



**EMPIRICAL STUDIES AND COMMUNICATION DEVELOPMENT
(A RESEARCH CENTER)**

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UYO, AKWA IBOM STATE, NIGERIA



BOOK OF PROCEEDINGS

“RE-ENGINEERING LOCAL CONTENT
DEVELOPMENT RESEARCH FOR
SUSTAINABLE INDUSTRIALIZATION”

22ND - 23RD JANUARY, 2024



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INTRODUCTION TO R-ELCDRFSI

In an era where global economies are intricately interwoven, the significance of harnessing local resources and knowledge for sustainable industrial growth cannot be overstated. This conference stands as a beacon, illuminating the path towards leveraging indigenous resources, research, and expertise to propel sustainable industrialization.

This conference acts as a testament to the commitment shared across borders, industries, and academic realms to explore, redefine, and revolutionize the paradigm of local content development. As we convene in this digital space, we embark on a journey of discovery, innovation, and collaboration, with a singular focus: catalyzing sustainable industrialization through cutting-edge research and strategic re-engineering.

Throughout our deliberations, we shall traverse diverse landscapes – from examining the symbiotic relationship between local content development and industrial sustainability to exploring methodologies that foster inclusive growth and equitable utilization of indigenous knowledge. Our aim is not solely to theorize but to forge actionable pathways that bridge academia, industry, and policy for tangible, lasting impacts.

Together, we assemble a mosaic of perspectives, expertise, and experiences, fostering an environment where ideas converge, ignite, and evolve. The exchange of insights, the fusion of methodologies, and the cross-pollination of ideas shall not only enrich our understanding but also illuminate novel avenues for transformative change.

As we embark on this intellectual odyssey, I urge each participant to immerse themselves fully, to engage passionately, and to collaborate earnestly. Let us harness the collective wisdom present within these digital walls to sculpt a future where local content development stands as a cornerstone for sustainable industrialization on a global scale.

CONFERENCE OBJECTIVES:

- ❖ **Knowledge Exchange:** Facilitate the exchange of cutting-edge research, innovative practices, and transformative ideas in the realms of science, technology education, and social sciences.
- ❖ **Interdisciplinary Collaboration:** Encourage collaboration among diverse disciplines to promote holistic approaches to sustainable development.
- ❖ **Global Perspectives:** Showcase a diverse array of global perspectives, experiences, and best practices to create a rich tapestry of insights.
- ❖ **Policy Implications:** Explore the policy implications of sustainable development initiatives, emphasizing evidence-based approaches and practical solutions.
- ❖ **Youth Engagement:** Provide a platform for the engagement of young scholars and professionals, recognizing the role of the youth in shaping sustainable development practices.

CONFERENCE THEMES

The conference will cover a wide array of themes related to sustainable development practice, including but not limited to:

- ❖ Policy Frameworks and Regulations: Exploring the role of governmental policies and regulatory frameworks in fostering sustainable industrialization through local content development.
- ❖ Technological Innovation and Adoption: Highlighting innovative technologies and their integration into local content development to drive sustainable industrial growth.
- ❖ Capacity Building and Skill Development: Discussing strategies for enhancing local capacity and skills to support sustainable industrialization.
- ❖ Economic Impact and Investment: Analyzing the economic implications of investing in local content development and its impact on sustainable industrial growth.
- ❖ Sustainability and Environmental Responsibility: Addressing the importance of integrating sustainability practices into local content development for environmentally responsible industrialization.
- ❖ Cultural Preservation and Localization: Examining how to preserve cultural values while developing local content for sustainable industrialization.
- ❖ Challenges and Opportunities: Identifying and discussing challenges and opportunities in re-engineering local content development for sustainable industrialization on a global scale.
- ❖ Future Trends and Strategies: Predicting future trends in local content development research and proposing strategies to align them with sustainable industrialization goals.

ADDRESSES/SPEECHES

WELCOME ADDRESS BY THE CHAIRMAN PLANNING COMMITTEE AT THE OPENING CEREMONY OF INTERNATIONAL VIRTUAL CONFERENCE ON RE-ENGINEERING LOCAL CONTENT DEVELOPMENT RESEARCH FOR SUSTAINABLE INDUSTRIALIZATION

Ladies and gentlemen,

Distinguished guests,

Esteemed participants,

It is my honor and privilege to welcome you all to the opening ceremony of the Re-Engineering Local Content Development Research for Sustainable Industrialization. On behalf of the Planning Committee, I extend a warm greeting to each and every one of you joining us from around the world for this momentous occasion.

