbates their unfavorable opinion. In their contribution, Mugisha & Nkwasibwe (2014) provided a very good example of Uganda, where youth still find agricultural-related activities unappealing in part because schools employ them as a form of discipline and reprimand for misbehavior. By implication, this influences how young people view agribusiness and may lessen their excitement for it.

Another challenge is the policy inconsistencies. As a democratic setting several governments come to power with their different ideology hence, leading to a constant change in the existing policies regarding agriculture in the country. According to a 2018 United Nations report, young rural women's and men's opinions are frequently ignored by the appropriate authorities, which mostly leads to subpar execution of the agricultural policy-making process in the SSA. Youths also often miss out on involvement in policy forums due to a lack of negotiation strength and experience. Laxity and a failure to engage young people have been seen as a deterrent to promoting agriculture (World Bank, 2016). Geza *et al.* (2022) also discovered that youth participation in agricultural and rural development projects is restricted by a lack of inclusivity in the creation and application of policies.

Again, inadequate funding is another major challenge bedeviling the sector of the economy. According to Afande *et al.* (2015), due to inadequacy of the funds, majority of the farmers particularly those from the rural populace have trouble getting loans from financial institutions because they don't have the collateral that the lenders require. As a result, young people, especially the rural farmers who formed the majority of the beneficiaries of the sector, are never able to get the money they need, which limits their ability to invest in agriculture (FAO, 2014). Because of this, young people are always dependent on traditional finance sources like friends, family, clubs, support groups, etc. for saving and lending, or on contractor loans for insurance or agricultural inputs (Demirguc-Kunt *et al.*, 2015).

The land tenure system is another factor contributing to the challenges facing the agricultural sector, and it still plagues the majority of African youth. While some young people are interested in engaging in agricultural ventures, their hopes are frequently dashed by the country's rigid tenure system. To support the aforementioned, Njeru & Gichimu (2014) believed that land is a valuable resource in agriculture, and that having access to it encourages one to work in the field. According to Justine *et al.* (2012), while parents typically hold the title to land for agricultural production, youths may also have access to small parcels of land that are unsuitable for commercial and large-scale agriculture. As a result, policymakers must immediately devise strategies to support and facilitate youths' access to land.

Furthermore, little is known about how information technology is used to produce food in agriculture. Because, many educational institutions still lack access to modern agriculture-related technology as they lack the funds to purchase the necessary gear, software, internet services, and

powering infrastructure or manipulative skills when available (Ajayi and Fapojuwo, 2013). Likewise, the choice of method of instruction among the instructors is crucial to an effective teaching-learning process but, in most cases the ones adopted may not be in conjunction with those of 21st century. Some challenges include insecurity, climate change, technical know-how etc. Finally, limited value addition and agro-processing also affects agricultural production as most agricultural products are sold raw limiting value addition and job creation (FAO, 2021). Additionally, over dependency on rainfed agriculture limit irrigation infrastructure which makes agriculture more vulnerable to climate variability.

The Way Forward

There will be no problem without solution and equally no solution without problem. However, agriculture as a sector of the economy holds enormous potentials for the nation's economic growth and national development if the identified challenges bedeviling its success and progress are proffered the lasting solution. Halima, (2014) asserted that, for the Nigeria's economy to be listed among the leading economies not only in Africa but globally, increase in food production, income diversification as well as job creation are important and all these are attributed to agriculture. Because, it involves transformation of the understanding and practice of farming to meet the changing world of the present time, teaching the subject in our learning institutions must be in tandem with the global best practices so to as ensure the attainment of sustainability in the country's economic development. Again, policy consistency and harmonization of agricultural policies and programmes in tandem with the curriculum contents of the national agricultural policy framework will accord the training institutions the opportunity to contribute to a long term sustainable national development (Eneji, *et al.*, 2021). However, these will bring about positive change to the system thereby, leading to a corresponding change to the nation's economy.

Conclusion

The review concludes that, sustainable agriculture presents a viable pathway for Nigeria to achieve economic diversification, enhance food security, and promote inclusive growth. Despite the pivotal roles played by agriculture to the Nigeria's economy, it was however, noted that having reviewed the related literature, the sector faces some systemic problems which need to be tackled such as limited access to finance, inadequate infrastructure, market distortions among others. Therefore, addressing these systemic challenges is paramount given the embedded benefits of the sector which will lead to the achievement of a sustainable economic development in the country. Future research should focus on exploring the long-term impacts of specific policy interventions, evaluating the scalability of innovative agricultural technologies, and deepening our understanding of the socio-economic dynamics within Nigeria's agricultural sector. By prioritizing sustainable agriculture e, Nigeria can unlock its latent potential and pave the way for a more prosperous and resilient future.

Recommendations

The paper forwarded the following recommendations;

i. The youth need to be reoriented about the inherent benefits of the agricultural industry to them and the larger society. Because it is regarded as a strong weapon for enhancing national development and economic prosperity in Nigeria.
ii. The government should expand funding for the agriculture sector by evolving a robust PPP. Nigeria should refocus its agricultural education curriculum approach, reformed and

restructured in accordance with the ethics of production and preparation for independence.

iii. Secure land access by simplify the bureaucracy for land access and tenure for young farmers.
iv. Digital Agriculture Promotion: Expand technology adoption particularly among the rural populace where agricultural activities are given more priorities.
v. Strengthen Market Linkages: Improve market access and value chain development within which the young aspiring Agripreneurship can showcase their entrepreneurial skills.
vi. Supportive Policy Framework: There is also the need to create enabling policies and regulations for youth Agripreneurship to thrive

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PRODUCTION OF LOCALLY MADE SILICON MODULE IN NIGERIA

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Abstract

Lack of Electricity is a major hindrance to third world Economy. Third world countries are static and with high cost of fossil fuel. This paper studies the production of silicon module which is a major product in the production of solar cells for electrical energy generation. A mixture of sharp sand and or Quartz was mixed with Coke and fired in a blast furnace at a temperature of 2000°C, a chemical reaction occurs producing 99% silicon module and carbon dioxide. This 99% silicon module was further cleaned by distillation or a chemical process to a very high purity of 99.9%. This result reveals that the main component of silicon module can be used to attract electrical energy from the sun.

Keywords: *Solar Energy, Silicon Module, Quartz, Sharp Sand, Distillation, Coke.*

Introduction

It is high time that Nigeria evolved a comprehensive survival plan to cope with the drastic shift in energy paradigm from fossil fuels to renewable sources. Gradually, the momentum is gathering. One by one, the industrialised and developed countries of the world are signing up for this shift which will take the wind from the sails of oil economies like Nigeria. Saturday Vanguard (2014) "One day, the Organisation for Economic Cooperation and Development, OECD, countries may gather in Kyoto, Copenhagen or some other city, and with a stroke of the pen, make the burning of fossil fuel illegal as the British Empire did to slave trade in 1807 and to slavery itself through the Slavery Abolition Act of 1833." Reader Digest (2014), listed the burning of fossil fuels among the eight things that would probably become internationally illegal in the next 50 years.

As temperatures around the globe rises, world leaders are cracking down on the second largest sources of climate change: fossil fuels used in transportation, which account for more than half of a typical household's carbon dioxide emissions millennium project 2020 (2010). In Germany, the leading country in renewable energy technology, about 12.4 per cent of their energy consumption comes from renewable sources as of end of 2015. In 2009, United States invested $20 Billion into renewable energy projects. These happened a few years ago. Since then, massive investments into renewable technology have continued. The United Kingdom, France, China, India and some other countries have promised to end internal combustion engines in favour of electric vehicles by 2050 or earlier.

Up to eight states in the United States have so far made their own goals to sell only zero-emissions vehicles over the next 35 years. The U.S Federal Government is likely to adopt the trend. Right now, oil-producing nations like Nigeria are sellers of energy in form of crude oil, and the West is the buyer. At the completion of this renewable energy revolution, the West will become sellers of renewable energy technology while Nigeria becomes the buyer. Our economy will lose its comparative advantage. The big question is: What are those entrusted with the management of our economic future doing about the approaching third industrial revolution?. Instead of working out the answers to this challenge, our ruling class is still frantically searching for oil deposits in Chad, Sokoto and Benue basins as if our oil rent-seeking bonanza will last forever. As of recent in Nigeria Akigwe I.M. and Ejikeme .l.(2014), Akigwe, I.M (2016) , Akigwe, I.M (2018) led a pioneer effort in producing molten iron from Cupuola Blast Furnace figure1-4 sponsored by Tetfund Abuja, 2015, (Millennium project 2020 (2010). A 200,000 TW (Terra watts) sunlight per hour can give electricity for 20 years. A family in a 3 Bedroom flat can enjoy electricity for two years with two panels, 1200 watts battery and inverter at a cost of N350,000 (Three Hundred and Fifty Thousand Naira). This cost will be cheaper if we start to produce solar panels and Batteries. Quartz can be got from Bauchi, Borno, Cross River and Plateau States while silicon sand from Benue, Bayelsa, Borno, Plateau, Akwa-Ibom and Gombe State.

Methodology

A measured quantity of sharp sand and or Quartz and Coke or Charcoal, wood chips or saw dust in a blast furnace and fired at a temperature of 2000°C till silicon module 99% purity is tapped at the corner part of the furnace according to the chemical equation.

$$SiO_2 + C \xrightarrow{2000^{\circ}C} CO_2 + Si \quad \text{..... (i)}$$

$$\text{Or } SiO_2 + 2C = 2CO + Si \quad \text{..... (ii)}$$

The silicon module solidifies to a shining grey metal.

This silicon module is further cleared by distillation to a very high purity of 99% or by a chemical process figure 5.

Conclusions and Recommendations

To be forewarned is to be forearmed. Now is the time for us to put on the proverbial thinking cap to ensure we do not lose out. This green technology must be emulated and enhanced. Benefits of Solar Energy will bring cost of cars down, car mechanics will be put away as electric car will drive cars. Nigeria economy will shrink as fossil fuel demand will decline. There will be benefits to low income Nigerian as cost of transportation will be reduced. Families will enjoy constant light, enjoy Television, Fridges and Technicians will be productive. Tripple Tree Hotel Oko, Anambra State utilizes this technology and Federal Polytechnic Oko can emulate this technology to save cost. More also, solar panel can produce Hot Water for Hotels and in our Household.

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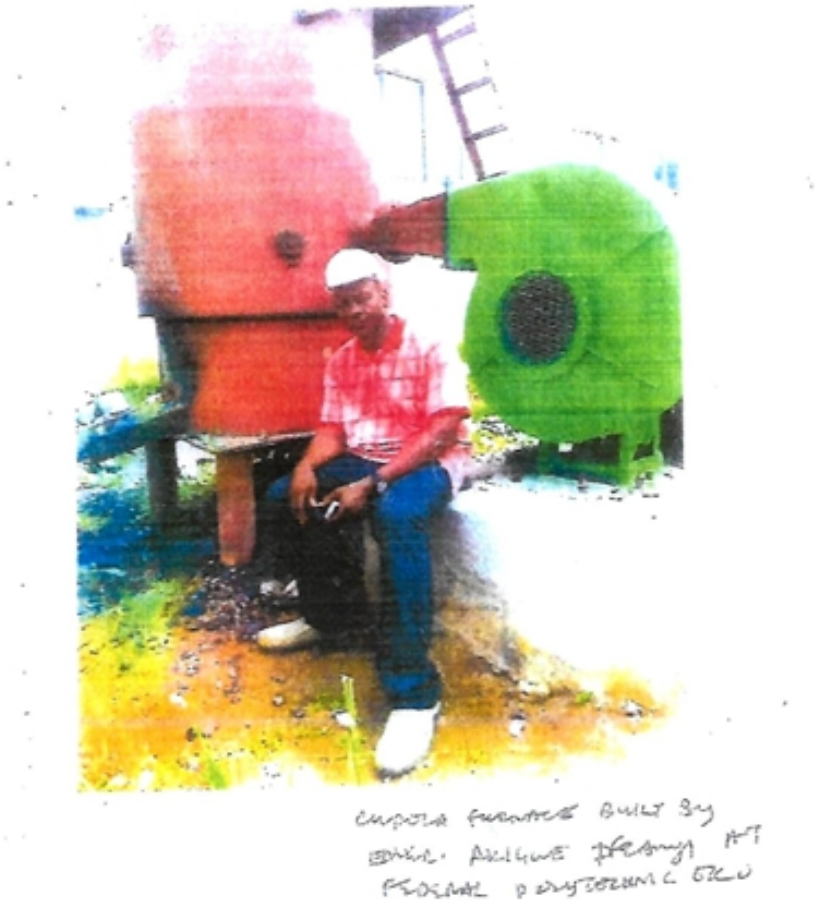

Figure 1

Figure 2: Coupling for Oil Mill Industry

Figure 2: Coupling for Oil Mill Industry

Figure 3: Gibult Joint for Water Connection

Figure 4: Screw Worm for Soya Beans Crushing

Figure 5: Silicon Module Casted

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PROSPECTS OF SOCIO-POLITICAL CULTURE FOR GOOD GOVERNANCE IN NIGERIA

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Abstract

The paper examined prospects of socio-political culture of good governance in Nigeria.The prospects of fostering a culture of good governance in Nigeria hold significant implications for the nation's development trajectory. The realization of a culture of good governance in Nigeria hinges on the collective will and determination of its people. Citizens, leaders, civil society organizations, and international partners all play crucial roles in driving this transformative agenda forward. As Nigeria works toward fostering a culture of good governance, it has the chance to shape its own narrative, harness its diverse strengths, and contribute to the sustainable development and prosperity of its people. In conclusion, while the journey may be arduous, the prospects for cultivating a culture of good governance in Nigeria are both necessary and achievable. Through a sustained commitment to transparency, accountability, and inclusivity, Nigeria can embark on a path toward a brighter and more equitable future. Therefore, curriculum planner should prioritize civic education programmes that inform citizens about their rights, responsibilities, and the importance of active participation in governance. An informed and engaged citizenry is essential for demanding transparency and accountability. Also, government should invest in building strong and independent institutions that can effectively carry out their mandates. This includes enhancing the capacity of the judiciary, electoral commissions, and anti-corruption agencies to ensure checks and balances in governance

Keywords: *Culture, Fostering, Good governance, Prospects, Socio-political.*

Introduction

The concept of good governance has emerged as a pivotal factor in the success of modern societies, enabling them to achieve sustainable development, social equity, and political stability. Across the globe, nations are increasingly recognizing the significance of cultivating a socio-political culture rooted in the principles of transparency, accountability, rule of law, and citizen participation. In the context of Nigeria, a nation rich in cultural diversity, abundant resources, and immense human potential, the prospects of instilling a robust culture of good governance hold the promise of addressing historical governance challenges, fostering economic growth, and improving the quality of life for its citizens.

Nigeria since gaining independence in 1960 has been characterized by a complex interplay of governance successes and challenges. Historically, the nation has grappled with issues such as corruption, weak institutions, and inadequate service delivery, which have impeded its progress and undermined public trust (Ibrahim& Abdullahi, 2018). These challenges have been exacerbated by ethnic and religious divides, resource mismanagement, and political power struggles. The ramifications of poor governance have been far-reaching, affecting sectors ranging from education and healthcare to infrastructure and security.

The concept of good governance encompasses a set of principles that are essential for the effective functioning of a society and its institutions. Key components include citizen participation in decision-making processes, adherence to the rule of law, transparent and accountable institutions, equitable distribution of resources, and the provision of essential services. Good governance serves as a catalyst for socio-economic development, political stability, and the protection of human rights (Kuye & Gberevbie, 2014). Drawing insights from countries that have successfully implemented these principles, such as Botswana and Mauritius, provides valuable lessons for Nigeria's own journey toward effective governance.

In recent years, Nigeria has undertaken various reform initiatives aimed at addressing its governance deficiencies. Measures such as the establishment of anti-corruption agencies, the introduction of e-governance platforms, and efforts to enhance fiscal transparency have shown progress, albeit with mixed results (African Development Bank Group, 2018). However, the broader governance landscape remains challenged by persistent corruption, inadequate public service delivery, and an uneven distribution of resources. The role of political institutions, civil society, and the media in shaping the governance culture cannot be underestimated, as these actors play a critical role in holding the government accountable. However, this paper seeks to explore the prospects of socio-political culture of good governance in Nigeria, with a keen focus on its potential implications for the nation's development trajectory.

Conceptualizing Good Governance

Good governance is a multifaceted and dynamic concept that forms the cornerstone of effective and accountable administration in any society. It encompasses a set of principles and practices that ensure the responsible management of public affairs, the protection of human rights, and the realization of social and economic development. While there is no universally agreed-upon definition, the World Bank (2012) provides a comprehensive framework that identifies six key dimensions of good governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

Ake (2016) also define good governance as effective, accountable, transparent, and participatory management of a country's political, economic, and social affairs. It involves the responsible exercise of power by government institutions, the protection of individual rights, the rule of law, and the equitable distribution of resources for the betterment of society as a whole. It encouraging active involvement of citizens in decision-making processes, policy formulation, and development planning (Ake, 2016). This includes opportunities for public consultation, engagement of civil society organizations, and inclusivity of marginalized groups. A robust culture of good governance is crucial for a nation's overall development and stability. Countries that prioritize good governance are more likely to experience reduced corruption, increased investor confidence, improved public service delivery, and greater social cohesion (EU, 2007). Good governance contributes to economic growth by creating an enabling environment for business, enhancing public trust, and attracting foreign investment.

Socio-Political Culture

Socio-political culture refers to the collective set of beliefs, values, norms, behaviors, and attitudes that shape the interactions and dynamics between individuals, groups, and institutions within a society, particularly in the realm of politics and governance (Almond& Verba, 2013). It encompasses the shared understanding of how power is distributed, how decisions are made, and how societal interests are represented and pursued through political processes. Socio-political culture deeply influences the way citizens engage with their government, participate in public affairs, and contribute to the formation of policies (Putnam, 2010).

Key Aspects of Socio-Political Culture

i. **Beliefs and Values:** Socio-political culture is rooted in the fundamental beliefs and values that individuals hold about their society and its governance. These beliefs can include notions of democracy, justice, equality, and the role of government in addressing societal needs.
ii. **Norms and Traditions:** Cultural norms and traditions shape the accepted patterns of behaviour in the political sphere. These norms might dictate how citizens express dissent, how political campaigns are conducted, and how leaders are chosen and evaluated.
iii. **Political Participation:** The extent and nature of citizens' involvement in political activities, such as voting, protest, and civic engagement, are influenced by socio-political culture. A culture that encourages active participation can lead to more informed and empowered citizens.
iv. **Political Trust:** The level of trust that citizens have in political institutions, leaders, and processes is a reflection of socio-political culture. Trust fosters cooperation and collaboration between the government and the governed.
v. **Attitudes toward Authority:** Socio-political culture shapes attitudes toward authority figures, governance structures, and the exercise of power. These attitudes influence whether citizens challenge or accept the status quo.

Socio-political culture plays a vital role in determining the health and effectiveness of a nation's political system. It influences the functioning of institutions, the legitimacy of government actions, and the overall stability of the society (Inglehart& Welzel, 2005). A positive socio-political culture characterized by active citizen engagement, trust in institutions, and a commitment to democratic values contributes to responsive and accountable governance.

Historical Context of Governance in Nigeria

The historical context of governance in Nigeria provides valuable insights into the challenges, transitions, and evolution of the nation's political and administrative landscape since gaining independence in 1960. The trajectory of governance in Nigeria has been marked by a complex interplay of colonial legacies, ethnic diversity, economic struggles, and attempts to establish stable democratic governance (Falola, 2009).