In a world where interconnectedness and collaboration drive progress, this conference stands as a testament to our collective dedication to fostering sustainable development through the amplification of local content research. Today, we are not merely convening for a conference; we are embarking on a transformative journey towards shaping the future of industrialization.

Throughout our deliberations over the coming days, we will explore cutting-edge research, innovative strategies, and collaborative frameworks that will propel us towards a future where local content development forms the bedrock of sustainable industrialization. This conference serves as a melting pot of ideas, perspectives, and experiences. We have gathered esteemed scholars, industry leaders, policymakers, and visionaries from across the globe to share insights,

engage in fruitful discussions, and forge alliances that will chart the course for a more sustainable and inclusive industrial landscape.

I encourage each of you to actively participate, exchange ideas, challenge conventional wisdom, and seek novel solutions to the pressing challenges we face. Let us leverage this platform to not only gain knowledge but also to build bridges that transcend geographical boundaries and foster a spirit of collaboration and innovation.

As we embark on this exciting journey, I extend my deepest gratitude to the organizing committee, speakers, sponsors, and all participants for their invaluable contributions in making this conference a reality.

Together, let us set the stage for a future where local content development becomes the cornerstone of sustainable industrialization. Thank you.

WELCOME ADDRESS BY THE EXECUTIVE DIRECTOR, EMPIRICAL STUDIES AND COMMUNICATION DEVELOPMENT AT THE OPENING CEREMONY OF INTERNATIONAL VIRTUAL CONFERENCE ON RE-ENGINEERING LOCAL CONTENT DEVELOPMENT RESEARCH FOR SUSTAINABLE INDUSTRIALIZATION

Ladies and gentlemen,

Distinguished guests, scholars, researchers, and participants,

It is my honor to extend a warm welcome to all distinguished guests, delegates, speakers, and participants at the inauguration of the International Virtual Conference on Re-Engineering Local Content Development Research for Sustainable Industrialization. As the Executive Director of Empirical Studies and Communication Development, I am thrilled to witness the convergence of bright minds and industry pioneers in this virtual space. Our collective presence here today marks the beginning of a significant and transformative dialogue focused on redefining the landscape of local content development for sustainable industrial growth.

The theme of this conference resonates profoundly with the evolving global narrative—highlighting the pivotal role of local content in fostering sustainable industrialization. It is a testament to our commitment to leveraging research, innovation, and collaboration to drive economic progress while ensuring environmental and societal sustainability.

Over the course of this conference, we will delve into a spectrum of empirical studies, cutting-edge research findings, and insightful discussions. Our aim is to explore how we can re-engineer the pathways of local content development to fuel industrialization that is not only robust but also environmentally conscious and socially responsible. This virtual gathering provides an unparalleled opportunity to transcend borders, share diverse perspectives, and catalyze collaborations that transcend geographical limitations. Through this platform,

we have the chance to pool our collective knowledge, harness the power of communication, and pave the way for novel strategies and solutions that can reshape the future of industrial development.

I extend my heartfelt appreciation to the organizing committee, the esteemed speakers, our sponsors, and each participant for their unwavering dedication and support in bringing this conference to fruition. As we embark on this intellectual journey together, I encourage all of you to actively engage, exchange ideas, challenge preconceptions, and foster a spirit of open dialogue. Let us collectively explore the avenues that will enable us to re-engineer local content development for a more sustainable and inclusive industrial future.

Thank you for your presence and commitment.