Nigeria's governance history is deeply influenced by its colonial past, where British rule played a significant role in shaping the administrative and political structures. The colonial era introduced centralized governance systems, contributing to the concentration of power in the federal government (Ihonvbere, 2014). As Nigeria gained independence in 1960, the transition to self-governance presented challenges in reconciling diverse ethnic, religious, and cultural identities within a unified political framework. Following independence, Nigeria experienced a series of military coups and counter-coups that culminated in a prolonged period of military rule. These coups were driven by power struggles among various ethnic and regional groups, leading to political instability and economic mismanagement (Ihonvbere, 2014). Military regimes governed Nigeria for the better part of its early years as an independent nation, contributing to weak institutions and governance deficits. Nigeria's transition back to democratic governance in 1999 marked a significant turning point. The Fourth Republic aimed to address historical governance challenges by instituting democratic principles, establishing a multi-party system, and ensuring regular elections (Okafor, 2015). However, this transition was accompanied by persistent issues such as corruption, lack of accountability, and weak infrastructure, which hindered effective governance and impeded development. Nigeria's diverse population, consisting of over 250 ethnic groups and a mix of religious affiliations, has contributed to governance challenges. Ethnic and religious identities have at times been exploited for political gain, leading to tensions and conflicts. The federal structure of governance has often struggled to balance the interests and demands of different regions (Okafor, 2015). The mismanagement of Nigeria's abundant natural resources, particularly its oil wealth, has been a critical governance challenge. Corruption and misappropriation of funds have hindered development efforts, undermined public trust, and contributed to economic inequality.

Factors Affecting Good Governance Prospects in Nigeria

The prospects of fostering a culture of good governance in Nigeria are influenced by a myriad of socio-cultural, economic, political, and international factors. These factors interact in complex ways to shape the nation's governance landscape, presenting both opportunities and challenges for meaningful reform and improvement.

Socio-Cultural Factors: Nigeria's rich cultural diversity, encompassing over 250 ethnic groups and a multitude of languages and traditions, can be both a source of strength and a challenge. Ethnic and religious differences have at times led to social tensions and political divisions, impacting governance dynamics (Odeyemi& Okorie, 2018). The need to balance the representation of diverse groups within governance structures can be complex and demanding.

Economic Factors: Nigeria's heavy reliance on oil revenue has historically exposed the nation to economic volatility and mismanagement. The misallocation of oil wealth, coupled with corruption, has hindered socio-economic development and eroded public trust (Asongu, Efobi&

Beecroft, 2015). Diversifying the economy, promoting sustainable resource management, and addressing wealth inequality are vital for fostering good governance.

Political Factors: Nigeria's political landscape is characterized by party politics, power struggles, and challenges in ensuring free and fair elections. The influence of powerful elites and the limited inclusivity of political processes can impede the emergence of transparent and accountable governance. Strengthening electoral institutions, reducing political patronage, and ensuring the independence of the judiciary are crucial steps (Transparency International, 2020).

International Factors: Global partnerships, foreign influence, and international aid also shape Nigeria's governance prospects. The nation's interactions with international actors can impact policy decisions, trade agreements, and development priorities (World Bank, 2018). Balancing external interests with domestic needs is essential for maintaining sovereignty and pursuing policies that prioritize good governance.

Prospects for Cultivating a Culture of Good Governance in Nigeria

The cultivation of a culture of good governance in Nigeria holds immense potential for addressing historical challenges and fostering sustainable development. While the road ahead is complex, several strategies and approaches offer promising prospects for transforming the nation's governance landscape.

I. **Embracing Technology and E-Governance:** The digital revolution presents an opportunity to enhance transparency, efficiency, and citizen engagement. E-governance platforms can streamline service delivery, reduce bureaucratic bottlenecks, and facilitate citizen interaction with government agencies, thereby reducing opportunities for corruption and increasing accountability (UN Department of Economic and Social Affairs, 2016).

ii. **Strengthening Institutions and Rule of Law:** Investing in the independence and capacity of institutions such as the judiciary, anti-corruption agencies, and electoral commissions is essential. A robust legal framework that upholds the rule of law and ensures accountability can serve as a bulwark against abuses of power.

iii. **Civic Education and Awareness:** Educating citizens about their rights, responsibilities, and the importance of active participation in governance processes can empower them to demand accountability from public officials. Civic education campaigns can promote a culture of transparency and encourage citizen engagement (Ibrahim&Ogunnubi, 2016).

iv. **Leadership and Ethical Governance:** Ethical leadership that emphasizes integrity, accountability, and transparency sets a precedent for good governance. Leaders who prioritize the public interest over personal gain can inspire a culture of service and responsibility among government officials (Maccoby, 2010).

v. **International Partnerships and Peer Learning:** Collaboration with international organizations and learning from the experiences of countries that have successfully transitioned to a culture of good governance can provide valuable insights and best practices. Global partnerships can facilitate knowledge exchange and support reform efforts (OECD, 2019).

Challenges and Roadblocks to Cultivating a Culture of Good Governance in Nigeria

The journey toward cultivating a culture of good governance in Nigeria is fraught with challenges and roadblocks that require careful consideration and strategic planning (UN Department of Economic and Social Affairs, 2016). These obstacles, rooted in historical, socio-political, and economic factors, can hinder reform efforts and impede progress toward effective governance.

i. **Corruption and Lack of Accountability:** Persistent corruption and a lack of accountability remain significant challenges in Nigeria. Corruption erodes public trust in institutions, diverts resources from development, and perpetuates a culture of impunity among public officials.
ii. **Political Patronage and Elite Capture:** The influence of powerful elites can undermine equitable representation and decision-making. Political patronage and favoritism often take precedence over merit-based governance, contributing to inefficiency and inequality.
iii. **Weak Institutions and Bureaucracy:** Inadequate institutional capacity, inefficient bureaucratic processes, and lack of professional expertise hinder effective governance. Strengthening institutions requires targeted reforms and investment in human resources.
iv. **Ethno-Religious Divides:** Ethnic and religious differences have historically fueled conflicts and hindered national cohesion. Socio-political tensions can undermine efforts to build a unified culture of good governance.
v. **Economic Inequality and Poverty:** High levels of economic inequality and widespread poverty can limit access to basic services and erode public confidence in governance institutions. Addressing these challenges is crucial for sustainable development.
vi. **Resistance to Change:** Deep-rooted practices, vested interests, and resistance to reform within existing power structures can hinder the implementation of transformative governance measures.
vii. **Lack of Civic Engagement and Awareness:** Low levels of civic education and citizen engagement can limit the demand for transparency and accountability. An informed and active citizenry is essential for fostering good governance.

Conclusion

In the pursuit of cultivating a culture of good governance in Nigeria, it is evident that the nation stands at a critical juncture. The historical context of governance, characterized by colonial legacies, political instability, and economic challenges, has influenced the socio-political culture and governance dynamics. However, the prospects for positive change are within reach, as numerous strategies and approaches offer the potential to transform Nigeria's governance landscape. The realization of a culture of good governance in Nigeria hinges on the collective will and determination of its people. Citizens, leaders, civil society organizations, and international partners all play crucial roles in driving this transformative agenda forward. As Nigeria works toward fostering a culture of good governance, it has the chance to shape its own narrative, harness its diverse strengths, and contribute to the sustainable development and prosperity of its people. In conclusion, while the journey may be arduous, the prospects for cultivating a culture of good governance in Nigeria are both necessary and achievable. Through a sustained commitment to transparency, accountability, and inclusivity, Nigeria can embark on a path toward a brighter and more equitable future.

Recommendations

i. Government should invest in building strong and independent institutions that can effectively carry out their mandates. This includes enhancing the capacity of the judiciary, electoral commissions, and anti-corruption agencies to ensure checks and balances in governance.
ii. Curriculum planner should prioritize civic education programs that inform citizens about their rights, responsibilities, and the importance of active participation in governance. An informed and engaged citizenry is essential for demanding transparency and accountability.
iii. Leaders should set an example of responsible governance and prioritize the interests of citizen's over personal gain
iv. There should be promotion of transparency in government operations by implementing open data initiatives and ensuring that information is readily accessible to the public. Establish mechanisms for holding public officials accountable for their actions, such as regular audits and reporting.
v. Policy makers should implement policies that prioritize economic diversification, poverty reduction, and wealth distribution. Reducing economic inequality can enhance social cohesion and promote public confidence in governance institutions.
vi. Federal government should empower local governments with resources, autonomy, and capacity-building to ensure effective service delivery and responsiveness to local needs.
vii. Public should engage the private sector in governance efforts by fostering collaboration in areas such as infrastructure development, service delivery, and anti-corruption initiatives.
viii. Government should ensure free, fair, and credible elections by enhancing the independence of electoral bodies, implementing electoral reforms, and addressing issues of voter intimidation and fraud.

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SCIENCE EDUCATION PERSPECTIVE ON DEVELOPING AND SUSTAINING THE NIGERIAN ECONOMY IN THE 21ST CENTURY

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Abstract

The 21st century has ushered in a knowledge-driven global economy, where science and technology are pivotal in determining a nation's competitiveness and development. In Nigeria, a country endowed with vast natural and human resources, the integration of science education into economic development strategies remains crucial. This paper explores how science education serves as a fundamental pillar in advancing and sustaining Nigeria's economy in the 21st century. It highlights the critical role of science education in promoting innovation, enhancing workforce skills, driving technological advancements and addressing pressing national challenges such as unemployment, poor healthcare, food insecurity and environmental degradation. The paper examines the current state of science education in Nigeria, identifies systemic challenges including poor funding, inadequate teacher preparation, obsolete curricula and weak industry-academic linkage and proposes strategic reforms. Emphasis is placed on aligning science education with Nigeria's economic diversification agenda, particularly in agriculture, manufacturing, renewable energy, ICT and biotechnology sectors. Furthermore, the paper argues that developing a scientifically literate citizenry is essential for fostering sustainable development and achieving the national Vision 2050 and the Sustainable Development Goals (SDGs). By investing in science

education at all levels, enhancing research and innovation capacity and promoting public-private partnerships, Nigeria can harness science education as a transformative tool for national prosperity. Recommendations are provided for policymakers, educators and stakeholders on how to reposition science education to drive Nigeria's 21st-century economic agenda.

Keywords*: Science Education, Sustainable Economic Development, Nigeria Economic Diversification, Technological Innovation, 21st Century Economy*.

Introduction

Science education has long been recognized as a critical driver of socioeconomic development and national progress. In the context of Nigeria, a nation grappling with challenges of economic instability, unemployment, technological backwardness, and a growing population the imperative to strengthen science education cannot be overemphasized. The paper sets out to explore the strategic role of science education in fostering economic development and sustainability in Nigeria within the 21st-century global knowledge economy.

The Concept and Scope of Science Education in Nigeria

Science education refers to the teaching and learning of science subjects, including physics, chemistry, biology and general science, as well as the application of scientific thinking and processes. In Nigeria, science education encompasses formal education systems (primary to tertiary levels) and non-formal learning that aims at promoting scientific literacy, critical thinking and technological competence. Despite curriculum reforms, Nigerian science education continues to suffer from poor quality delivery, lack of infrastructure, insufficient funding and minimal practical exposure. Science education refers to the structured transmission of scientific knowledge, skills and attitudes through formal and informal channels. In the Nigerian context, science education is offered at all levels basic, secondary and tertiary covering disciplines such as physics, chemistry, biology, agricultural science and integrated science. This foundational knowledge is instrumental in developing critical thinking, problem-solving abilities and creativity, which are indispensable for national development (Ogunleye, 2020). In recent years, the global economy has shifted toward innovation and knowledge-driven systems, positioning science education as a cornerstone of economic sustainability. Nigeria's National Policy on Education underscores the importance of science education for self-reliance, industrial development and environmental management (Federal Ministry of Education [FME], 2020). However, despite policy recognition, the practice of science education in Nigeria, remains marred by infrastructural decay, poor funding and limited practical exposure (Nworgu et al., 2022).

Moreover, the quality of science education delivery in Nigeria is hampered by teacher inadequacy, weak curriculum relevance and minimal integration of digital tools. These issues not only affect students' performance in STEM (Science, Technology, Engineering and Mathematics) subjects but also limit their ability to apply knowledge to real-world problems (Iwuanyanwu & Ekwe, 2021). Research studies have shown that nations with robust science education frameworks demonstrate higher indices of innovation, productivity and socio-economic development (Olayemi & Eze, 2019). The scope of science education also extends to fostering environmental awareness, public health literacy, and technological adaptability. These elements are critical for a sustainable

economy, particularly in a country like Nigeria, where climate change, poor healthcare infrastructure and energy poverty threaten long-term growth. Therefore, reforming science education must be at the center of Nigeria's developmental agenda. Furthermore, understanding the nature and scope of science education is essential for appreciating its transformative potential. By expanding its focus beyond traditional subject boundaries and aligning with economic priorities, science education can equip learners with competencies to drive innovation and sustainability in Nigeria.

The 21st Century Economy: Trends and Demands

The global economy in the 21st century is knowledge-based, innovation-driven and technology-intensive. Economic competitiveness now hinges on nations' ability to produce, adapt and apply scientific and technological knowledge. For Nigeria, this means that the development of human capital through effective science education is critical to meeting the demands of global economic participation, local industrialization and sustainable growth. This is very important as almost every sectors of the economy is not left out in the bandwagon of technological innovation and artificial intelligent (AI) era.

Science Education as a Driver of Technological Innovation and Industrialization in Nigeria

Science education plays a pivotal role in promoting technological innovation and industrialization, two critical components for economic growth in the 21st century. In the Nigerian context, where over-reliance on crude oil has exposed the fragility of the economy, the imperative to diversify through technology-driven industrialization becomes more pronounced. Science education provides the cognitive, technical, and practical foundations necessary for nurturing innovators, engineers and technologists capable of driving this transformation in our economy in the 21st century. The integration of scientific knowledge with technical skills fosters innovation by enabling individuals to identify problems, develop solutions and create products or services that enhance productivity. According to Nwanekezi et al. (2021), science education equips learners with inquiry-based approaches that stimulate creativity, experimentation and design thinking skills indispensable for entrepreneurship and industrial processes. The development of new technologies in agriculture, renewable energy, telecommunications, ICT and manufacturing is often anchored in the competencies that science education fosters. One of the hallmarks of industrialization is the mechanization of production, which demands a skilled workforce with scientific and technological expertise. Science education thus forms the backbone of workforce development by producing graduates competent in STEM disciplines. As noted by Adebayo and Okafor (2020), the quality of a nation's science education directly influences its industrial competitiveness and innovation capacity. Furthermore, countries that have achieved rapid economic progress, such as South Korea, China and India, have done so by heavily investing in science education and aligning it with industrial policy (Okonkwo et al., 2020). Nigeria can learn from these models by restructuring its science education system to be more research-intensive, industry-responsive and innovation-oriented. However, the current disconnect between academia and industry in Nigeria hampers the translation of scientific knowledge into industrial applications.

Another issue is the limited infrastructure for research and development (R&D) in Nigerian educational institutions. Despite policies such as the National Science, Technology and

Innovation Policy (NSTIP), implementation has been weak due to inadequate funding and poor institutional coordination (Uche et al., 2022). Science education must be supported by strong R&D ecosystems, laboratories, science parks, and innovation hubs that facilitate the transition from research to product development. To move forward, Nigeria must encourage public-private partnerships, incentivize investment in scientific research and establish platforms for collaboration between tertiary institutions and industries. By doing so, science education can become a transformative force that drives technological advancement and catalyzes sustainable industrial growth in Nigeria in the 21st century. In our opinion this can lead to the fabrication of local machinery for our agricultural and manufacturing industries, thereby reducing importation of machineries from China and European countries, increasing naira value and GDP.

Contributions of Science Education to Economic Development

Some of the notable contributions of science education to the economic growth and development of Nigerian economic includes:

Technological Advancement and Industrialization: Science education nurtures the foundation for innovation and technology, leading to industrialization and improved productivity. Graduates in science, engineering, mathematics and technology fields are essential for powering Nigeria's aspirations in sectors such as manufacturing, ICT, agriculture and healthcare (Okebukola, 2020).

Job Creation and Skills Development: Equipping students with scientific knowledge and hands-on skills enhances their employability and entrepreneurial potential. Technical and vocational science education fosters creativity, problem-solving, and self-reliance vital for reducing unemployment and underemployment in Nigeria. This will go a long way in reducing the level of youth unemployment in the Nigerian society which is made up of over 45 % youth population. Furthermore, in the opinion of the researchers, this singular act will positively increase Nigerian gross domestic products (GDP) especially when these teeming youth population are made to be productive via science education both through formal and informal methods.

Research and Innovation for Sustainable Development: Research and development (R&D), underpinned by science education, contribute to solving local problems. In agriculture, health, energy and climate change, science-based innovations can improve efficiency, reduce costs and support environmentally sustainable practices.

Science Education and Economic Diversification in Nigeria

Economic diversification involves the process of shifting an economy from a single or narrow revenue base to multiple productive sectors, this becomes essential for Nigeria's sustainable growth in the 21st century. For decades, Nigeria has been over-dependent on crude oil, making the economy vulnerable to global oil price shocks. Science education offers a strategic avenue to diversify the Nigerian economy by empowering the workforce with scientific knowledge, innovative skills, creative thinking and technical competencies needed across various sectors such as agriculture, manufacturing, information technology, renewable energy and healthcare.

Science education fosters human capital development, which is the cornerstone of economic diversification. By equipping learners with problem-solving skills, critical thinking abilities and

scientific literacy, it enables the workforce to adapt to emerging sectors and technologies. As noted by Adegbite et al., (2020), science-based education enhances productivity and innovation in non-oil sectors, thereby expanding economic opportunities. For instance, modern agricultural practices, such as precision farming, biotechnology and irrigation technologies, rely heavily on scientific training and research. These often leads to the development of local, indigenous knowledge and technological know-how, that are adapted the local environment and their peculiar needs and problems and their corresponding solutions (Okebukola, 2020).

The Nigerian government, through policy instruments like the Economic Recovery and Growth Plan (ERGP) and Vision 2050, has emphasized the need for diversifying into agriculture, solid minerals and manufacturing. However, the success of these policies is contingent upon a robust science education system that aligns with industry demands (Salihu & Danjuma, 2021). Universities and research institutions must be empowered to conduct applied research that supports local industries, while vocational science education can provide immediate technical manpower to the real sector. Moreover, science education can enhance Nigeria's competitiveness in the digital economy. Fields such as artificial intelligence, data science, robotics and green technologies are rapidly growing and require a science-literate population. According to Adediran et al. (2021), integrating digital literacy and coding into science curricula at all levels of education will prepare Nigerians for new economic frontiers and reduce youth unemployment. Despite its potential, the contribution of science education to economic diversification remains underutilized due to systemic challenges. These include outdated curricula, a weak science-industry linkage, low research funding and a lack of entrepreneurial integration into science education programs (Ogunyemi & Olagunju, 2022). Addressing these issues requires comprehensive reforms in the educational system to emphasize interdisciplinary learning, innovation incubation, and skill-based science teaching.

However, science education is indispensable to Nigeria's journey toward a diversified and resilient economy. By leveraging science to build capacities in agriculture, ICT, energy, and industrial production, Nigeria can reduce its dependence on oil, improve its global competitiveness, and achieve inclusive economic growth.

Science Education and Nigeria in Attainment of Sustainable Development Goals (SDGs)
Science education is directly linked to several SDGs particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). By strengthening science education, Nigeria positions itself to meet these goals, reduce poverty and build a resilient economy.

Case Studies: Global Best Practices
Countries like South Korea, Singapore, and China have demonstrated how investments in science and technology education lead to rapid economic development. These nations aligned their educational policies with national industrial strategies and created innovation ecosystems supported by strong educational institutions.

Challenges Facing Science Education in Contributing to Nigerian Economic Development
Omoogun & Onasanya, (2021) stated that despite its potential, science education in Nigeria faces multiple barriers:

i. **Inadequate Infrastructure**: Laboratories, equipment, and instructional materials are lacking in many schools.
ii. **Poor Teacher Training**: Many science educators are poorly trained and under-motivated.
iii. **Funding Deficits**: Investment in science education is inadequate relative to global benchmarks.

Weak Industry-Academic Linkages: There is minimal collaboration between educational institutions and the productive sectors of the Nigerian economy. Despite its recognized potential, science education in Nigeria faces numerous challenges that hinder its full contribution to national economic development (Obi, 2019). These challenges span infrastructural, pedagogical, policy, and institutional dimensions (Okebukola, 2020). They limit the ability of science education to foster innovation, drive industrialization and support economic diversification efforts in the 21st century.

One of the most pervasive issues is inadequate infrastructure. Many science laboratories in primary, secondary, and tertiary institutions are ill-equipped or completely non-functional. According to Ezeudu et al. (2020), over 60% of science classrooms in public schools lack basic laboratory materials, making it difficult to teach science through practical, inquiry-based approaches. This lack of infrastructure undermines experiential learning, which is critical for scientific understanding and innovation (Omoogun & Onasanya, 2021).

Another major challenge is the shortage of qualified science teachers. The supply of trained and competent science educators remains far below national demand. Many existing teachers lack up-to-date training in both content and pedagogy. Ilesanmi and Oladejo (2021) found that science teachers in Nigerian secondary schools often rely on rote teaching methods due to a lack of continuous professional development. This hampers students' engagement, creativity and ability to apply scientific knowledge to solve real-world problems.

The curriculum content also poses a significant barrier. It is often outdated and misaligned with contemporary global science and technological trends. Adebisi and Ayoola (2022) argue that the current science curriculum does not adequately integrate emerging disciplines like artificial intelligence, environmental science and biotechnology, thus failing to prepare students for the demands of the digital and green economies. Furthermore, entrepreneurship education is rarely embedded into science curricula, limiting graduates' ability to transform knowledge into business ventures.

Low investment in research and development (R&D) is another critical concern. The funding allocated to R&D in Nigeria is far below UNESCO's recommended 1% of GDP. According to the National Bureau of Statistics (NBS, 2021), Nigeria spends only about 0.13% of its GDP on scientific research. This underfunding restricts innovation, discourages academic research, and weakens the link between science education and national productivity.

Lastly, the disconnect between academia and industry continues to hinder the practical application of scientific knowledge. There is minimal collaboration between educational institutions and industries in Nigeria, resulting in science graduates who are ill-prepared for the labor market (Ofoegbu & Iroha, 2019). The absence of internships, research partnerships, and

curriculum co-design with industry stakeholders widens the gap between classroom learning and economic realities. In sum, addressing these systemic challenges is critical for repositioning science education as a catalyst for Nigeria's economic transformation. Strategic interventions including infrastructure upgrades, teacher training, curriculum reform, increased R&D funding and strengthened industry-academic linkages are urgently needed to unlock the full potential of science education.

Policy Recommendations for Strengthening Science Education to Support Nigeria's 21st Century Economy

To harness science education for economic development, strategic reforms are necessary:

i. **Curriculum Reform**: Integrate entrepreneurial and digital literacy into science curricula.
ii. **Teacher Capacity Building**: Enhance training programs and provide continuous professional development.
iii. **Public-Private Partnerships (PPPs)**: Engage industries in curriculum development, internships, and research funding.
iv. **Research Commercialization**: Promote the transformation of research outputs into marketable products and services.

To reposition science education as a driver of economic growth and sustainable development in Nigeria, urgent and strategic policy interventions are necessary. The 21st-century economy is characterized by rapid technological innovation, digitization, and an increased demand for a scientifically literate and skilled workforce. Therefore, educational policies must be tailored toward fostering a robust science education ecosystem that is responsive to national development goals and global trends.

Curriculum Reform for Relevance and Innovation: The existing science curricula at all levels must be revised to reflect emerging global challenges and opportunities. Courses on climate change, artificial intelligence, robotics, biotechnology, renewable energy, and digital literacy should be integrated into the science education framework. According to Akintunde and Ezenwa (2022), aligning science curricula with the demands of the Fourth Industrial Revolution (4IR) will enhance students' preparedness for the knowledge economy and foster innovation.

Investment in Science Education Infrastructure: Effective science teaching requires functional laboratories, modern equipment, internet access, and multimedia teaching tools. The government should increase budgetary allocation to education, ensuring that a significant portion is channeled into upgrading science facilities in public institutions. Olatunji and Bamidele (2021) emphasize that infrastructure investment is key to bridging the quality gap between public and private schools and improving learning outcomes in science disciplines.

Teacher Training and Professional Development:
Policies should mandate regular capacity building for science teachers through workshops, scholarships, and certification programs. Training should cover both content mastery and innovative pedagogical approaches such as inquiry-based learning and ICT integration. As highlighted by Okoye et al. (2020), empowering teachers enhances the quality of instruction and contributes to students' interest and performance in science (Olatunji and Bamidele, 2020).

Strengthening Research and University-Industry Linkages:
The government must increase funding for research and development (R&D), particularly in science and technology. Tax incentives and research grants should be provided to encourage private sector participation in educational R&D. Building research clusters and innovation hubs within universities can promote collaboration between academia and industries. This linkage enhances the relevance of research and ensures that scientific outputs contribute directly to national productivity (Akinwale & Ogundari, 2021).

Establishing National Science Education Policy Framework:
A comprehensive National Science Education Policy (NSEP) should be developed to coordinate all science-related educational activities and initiatives across ministries, agencies, and institutions. This policy would set national goals, define standards, promote inclusivity (e.g., gender in STEM), and guide monitoring and evaluation mechanisms. According to Abubakar and Hassan (2019), policy coherence and continuity are essential for achieving sustainable outcomes in science education. In conclusion, strengthening science education in Nigeria requires a holistic and sustained policy approach involving curriculum reform, infrastructure development, teacher empowerment, R&D funding, and institutional collaboration. With the right policies in place, science education can serve as a catalyst for innovation, industrialization, and inclusive economic development in Nigeria.

Bridging Global Trends and Local Realities in Nigerian Science Education
As nations worldwide increasingly adopt innovation-driven policies and prioritize science, technology, engineering, and mathematics (STEM) in their educational systems, Nigeria must not lag behind (Aina, 2023). Global economies such as Finland, South Korea and Singapore have consistently demonstrated that the strategic deployment of science education enhances technological independence and competitiveness (Ajayi, 2020). These countries have integrated inquiry-based, learner-centered science instruction with robust national policies, thereby achieving sustained economic growth.

In contrast, Nigeria grapples with context-specific challenges such as political instability, inconsistent education funding, poor governance, and policy discontinuities, which obstruct the translation of science education into national prosperity. However, these challenges are not insurmountable. Nigeria's rich human capital, youthful population, and growing access to digital technologies offer untapped opportunities for transformative reforms. By adapting global best practices to its peculiar socio-economic realities, Nigeria can strengthen its science education system to become a catalyst for innovation-led growth. To achieve this, three elements must align: curriculum transformation, systemic accountability, and policy harmonization. First, science education must evolve from theoretical emphasis to competency-based, interdisciplinary, and problem-solving approaches that reflect 21st-century realities. Second, education stakeholders must implement rigorous monitoring and evaluation frameworks to ensure quality control across science teaching and learning environments. Finally, the federal and state ministries of education, science, and labor must harmonize policies to ensure coherence between educational outcomes and labor market demands.

According to Nwankwo and Igwe (2019), a science education system that supports local innovation ecosystems can bridge the gap between scientific discovery and industrial application, thereby

promoting inclusive economic growth. Aligning local knowledge with global science also ensures cultural relevance and encourages indigenous innovation a key strategy for building self-reliant economies. Therefore, the future of Nigeria's economic sustainability lies in its ability to fuse global scientific advancements with local entrepreneurial, environmental, and technological imperatives (Aina, 2023).

Enhancing Science Education through Inclusive and Sustainable Practices in Nigeria

To ensure science education contributes meaningfully to economic development, inclusivity and sustainability must be at the core of its policies and implementation strategies. Inclusive science education ensures that all segments of society regardless of gender, socio-economic background, or disability status have equitable access to quality science learning opportunities. Meanwhile, sustainable practices promote long-term educational quality and relevance by fostering environmental consciousness, interdisciplinary learning, and social responsibility among learners.

Gender inclusivity remains a key concern in Nigerian science education. Despite policies promoting female participation in STEM, gender disparities persist. According to UNESCO (2020), women make up less than 30% of science researchers in Nigeria, reflecting systemic inequalities in access, retention, and progression. Overcoming these disparities requires deliberate interventions such as mentorship programs, STEM clubs for girls, and scholarship schemes targeting female science students.

Socioeconomic exclusion also limits the reach of science education. In rural and underserved communities, schools are often under-resourced, and students lack exposure to practical science due to the absence of laboratories, equipments, or qualified teachers. Implementing mobile science laboratories and leveraging technology-enhanced learning like virtual labs and open-access educational resources can bridge these gaps (Aina, 2019).

Sustainability in science education involves integrating environmental education, green technology, and social ethics into curricula. As Nigeria faces ecological challenges like deforestation, desertification, and pollution, science education must address the nexus between science, sustainability, and development. Teaching climate change, renewable energy, waste management, and environmental justice can empower students to become agents of change (Nnaji & Ekwe, 2020).

Furthermore, indigenous knowledge systems (IKS) should be incorporated into science teaching. Nigeria's diverse cultures have longstanding empirical knowledge in agriculture, medicine, and environmental conservation. Blending indigenous knowledge with modern scientific thinking promotes cultural relevance and enhances student engagement (Olaniyi & Ajayi, 2019).

The teacher is central to delivering inclusive and sustainable science education. Thus, continuous capacity building should cover inclusive pedagogies, universal design for learning (UDL), and education for sustainable development (ESD). Teachers trained in these areas are more equipped to reach diverse learners and prepare them for a future defined by global interdependence and environmental sensitivity.

In essence, integrating inclusive and sustainable practices into Nigeria's science education system not only promotes social justice and equity but also ensures that science education remains relevant, impactful, and capable of addressing present and future developmental challenges.

Conclusion

The paper critically examined science education as a key driver for economic development and sustainability in Nigeria in the 21st century. Through the exploration of its role in technological innovation, industrialization, and economic diversification, the study established that science education serves not merely as an academic pursuit but as a strategic instrument for national transformation.

Science education in Nigeria is currently hindered by multifaceted challenges ranging from infrastructural inadequacies and poor teacher preparation to weak research systems and limited industry collaboration. These systemic issues impede the nation's ability to leverage scientific knowledge for productivity, innovation, and competitive global participation.

Nonetheless, science education holds tremendous promise for Nigeria's economic future. If strengthened through appropriate policy frameworks, investment in infrastructure and research, inclusive practices, and sustainability-centered curricula, it can empower a new generation of scientists, technologists, and entrepreneurs who will drive the nation's development agenda. Moreover, science education can serve as a critical enabler for achieving Nigeria's Vision 2050 and several Sustainable Development Goals (SDGs), particularly those related to education, innovation, industry, employment, and climate action. Ultimately, science education should be seen not just as a sectoral concern of the education ministry but as a national priority that requires the concerted efforts of government, academia, industry, civil society, and international partners.

Recommendations

Through these strategic reforms, Nigeria can harness the full potential of science education to drive economic development, global competitiveness, and long-term national sustainability. Based on our analysis presented in this paper, the following recommendations are proposed:

i. **Comprehensive Curriculum Reform:** Revise science curricula at all educational levels to integrate emerging global disciplines such as artificial intelligence, green technology, robotics, and climate science. Practical, interdisciplinary, and entrepreneurial learning should be emphasized to align scientific knowledge with national development goals (Ajayi, 2020).
ii. **Substantial Investment in Science Education Infrastructure:** Federal and state governments must allocate at least 15–20% of the education budget to science infrastructure including laboratories, science parks, and ICT facilities. This investment must be accompanied by performance benchmarks and audits to ensure accountability. Government and private sector should significantly increase investment in science education infrastructure including laboratories, digital tools, and research facilities to provide an enabling learning environment across all educational levels.
iii. **Teacher Development and Motivation:** Continuous professional development programs should be implemented to train teachers in 21st-century pedagogies, digital teaching tools, and inclusive education. Science teachers should also be incentivized through better welfare and recognition programs. Establish national science teacher

academies to provide regular training, certification and incentives. Teachers should be exposed to global pedagogical practices, ICT tools and research methodologies to enhance classroom effectiveness.

iv. **Strengthened Industry-Education Linkages:** Develop policy frameworks that mandate collaboration between industries and educational institutions through internships, research funding, joint curriculum design, and innovation incubators. This ensures that scientific knowledge is market-relevant and solutions-oriented.

v. **Increased R&D Funding and Commercialization of Innovation:** Nigeria should raise R&D funding to at least 1% of GDP as recommended by UNESCO (2022) Policies should support the commercialization of research outputs and intellectual property developed within educational institutions.

vi. **Creation of a National Science Education Policy (NSEP):** A unified policy must be enacted to coordinate all science-related education activities across ministries, ensuring clarity in objectives, coherence in strategies, and alignment with the National Economic Development Plan. A standalone science education policy should be developed to harmonize existing interventions, guide innovation, and ensure coordination among stakeholders, including ministries, regulatory agencies, industries, and donors.

vii. **Integration of Indigenous Knowledge Systems:** Science education should incorporate indigenous practices and local technologies to promote cultural relevance and innovation in local contexts, especially in agriculture and traditional medicine.

viii. **Industry-Academia Collaboration:** Establish strong partnerships between educational institutions and industries to support curriculum co-development, internships, mentorships, and applied research, ensuring that science education is industry-relevant and job-market aligned.

ix. **Promotion of Inclusivity and Gender Equality in STEM**: Specific policies should support the participation of girls, rural learners, and persons with disabilities in science education through targeted scholarships, inclusive pedagogy, and community-based outreach programs.

x. **Strengthening Research and Innovation Ecosystems:** Encourage the establishment of science parks, innovation hubs, and incubation centers in universities and polytechnics to promote local R&D, product development, and commercialization of innovations.

xi. **Curriculum Re-engineering for Relevance and Skills:** Science curricula should be revised periodically to include emerging scientific fields, digital skills, sustainability education, and entrepreneurial competencies. This will make science education more relevant to industry needs and national development goals.

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EFFECT OF LAND SLOPE ON SOIL EROSION USING SOIL BIN

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Abstract

The study investigates the effect of land slope on soil erosion using soil bin. The soil samples obtained from three study areas at different locations within the north-core area of the institution which were the loamy soil was collected near block D hostel, clay soil was collected behind the class rooms of the College of Agronomy and sandy soil was collected very close to the old Engineering Auditorium. Water used was obtained from the borehole located at block D hostel. The study was carried out at various slope gradients using sandy soil, clay soil and loamy soil as the runoff source material. From the results obtained revealed that the run off (soil + water) for the various slope percentage (0-9%) ranged from 0.5 to 17.8kg for sandy soil, 0.3 to 10.7kg for clay soil and 1.2 to 20.4kg for loamy soil respectively. The water used at each percentage slope reduces with time, due to high initial use of water absorbed by soil. However, the subsequent use reduces with time due to saturation. The runoff notably increased with increases in both the flow discharge and the slope gradient. However, Flow discharge in terms rainfall intensity effect on the same environmental soil and the parameters. High runoff was observed from the clay due to it less porosity of the soil. Higher slope influenced higher runoff therefore it is recommended that land preparations for crops cultivation should be at lesser slopes.

Keywords: *Soil erosion, Land slope, Soil bin, Runoff, Discharge*

Introduction

Soil erosion is one of the most severely environmental problems in the world (Zhanyu *et al*., 2015), as it directly causes soil and water losses and soil degradation (Johnson and Shuaibu,2021). Soil erosion and soil loss, according to Lal (1990) have adverse effects on agriculture because they deplete the soil's productivity and diminish the resource base (Tarolli *et al*, 2019). The physical process of soil erosion occurs in three main steps, detachment of soil particles, transportation and deposition of soil particles downslope by raindrop impact and runoff over the soil surface (Abdus, 2001; Lal 1990) followed by overland flow in entraining soil particles (Lal,1990). Soil erosion reduces soil productivity by physical loss of topsoil, reduction in rooting depth and loss of water. In contrast soil, soil depletion means loss or decline of soil fertility (Oostererbaan, 2020), due to crop removal or removal of nutrients by eluviation's from water passing through the soil profile (Lal, 1990). Sedimentation however, causes off site effects like degradation of basins (Peter, 2025), accumulation of silts in water reservoirs and burial of low-lying productive areas and other problems. Sediments is the main cause of pollution and eutrophication. According to Lal 1990, soil degradation may be caused by accelerated soil erosion, depletion through intensive land use (Johnson and Shuaibu, 2021), deterioration in soil structure, changes in soil pH, leaching, salt accumulation, (Muleta, 2024, Ashenafi and Bobe,2016) buildup of toxic elements such as aluminum or zinc, (Hailu *et al*,2019; Worku and Bedadi,2016) excessive inundation leading to reduced soil conditions and poor aeration. Researches indicate that the soil erosion process (Nada, andTijana,2020), is influenced by rainfall, overland flow, topography, and soil properties (Liu *et al*., 2015; Tao.*et al,2022*). As soil erosion by rainfall is highly dependent on flow hydraulic properties (flow velocity, flow regime and hydraulic resistance). These parameters are frequently used in predicting sediment concentration. Zhang *et al*., (2007), found a linear function between flow velocity and sediment transport (Lei *et al,2018)*. For a given shear stress, detachment rate by shallow flow is primarily associated with flow regime.

Defersha and Melesse (2012) studied the effects of slope gradient and rainfall intensity on sediment concentration with three soils (Eastern Ethiopia Alemaya Black soil, Regosols and Cambisols). Their results showed that sediment concentration and sediment yield varied with soil type, which had textures ranging from clay to sandy clay loam. Consideration for sandy, loamy and clay soils showing the overlying soil, underlying rock which is known as "the Geotechnical dual structure", subsurface flow is a prominent runoff process (Jourgholam.*et al,2021),* in these soil slopes. However, few studies have focused on this runoff process and the influence of the processes on sediment yielding process. Thus, it is necessary to analyze the hydrological processes and the associated erosional responses on the sandy, loamy and clay soil slopes. We hypothesized that the hydrological processes and the associated erosional responses on the sandy, loamy and clay soil slopes can be described in terms of the combination of distance, rainfall intensity and slope gradient.

Slope gradient has a stronger impact on sediment transport capacity than unit discharge and mean flow velocity, this is most likely due to the fact that the tangential component of the gravity force increases with slope gradient (Ali, *et al* 2012). According to Defersha and Melesse, (2012) and Wang *et al.,* (2015), in slope gradient and flow discharge increasing sediment yield rate. According to Feng *et al*., (2016), under conditions of low, moderate and high rainfall intensities, the sediment yield rates increase respectively, as the slope gradients increased from 5° to 20°. On the other hand, for the slope gradients of 5°, 10°, 15° and 20°, the sediment yield rates increased respectively, as the

rainfall intensities increases. This result showed that sediment yield rate was more sensitive to rainfall intensity changes than to slope gradient changes. Similarly, Ziadat and Taimeh (2013) reported that rainfall intensity was the most important factor affecting soil erosion (Sinha,2021; Wandra,2021), among rainfall intensity, slope gradient, land use and antecedent soil moisture. However, this result disagreed with Liu *et al*. (2015), who found that the sediment loss rate was more sensitive to changes in slope gradient than to changes in the rainfall intensity. This may be associated with the difference in soil type, simulated rainfall intensity and slope gradient. Defersha and Melesse (2012) and Fang *et al*. (2015) found that the effects of slope and rainfall intensity on runoff and soil loss varied with soil type.

Sandy, loamy and clay soil are the dominant soils in the Federal University of Agriculture Makurdi and environment. Many reasons, such as shallow and loose soil layers, improper land use, topography and numerous rainstorms, have caused serious soil erosion in the environment, which is a major environmental problem in Nigeria. Severe soil erosion can cause land degradation and ecological destruction (Jiadong *et al*,2020). Therefore, it is essential to understand the mechanisms of soil erosion process in order to accurately predict Sandy, loamy and clay soil loss and implement specific soil and water conservation measures. Sediment transport occurs in natural systems where the particles are clastic rocks (sand, gravel, boulders, etc.), mud, or clay; the fluid is air, water, or ice; and the force of gravity acts to move the particles along the sloping surface on which they are resting.