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EFFECTS OF POURING TEMPERATURE ON MECHANICAL PROPERTIES OF ALUMINUM ALLOY

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ABSTRACT

The study, effects of pouring temperature on mechanical properties of aluminum alloy was successfully investigated. A total of thirty-two (32) casts, were produced via sand mould at four (4) different pouring temperatures namely 660°C, 690°C, 710°C and 740°C which were achieved with the aid of a thermocouple. All other process parameters were kept constant. The specimens were afterwards tested for quality of properties such as density, hardness, water retention capacity and tensile strength, and on how these mechanical properties failed under different pouring temperatures. More so, sample was taken to an Atomic Absorption Spectrometer to test for their chemical composition which read Al (83%), Si (11%), Cu (3%) and others (3%). The results were analyzed using laboratory techniques. Observations and results revealed that variation in the pouring temperature significantly affected the quality of density, tensile strength and hardness, whereas, it had no significant effect on the water retention capacity of the aluminum casts. The advantages of sand casting over other forms of casting to produce quality aluminum alloy casts of similar sizes and designs were also analyzed.

KEYWORDS: Aluminum alloy, Pouring temperature, Mechanical properties, Hardness

INTRODUCTION

It has been noted that iron (5.0%) and aluminum (8.1%) are the two most abundant metallic elements used in alloyed form in all industrial and engineering applications. Iron and aluminum are also the most commonly used structural metals. According to Jonathan (2003), Aluminum Alloy casts have found their usefulness in the automotive industry in the production of components such as pistons, cylinder blocks, cylinder heads, cylinder liners, bearings,

connecting rods, turbo chargers, jet engine parts, impellers, metal composites, actuators, brake calipers and rotors. Increase in the performance, efficiency and reliability of these cast parts for service has been found to be proportional to the improvement in their mechanical properties. However, these mechanical properties are affected by the pouring temperature during casting. Analyzing the relationship to understand how the pouring temperature affects the mechanical properties of a cast using a very reliable statistical analytical technique like the Analysis of Variance (ANOVA) will be of best interest.

Oji et al., (2011) revealed that Aluminum Alloy casting process involves so many parameters such as melting temperature of the charge, temperature of the mold, pouring speed, pouring temperature, composition, micro structure, size of casting, runner size, and solidification time. The difference in the structure of the casting occurs due to the non-uniform cooling of the molten metal in the mold. This difference results in low mechanical properties if not controlled and will affect the performance of the casting during service. Among these various parameters of casting process, pouring temperature proves to be a reoccurring decimal, and stands out as the most influential parameter. Almost every research analysis on the factors that affect casting process, considered the pouring temperature. According to Raji and Khan (2006) concluded that optimum pouring temperature of 700°C among other things, yielded a sound aluminum Alloy. Hence, the paper aimed at determining the effects of pouring temperature on mechanical properties of aluminum alloy.

OBJECTIVE OF THE STUDY

The general objective of this research work is to determine the effects of pouring temperature on mechanical properties of aluminum alloy in order to improve the service performance and reliability of Aluminum alloy products.

MATERIALS AND METHODS

The study adopted laboratory measurement techniques. These techniques can be used only for obtaining numerical data. It is to be used to determine whether there are significant differences among the means of four pouring temperature groups of aluminum cast (650°C, 690°C, 710°C, and 740°C) in relation to mechanical properties (density, water retention capacity, tensile strength and hardness).

CASTING METHOD

As regards the casting methods utilized, it started with the making of patterns, bearing in mind the expected tests to be carried out at the testing machines, followed with the making of the mold. Next, scraps of neat aluminum ceilings, free of dust and contamination, were charged into a graphite crucible furnace. The crucible, which uses combustion to melt the material, was powered by Automated Gas Oil (AGO) or diesel mixed with air from a blower. Furthermore, to minimize oxidation of aluminum, mixture of sodium chloride and potassium chloride powder known as halide salt was added to exclude oxygen and create a protective atmosphere inside the furnace. This will reduce the effect of oxidation. The resulting melt was thoroughly stirred intermittently to ensure uniformity of material, especially the times that the temperature of the molten metal were checked with the use of thermocouple by dipping the tip into the liquid. Finally, the molten metal was then skimmed to remove the oxides and impurities before pouring. The distance from the cope to the drag was measured to be 12cm (0.12m), while the

average pouring duration was 5seconds which resulted in a pouring speed of 2.4cm/s (.024m/s). After the casting process, some of the samples were polished and taken to an Atomic Absorption Spectrometer to test for their chemical composition which showed the percentage composition as Al (83%), Si (11%), Cu(3%),others (3%).

POURING TEMPERATURE

Pouring is a process by which molten metal is transferred to the cast for cooling and solidification and thus be converted into final product. Pouring temperature is the temperature to which the molten metal has to be raised. Temperature must also take into account the heat loss and caused due to the transfer of metal through ladles. Also, distance between the furnace and mold has to be considered as well as heat loss due to the heat absorbed by ladles. The casting process can usually be done in permanent metal casts. However, due to repeated exposure to high temperature of molten metal, these casts have a limited life, or can be used for metals with low pouring temperature requirements. Therefore one of the main requirements of the casting process is refractoriness or in other words, the capability of east to bear high temperatures of the molten metal without undergoing any changes in its physical properties. This is a very important requirement in alloys with high melting point such as steel. However, this issue may be taken secondary in alloys with lower melting points. Where alloys with high melting point are being used, the molds need to be lined with an insulation material with refractory properties so that the mold retains its shape and original characteristics. Sand and ceramic materials have very high ability to withstand high temperatures of molten metal without undergoing a change in their properties. Therefore, they are used as coating material for molds in which alloys with high temperatures have to be poured for cooling. Sand and ceramic can withstand temperatures as high as 165°C-1820°C. Also, sand retains the shape given to it when it is put into a mold. It also permits various gases to escape through its structure. Sand casting can be used in processing of low-temperature metals, such as iron, copper, aluminum, magnesium, and nickel alloys and also for high temperature metals where other mold material cannot be used.

Metal molds have a limited capacity to withstand high temperatures. Metal molds are used in processes like Die Casting (where molten metal is forced into steel molds under high pressure) and permanent molding. These molds may change their physical properties in case molten metal above 118°C pouring temperature are processed in such molds. For any alloy with temperature above this temperature, metal molds are not suitable.

RESULTS

Some of the Aluminum Alloy Cast specimen results data are presented below.

Table 1: Masses of the Casts and Their Pouring Temperatures

MASS (8)	POURING TEMPERATURE (°C)			
	660°C	690°C	710°C	740°C
	400	403	378	383
	402	414	390	399
	409	409	366	358
	411	393	373	364
	420	417	350	348
	417	390	377	374
	398	401	387	349
	399	384	370	345

Density Values

In the first premise, all thirty-two (32) casts were weighed at the Avery Loading Balance to ascertain their individual masses. In the same vein, an empty calibrated cylindrical flask was weighed to be 94g. Next, an empty weighing bowl and collector were obtained, and the bowl, filled with water to the brim, was placed in the collector. Next, the casts were immersed into the bowl, one at a time, to displace a certain quantity of water.

For each of the immersions, the displaced water into the collector was transferred into the cylindrical flask and weighed. The difference in the masses of the cylindrical flask as a result of the displaced water were obtained, which is equivalent to the displaced volume. This is in accordance with Archimedes' principle that an object submerged in water will displace the volume of water equivalent to its mass/weight. For example, for the cast with known mass of 378g and submerged into the bowl of water:

Mass of empty cylindrical flask = 94g

Mass of cylindrical flask containing water displaced by the 378g cast ~ 288g

Therefore, mass equivalent of the water displaced = 288g - 94g = 194g

from, Density = 378/194

$$= 1.94\text{g/cm}^3 \sim 1.9(\text{ld.p.})$$

Following suit, the table of values for density is obtained below:

Table 2: Values of Density Parameter

DENSITY (g/cm ³)	TEMPERATURE (°C)			
	660 °C	690 °C	710 °C	740 °C
400/189 = 2.11	403/190 =2.1	378/194 = 1.9	383/196 = 2.0	
402/212 = 1.9	414/137 = 3.0	390/136 =2.8	399/197 = 2.0	
409/190 =2.2	409/129 =3.2	366/135 =2.71	358/191 = 1.9	
411/179 = 2.3	393/143 2.7	373/171 = =2.2	364/202 = 1.8	
420/247 = 1.7	417/200 =2.1	350/181 = 1.9	348/181 = 1.9	
417/232 = 1.8	390/200 =2.0	377/187 = 2.0	374/220 = 1.7	
398/209 =1.9	401/225 = 1.8	353/182 = 1.9	349/180 = 1.9	
399/196 =2.0	384/135 =2.8	370/135 = 2.7	345/133 =2.6	

Water Retention Capacity

Here, the samples were simply submerged in water, after their original masses were noted, for duration of twenty (20) hours (almost 1 day). Thereafter, they were removed from the water and re-weighed. All the samples recorded increase in mass showing they had absorbed some water. The difference in mass shows the water retention capacity of aluminum, and which forms the data. It is important to note that aluminum that absorbed water will not rust, but reduces in size and ages faster than the one that did not absorb water. Thus, mass after immersion minus mass before immersion gives the data values.