The objectives of this study measured and analyzed flow hydrodynamic parameters variation by water splash and runoff using soil bin, under varied slope gradients in sandy, clay and loamy soil; and to investigate mechanism of surface flow, relationship between sediment concentration and hydraulic parameters. The findings and data are useful for the maintenance and prevention of soil erosion mechanics.

Materials and Methods

2.1 Experimental Materials

For this study, a 1.0 m long, 0.3 m wide and 0.12m deep rectangular wooden flume with a wooden floor wall covered with an amino plastic web material to prevent leakage was constructed (Figure 1) (Plate1). The experiments were conducted on experimental flume at laboratory of soil and water engineering, Federal University Agriculture Makurdi, Benue State, Nigeria. Three soil samples (sandy, clay and loamy soil) were selected from within the environment as the main soil materials for the study.

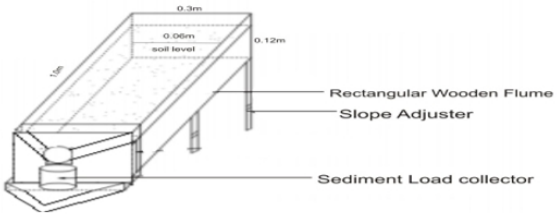

Figure 1: Experimental setup Apparatus

Plate 1: Constructed Soil Bin

2.2 Simulation of the Experiment

In order to minimize the difference among treatments, each soil sample were compacted in the rectangular flume prior to each experiment, the test section was filled with a 0.06m thick layer of the selected soil and saturated with water at field capacity (gravimetrically) for all the treatments as shown in Plate 2. At the beginning of simulation, water was gradually poured through the gradient gently at slope of 0 – 9% , giving a range equivalents of 0°- 30.96°. As the flowing water erodes and transport the sediments, the mixture (sediment + water) were collected downwards using Sediment load collector, at each slope angle and selected soil sample (Plate 2). The simulation was repeated three times to ensure the results and the mean were taken. Runoff samples with sediment were allowed to settled and separated from the water. The sediment was oven-dried at 105°C for more than 8 hours, before it was weighed to ascertain the sediment load in kilograms.

Plate 2: Simulation of Different Types of soil Samples.

The experiment was repeated using a different approach with different soil samples from different soil sites. This approach used four slope gradients (5°, 10°, 15° and 20°), which serves as representative of main slope gradients in the environment. Standard procedures were maintained.

Water was equally poured through the gradient gently at varying slopes of 5°, 10°, 15° and 20°. Standard procedures were equally followed to collect the flowing water and transported sediment, and oven dried before measurement were done in kilograms.

Result and Discussion

3.1 Results

The effects of run off caused by various land slopes on the initial experiment where percentage slopes were used on gradients are presented in Tables 1-3, representing the sandy soil, clay and loamy soils respectively.

The results from the second approach using slope gradients in degrees (°) are presented in Tables 4 -5.

Table 1: Hydraulic Sediment on Slope Erosion from Sandy Soil

Slope %	Slope angle (°)	Time taken (min)	Water used (L)	Run off (Soil + water) (kg)	Soil loss (kg)	Water displaced (L)	Water absorbed by the bin (L)
0	0	5.30	96.20	0.5	0.2	170	96.03
1	3.8	4.38	86	1	0.7	280	85.72
2	7.5	4.10	71.4	2.4	1.2	320	71.08
3	11.3	3.63	51	3.2	2.4	390	50.61
4	14.9	3.40	43	3.4	2.7	430	42.57
5	18.4	3.10	31	4.4	4	580	30.42
6	21.8	2.80	28	5	4.7	780	27.22
7	25.0	2.2	21.20	7	5.3	970	20.23
8	28.1	1.56	15.1	13.3	7.4	1800	13.30
9	30.96	0.57	9.70	17.8	11.4	2100	7.60

Table 2. Hydraulic Sediment on Slope Erosion from Clay Soil

Slope %	Slope angle (°C)	Time taken (min)	Water used (L)	Run off (soil+water) (kg)	Soil loss (kg)	Water displaced (L)	Water absorbed by Bin(L)
0	0	1.5	15.3	0.3	0.1	0.21	15.09
1	3.8	0.58	10.3	0.5	0.4	0.29	10.01
2	7.5	0.48	7.8	0.9	0.5	0.35	7.45
3	11.3	0.41	6.90	2.4	1.3	0.68	6.22
4	14.9	0.37	6.0	2.8	2.5	0.71	5.29
5	18.4	0.35	5.8	4.1	2.7	0.83	4.97
6	21.8	0.33	5.4	5.7	4.4	1.10	4.30
7	25.0	0.31	5.2	7.4	5.2	1.20	4.00
8	28.1	0.28	4.8	8.8	7	1.50	3.30
9	30.96	0.25	4.1	10.7	8.1	2.10	2.00

Table 3: Hydraulic Sediment on Slope Erosion from Loamy Soil

Slope %	Slope angle (°C)	Time taken (min)	Water used (L)	Run off (soil+water) (kg)	Soil loss (kg)	Water displaced (L)	Water absorbed by Bin(L)
0	0	1.48	19.3	1.2	0.7	0.45	18.88
1	3.8	1.10	16.1	1.8	1.2	0.62	15.48
2	7.5	0.56	14.1	2.4	1.9	0.63	13.47
3	11.3	0.49	11.3	3.3	2.5	0.80	10.5
4	14.9	0.43	10.4	4.8	3.2	0.95	9.45
5	18.4	0.38	8.9	5.5	4.1	1.20	7.70
6	21.8	0.32	8.2	6.8	4.7	1.28	6.92
7	25.0	0.29	7.8	9.0	5.8	1.37	6.43
8	28.1	0.27	7.1	13.9	9.9	1.46	5.64
9	30.96	0.23	6.5	20.4	17.0	1.83	4.67

Table 4: Hydraulic Sediment on Slope Erosion (2nd Experiment)

Angle in degree	Sediment loads		
	Sandy soil(g)	Clay soil (g)	loamy soil (g)
5	6.6	2.9	1.4
10	18.7	10	5.8
15	140.7	15.3	30.4
20	228.3	9.8	43.2

Table 5: Sediment Yield as the Slope Gradients Increased(2nd Experiment)

Angles in degree (°)	Sediment loads					
	Sandy soil(g)	Sandy soil sediment increase(g)	Clay soil (g)	Clay soil sediment increase (g)	loamy soil (g)	loamy soil sediment increase(g)
0 - 5	6.6	6.6	2.9	2.9	1.4	14.4
5 - 10	18.7	12.1	10	7.1	5.8	4.4
10 - 15	140.7	122.0	15.3	5.3	30.4	24.6
15 - 20	228.3	87.6	9.8	-5.5	43.2	12.8

Figure 2: Sediment load of sandy, clay and loamy soils for different slope gradients

3.2 Discussion

Initial Experiment: From the experimental results of the three soil samples (clay, sandy and loamy) (Table 1, 2 and 3) respectfully. Run off (soil + water) for the various slope percentages (0-9%) ranged from 0.5 to 17.8kg in sandy soil. Water use at each percentage slope reduces with time, this is because the high initial use of water (99.03L) was absorb by soil, hence subsequent use reduces with time due to saturation. The run off (soil + water) in clay soil for the various slope percentages (0-9%) ranged from 0.3 to 10.7kg (Table 2). Water use at each percentage slope reduces with time, the high initial use of water the (15.36L) was absorb by soil, hence subsequent use reduces due to saturation. The run off (soil + water) in loamy soil ranged from 1.2 to 20.4kg (Table 3). High initial use of water (18.88L) was absorbed by soil, hence subsequent use reduces with time due to saturation. The variation in water runoff is indicated as shown in graphs (Figures 2, 3 and 4). The soil loss and water displaced increased with respect to the change in slope. The water absorbed by the soil bin reduces as the change in slope increases.

The measured runoff capacity for the selected Sandy, Clay and loamy soils at distance of one meter in ten seconds on four slope gradients (0°, 3.8°, 7.5°, 11.3°, 14.9°, 18.4°, 21.8°, 25.0°, 28.1°, and 30.96°) are given in Table 1-3. The graph of runoff load of the three soils against the gradient is shown in figures 1, 2 and 3. Soil erosion is a process of detachment and transportation of soil materials(Jourgholam *et al,* 2021), by erosive agents (here water), there was significant difference in the runoff yield rate among different slope gradients (Table 1-3), runoff yield rates(Nang *et al,*2024),increased with increases in both rainfall intensity and slope gradient (Figure2 - 4).

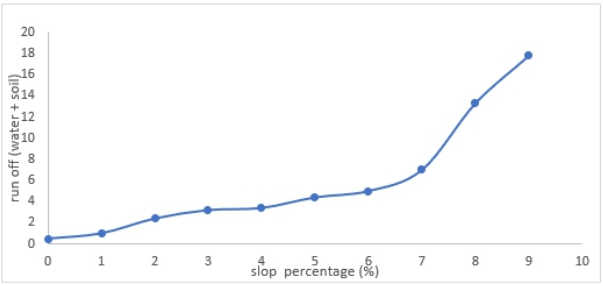

Figure 2: Increase in runoff against slope gradient on sandy soil

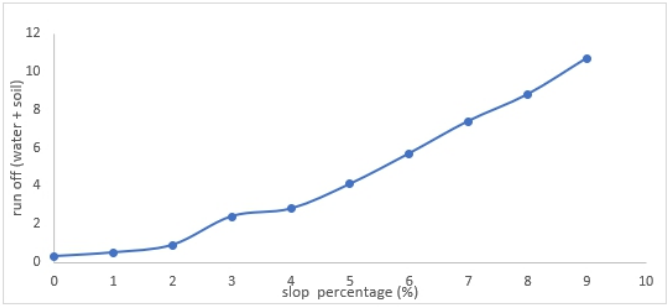

Figure 3: Increase in runoff against slope gradient on clay soil

The runoff rates increased by 0.5, 1.0, 2.4, 3.2, 3.4, 4.4, 5.0, 7.0, 13.3 and 17.8kg in sandy soil; 0.3, 0.5, 0.9, 2.4, 2.8, 4.1, 5.7, 7.4, 8.8 and 10.7kg in clay soil and 1.2, 1.8, 2.4, 3.3, 4.8, 5.5, 6.8, 9.0, 13.9 and 20.4kg in loamy soil respectively, as the slope gradients increased from 0°, 1.8°, 7.5°, 11.3°, 14.9°, 18.4°, 21.8°, 25.0°, 28.1°, and 30.96° respectively(Table 1- 3).

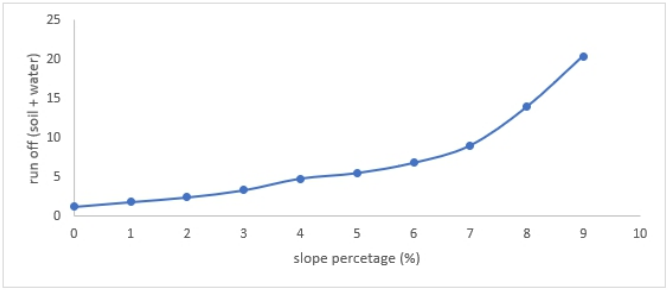

Figure 4: Increase in runoff against slope gradient on loamy soil

Second Experiment: The measured sediment transport load for the selected Sandy, Clay and loamy soils at distance of one meter in ten seconds on four slope gradients (5°, 10°,15° and 20°) are as shown in Table 4. The graph of sediment transport load of the three soils against the gradient is shown in Figure 5.

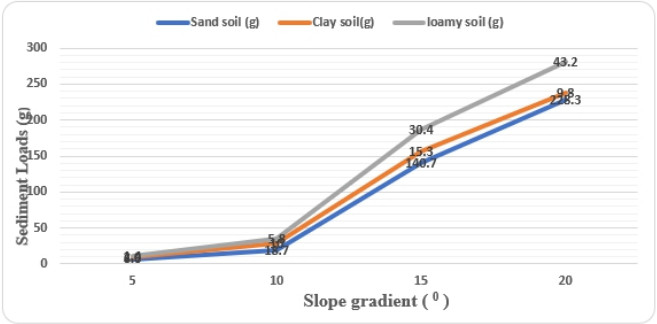

Figure 5: Sediment transport load of the three soils against slope gradient

Soil erosion is a process of detachment and transportation of soil materials by erosive agents (here water). There was significant difference in the sediment yield rate among different slope gradients

(Table 4). Sediment yield rates increased with increases in both rainfall intensity and slope gradient (Figure 5). This pattern accorded with other studies (Defersha and Melesse, 2012; Wang *et al.,* 2015; Zhang *et al.*, 2002) in slope gradient and flow discharge increasing sediment yield rate(Bingyi and Xinrong, 2022). The sediment yield rates increased by 6.6, 12.1, 122.0 and 87.6 in sandy soil, 2.9, 7.1, 5.3 and – 5.5 in clay soil and 1.4, 4.4, 24.6, and 12.8 in loamy soil respectively, as the slope gradients increased from 5°, 10°, 15° and 20° (Table 5).

Conclusion

This study investigated the sediment transport capacity of flows within artificial rill channels at various slope gradients using sandy soil, clay soil and loamy soil as the sediment source material. Sediment transport load notably increased with increases in both the flow discharge and the slope gradient. However, Flow discharge in terms of rainfall intensity effect on the same environmental soil and the parameters.

By comparison, predicting sediment transport capacity resulted in a poor fit, implying that sediment transport capacity requires verification even though several previous models have been developed. Sediment transport capacity under these conditions could thus be accurately predicted by the derived empirical relationship with flow discharge and slope gradient or by the relationship with flow velocity. The differences between the relationships determined by this study and those of other studies can be attributed to the use of a non-erodible bed and soil as the sediment source and to rill width and the ranges of flow discharge and slope gradient.

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NATIONAL AGENCY FOR FOOD AND DRUG ADMINISTRATION AND CONTROL AND THE CHALLENGES OF NARCOTICS DRUG CONTROL IN NIGERIA, 2013-2023

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Abstract

The increasing level of fake and counterfeit drugs as well as the prevalence of narcotics drugs in Nigeria, which has impacted negatively on the lives of Nigerians since 2011 has been a major source of concern. The illegal importation, smuggling, merchandize, and use of narcotics drugs have not just constituted physical, psychological, economic, and biological harm to its victims, they have overtime crippled the effectiveness and productivity of the consumers. This has further resulted in the proliferation of psychiatric hospitals in the country, increased number of deaths, among others. Extant literature shows that while scholars have examined how variables like border porosity, effective intelligence sharing among smugglers among others have engendered the illegal importation of narcotics drugs in Nigeria, there has not been any systematic scholarly effort directed at exploring the nexus between the institutional and operational weaknesses of NAFDAC and the control of narcotics drugs. The study adopted the social network theory and the time series as theoretical framework and research design, respectively. Similarly, the documentary and qualitative methods were respectively adopted for data collection and analysis. The study found that both the regulatory control strategies and the establishment of the NCS directorate by NAFDAC have neither reduced the importation and smuggling of narcotic drugs into Nigeria nor reduced the incidence of drug abuses in Nigeria. The study therefore recommends a review of the subsisting strategies adopted by NAFDAC in the fight against illegal importation and use of narcotics drugs in Nigeria.

Keywords: *NAFDAC, Illegal importation, Smuggling, Social Network Theory, Narcotics Drugs.*

Introduction

The proliferation of counterfeit and fake drugs in Nigeria has been a persistent public health challenge since the 1980s, with far-reaching implications for national and international health security. Osibo (1998) noted that during this period, there might have been more counterfeit drugs than genuine drugs in circulation in Nigeria. The gravity of this issue came to the forefront of public consciousness in 1989 when a tragic incident claimed the lives of between 109 and 150 children who consumed fake paracetamol syrup (Aluko, 1994; Lerer, 2006). This event not only highlighted the dire consequences of substandard pharmaceuticals but also significantly tarnished Nigeria's international reputation, prompting neighboring countries like Ghana and Sierra Leone to ban the import of Nigerian-manufactured food and drug products. In response to this crisis and mounting public pressure, the Nigerian government enacted the Counterfeit and Fake Drug (Miscellaneous Provisions) Decree No. 21 of 1988, which aimed to prohibit the sale and distribution of counterfeit, adulterated, banned, and fake drugs (Akinyandenu, 2013). This legislative action laid the groundwork for the establishment of the National Agency for Food and Drug Administration and Control (NAFDAC) in 1993. Inspired by a 1988 World Health Assembly resolution, NAFDAC was tasked with the critical mission of creating a fake drug-free environment and ensuring effective registration of good quality drugs (NAFDAC Consumer Safety, 2003; Ikhilae, 2016).

Since its inception, NAFDAC has been at the forefront of efforts to combat the proliferation of fake drugs and ensure the quality of pharmaceuticals in Nigeria. The agency's mandate encompasses a wide range of responsibilities, including conducting product tests, inspecting production facilities, registering regulated products, and controlling imports and exports (NAFDAC, 2017). In executing these duties, NAFDAC collaborates with other governmental bodies such as the National Drug Law Enforcement Agency, forming a multi-agency approach to drug control and regulation.

However, despite nearly three decades of concerted efforts, the efficacy of NAFDAC's regulatory strategies and Nigeria's broader narcotic prohibition policy has come under scrutiny. Critics argue that the country's approach to drug control has been underpinned by an ideologically-driven demonization of narcotics, leading to a criminal prohibition policy that resists rational analysis and reform (Bewley-Taylor & Jelsma, 2012; Crick, 2012). Some scholars contend that Nigeria's aggressive enforcement stance is motivated more by a desire to maintain a favorable international image and secure U.S. counter-narcotics aid than by evidence-based public health considerations (Csete & Sanchez, 2013; Klantschnig, 2015).

The challenges facing NAFDAC's regulatory efforts are multifaceted and complex. Corruption within the system has allowed for the circumvention of controls, while a lack of coordination between government entities has created gaps in enforcement (Agbo & Gwom, 2021). The rapid expansion of online commerce has further complicated regulatory efforts, providing new avenues for the distribution of counterfeit and illicit drugs. Additionally, the high cost of legitimate pharmaceuticals has inadvertently fueled the market for cheaper, often substandard alternatives (Chiwendu, 2008; Lambo, 2006). Alarmingly, despite the implementation of prohibition and eradication strategies, the use, production, and trafficking of narcotic drugs in Nigeria have continued to rise. United Nations Office on Drug and Crime (UNODC) data from 2018 revealed that approximately one in seven Nigerians aged 15-64 had used illegal substances in the previous year, underscoring the persistent nature of the problem.

Scholars have examined various aspects of Nigeria's narcotic drug problem, with researchers like Akinyandenu (2013), Foreman (2014), and Iwokwagh (2013) highlighting the dangers of excessive drug consumption, particularly among Nigerian youth. Bewley-Taylor and Jelsma (2012) criticized the ineffectiveness of Nigeria's narcotic prohibition policy, while Jelsma (2010) and Wodak (2007) noted that coercive implementation patterns have hindered policy success. NAFDAC faces several challenges in its efforts to control narcotic drugs, including corruption, which remains a significant roadblock to progress. Institutional deficits also pose problems, with Finlay (2011) identifying inadequate monitoring mechanisms and Agbo and Gwom (2021) pointing out lack of coordination among government entities. Market forces contribute to the issue, as high costs of legitimate drugs have led to counterfeit proliferation (Chiwendu, 2008; Lambo, 2006). Additionally, technological challenges such as the expansion of online commerce have complicated regulatory efforts (Agbo & Gwom, 2021). While previous studies have explored socioeconomic impacts of drug abuse and policy implementation challenges, there remains a significant gap in understanding the relationship between NAFDAC's regulatory strategies and the ongoing increase in drug importation and consumption in Nigeria. This knowledge gap in existing literature underscores the need for further research to comprehensively assess the effectiveness of NAFDAC's approach to narcotic drug control in the country.

Theoretical Framework

The study is grounded in Social Network Theory, which conceptualizes social connections as nodes and ties. Nodes represent individual players, while ties are the connections between them. This theory differs from traditional sociological research by emphasizing the importance of connections and linkages over individual characteristics (Claywell, 2020). Social network theory has been applied to various fields, including business interactions and informal relationships between CEOs. Scott (1991) identified three research traditions that contributed to the theory's early development: interpersonal relations, socio-metric analysis, and anthropology. The 1960s saw the consolidation of these traditions into a coherent theoretical framework, with researchers proposing methods like block modeling and multidimensional scaling.

Three fundamental network principles have structured research on network effects: centrality, cohesiveness, and structural equivalence. Freeman (1979) proposed three measurements for structural centrality: degree, closeness, and betweenness. This work inspired further research on how different types of network centrality interact with information flow. Borgatti (1997, 2005) developed a typology of flow processes and demonstrated how central position values depend on process properties. Network cohesiveness measures how interconnected nodes are within a network. Friedkin (1993) showed that more cohesive social networks have stronger personal influence. Structural equivalence describes network positions with similar connections to the rest of the network. Burt (1987) found that innovations were more likely to spread through structural equivalence than direct links, and later elaborated on these mechanisms to explain the role of opinion leaders in media effects (Burt, 1999).

Since the 1990s, network concepts have been widely applied in various research contexts. The field of medical research now focuses on how social networks impact the flow of media messages and their effects on audiences. Although communication research did not significantly influence the initial development of social network theory, there is a growing interaction between the two fields, largely due to the rise of computer-mediated communication.

The theory rests on three central assumptions:

i. Interactions are based on nodes and linkages within the network.
ii. Social relationships facilitate information spreading, influence channeling, and health behavior change.
iii. An actor's behavior and performance depend on its position and relationships in the network

The social network theory is fundamental to the inquiry into the nature of National Agency for Food and Drug Administration and Control (NAFDAC) and the control of narcotic drugs in Nigeria. The bourgeoning level of illegal importation and smuggling of narcotics drugs find expression on the first central thesis of the theory of Social network. For instance, 'Individuals or organizations interact based on the nodes and linkages they possess within the network' presents an overture suggesting that the incidence of increasing illegal importation and smuggling of narcotics drugs into Nigeria has been a function of the existence of the nodes (individuals of like-minds) and linkages (relationship) between the routes or network of common concern in the movement of narcotics drugs in Nigeria. The operations and activities of the nodes and linkages have continued to undermine the NAFDAC regulatory control strategies. Consequently, the movement of narcotic drugs in Nigeria has continued to thrive irrespective of the activities of NAFDAC and other sister agencies following the strong and formidable network of smugglers and actors within and outside Nigeria. Of course, the porosity of Nigerian borders has not helped in any way in ensuring that these illicit drugs pushed into Nigeria from other countries are restrained. The resultant effect of this menace has further facilitated the spreading and permeation of narcotic drugs into the Nigerian society, thereby making it accessible to anybody to make use of. This very act has facilitated drug abuses in Nigeria.

Furthermore, situation as we have it in literature about illegal importation and smuggling of narcotics drugs and the abuse of same could receive scholarly explanations via the instrumentality of the second central thesis of the theory, namely: that 'The social relationships facilitates the spreading of information, channeling of influence, and enabling of health behavior change within the network'. This implies that the continued existence and increasing level of illegal importation and smuggling of narcotics drugs into the country irrespective of the activities and operational mechanisms of NAFDAC could be traced to the presence of a strong intelligence and information sharing between and among the smuggling networks in and outside the country. This explains why NAFDAC in the myriads of their regulations and rules as to the control and use of narcotics drugs, has not been able to arrest the unfortunate incidences of illegal narcotic drug importation that has bedeviled the country. It is interesting to know that accompanying the large number of this intelligence, are some notable politicians and business persons who derive the bulk of their income from the importation and merchandise of narcotic drugs.

Methodology

The study employed the documentary method for data gathering, which is ideal for obtaining in-depth information and concept clarity. This technique focuses on depicting, decoding, and understanding meaning rather than frequency. It's particularly suitable for contextual analysis and extracting relevant information to make inferences from current evidence. The research relied on secondary data sources, including institutional and official documents from NAFDAC and other agencies involved in combating illegal drug importation and smuggling in Nigeria. Other sources

included conference papers, journal articles, and publications. Secondary data offers benefits such as cost-effectiveness and the ability to construct trends over time. Content analysis was used to examine the collected data. This method involves verbally summarizing the material gathered during the study process. Unlike quantitative analysis, qualitative content analysis is data-driven, with codes formed from the data during the research process. This approach aims to understand both visible and hidden content to identify patterns or regularities in the data. The content analysis method allows for deeper interpretation of the data, going beyond surface-level information. Tables were also utilized to clarify and illuminate the issues being discussed.

Controlled Medicine Regulation and Illicit Traffic of Cocaine into Nigeria

Controlled drugs are categorized into narcotics, psychotropic substances, and precursor compounds. These categories are crucial for establishing national policies for controlled medicines (Ashigbie, Azameti, & Wirtz, 2016). Narcotics, derived from opium and its derivatives, cannabis, and coca leaf plants, are regulated by the UN Single Convention on Narcotics. Psychotropic substances, which affect the central nervous system, are listed in the UN Convention on Psychotropic Drugs of 1971. Precursors are substances used in drug production but not typically found in the end product (World Health Organization, 2011).

The regulation of controlled medicines in Nigeria is based on three primary international agreements: The Single Convention on Narcotic Drugs of 1961 (and its 1972 Protocol), the Convention on Psychotropic Substances of 1971 (and its 1988 adoption), and the 1988 United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances. The International Narcotics Control Board (INCB) oversees the implementation of these conventions, ensuring adequate supplies for medical use while preventing diversion to illegal channels. In Nigeria, several laws and policies regulate controlled substances, including the National Drug Law Enforcement Agency Act, the National Drug Policy, the Dangerous Drug Act, and the Poison and Pharmacy Act (National Drug Policy, 2009). Key agencies involved in regulation and enforcement include the National Agency for Food and Drug Administration and Control (NAFDAC), the National Drug Law Enforcement Agency (NDLEA), and the Federal Ministry of Health (FMOH).

The NAFDAC is responsible for upholding laws and conventions that support access to restricted medications for medical and scientific purposes. This includes controlling the manufacture, distribution, storage, sales, and use of restricted medicines. The FMOH ensures that essential medications, including Schedule I narcotics, are adequately accessible and available for medical and research use (World Health Organization, 2011). Table 1 below presents a classification of controlled medicine as well as their degree of harmfulness and control.

Table 1: Controlled Medicine, Degree of Control and Harmfulness for Narcotic Drugs

S/N	Schedule	Harmfulness	Degree of control	Examples of listed drugs
1	I	Substances with a high potential for abuse and addictive qualities	Very strict: "All drug control measures applicable to substances under this Convention shall apply to the drugs in Schedule I." (art. 2.1)	Cocaine, heroin, marijuana, and its derivatives methadone, morphine, opium.
2	II	Substances with a low risk of addiction that are typically utilized for medical causes	Less rigid	Propiram, Dihydrocodeine, and codeine
3	III	Schedule II preparations of substances as well as cocaine preparations	Convenient; the World Health Organization states that there is no abuse risk with these preparations.	Codeine, Dihydrocodeine, and propiram preparations
4	IV	The most toxic substances, those already on Schedule I, that are exceedingly destructive and have very little therapeutic or medicinal value	Very rigorous, with the exception of any amounts that may be required for medical and scientific study, resulting in a complete ban on "the production, manufacture, export and import of, trade in, ownership of, or use of any such medication" (art. 2.5.b)	Heroin

Source: European Monitoring Centre for Drugs and Drug Addiction (2022).

The table above summarizes the categories of narcotics drugs as well as its degree of harmfulness and control, from a global context. The drugs mentioned above, however, exist in different countries, including, Nigeria. Similarly, the 1971 United Nations Convention on Psychotropic Chemicals established global regulation over psychotropic substances. Restricting the use of these chemicals to medical and scientific purposes is one of this Convention's goals (Articles 5 and 7). Although some psychotropic drugs may be therapeutically useful, they also carry a serious risk of abuse.

Table 2: Classification Controlled Medicine, Degree of Control and Harmfulness for Psychotropic Substances

S/N	Schedule	Harmfulness	Degree of control	Examples of listed drugs
1	I	substances with a high potential for abuse, a major hazard to the public's health, and little to no therapeutic value	Very rigorous; only permitted for limited medical or scientific purposes	Mescaline, psilocybin, tetrahydrocannabinol, LSD, MDMA (ecstasy), and mescaline
2	II	substances with a poor or moderate therapeutic value that are highly addictive and pose a major threat to the public's health	Less rigid	Amphetamines and stimulants of the amphetamine type
3	III	substances with a moderate to high therapeutic benefit but a significant potential for addiction and a serious hazard to public health	These chemicals are accessible for use in medicine.	Amobarbital and buprenorphine are examples of barbiturates.
4	IV	substances with a significant potential for addiction, a minimal public health danger, and a high therapeutic value	These chemicals can be used for medical reasons.	Tranquilizers, analgesics, and narcotics, such as temazepam, phenobarbital, diazepam, and lorazepam

Source: European Monitoring Centre for Drugs and Drug Addiction (2022).

Table 2 above captures the content, dangers of consumption, as well as the degree of control of Psychotropic Substances. It could be deduced from the above table that narcotics drugs can be injurious and also helpful in varying ways, depending on the purpose or essence of use. As established in the preceding analysis of narcotics drugs, it could be argued that narcotics drugs are not just a global phenomenon, but an important aspect of an average African society. The increasing and bourgeoning level of use and of narcotics drugs in Nigeria presents an overture suggestion that there exists the presence of narcotics drugs in Nigeria. The table below will seek to address the names and categories of Controlled Medicine as they exist in Nigeria, i.e. Classification of Narcotics, Psychotropic Substances and Precursor Chemicals currently approved by INCB for used in Nigeria.

Table 3: Names and Categories of Narcotics Drugs under the 1961 Convention

S/N	SCHEDULE I	SCHEDULE II	SCHEDULE III	SCHEDULE IV
1	Cocaine	Codeine	-	-
2	Diphenoxylate	Dihydrocodeine	-	-
3	Etorphine	-	-	-
4	Fentanyl	-	-	-
5	Hydromorphone	-	-	-
6	Methadone	-	-	-
7	Morphine	-	-	-
8	Oxycodone	-	-	-
9	Oxymorphone	-	-	-
10	Pethidine	-	-	-
11	Pholcodine	-	-	-

Source: Federal Ministry of Health (2017).

The above table (Table 3) presents an overture suggestion that there exist in 1961 Convention of the United Nations that deals with the nature, dynamics and use of narcotics in Nigeria as well as its names and types. The table further suggests that Nigeria in a bid to control the use of narcotic drugs in Nigeria is a signatory to international standards on the use of narcotics drugs.

Table 4: List of Psychotropic Substances under the 1971 Convention

S/N	SCHEDULE I	SCHEDULE II	SCHEDULE III	SCHEDULE IV
1	None	Methylphenidate	Flunitrazepam	Alprazolam
2	-	-	Pentazocine	Bromazepam
3	-	-	-	Buprenorphine
4	-	-	-	Clonazepam
5	-	-	-	Diazepam
6	-	-	-	Lorazepam
7	-	-	-	Meprobamate
8	-	-	-	Midazolam
9	-	-	-	Nitrazepam
10	-	-	-	Phenobarbital
11	-	-	-	Temazepam
12	-	-	-	Zolpidem

Source: Federal Ministry of Health (2017).

It could be deduced from the table above that Psychotropic Substances is recognized under the 1971 Convention of the United Nations, which Nigeria is a signatory to. This makes it fitting to be argued that Psychotropic Substances as one of the controlled medicines, is licensed to be used and traded within the confines of Nigeria. Furthermore, as recognized by the National Policy for Controlled Medicines and its Implementation Strategies, there are specific drugs that are nationally controlled and recognized by the Nigerian government. This logically implies that any use,

merchandize and importation of any narcotic drugs outside these drugs would be seen or recognized as crime by the Nigerian State. Table 5 below enumerates the names of the narcotic drugs that are nationally-controlled in Nigeria.

Table 5: Narcotics Drugs that are Nationally Controlled in Nigeria

S/N	Names of the Narcotics Drugs
1.	Amitryptyline
2.	Caffeine
3.	Chloramphenicol
4.	Dextromethophan
5.	Imipramine
6.	Ketamine
7.	Ketamine
8.	Phenylepherine
9.	Thiopental
10.	Clomipramine
11.	Tramadol HC

Source: Federal Ministry of Health (2017).

The table provides convincing evidence of the nationally controlled drugs that are operational in Nigeria. It is pertinent to posit that the control of the above drugs is under the oversight of the National Policy for Controlled Medicines and its Implementation Strategies. The National Policy for Controlled Medicines is divided into 38 targets, 5 objectives, and 1 primary goal. When creating strategies and action plans for implementing actions to enhance access to controlled medications for medical and other purposes.

Nigeria has emerged as a significant hub for drug trafficking, particularly cocaine. According to a 2012 assessment by the International Narcotics Control Board (INCB), Nigeria leads West Africa in drug consumption and trafficking (Ojo, 2016). Lagos has become a major transit point for cocaine air trafficking, with Nigerian trafficking organizations operating extensively in South America. The United Nations Office on Drugs and Crime (UNODC) 2013 Threat Assessment report highlighted the active role of Nigerian trafficking organizations in importing cocaine via containerized consignments, maritime shipping, air couriering, and postal shipments. There is also growing concern over methamphetamine production in West Africa, with Nigeria playing a significant role (Henry, 2007).

Common smuggling methods include exploiting porous borders, using internet and dark web markets, air routes (including concealment in luggage or body-carrying), and containerized consignments and maritime shipping (Abiola, 2014; Esoimeme, 2017). The NDLEA has been at the forefront of combating drug trafficking, with regular seizures and destruction of drugs, arrests of traffickers at airports and borders, and collaboration with international partners. Notable enforcement efforts include the destruction of cannabis plantations, interception of drug shipments from South America and Asia, and convictions of traffickers (UNODC, 2013; Eteghe, 2016). For instance, in 2015, the NDLEA intercepted a letter containing heroin in Lagos, and in 2013, they arrested several individuals, including a relative of a prominent statesman, for cocaine trafficking (Eteghe, 2016).

International cooperation has played a crucial role in Nigeria's fight against drug trafficking. The United States has provided security training and body scanning equipment for Nigerian airports, which has proven effective in apprehending drug couriers (UN Summit, 2005). The implementation of AIRCOP at Murtala Muhammed International Airport has improved communication among agencies and increased information sharing with other law enforcement agencies and stakeholders.

Despite these efforts, significant challenges remain, including the persistent issue of porous borders and the adaptability of trafficking networks. The situation is further complicated by the shift of cocaine trafficking routes from Latin America to West Africa over the past 15 years, with Lagos emerging as a particularly active hub (Ojo, 2016). Ongoing, adaptive strategies will be necessary to effectively combat this complex issue and address the persistent problem of illicit drug trafficking in Nigeria.

Drug and related Product Labeling Regulation and Illicit Importation of Tramadol into Nigeria

Drug labeling plays a crucial role in medication safety and proper usage. Inadequate labeling systems can lead to adverse drug events (ADEs), often due to misinterpretation of pharmacological information (European Directive, 2010). In the United States, ADEs and pharmaceutical errors cause over 100,000 deaths annually (Bates et al., 1993). To mitigate these risks, pharmaceutical companies are expected to provide comprehensive information on warnings and contraindications to both physicians and patients.

Effective drug labeling is essential for accurate dispensing and rational drug use. It helps prevent medication errors by including therapeutic instructions and proper storage information (Pirmohamed et al., 2004). However, issues such as illegible labeling, insufficient font size, and poor writing style can contribute to prescription errors (Rawlins & Thompson, 1977). The National Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria has established requirements for pharmaceutical labeling to address these concerns. NAFDAC's regulatory process involves drafting proposed regulations, seeking feedback from stakeholders, and implementing provisional regulations.

Tramadol, a controlled medication, has become a subject of concern due to its potential for abuse. While it has legitimate medical uses, its presence in the hands of addicts can lead to physical, emotional, psychological, and economic damages. As a result, NAFDAC and other agencies are actively working to apprehend and destroy illegally imported tramadol in Nigeria. It is against this backdrop that NAFDAC and her sister agencies are constantly on the alert to apprehend and destroy illegally imported tramadol in the country. Table 6 below provides the data of apprehended and destroyed carton, containers, and parcels of tramadol as well as the agency that was involved.

Table 6: Statistics of Apprehended and Destroyed Tramadol Containers in Nigeria

S/N	Quantity	Location	Agency Involved	Individuals/ Company Involved	Year	Status	Source
1.	10 cartons of tramadol 225mg with an estimated street value of N200 million	Tincan seaport, Lagos	NDLEA and Nigerian Customs Service	Skyway Aviation Handling Company (SAHCO)	2022	Seized	Guardian. 19 June 2022
2.	214 cartons of tramadol 225	Murtala Muhammed International Airport, (MMIA), Ikeja Lagos	NAFDAC	Not Available	2022	Seized	Business Day. Apr 4, 2022
3.	About 228,740 tablets and capsules of tramadol	Abuja area of FCT	NAFDAC	Usman Abdulmumini (23) and Aminu Ahmad, (22)	2022	Seized	Business Day. Apr 4, 2022
4.	A total of 9,638 Tramadol capsules.	Benin city, Edo state.	NAFDAC	A patent medicine dealer, Harrison Odion	2022	Seized	Business Day. Apr 4, 2022
5.	Two containers containing 1,284 cartons of Tramadol	Lagos airport, Ikeja	NDLEA	Chief Afam Mallinson Ukatu,	2022	Seized	Vanguard. May 3, 2022
6.	58 containers of tramadol	Ogun state	NAFDAC and NCS	Not Available	2019	Destroyed	Premium Times. July 24, 2019
7.	5 containers of Tramadol worth N1.7 billion	Lagos	NAFDAC	Three persons were involved and names withheld.	2018	Destroyed	Premium Times. December 2nd, 2018.
8.	N1,708, 750, 000 street value of tramadol	Ogun state	NAFDAC	Not Available	2018	Destroyed	The Tribune. Jul 1, 2018
9.	1000 tablets of Tramadol 200mg concealed in food items.	Lagos state	NAFDAC	Odia Emiliana Efe	2022	Destroyed	The Cable. May 15, 2033.
10.	67,100 tablets/capsules of Tramadol	Abia state	NAFDAC	Three trucks involved and names concealed	2022	Destroyed	The Cable. May 15, 2022.
11.	7,029 tablets of Tramadol	Yobe state	NAFDAC	Ibrahim Yakubu	2022	Destroyed	The Cable. May 15, 2022
12.	19,600 tablets of Tramadol	Okene/Abuja highway, Kogi state	NAFDAC	Not Available	2022	Destroyed	The Cable. May 15, 2022.
13.	Large consignments of different	Abuja	NDLEA	Ukatu, who is Chairman of Mallinson	2022	Apprehended	The Guardian. 25 April 2022
14.	1.9 million tablets of Tramadol	Murtala Muhammed International Airport, Lagos.	NDLEA	Murtala Muhammed International Airport, Lagos.	2022	Seized	This Day. 10th July, 2022

Source: Compiled by the Researcher (2022).

The table above (Table 6) summarizes a handful of apprehensions, arrests, and destructions of tramadol and its barons over time in Nigeria, detailing the quantity of tramadol that was apprehended and subsequently destroyed as well as the individuals and personalities that were involved in the ordeal. It is crystal clear that the Nigerian government, through NAFDAC and other agencies involved in the prosecution of the illegal importation and use of narcotic drugs have made some encouraging moves in combating the use and merchandize of narcotics drugs in Nigeria. However, the activities of the drug abuse and illegal importation of these narcotics drugs into Nigeria have rather increased. It therefore appears that NAFDAC and other agencies in the business of curtailing the illegal use and importation of narcotics drugs have not been effective, hence, an increase in the consumption and merchandize of narcotics drugs in Nigeria. Evidence form the increasing number of reports on tramadol abuses could stand a veritable material or exhibit to affirm the above made assertion. Table 7 below reveals the increasing or rising dimension in the abuse of tramadol in Nigeria.