Table 3: Values for Water Retention Capacity

WATER RETENTION CAPACITY (g)	TEMPERATURE(°C)			
	660°C	690°C	710°C	740°C
402 – 400 =2	405 - 403 =2	378-381 =3	385-383 =2	
404 - 402 =2	416-414 =2	394 - 390 =4	402-399 =3	
410-409 =1	411 -409 =2	368 - 366 =2	359-358 =1	
414-411 = 3	398 - 393 =5	376-373 = 3	366 - 364 = 2	
422 - 420 =2	420-417 - 3	354-350 = 4	352-348 =4	
419-417 =2	393-390 =3	379-377 = 2	377-374 = 3	
399-398 =1	404-401 =3	356-353 =3	351-349 =2	
401-399 =2	385-384 =1	372-370 = 2	348-345 =3	

Tensile Strength Values

The castings were taken to the grinder to remove the excess flakes bringing the shape to be properly locked into a bolted socket provided. Next, they were taken to the equipment used for ultimate tensile test which is Avery - Denison Universal Testing Machine with a capacity of 600KN and an analog scaling system. The machine is hydraulically operated. The test specimens, having been locked in the bolted socket were then fed into a locking socket which provided the grip of specimen at the base and at the top. Thus, the test specimen were held at both ends and made to be slightly tensioned, with the scale meter and load meter set at zero and the pump handle in the down position and locked. The pump handle was then operated to apply the load. The load was increased uniformly and the corresponding extension was noted. This process was repeated for other specimens.

Table 4: Values for Tensile Strength

TENSILE STRENGTH (N/mm ²)	TEMPERATURE (°C)			
	660°C	690°C	710°C	740°C
	141.5	151.2	141.0	131.7
	149.0	162.2	153.3	133.5
	134.1	154.1	155.1	150.1
	134.1	149.3	150.2	145.3
	139.4	154.1	150.3	140.7
	130.3	153.2	144.2	132.2
	129.8	159.6	148.1	131.9

Hardness Values

In continuation with the values got from the tensile strength test, Meyer's law was applied which reveals that there exist a relationship between ultimate tensile strength (UTS) and Brinell Hardness Number (BHN) which is given as $UTS = 3.4(BHN)$

Where 3.4 represents Meyer's index for materials like aluminum cast

Table 5: Values for Hardness

HARDNESS (N/mm ²) or (MPa)	TEMPERATURE (°C)			
	660°C	690°C	710°C	740°C
	41.6	44.5	41.5	38.7
	43.8	47.7	45.1	39.3
	39.4	45.3	45.6	44.1
	39.4	43.9	44.2	42.7
	41.0	45.3	44.2	41.4
	38.3	45.1	42.4	38.9
	38.2	46.9	43.6	38.8
	38.8	46.6	43.4	38.1

DISCUSSION OF FINDINGS

The outcome of the study, effects of pouring temperature on mechanical properties of aluminum alloy was discussed here. The data in **table 1** was analyzed and it showed that mass

of aluminum alloy cast produced increases at lower pouring temperature. This implies that high pouring temperature could increase shrinkage effect and hence, reduce weight.

According to the data in **table 2** was also analyzed and it revealed that the pouring temperature significantly affects the density of aluminum cast. In other words, there is differential treatment among the different pouring temperatures on the density of aluminum.

Furthermore, the data in **Table 3** showed that there appears to be no significant difference among the means of the test samples for water retention capacity. In other words, the temperature at which you do the pouring during casting does not significantly affect the water retention capacity of aluminum alloy.

In addition, the data in **Table 4** showed that the pouring temperature significantly affects the tensile strength of aluminum cast produced. Maximum tensile strength of 159.6 N/mm² was obtained at lower pouring temperature of 690°C.