Table 7: Prevalence of Tramadol Abuse in Nigeria by Geopolitical Zones

S/N	Geopolitical zone	Statistics
1.	North-West zone	Prevalence: 12.0% Numbers: 3,000,000
2.	North-Central zone	Prevalence: 10.0% Numbers: 1,500,00
3.	North-East zone	Prevalence: 13.6% Numbers: 2,090,000
4.	South-West zone	Prevalence: 22.4% Numbers: 4,382,000
5.	South-South zone	Prevalence: 16.6% Numbers: 2,124,000
6.	South-East zone	Prevalence: 13.8% Numbers: 1,550,000

Source: United Nations Office on Drugs and Crime (2018).

The table above presents a summary of the total of narcotics drugs abuses, which the abuse of tramadol is inclusive. The table also presented a geopolitical analysis of the total number of persons who are caught in the web of tramadol abuses in the different geopolitical zones of the Nigerian state. Clearly, the incidence of controlled drugs abuses, including tramadol and cocaine, are on the rise. Impliedly, NAFDAC and her sister agencies has not been effective in the control of illegal importation, merchandize, and use of narcotics drugs in Nigeria, hence, validating our first hypothesis.

Monitoring and Inspection of Importers, Marketers for Controlled Drugs and Prevalence of consumption level of Narcotic Drugs by 14% throughout the Federation

The Narcotics and Controlled Substances (NCS) Directorate of NAFDAC, established in 1988, plays a crucial role in Nigeria's compliance with international drug control conventions. Its primary objectives are to prevent drug diversion and ensure that narcotic drugs and psychotropic substances are used solely for medical and scientific purposes. The Directorate's regulatory purview extends to psychotropic substances, bulk and finished narcotics, and precursor chemicals, with a particular focus on opioids used in pain management for conditions such as HIV/AIDS, cancer, and sickle cell anemia (NAFDAC, 2017).

NAFDAC's regulatory framework encompasses a range of activities, including granting import permits, providing clearance permits, collaborating on drug demand reduction, monitoring

facilities, and investigating trafficking when alarms are raised. The agency maintains strategic relationships with national and international organizations to establish benchmarks and enhance its mandate fulfillment. These partnerships include collaborations with the National Drug Law Enforcement Agency (NDLEA), Standard Organization of Nigeria (SON), and the Consumer Protection Council of Nigeria (CPC), among others (NAFDAC, 2017).

NAFDAC's inspection processes have evolved to address the challenges of drug regulation in Nigeria. Key measures include requiring pre-shipment data from importers, collaborating with banks to ensure agency approval before processing financial documents, monitoring airlines for unauthorized imports, imposing fines on unregistered products, conducting post-marketing surveillance, and regularly inspecting local factories (Chinwendu, 2008). The drug product registration process by NAFDAC is rigorous, requiring WHO prequalification or GMP certification for manufacturing plants. The agency has implemented measures to enhance transparency and public awareness, such as appointing analysts in major exporting countries, requiring registration numbers on packaging, publishing lists of registered products, and issuing 5-year licenses for approved items (Chinwendu, 2008).

NAFDAC's enforcement efforts have intensified since 2001, with the enforcement directorate acting as an intelligence unit. Their activities include investigating cases, utilizing public information, conducting raids, and holding property owners responsible for tenants engaged in counterfeit drug trade. The agency has also proposed establishing model drug markets run by pharmacists in each of Nigeria's six geographical zones, though implementation has faced challenges due to stakeholder conflicts (Chinwendu, 2008).

Despite these comprehensive efforts, Nigeria continues to grapple with a significant drug abuse problem. A 2018 survey by the United Nations Office on Drugs and Crime revealed alarming statistics, with a 14.4% overall prevalence of drug use in Nigeria. The survey, covering 38,580 households and identifying 9,344 drug users, found cannabis (10.8%) and opioids (4.7%) to be the most commonly abused substances, followed by codeine-containing cough syrup (2.4%), tranquilizers (0.5%), amphetamines (0.2%), cocaine (0.1%), and heroin (0.1%) (United Nations Office on Drugs and Crime, 2018). Table 8 below presents a statistic on narcotic drugs abuse and consumption in Nigeria in recent times.

Table 8: Statistics on Narcotic Drugs Consumption in Nigeria

Population	**Setting**	**Prevalence/commonly abused drugs Prevalence (14.4%)**	**Sources of drugs**	**Reasons**
38, 580 Household. 9,344 drug users throughout the federation.	Community centers, houses in the 36 states and FCT	Cannabis (10.8%), Opioids (tramadol, codeine, or morphine) (4.7%) Cough syrup -containing codeine and Dextromethorphan (2.4%), Tranquilizers (0.5%), Amphetamines (0.2%), Cocaine (0.1%), Heroin (0. 1%)	Not reported	Not reported

Source: United Nations Office on Drugs and Crime (2018).

The table above summarizes the level of consumption of narcotics drugs in Nigeria, detailing the percentages of consumption as well as the total number of persons or household indulging in the

abuse of narcotics drugs throughout the length and breadth of the Federation. The data above was derived through a 2,787 key informants National survey (36 states and FCT) conducted by the United Nations Office on Drugs and Crime in 2018. To further corroborate the above contention as to the extent to which the agency has not succeeded in the curtailment of illegal importation of narcotics drugs, hence increasing its availability in the country, Table 9 below addresses the increasing level of consumption of narcotics drugs in Nigeria.

Table 9: Annual Prevalence of Drug use in Nigeria

Table :Annual prevalence of drug use in Nigeria among the population 15-64 years of age, 2017

	Estimated prevalence (per cent)*	Low estimate (per cent)	High estimate (per cent)	Estimated numbers
Any Drug Use[¥]	**14.4**	**14**	**14.8**	**14,300,000**
Cannabis	10.8	10.3	11.3	10,640,000
Opioids	4.7	4.3	5.1	4,610,000
Heroin	0.1	0.0001	0.2	87,000
Pharmaceutical Opioids (tramadol, codeine, morphine)	4.7	4.2	5.1	4,608,000
Cocaine	0.1	0.0001	0.2	92,000
Tranquilizers/sedatives	0.5	0.0001	0.9	481,000
Amphetamines	0.24	0.0001	0.6	238,000
Pharmaceutical Amphetamines	0.16	0.0001	0.5	155,000
Methamphetamine	0.1	0.0001	1	89,000
Ecstasy	0.3	0.0001	1.2	340,000
Hallucinogens	0.03	0.0001	0.8	27,000
Solvents/inhalants	0.3	0.0001	1.2	300,000
Cough syrups (containing codeine or dextromethorphan)	2.4	1.5	3.3	2,360,000

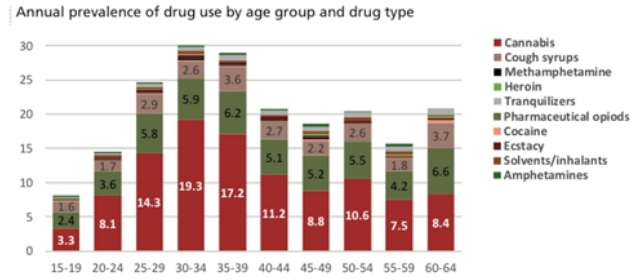
Based on the national population estimate of 98,882,000 people aged 15-64 (United Nations, Department of Economic and Social Affairs, Population Division)
¥Aggregated categories were adjusted for the proportion of users in the total population known to be poly-drug users (75 per cent). Aggregated estimates for categories of opioids and amphetamines were adjusted for the proportion of users known to be poly-drug users. Poly-drug use rates for specific drug categories were determined from the source population of the prevalence estimate (the general population or high risk drug users).

**Based on the national population estimate of 98,882,000 people aged 15-64 (United Nations, Department of Economic and Social Affairs, Population Division*
**For the purpose of this survey, high-risk drug users were defined as those who had used opioids, crack/cocaine or amphetamines in the past 12 months as well as used for at least 5 times in the past thirty days.*

Source: UNODC (2017)

It could be deduced from the above table that the Nigerian state is confronted with the high-level consumption of narcotics drugs. The table presents an overture suggestion that narcotics drugs consumption in Nigeria has been on the rise. This raises a critical question of concern on the ability of NAFDAC and other sister agencies that are constantly fighting against the illegal importation and smuggling of narcotics drugs into the country. More so, there exists an evidence that portrays an annual prevalence of narcotics drugs use and abuse by age group.

Figure 1 below presents the degree of drug abuses as perpetrated by age groups in Nigeria.

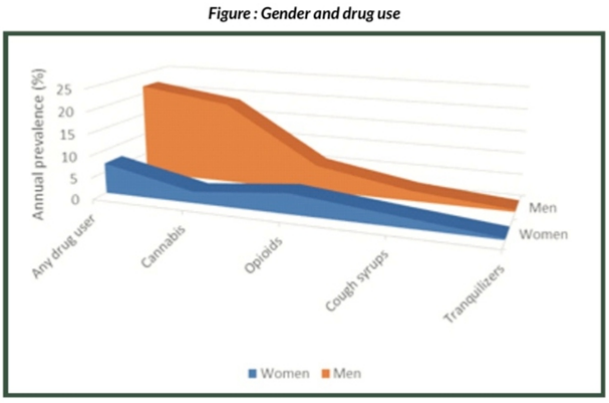


Source: UNODC (2017)

The figure above from its presentation of the age distribution of drug abuses in Nigeria as well as the type of drugs they are disposed to will serve a veritable evidenced to further corroborate the inability of NAFDAC to partially, if not successfully quell the bourgeoning level of illegal

importation and abuse of narcotics drugs in Nigeria. Going further, there is a persuasive gender dichotomy and variation in the use and abuse of narcotics drugs in Nigeria. This is prevalent due to exposure and affordability as well as commonality of narcotics drugs in the society, especially in the rural communities scattered throughout the length and breadth of Nigeria. The following figure (Figure 2) presents the gender statistics of drugs abuse in Nigeria since 2011.

Figure 2: Gender Dichotomy of Narcotics Drug Abuses in Nigeria



Source: UNODC (2017)

It could be deduced from the figure above that the abuse of narcotics drugs is not exclusive to men, but to also the female gender. Figure 2 above draws a conclusive analysis of the extent to which the abuse of narcotics drugs has permeated the Nigerian society to the extent that women who are ordinarily supposed to fight against abuse, are now core stakeholder in not just the sale but also the consumption of narcotics drug. From the above, it could be argued that NAFDAC has not been effective in the control of the illegal importation and smuggling of narcotics drugs into Nigeria.

There can never be the presence of drug abuse, if there were no presence of drug availability in Nigeria. The inability of NAFDAC and her sister agencies to curtail the excessive importation of narcotic drugs into the country has made the availability of narcotics drugs unquestionably high in Nigeria. The table below will seek to present the number of narcotics drugs that are common to the Nigerian drug markets and the number of people that are involved in its patronage.

Figure 3: Statistics of Narcotics Drugs Available in Nigeria

Source: UNODC (2017)

Figure 3 above presents an overture suggestion that the use of narcotics drugs is prevalent in Nigeria as there are increased number of persons who are caught in the web of its abuse and consumption. Conclusively, it could be argued from the foregoing data presented that NAFDAC and other sister agencies in the fight against the illegal importation and smuggling narcotics drugs into Nigeria have not been effective.

Monitoring and Inspection of Importers, Marketers for Controlled Drugs and Increased number of Psychiatric Hospitals in Kano, Katsina, Kaduna, Kebbi, Sokoto and Zamfara state

There is no gainsaying the obvious that NAFDAC and other accompanying sister agencies operational in Nigeria are mandated by law to inspect, monitor importers and marketers to ensure the delivery of quality drugs into Nigeria as well as to make sure that the use of controlled drugs are administered appropriately. The increasing number of psychiatric hospitals in Nigeria, especially in Kano, Katsina, Kebbi, Sokoto and Zamfara presents an overture suggestion that the abuse of narcotics drugs in Nigeria has not just caused a physical injury to its abusers, but also an emotional and psychological damage. Table 10 below showcases the increasing number of psychiatric hospitals in the above-mentioned states of the country.

Table 10: Increasing Number of Psychiatric Hospitals in Nigeria

S/N	State	Number	Source
1.	Kaduna	20	Branches.com
2.	Kano	39	Finelib.com
3.	Katsina	25	Yellow pages.net
4.	Sokoto	11	Capitalheath.com
5.	Zamfara	10	Medianigeria.com
6.	Kebbi	10	Manpower.com

Source: Compiled by the Researchers (2022).

The table above (Table 10) summarizes the reported number of psychiatric hospitals in some of the selected states in the North-West Nigeria. The increasing number of psychiatric hospitals in these states supports the existence of increased abuse of narcotics drugs. It is on this basis that we agree that NAFDAC and other sister's sister agencies in the fight against the illegal importation, smuggling and abuse of narcotics drugs has not been effective in arresting the situation as it has depreciated, hence, threatening the existence and development of the Nigerian state. This, in agreement with the foregoing data, further validates our second hypothesis that the operational frameworks of the Narcotics and Controlled Substance (NCS) Directorate of NAFDAC has not reduced the incidence of drug abuses in Nigeria.

Conclusion and Recommendation

This study investigated NAFDAC's role in controlling narcotic drugs in Nigeria from 2011 to 2023, a period characterized by increased illegal importation and abuse. Despite NAFDAC's efforts and collaborations with other agencies, drug abuse remains prevalent in the country. The United Nations Office on Drug and Crime (2019) reported that one in seven Nigerians aged 15-64 had used illicit drugs in the past year, with higher prevalence in southern geopolitical zones. The research addressed two key questions: whether NAFDAC's regulatory control strategies have reduced narcotic drug importation and smuggling, and if the operational frameworks of NAFDAC's Narcotics and Controlled Substance (NCS) Directorate have reduced drug abuse incidents.

Employing qualitative analysis of secondary data and guided by Social Network Theory, the study found that NAFDAC's regulatory strategies have not effectively reduced narcotic drug importation and smuggling, partly due to porous borders. Additionally, the NCS Directorate's operational frameworks have not significantly reduced drug abuse incidents. The study concludes that the illegal importation, sale, and abuse of narcotics have continued unabated in Nigeria, despite government efforts. It recommends an internal review of NAFDAC's and partner agencies' strategies, as well as the formation of state-level task forces to monitor and prevent drug abuse in rural communities beyond federal agencies' reach.

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UNLOCKING THE NIGERIA'S ECONOMIC POTENTIALS FOR HOLISTIC APPROACH TO SUSTAINABLE DEVELOPMENT

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Abstract

Nigeria possesses immense economic potentials, ranging from vast natural resources and a youthful population to a growing digital economy. However, the country's journey towards sustainable development has been hindered by several structural challenges, including poor infrastructure, corruption, overdependence on oil, high unemployment, and insecurity. This paper explores the holistic approach required to unlock Nigeria's economic potentials for sustainable development. Drawing on relevant literature and empirical data, the paper emphasizes the need for integrated strategies that promote economic diversification, institutional reforms, human capital development, and environmental sustainability. It furthers advocates for strong governance, inclusive policies, and cross-sector collaboration as essential components for driving long-term prosperity. Qualitatively, this paper adopts secondary sources such as chapters in books, journal articles, books, internet materials, newspapers, and social media captions and narrations. The paper concludes that sustainable development in Nigeria can only be achieved through a coordinated and inclusive framework that aligns economic growth with social well-being and environmental preservation. The paper recommends that policy makers should adopt inclusive development strategies that integrate economic, social, and environmental objectives. This will ensure that development efforts are sustained and beneficial to all segments of the population. Stakeholders in the private sector and civil society should collaborate with government in implementing development programmes. A multi-stakeholder approach will ensure accountability, innovation, and community engagement in the development process

Keywords: *Approach, Holistic, Potentials, Unlocking, Sustainable development,*

Introduction

Nigeria, as the largest economy in Africa, holds significant economic potentials derived from its vast natural resources, growing population, and strategic geopolitical position. Despite these advantages, the country has faced persistent challenges in fully unlocking and harnessing its economic potentials for sustainable growth. Nigeria is endowed with abundant oil reserves, agricultural resources, and a young, dynamic workforce, yet the country continues to grapple with issues such as poverty, unemployment, and inequality (Adeola & Olanrewaju, 2018). The untapped potentials in sectors such as agriculture, technology, and renewable energy remain a key concern, as the economy is overly reliant on crude oil exports, which are susceptible to global price fluctuations. This overdependence on oil has hindered the diversification of the economy and limited the country's ability to foster long-term, sustainable development (Ogunleye, 2019).

The notion of sustainable development has gained increasing importance in the context of Nigeria's economic policy agenda, especially as the country seeks to align its development goals with global frameworks like the United Nations' Sustainable Development Goals (SDGs). Sustainable development in Nigeria is not only about economic growth but also about ensuring social and environmental sustainability. It calls for an integrated approach that balances economic, social, and environmental factors. This approach is crucial for addressing the systemic challenges Nigeria faces, such as environmental degradation, social inequalities, and lack of infrastructure (Obi & Adebayo, 2020). For Nigeria to achieve sustainable development, it must adopt a holistic model that maximizes its resource potential, promotes innovation, and ensures that development benefits are equitably distributed across all segments of society.

While there have been numerous efforts by successive Nigerian governments to unlock the country's economic potential, such as initiatives to diversify the economy and improve infrastructure, these efforts have often been hampered by governance issues, corruption, and policy inconsistency. The lack of a coherent and well-executed strategy has resulted in the failure to create a robust economy capable of sustaining long-term growth (Ibeanu, 2017). Despite these challenges, recent advancements in digital technology, renewable energy, and human capital development present new opportunities for growth. These emerging sectors offer a promising avenue for Nigeria to achieve a more diversified and resilient economy that is capable of delivering inclusive and sustainable development (Olatunji & Adebisi, 2021). This study seeks to explore how Nigeria can unlock these untapped economic potentials through a holistic approach to development.

Concept of Sustainable Development

Sustainable development is broadly defined as a development approach that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition, originally articulated by the Brundtland Commission in 1987, emphasizes the importance of intergenerational equity and responsible resource management (World Commission on Environment and Development [WCED], 1987). It encompasses three core pillars: economic growth, environmental protection, and social inclusion. These pillars must be pursued simultaneously to ensure balanced progress that not only improves the quality of life today but also safeguards the environment and social systems for the future (Sachs, 2015). In essence, sustainable development calls for a holistic approach that integrates economic policies with environmental stewardship and social equity.

In the Nigerian context, sustainable development is particularly relevant due to the nation's complex socio-economic challenges, such as high poverty rates, environmental degradation, and inadequate infrastructure. It involves policies and actions aimed at reducing dependence on non-renewable resources, promoting inclusive economic participation, and improving living standards without exhausting natural resources or exacerbating social inequalities (Akinbami, 2016). This concept goes beyond economic metrics to consider the well-being of people and the planet, encouraging practices that foster renewable energy use, equitable education access, healthcare, and sustainable urban planning. For Nigeria, adopting a sustainable development framework is crucial in ensuring that the country's economic growth translates into long-lasting, inclusive prosperity (Ogunyemi & Olatunji, 2020).

Nigeria's Economic Potentials

Natural Resources: Nigeria is abundantly blessed with a variety of natural resources that hold significant economic value. Chief among these are oil and natural gas, which form the backbone of the country's revenue generation and foreign exchange earnings. Nigeria is the largest oil producer in Africa and possesses the second-largest proven gas reserves on the continent, making the energy sector a critical component of its economic potential (NNPC, 2020). In addition to petroleum resources, Nigeria has vast deposits of solid minerals such as limestone, gold, coal, bitumen, and tin, most of which remain underexploited due to inadequate infrastructure and investment. If effectively managed and diversified beyond oil, these resources could significantly enhance government revenue and drive industrialization (Adewuyi & Awoyemi, 2018).

Agriculture: Agriculture remains one of Nigeria's most promising economic sectors. The country boasts over 84 million hectares of arable land, out of which less than 40% is currently cultivated (FAO, 2021). Nigeria is a major producer of crops such as cassava, yam, maize, and rice, and its climate supports a variety of both food and cash crops. Agriculture employs more than 60% of the workforce and holds enormous potential for rural development, job creation, and food security. However, the sector is plagued by issues such as poor mechanization, lack of access to credit, and inadequate storage and transport infrastructure. With strategic investments and policy reforms, the agricultural sector could serve as a foundation for inclusive economic growth and poverty reduction (Oluwatayo & Adedeji, 2019).

Human Capital: Nigeria's most valuable asset is its youthful and growing population. With a population exceeding 200 million more than 60% of whom are under 30 years of age Nigeria possesses a potentially large and productive labour force (NBS, 2020). This demographic advantage, often referred to as a "youth bulge," presents a unique opportunity to harness human capital for economic growth, provided that the right investments are made in education, healthcare, and skills development. If adequately equipped, this young population can drive innovation, boost productivity, and power industries such as technology, manufacturing, and services. However, high youth unemployment and underemployment pose significant threats if not addressed promptly (Akinola & Oluwafemi, 2019).

Technological Innovation and the Digital Economy: The rise of Nigeria's tech ecosystem, particularly in sectors such as fintech, e-commerce, and digital services, showcases the country's potential in the knowledge and innovation economy. Lagos, in particular, has emerged as a tech hub in Africa, attracting investment and producing successful startups that are solving local

problems with global relevance (PwC Nigeria, 2021). The increasing penetration of mobile technology and internet access has opened up new markets and created job opportunities, especially for the youth. With improved digital infrastructure, regulatory support, and investment in digital literacy, Nigeria could position itself as a leading player in the Fourth Industrial Revolution and transition toward a technology-driven economy (Okeke & Aluko, 2020).

Strategic Geopolitical Position and Regional Trade: Nigeria's geographical location gives it a strategic advantage as a trade hub in West Africa. Sharing borders with several countries and having access to the Atlantic Ocean makes Nigeria well-positioned for regional and international trade. As a leading member of the Economic Community of West African States (ECOWAS) and a signatory to the African Continental Free Trade Area (AfCFTA), Nigeria can leverage its market size and location to boost trade, attract foreign direct investment, and strengthen its industrial base (UNECA, 2020). However, realizing this potential requires upgrading transport infrastructure, reducing trade barriers, and improving border efficiency.

Challenges to Economic Development

1. Poor Infrastructure

One of the most pressing challenges to Nigeria's economic development is the persistent lack of adequate infrastructure. The country suffers from unreliable electricity supply, poor road networks, inadequate transportation systems, and insufficient water and sanitation facilities. These deficiencies increase the cost of doing business, reduce productivity, and discourage both local and foreign investment (Eboh & Oduh, 2019). For instance, unreliable power supply forces industries and businesses to rely heavily on generators, significantly increasing operational costs. The World Bank (2020) reported that Nigerian firms experience more than 30 power outages monthly, which directly affects manufacturing output and service delivery. Without massive investment in infrastructure, economic diversification and industrialization will remain difficult to achieve.

2. Corruption and Weak Governance

Corruption and poor governance have deeply eroded Nigeria's institutional capacity and stifled economic growth. Corrupt practices permeate nearly all levels of government and public service, affecting public resource management, procurement processes, and project implementation. According to Transparency International (2022), Nigeria continues to rank low on the Corruption Perceptions Index, indicating systemic challenges in accountability and transparency. Weak governance systems also manifest in policy inconsistency and poor regulatory enforcement, which create an unstable business environment. This discourages investor confidence and undermines long-term development planning (Okonkwo & Eze, 2018). Sustainable development requires strong institutions that can effectively implement policies and manage resources for the benefit of the wider population.

3. Overdependence on Oil

Nigeria's economy remains heavily dependent on crude oil exports, making it vulnerable to global oil price fluctuations. Oil accounts for about 90% of export earnings and over 50% of government revenue (NNPC, 2020). This dependence creates a mono-economic structure that limits diversification and exposes the economy to external shocks, such as the 2014 oil price crash and the 2020 COVID-19 pandemic. The neglect of other sectors like agriculture, manufacturing, and

tourism has prevented the economy from achieving inclusive and sustainable growth (Adewuyi, 2020). To break this cycle, Nigeria needs to diversify its economy by investing in non-oil sectors, promoting innovation, and building value chains in agriculture and industry.

4. High Unemployment and Underemployment

Nigeria faces a serious unemployment crisis, especially among its youth population. According to the National Bureau of Statistics (2021), the unemployment rate stood at 33.3%, with youth unemployment exceeding 40%. Many graduates are unable to find jobs due to a mismatch between the education system and labour market needs. Underemployment is also widespread, with many Nigerians working in informal, low-paying jobs that do not provide job security or social benefits. This situation not only contributes to poverty but also fuels social unrest and crime (Akinyemi & Isiaka, 2019). Solving unemployment requires comprehensive labour reforms, investment in vocational and entrepreneurial education, and support for small and medium enterprises (SMEs).

5. Insecurity and Political Instability

The rise in insecurity, including insurgency in the Northeast, banditry in the Northwest, and separatist agitations in the Southeast, poses a significant threat to Nigeria's economic development. Insecurity disrupts agricultural activities, displaces populations, damages infrastructure, and deters investors from establishing or expanding businesses in affected regions (Obi & Omede, 2020). Political instability and ethnic tensions also hinder national unity and make it difficult to implement long-term development plans. A secure and stable environment is fundamental for sustainable development, and Nigeria must prioritize national security, justice, and inclusive governance to foster economic growth.

Global Perspectives on Economic Potentials and Sustainability

Across the globe, countries are increasingly recognizing the imperative of integrating economic potentials with sustainable development strategies. The traditional model of economic growth, driven solely by industrialization and resource exploitation, is no longer sufficient in a world facing climate change, environmental degradation, and social inequalities. Instead, nations are now focusing on inclusive, green economies that prioritize long-term well-being over short-term gains (United Nations, 2015). This shift is evident in global frameworks like the United Nations Sustainable Development Goals (SDGs), which outline 17 goals aimed at ending poverty, protecting the planet, and ensuring prosperity for all by 2030. These goals emphasize the need for a balanced approach that leverages economic strengths while safeguarding environmental and social systems.

Developed economies such as Germany and the Scandinavian countries have demonstrated how sustainable economic policies can drive prosperity. Germany, for example, has integrated renewable energy and green technologies into its industrial policies through initiatives like *Energiewende*, which aims to transition the country to a low-carbon economy (Mathews & Tan, 2015). Similarly, countries like Sweden and Denmark have focused on circular economies, where waste is minimized and resources are continually reused, contributing to both environmental sustainability and economic competitiveness (Korhonen et al., 2018). These nations show that sustainability can coexist with innovation and profitability, offering valuable lessons for developing economies like Nigeria.

In emerging economies, countries such as China and India are also adapting their development models to incorporate sustainability. China, despite its rapid industrial growth, is investing significantly in green infrastructure, renewable energy, and electric mobility to reduce its carbon footprint and address environmental challenges (Zhang & Wen, 2016). India, through policies such as the National Solar Mission and smart cities initiative, is focusing on sustainable urban development and clean energy solutions to meet the demands of its growing population (Ghosh & Ghosh, 2018). These examples underscore how developing countries can unlock their economic potential while embracing sustainable practices tailored to their local contexts.

On the African continent, several nations are also aligning their growth strategies with sustainable development principles. Rwanda, for instance, has made significant strides in promoting eco-tourism, digital innovation, and environmental conservation as pillars of its economic plan. Its Vision 2050 strategy places sustainability at the core of its development aspirations, aiming for inclusive growth driven by knowledge and green energy (Boudreaux, 2019). Similarly, Kenya has become a regional leader in geothermal energy production, which supports both industrial expansion and climate resilience (Ondraczek, 2013). These countries illustrate that even with limited resources, African nations can chart a sustainable path by capitalizing on unique local strengths and investing in future-proof sectors.

International organizations such as the World Bank and the International Monetary Fund (IMF) are also playing a pivotal role in promoting sustainable development globally. They support developing countries with policy advice, financial resources, and technical assistance to implement reforms that promote economic diversification, environmental protection, and social inclusion. For instance, the World Bank's Green, Resilient, and Inclusive Development (GRID) framework encourages countries to adopt reforms that foster long-term sustainability while addressing immediate development challenges (World Bank, 2021). These global efforts reflect a growing consensus that sustainability is not a luxury but a necessity for meaningful economic transformation.

For Nigeria to align with these global perspectives, it must rethink its development model by moving beyond its dependence on oil and investing in sectors such as renewable energy, agro-processing, ICT, and human capital development. The lessons from other nations show that economic growth does not have to come at the expense of the environment or social cohesion. Rather, through strategic investments, policy reforms, and partnerships, Nigeria can unlock its vast economic potential while ensuring a sustainable future for its citizens. By adopting global best practices and localizing them to suit its unique context, Nigeria can become a model of sustainable development in Africa and beyond.

Unlocking the Nigeria's Economic Potentials for Holistic Approach to Sustainable Development

Unlocking Nigeria's economic potentials requires a comprehensive, multi-sectoral strategy that addresses structural weaknesses while leveraging the country's abundant resources and demographic strength. At the heart of this transformation is the need to diversify the economy away from overdependence on crude oil. Although oil has been a major source of national revenue, its volatility has made the economy susceptible to global price shocks. Therefore, investing in agriculture, solid minerals, tourism, and manufacturing will help build a resilient economic base

(Adewuyi, 2020). For instance, revitalizing the agricultural sector through mechanization, access to finance, and improved value chains can create jobs, reduce food imports, and boost exports, thereby contributing to inclusive economic growth (FAO, 2021).

A holistic approach to sustainable development also requires strategic investment in infrastructure and human capital. Adequate infrastructure, such as power supply, transport networks, and ICT facilities, are prerequisites for economic development. Without them, productivity is reduced, and business operations are hindered. At the same time, enhancing human capital through quality education, health services, and vocational training will equip the population with the skills and capacity to innovate and drive economic growth (Akinola & Oluwafemi, 2019). Moreover, Nigeria's youthful population, if properly harnessed, could become a major driver of development. According to the National Bureau of Statistics (2020), over 60% of Nigerians are under 30, indicating a demographic dividend that can boost productivity if properly educated and employed.

Furthermore, unlocking economic potentials must be accompanied by strong governance and anti-corruption measures. Weak institutions and corruption have historically impeded development by diverting public resources and eroding investor confidence. Strengthening transparency, enforcing the rule of law, and ensuring policy consistency will help create a stable environment for long-term investments (Okonkwo & Eze, 2018). In addition, decentralizing economic governance and empowering local governments to manage and develop their resources can promote inclusive development, especially in rural communities that are often marginalized in national planning. Finally, environmental sustainability should be integrated into all aspects of Nigeria's development planning. Rapid urbanization, deforestation, and pollution have contributed to environmental degradation, undermining the prospects for long-term growth. Transitioning to a green economy through the adoption of renewable energy, climate-smart agriculture, and sustainable waste management practices will help preserve ecosystems while opening up new economic opportunities (Ogunyemi & Olatunji, 2020). A holistic approach to sustainable development thus involves not just economic reform, but also social inclusion, environmental protection, and institutional strengthening. Only through this integrated framework can Nigeria achieve lasting development that benefits both current and future generations.

Conclusion

Unlocking Nigeria's economic potentials through a holistic approach to sustainable development is both an urgent necessity and a strategic pathway for national transformation. Despite the country's abundant natural resources, youthful population, and emerging digital economy, persistent challenges such as poor infrastructure, corruption, insecurity, and overreliance on oil have hindered inclusive growth. A sustainable future for Nigeria lies in adopting an integrated development model that promotes economic diversification, strengthens institutions, and invests in human capital and innovation. By aligning its policies with sustainable development principles, Nigeria can build a resilient economy that delivers long-term prosperity, environmental sustainability, and social equity for current and future generations.

Recommendations

Based on the findings of the study, it is recommended that;

i. The Nigerian government should invest heavily in critical infrastructure such as electricity, transportation, water supply, and digital connectivity. This will reduce the cost of doing business, improve productivity, and attract both local and foreign investors.
ii. Anti-corruption agencies should be strengthened to enhance transparency and accountability in governance. Robust enforcement of anti-corruption laws will help to rebuild public trust and ensure efficient management of national resources.
iii. Nigeria should diversify its economy beyond oil by promoting sectors like agriculture, manufacturing, and the digital economy. Policies and incentives should be put in place to support local industries, value addition, and export development.
iv. The government should prioritize education and vocational training to equip the youth with relevant skills for the labor market. This should include support for entrepreneurship and innovation to reduce unemployment and underemployment.
v. Security agencies should be reformed and adequately equipped to address the growing insecurity across the country. A secure environment is essential for investment, business operations, and social stability.

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ASSESSING CURRENCY DEVALUATION'S INFLUENCE ON STOCK MARKET RETURNS AND MACROECONOMIC GROWTH IN SUB-SAHARAN AFRICAN NATIONS

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Abstract

The study investigates the connection between Sub-Saharan Africa's (SSA) economic growth, stock market returns, and currency devaluation. The drive of the study is to evaluate the ways in which these factors interact and affect the economic stability of SSA nations. Eight SSA nations were chosen for the scope based on their active stock markets, history of currency devaluation, and GNI per capita. The region's dependence on foreign currencies, especially the US dollar, and the increasing demand for financial reforms to strengthen local economies make the study significant. The paper discusses the difficulties the region faces in attaining sustainable economic growth, paying particular attention to stock market dynamics and exchange rate pressure. Using econometric methods like Granger Causality tests and Panel Co-integration, the methodology analyzes secondary data from 2003 to 2023. The theoretical underpinning is the Mundell-Fleming model, which provides information on the interplay between monetary and fiscal policy in open economies. Findings show that market capitalization, exchange rate swings, and economic expansion are strongly correlated; the model accounts for 87% of the variation in real GDP. The study concludes that SSA's economic progress depends on controlling the balance of payments, preserving exchange rate stability, and developing its financial markets. Economic diversification, improved financial market infrastructure, and coordinated fiscal and monetary policies are some of the policy recommendations made to lessen the adverse effects of exchange rate volatility.

Keywords: *Market dynamics, economic diversification, economic growth, market capitalization, exchange rate swings*

Introduction

The majority of developing nations, particularly those in Africa, have implemented a number of economic and financial reforms over the years in an effort to improve their macroeconomic performance and foster sustainable economic growth. One of these reforms is currency devaluation, a macroeconomic strategy that is frequently employed in developing economies to support the growth of local content and boost exports. Currency devaluation, according to Mishkin (2019), is the intentional reduction of a nation's domestic currency's value relative to the value of other significant foreign currencies. This indicates that a country's official exchange rate has been devalued relative to other countries, which is a frequent practice among emerging countries that use trade openness to spur growth and development when necessary. Given that, there are differing views if currency devaluation has an expansionary or contractionary effect, which are open to empirical testing, it may also help address social and macroeconomic problems including inflation, depression, and unequal income distribution.

Furthermore, currency devaluation has recently gained attention in the global economy due to the currency crises that many emerging economies have faced since the 20th century. This has led some to question whether currency devaluation or additional financial and economic reforms would be a better course of action. Whether currency devaluation is expansionary or contractionary, whether it has a positive or negative impact on output growth, and if it makes sense for a country with a large amount of foreign debt to devalue its currency are all points of contention (Saibene & Sicouri, 2012). Previous research and the International Monetary Fund's investment in currency devaluation research, such as SAP (1986), demonstrate the significance of currency devaluation. The overwhelming body of evidence demonstrates the exchange market's contributions to economic development, which cannot be ignored, as it raises capital for investment, corporate social responsibility, and job creation, among other purposes.

Furthermore, the over-reliance on loans from financial institutions dominated by developed nations to finance capital projects and budgets in SSA countries has resulted in this currency's domination over currencies of developing economies, particularly in the region due to trade openness. As a result, SSA nations can use currency devaluation to encourage exports and discourage imports of goods and services. Additionally, the necessity for funding for development prompted the establishment of stock markets in the majority of SSA nations as a means of obtaining the cash required for investments. This move was sparked by economic reforms aimed at reshaping the SSA region, which has been a vital and necessary part of any economy, whether it is developed or developing.

However, the nation's economy may be impacted by the stock market in a different way than other nations' economy. This is because a variety of factors, such as the structure of stock exchanges, how they interact with other elements of the financial system, the governance structure of the nation, and other factors, determine how much of an impact stock markets have on the economy. Consequently, economic growth fueled by new products, services, and technological developments is expected to create a considerable need for stock market development. Numerous researches support the idea that the stock market is a crucial platform for economic progress. For example, Zhongming et al. (2018) determine the extent to which Ghana's stock market fueled the nation's economic growth. Therefore, the stock market has been the primary engine for the expansion of the financial sector of any economy, which will significantly boost the GDP of any nation that possesses it. Ariyo and Adelegan (2005) asserted that when policies are aimed at the

effective distribution of resources, there will be a greater contribution to growth if resources traded within the capital market are properly channeled.

Because of this, the majority of SSA countries are affected by difficulties such as local currencies under pressure to exchange against global currencies, and interest rates that are pegged on the US dollar. Therefore, the IMF data from 2023 indicates that, on average, 84% of exports, 67% of imports, and 60% of external debt are priced in dollars for Sub-Saharan African nations. Non-pegged countries have a debt portfolio that is composed of 66% foreign debt and 99% US dollar-denominated Eurobonds, compared to 50% and 45%, respectively, in pegged countries. Therefore, it seems that the majority of SSA nations heavily rely on the dollar as a standard of commerce and a accumulation of wealth.

Statement of the Problem

The need for capital for economic growth and development kick started establishment of stock market as an essential characteristic of a modern economy to promote economic sustainability according to Tokunbo (2005). It is no longer new that most countries across the globe has implemented a number of financial and economic reforms throughout the years in an effort to improve the macroeconomic performance of their economies; one such reform in the SSA region is the devaluation of member nations' currencies. The bulk of these SSA nations' currencies continue to plummet against the dollar and every other major foreign currency in the exchange rate market in spite of these reforms, which make it necessary to explore this field of research. Additionally, currency crises among emerging economies from the 20th century to the present have drawn attention to currency devaluation in the global economy, according to Ojuolape et al. (2020). Although a plethora of research suggests that liquidity is valued in the market and is frequently linked to stock pricing efficiency that illustrates the interdependence of stock market liquidity and a country's economic growth, Ochenge et al. (2020) contend that low market liquidity hinders stock price discovery.

There is also a research gap that needs to be addressed because of a more recent study by Umoru and Omomoh (2023) that used data from ten African countries—including Malaysia and Indonesia, which are Asian rather than African—to determine the causal relationship between currency devaluation and stock prices using the Toda Yamoto model. In addition, most previous and current studies related to the subject matter of this research were done in isolation on individual countries across the globe. For instance, Dilip, John and Yangru (2014) examine Stock market returns reaction or response to currency devaluation in emerging markets in 24 countries outside SSA region. Studies on SSA region are more fixated on exchange rate and stock market volatility or stock market and economic growth, evident. Also outdated review due to passage of time, incompleteness of recent studies based on selection criteria of countries that are not SSA countries coupled with recent economic reality at present necessitated the need for the study. To this end, SSA countries insatiable need of funds for economic growth and development through international financial institutions like world bank and IMF as well as its own financial markets over the years necessitated the need for this research to establish the direction of relationship that exist between currency devaluation and stock market returns in SSA region by applying econometric techniques so as to make viable policies that will improve the region economic growth and performance. This study is made up of five sections: with section one being introduction, section two providing review of literatures, section three gives the methodology, section four is devoted to empirical results and findings and section five conclusion and policy recommendation from the study.