Also, the data in **Table 5** showed that the pouring temperature created sufficient differences among the mean hardness of the test samples. Maximum hardness of 47.7 N/mm² was obtained at pouring temperature of 690°C.

CONCLUSION

Obviously, results from the study revealed that the pouring temperature of aluminum alloy cast has significant effect on its density, tensile strength and hardness. On the other hand, the pouring temperature had no effect on the aluminum's water retention capacity. Consequently, it is discovered that pouring temperature of 690°C yielded maximum value for density, tensile strength and hardness.

RECOMMENDATIONS

Pouring temperature of 690°C should be adopted when maximum value for density, tensile strength and hardness are required.

Further research can also be done in future to establish an accurate mathematical model between pouring temperature and density, tensile strength, hardness for easy of prediction.

Casting method adopted could influence the quality of Aluminum Alloy produced.

LIMITATION OF THE STUDY

In the course of carrying out this research, effects of pouring temperature on mechanical properties of aluminum alloy, the researchers encountered many encumbrances which might cause deviations from actual results. Some of the hindrances includes: data collection, cost of data analysis and evaluations, lack of electricity, etc.

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DISCLOSURE OF CONFLICT OF INTEREST

This research article is original and the corresponding author hereby confirms that co-authors participated actively in the development of the paper and have read and approved the manuscript with no ethical issues and with declaration of no conflict of interest.

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APPENDIX

CHEMICAL COMPOSITION OF THE ALUMINUM ALLOY CAST

Base: Al

Matrix: Al Si Cu

Elements	Burn1 (Standard)	Burn 2	Burn 3	Mean
Si	11.1730	<1.0000	< 1.0000	11.1730
Fe	1.0637	0.5018	0.4859	0.6838
Cu	3.4714	< 1.0000	<1.0000	3.4714
Mg	0.1115	0.5482	0.5875	0.4157
Mn	0.3161	0.4242	0.4299	0.3901
Ti	0.0606	0.0418	0.0460	0.0495
Ni	0.2839	0.0296	0.0742	0.1292
Pb	0.1305	0.0014	0.0543	0.0621
Zn	0.6064	0.2563	0.2974	0.3867
Sn	0.1423	0.0255	0.0936	0.0871
Zr	0.0061	0.0066	0.0117	0.0082
V	0.0119	0.0046	0.0092	0.0086
Ca	0.0027	0.0011	0.0016	0.0018
Sr	0.0197	0.0000	0.0002	0.0066
Cr	0.0287	0.0388	0.0450	0.0375
Be	0.0000	0.0006	0.0007	0.0004
Al	182.5713	96.6991	96.4090	91.8931



EVALUATION OF HOUSING ESTATES USING HOUSING QUALITY INDICATORS IN KUBWA, FEDERAL CAPITAL TERRITORY ABUJA, NIGERIA

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ABSTRACT

The study evaluates five housing estates in Kubwa, Federal Capital Territory Abuja, using Housing Quality Indicators. In achieving its aim, the study assessed the problems of housing quality in the study areas and examined the government and housing agency interventions in the improvement of the qualities of those housing estates. Literatures were reviewed around estates and housing quality indicators. The research design used in this dissertation is descriptive design, utilizing questionnaire instruments to obtain information from the respondents. A total of 150 respondents were selected for this study. The data were presented on a frequency distribution table and analyzed using simple statistical tools. The study found that government did not specify standard building features. It was also found that on the scale of housing quality indicators, some of the estates were performing better than the others. Other findings include the failure of the architectural design to cater for adequate space needs, proper ventilation, cultural characteristics and environmental sanitation. The study concludes that there is a need for all architectural designs of housing estates in Kubwa to provide for proper ventilation and space needs of the occupants. It is recommended that the profiling should include statistical analysis of the household size, housing prices, land supply, housing loan with subsidized interest rate.

KEYWORDS: Housing indicators, housing quality and housing satisfaction

Introduction

Housing is recognized world-wide as one of the basic necessities of life and a pre requisite to survival of man (Henilane, 2016; United Nation, 1992). A house is a place in which it provides shelter, refuge, comfort and security (Adeyemi et al., 2022). A house also provides the physical framework in which human, social economic and cultural resources are realized and integrated (Emma & Kathleen, 2020). In the traditional African setting housing is one of the greatly cherished material properties (Emma & Kathleen, 2020), this is because of the other functions that a house perform in the traditional society which include the protection of family cohesion and values, taking care of the aged through the protection of the ancestral values, among others (Henilane, 2016). Taylor & Francis (2019) a prominent economist gave a presentation in June 2019 on housing as an economic infrastructure. The attention paid to the notion of housing as an infrastructure is a result of increasing concern among many commentators about a housing crisis in Australia, with falling rates of home ownership and increasing housing stress

particularly for low-income households in the private rental market and rising rates of homelessness (Emma & Kathleen, 2020). Housing has an essential role in economic development of each country, accounting for 10–20% of total economic activity in the country as well as being to be the biggest fixed asset of households (Henilane, 2016). The need for housing is not only one of the basic human basic, but also the indicator of living standard of the population as posited by author above. Today it is a topical issue that housing has to be comfortable, economical and reasonably maintainable as well as architectonically expressive and compliant with the environment (Henilane, 2015a). Ezeanah (2018) noted that quality housing can be defined as one that is based on; infrastructure provision, user perceptions. Whether the dwelling has been self-built and levels of household Investment in the materials and finishing. For this study, housing quality is defined as a house that includes provisions such as water, electricity, and adequate transportation (Ezeanah 2018). In addition, it should have adequate space and to be constructed with good quality materials and also should ensure security and privacy (Ezeanah 2018).

There is a limited number of research works of the housing indicator in kubuwa. However, topical research has been done by different authors (Henilane, 2015a, Henilane, 2015b; Zubkovs & Geipele, 2011). There for the study fill the research gap by evaluating the Housing Estates in Kubwa using housing quality indicators. The principal objectives are to evaluate housing quality in kubuwa estates using housing quality indicators; to examine government and Housing agency intervention in the improvement of quality housing estate in Abuja Fct. The study focuses on the Evaluation of Housing Estates in Kubwa, Federal Capital Territory Abuja, using Housing quality Indicators.

Study Area

The territory is located just north of the confluence of the Niger River and Benue River. It is bordered by the states of Niger to the West and North, Kaduna to the northeast, Nasarawa to the east and south and Kogi to the southwest. Lying between latitude 8.25 and 9.20 north of the equator and longitude 6.45 and 7.39 east of Greenwich Meridian; Abuja is geographically located in the center of the country and has a landmass of approximately 7,315 km² and is situated within the Savannah region with moderate climatic conditions (Wikipedia 2021).