Literature Review

Currency Devaluation and Economic Growth Relationship

Ojuolape et al. (2015) define currency devaluation as the downward adjustment of a nation's official exchange rate in comparison to other nations and the reduction of a country's domestic currency's value relative to the value of dominant foreign currencies. According to Kidane (1991), devaluation has become a hot topic of debate in developing nations because, for some, it promotes local content through exports, improving terms of trade, lowering debt, and increasing foreign reserves from export revenue. For others, however, it slows down social and economic issues like inflation, depression, and unequal income distribution. Currency devaluation has been a significant factor in the history of international banking and economics. It has been demonstrated to have a range of consequences on various economies; some benefit from it in terms of trade, development, and growth, while others suffer from it. According to Bouvet (2022), any nation that participates in trade openness must devalue its currency in order to prosper and develop. Furthermore, the use of foreign currencies as a store of value, unit of accounts, and medium of trade or exchange in African nations demonstrates how precarious the macroeconomic conditions in the region have become in recent years.

As a result, currency devaluation can be utilized to improve imports, discourage exports, and create a trade balance. Stock markets, on the other hand, provide participants (listed firms) with a means of diversifying their risk and a source of funding for expansion, which is necessary for economic progress. According to Brown (2011), this provides business owners with the opportunity to earn returns on their investments. According to Mbengue et al. (2023), any economy that wishes to expand must expand its stock markets because they boost resources. Political instability, corruption, declining foreign reserves, and an increase in the debt portfolio on domestic currencies all contributed to the devaluation of the SSA's currency, which began in the 1990s and lasted into the 2000s. The 2010s saw a decline in the region's economy and an excessive reliance on imported goods, which made devaluation necessary to support domestic content. Additionally, the COVID-19 pandemic, declining oil prices worldwide, and the trade deficit, among other factors, caused the majority of SSA countries' currencies to devalue in the 2020s. In light of this, it is clear that most of SSA periodically devalued its currency between the 1990s and 2020s in an effort to boost the local economy and prevent an excessive dependence on foreign aid.

The link between Stock Market Returns and Expansion in the Economy

The ways in which stock markets impact the economies of different nations may differ, despite the fact that they are an essential and vital component of every economy. The structure of stock exchanges and their relationships with other components of the financial system and the national government system are among the factors that determine how much the economy is influenced by stock markets. Each of these traits is exclusive to a country, and the impact of stock markets on a country's economy is no different. Stock markets are crucial to the economic development of SSA nations because they enhance and fortify businesses' capital and financial standing, making the capital market the industry's handmaiden and the most essential element of a free economy system since it controls capital formation.

Furthermore, according to Gelb (1995), the stock market still plays a very small part in helping businesses in the majority of the world raise cash. Common shares, convertible bonds, unsecured lending stock, and debentures are examples of long-term financial instruments that are traded on exchanges. However, according to Jefferis (1995) and Mbengue et al. (2023), SSA stock markets have generally underperformed compared to other developed and emerging economies in terms of

various stock market development measures. They attribute this underperformance to factors like the size of the economy overall, a lack of experience trading a wide range of assets, and government regulations that favor debt financing over equity investment. Hence, the importance of stock market as means of raising funds need to bolster economic growth and development through various sectors of any given economy cannot be overlooked in an open economy. Nellor (2008) states that the Nigerian Stock Exchange (NGSE), Johannesburg Stock Exchange (JSE), and Nairobi Stock Exchange (NSE) are the three main frontier markets in Sub-Saharan Africa.

Currency Devaluation, Stock market returns and Economic growth Relationship

To affirm the connection between currency devaluation, stock market returns and economic growth in SSA countries by looking at how these variables affect each other through interactions in any given economy, insights were given in some studies from Jangwe and Takawira (2022) that examine the relationship between South Africa's stock market and exchange rate from 1980 to 2020, Fasanya and Akinwale (2022) investigates how exchange rate shocks affected the returns on ten (10) Nigerian sectoral stocks between January 2007 and December 2018, where exchange rates and sectoral stock returns are examined for symmetric and asymmetric relationships amidst other studies.

Apart from these research studies, Blanchard (2017) also offers an extensive framework on macroeconomic theory and policy by investigating how exchange rate movements affect stock markets and economic performance. He does this by utilizing important models such as the IS-LM model, the AD-AS framework, and the Mundell-Flemming model, which validate a sophisticated comprehension of the ways in which exchange rate movements affect financial markets and economic results. While the flow-oriented approach was supported by Dornbusch and Fischer's (1980) evidence that clarified the fundamental relationship between the stock market and the exchange rate. And most recently, Umoru and Omomoh (2023) use the T-Y model to test for a dynamic causal relationship between stock prices and exchange rate devaluation. Their analysis shows how the devaluation of the local currency in relation to the dollar, the annual percentage rate of return on loans, the consumer price index, and the stock price are all related. But according to the reviewed literature, the majority of studies are conducted based on the never-ending debate in this field about the technique employed, and the findings made this research necessary for the SSA region. Due to the fact that the majority of SSA countries heavily rely on the US dollar as a store of wealth and a medium of exchange in the face of the region's need for sustainable economic growth, this study is therefore required. Local currencies have recently been subject to exchange rate pressure against the world's dominant currencies, with interest fixed on the US dollar.

Theoretical and Conceptual Framework

The research's direction is made clearer by the theoretical and conceptual framework, which also provides a strong theoretical foundation. The two frameworks' overall goal is to increase the significance of research findings, ensure generalizability, and satisfy fictitious constructions in the exploratory sector. By giving the research's investigation both direction and drive, they support stimulating analysis while ensuring the expansion of information. A number of exchange rate theories indicate that the capitalization of the stock market is significantly impacted by exchange rates. Due of their crucial role as the study's nuclear component, these ideas are extremely important. Using the empirically accepted theories, Chen, N.F., Roll, R., and Ross, S.A. (1986) created various regression models using the capital asset pricing model and Arbitrage pricing theory to investigate the theoretical conundrum between exchange rate changes and stock returns. The two models investigated the potential explanatory role of exchange rate on stock return.

While a conceptual framework, according to Camp (2001), is a framework that the researcher thinks can explain how the event under study would naturally proceed. The researcher's notions, empirical findings, and significant theories for advancing knowledge are all connected to the framework. It explains the methodology that will be used to investigate the researcher's challenge. From a statistical perspective, the framework explains how a study's key concepts relate to one another.

Methodology

Eight (8) SSA countries—Nigeria, Ghana, Cameroon, South Africa, Botswana, Namibia, Zambia, and Kenya—will be used in this study based on their GNI per capita grouping, sub-regional block in the region, and ability to implement currency devaluation as macroeconomic reforms with thriving stock markets. Employing secondary data gathered from relevant sources, this analysis examines the relationship among currency devaluation, stock market returns, and economic development. As a result, both short-term impacts and long-term trends can be recorded, which is essential for informed policy recommendations and strategic planning.

The conceptual framework of this research study is based on Mundell-flemming model which is based on the works of Mishin (1995) and Yu (2021). It offers a framework for examining fiscal and monetary policy and describes the workings of a tiny economy that is open to the exchange of goods and financial assets. However, few studies have empirically estimated output and the real effective exchange rate simultaneously in certain countries while no studies were done is sub Saharan Africa region within the framework of Mundell-flemming model. Suppose the goods market is a function of balance of payment (BoP), real interest rate(iR) and real effective exchange rate (EXr), while money market is determine by real output (Rgdp), real stock market returns(StockR) and real effective exchange rate (EXr), this research expresses IS and LM functions as

$$Y = f(BoP, iR, EXr)$$
$$M/_P = f(Rgdp, EXr, StockR)$$

Since the panel co-integration test and the Dumitrescu-Hurlin panel Granger causality test (2012) allow for flexibility in lag structures, accommodate various dynamics and relationships among variables, and provide insights into long-term relationships among variables, they were used to examine the relationship between currency devaluation, stock market returns, and economic growth for causality and its interactions. With this approach, correlations between units in the panel data are handled, more observations are permitted, and data can be pooled across cross sectional units. It is an adaptation of the Granger causality test, which was created in 1969 to examine the causal connections between time series. The cointegration and Granger causality test have been used in a number of studies. For example, Asiamah (2023) used this test to investigate the causal relationship between Ghana's financial system and economic growth, and Idenyi (2017) described how capital market indicators influenced Nigeria's economic growth from 1986 to 2016 among other related studies. To calculate the co-integration of panels across several cross-sectional units,

$$EG_{it} = \alpha_i + \beta_i CD_{it} + \beta_i StockR_{it} + \epsilon_{it}$$

Where EG_{it} is the dependent variable for unit (i) at time (t), CD_{it} is the first independent variable for unit (i) at time (t), $Stock_{it}$ is the second independent variable for unit (i) at time (t), α_i is the intercept, β_i is the co-integrating coefficient for unit (i). In sub-Saharan Africa, the regression models would be configured as follows to estimate the causal link between currency depreciation (CD), stock market returns (StockR), and economic development.: Causality from currency devaluation to economic growth (CD→EG) and economic growth to currency devaluation (EG→CD)

$$EG_{it} = \propto + \sum_{j=1}^{K} \beta_j CD_{it-j} + \sum_{j=1}^{K} \gamma_j EG_{it-j} + \epsilon_{it}$$
$$CD_{it} = \propto + \sum_{j=1}^{K} \beta_j EG_{it-j} + \sum_{j=1}^{K} \gamma_j CD_{it-j} + \epsilon_{it}$$

Causality from stock market returns to economic growth (StockR→EG) and economic growth to stock market (EG→StockR)

$$EG_{it} = \propto + \sum_{j=1}^{K} \beta_j StockR_{it-j} + \sum_{j=1}^{K} \gamma_j EG_{it-j} + \epsilon_{it}$$
$$StockR_{it} = \propto + \sum_{j=1}^{K} \beta_j EG_{it-j} + \sum_{j=1}^{K} \gamma_j StockR_{it-j} + \epsilon_{it}$$

Causality from currency devaluation to stock market returns (CD→StockR) and stock market returns to currency devaluation (StockR→CD)

$$StockR_{it} = \propto + \sum_{j=1}^{K} \beta_j CD_{it-j} + \sum_{j=1}^{K} \gamma_j StockR_{it-j} + \epsilon_{it}$$
$$CD_{it} = \propto + \sum_{j=1}^{K} \beta_j StockR_{it-j} + \sum_{j=1}^{K} \gamma_j CD_{it-j} + \epsilon_{it}$$

Where EG_{it} denotes economic growth for country i and t, CD_{it} is the stock market return for country (i) at time (t), $StockR_{it}$ is the stock market returns for country (i) at time (t), $\propto$ is the intercept, β_j γ_j δ_j η_j are coefficients to be estimated, (K) is the lag length and ϵ_{it} is the error term.

Given that:
CD = f (BOP, EXR) and Stock R = f (MKTCAP,)
EG= f (Rgdp, BOP, EXR, MKTCAP)

Where Rgdp is real gross domestic product, BOP is balance of payments, EXR is exchange rate and MKTCAP is total market capitalization. Thus, we have;

$$Rgdp = \propto + \beta_1 BOP + \beta_2 EXR + \beta_3 Mktcap + \mu$$

Results and Findings

One econometric method for determining whether the mean and variance change over time is unit root testing, which considers the autoregressive nature of the time series. An examination to determine if the variance, covariance, and mean of a time series are independent of time. To put it briefly, the panel unit tests are designed to confirm the heterogeneity assumption.

Table 1: Panel unit root test at levels

Unit root test / **Variables**	Levin, Lin & Chut Prob(statistics)	Im,Pesaran and Shin W-stat Prob(statistics)	ADF-Fisher Chi-square Prob(statistics)	PP-Fisher Chi-square Prob(statistics)	Conclusions
Rgdp	0.0005(-3.26651)	0.0767(-1.42795)	0.1275(22.5104)	0.0811(24.4010)	-
Exr	0.9984(2.94104)	1.0000(4.37604)	0.9993(3.73095)	0.9947(5.19355)	-
BoP	0.0002(-3.54249)	0.0160(-2.14346)	0.0119(31.4216)	0.0954(3.7379)	-
Tmcap	0.4402(-0.15035)		0.8809(9.71877)	0.8373(10.5342)	-

Table 2: First-difference panel unit root test

Unit root test / **Variables**	Levin, Lin & Chut Prob(statistics)	Im,Pesaran and Shin W-stat Prob(statistics)	ADF-Fisher Chi-square Prob(statistics)	PP-Fisher Chi-square Prob(statistics)	Conclusions
Rgdp	0.0000(-6.80241)	0.0000(-5.56407)	0.0000(58.0471)	0.0000(125.595)	I(1)
Exr	0.0000(-4.55235)	0.0000(-4.49175)	0.0000(51.7487)	0.0000(82.5584)	I(1)
BoP	0.0000(-6.58253)	0.0000(-5.05656)	0.0000(53.7991)	0.0000(76.0714)	I(1)
Tmcap	0.0000(-7.79481)		0.0000(76.2938)	0.0000(128.366)	I(1)

It should be noted that table 1 and 2 implies that variables employed in the research are stationary at first difference but non-stationary at levels or order zero.

Table 3: Cross section dependence test among variables

CD test / Variables	Breusch-pagan LM Prob(Statistics)	Pesaran scaled LM Prob(Statistics)	Bias corrected scale LM Prob(Statistics)	Pesaran CD Prob(Statistics)
Rgdp	0.0000(406.3890)	0.0000(50.56436)	0.0000(50.35383)	0.0000(20.03377)
Exr	0.0000(400.3223)	0.0000(49.75365)	0.0000(49.54313)	0.0000(19.47203)
BoP	0.0000(116.0584)	0.0000(11.76730)	0.0000(11.55677)	0.0000(5.054940)
Tmcap	0.0000(109.5183)	0.0000(10.89335)	0.0000(10.68282)	0.0000(7.545226)

While table 3 depicts that there is no independent cross section dependence within variables employed in the study.

Table 4: Panel Co-integration test results

Hypothesized No of CE(s)	Fisher Stat* (from trace test)	Prob.	Fisher Stat* (from max-eigen test)	Prob.
None	84.52	0.0000	83.14	0.0000
At most 1	19.29	0.2541	18.93	0.2722
At most 2	10.84	0.8193	10.38	0.8462
At most 3	12.86	0.6831	12.86	0.6831

To calculate probabilities, the asymptotic Chi-square distribution is used.

From the above table 4, there is a co-integration relationship among variables employed in this study. Also, when there is no co-integration equations, the null hypothesis was rejected with a p-value of less than 0.05, while at most 1 co-integration Relationship, the findings (p-value > 0.25) depicts that there may be just a few additional long-term linkages beyond the initial one, without providing substantial evidence. Whereas, in at most 2 and 3 Co-integration associations, there were not many more long-term associations, as indicated by the evidence for these hypotheses presented in the table at p-values > 0.6. From this panel co-integration approach, there are indications of a long-term equilibrium relationship between BOP, MKTCAP, EXR and RGDP.

Table 5: Panel EGLS (cross section SUR) results

Variable	Coefficient	Std error	t-statistic	Probability
Exr	1.47E+08	18167925	8.102423	0.0000
BoP	2.294970	0.335683	6.836713	0.0000
Tmcap	0.361279	0.016667	21.67635	0.0000
C	4.65E+10	3.72E+09	12.49995	0.0000
R^2		0.872892		
Adjusted R^2		0.870400		
SER		0.868810		
SSR		115.4890		
F- Statistic		350.2340		
Prob (F- Statistic)		0.000000		
Mean dependent var		0.476869		
S.D dependent var		2.841743		
Durbin- Watson statistic		0.894308		

The table 5 above indicates low p-values (all < 0.0001) show that all independent factors have a substantial impact on RGDP. R-squared is 0.872892, meaning that 87.29% of the variance in RGDP is explained by the independent variables, while adjusted R-squared shows 87% of the variance in RGDP explained. However, the model's statistical significance is demonstrated by the F-statistic, which has a probability value of 0.000000.

While the study residual cross section dependence test shows the Pesaran scaled LM test with a probability value of 0.58 that suggest the rejection of the null hypothesis with a significant borderline result. Also, because the panel data model has a large cross-sectional units and suspicion of potential cross-sectional dependence leading to a bias result in table 7 below.

Table 6: Cross-sectional dependence test

Test	Statistic	d.f	Prob.
Breusch-pagan LM (B-PLM)	42.21040	28	0.0414
Pesaran scaled LM (P-SLM)	1.898945		0.0576
Pesaran CD (PCD)	2.088340		0.0368

As shown in table 7 cross-sectional dependence is present in the data according to the results of the PCD and B-PLM tests. The P-SLM test, however, demonstrates minimal significance. Therefore, there is enough data to draw the conclusion that the panel data for this research exhibits cross-sectional dependence.

Table 7: Panel Granger causality test

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 09/22/24 Time: 06:22
Sample: 2003 2022
Lags: 2

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
EXR does not homogeneously cause RGDP	2.54764	0.18321	0.8546
RGDP does not homogeneously cause EXR	8.24453	5.85541	5.E-09
BOP does not homogeneously cause RGDP	3.74915	1.37951	0.1677
RGDP does not homogeneously cause BOP	4.02620	1.65535	0.0979
TMCAP does not homogeneously cause RGDP	4.23806	1.81660	0.0693
RGDP does not homogeneously cause TMCAP	2.29631	-0.08252	0.9342
BOP does not homogeneously cause EXR	5.24238	2.86627	0.0042
EXR does not homogeneously cause BOP	2.51041	0.14613	0.8838
TMCAP does not homogeneously cause EXR	3.23275	0.83337	0.4046
EXR does not homogeneously cause TMCAP	2.15993	-0.21590	0.8291
TMCAP does not homogeneously cause BOP	2.14929	-0.22631	0.8210
BOP does not homogeneously cause TMCAP	3.24315	0.84354	0.3989

Pairwise Dumitrescu Hurlin Panel Causality test looks for relationships between panel data variables, such as those between exchange rate (EXR), real gross domestic product (RGDP), balance of payments (BoP), and total market capitalization (TMCAP). Exchange rate does not significantly have a homogenous causal effect on RGDP, as the null hypothesis was not rejected, indicating that EXR is not the cause of RGDP. Furthermore, the rejection of the null hypothesis indicates that RGDP has a substantial and significant causal influence on the exchange rate, which is why RGDP causes EXR. The test indicates that BOP is not the cause of RGDP because the null hypothesis was not ruled out.

Since the null hypothesis is marginally rejected at the 10% level, suggesting a possible causal influence, RGDP causes BOP. To summarize, the results of the tests indicate that RGDP and BOP have a causal link with EXR and EXR, respectively, but that other relationships, such as EXR causing RGDP, are not statistically significant. While there is no substantial evidence of a causal relationship between TMCAP and other variables like the exchange rate or balance of payments, there is some weak evidence (at the 10% level) that TMCAP may cause RGDP.

Conclusion and Recommendations

The strong correlations between market capitalization and exchange rate fluctuations and economic growth are indicated by the considerable linkages observed among RGDP, EXR, BOP, and TMCAP. These are things that policymakers might have to consider when creating economic policies. Also, the high R-squared value suggests that the model fits the data well, cross-section dependence problems call for cautious interpretation. It implies that several units' economic circumstances may be impacting one another. One of the primary findings of this study in Sub-Saharan Africa is that the variables have a reasonably good association with one another. Additionally, the model demonstrates a high correlation by explaining around 87% of the variation in real gross domestic output. As a result, the study's economic implications for a few chosen SSA nations include the necessity of managing the balance of payments, preserving exchange rate stability, coordinating fiscal and monetary policy, giving financial market growth first priority, and promoting economic diversification.

In order to reduce reliance on primary products like oil, gold, and other solid minerals that generate good foreign earnings in the SSA region, this study suggests implementing monetary policies aimed at maintaining stable exchange rates, creating strategies to improve the balance of payments, bolstering the infrastructure of the financial markets to make them more resilient, and making sure that the monetary and fiscal authorities are operating in concert and with coherence. By implementing these policy recommendations, governments can create a more stable and favorable economic environment that ensures long-term growth, encourages the growth of market capitalization, and mitigates the adverse effects of exchange rate volatility and balance of payments issues on the economy. Further research could investigate the dynamics of these interactions over shorter periods of time or under different economic conditions in order to get deeper insights, given the limited co-integration relationship discoveries beyond the first.

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