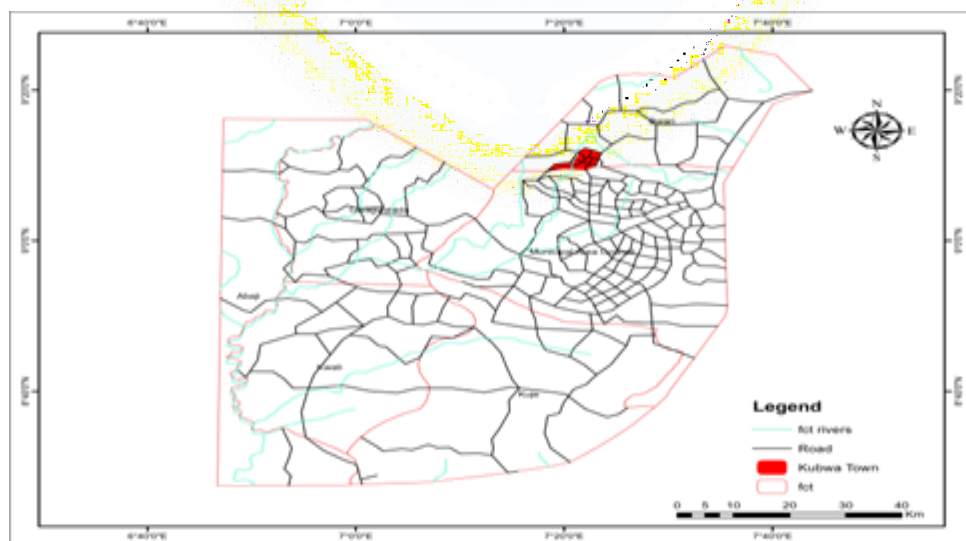
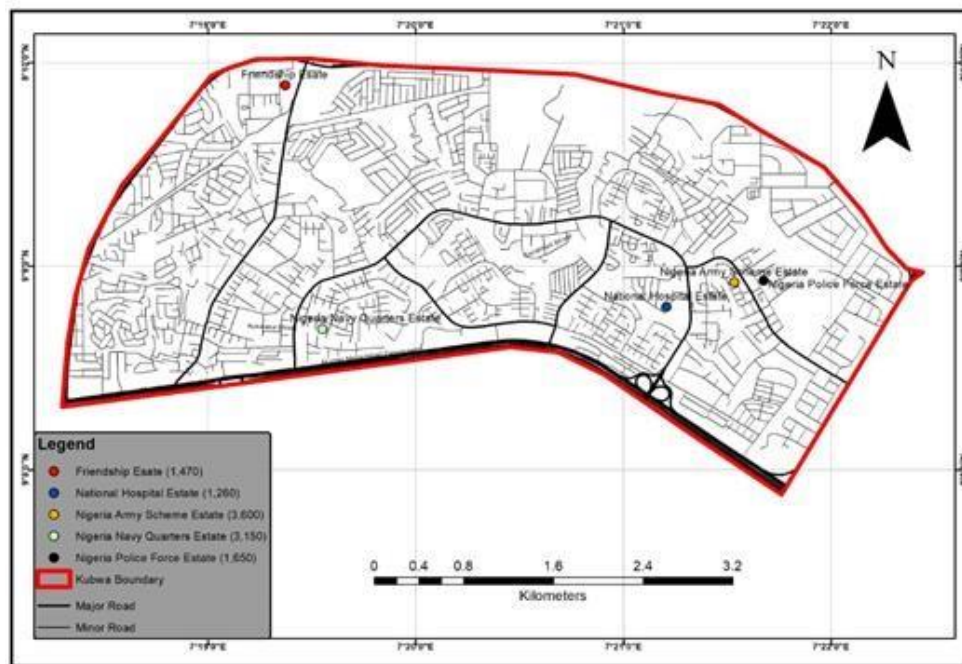


Figure 1: F.C.T, Abuja showing Kubwa town
Source: Abuja Geographic Information System 2024.



Source: Abuja Geographic Information System 2024
Figure 2: Digitized Map of Kubwa showing the Estates (the five study areas)

Literature Review

The United Nations Centre for Human Settlement (UNCHS, 2001) notes that access to decent housing is a basic right that should be made available to all individuals. The National Housing Policy (NHP, 2006) which provides the direction to housing development in Nigeria, emphasizes the human settlement for better quality of life, national integration, and unity. Its ultimate goal is to ensure that all Nigerians own or have access to adequate, safe and healthy housing accommodation at affordable cost particularly for the low-and-medium-income groups in the society (NHP, 2006). (Cheserek & Opata, 2011) argued that it is difficult to have uniform criteria for determining adequate housing throughout the world but some general norms are legal security of tenure, availability of services and infrastructure, affordability, habitability, accessibility, location, and cultural adequacy. Residential and neighborhood satisfaction are important indicators of housing quality and condition, which affect the individual's quality of life. In order to enhance the quality of life, promote greater community participation, and social integration of the population, it is necessary to provide adequate, quality housing and well organized urban services (Dimuna, 2017). In the same vein (Hoelzel, 2016) assertion corroborates previous observation that the housing problems ranging from lack of access to basic facilities, poor quality and physical conditions, proliferation of informal settlement evolved in response to government inability to provide adequate housing for the teeming low income population. This situation provides the need to take another look at the current housing sector in Nigeria in respect of low income housing group with a view to improving the national economic development. It is against this background that this study aims at assessing the performance of the housing policy towards enhancing the low income group.

Materials and Methods

During this study, a combination of primary and secondary data was explored. Qualitative data were collected on the field using questionnaires and focused group discussion that covered the five areas.

Analytical Techniques

All data collected were analyzed using descriptive statistics, specifically, the mean, rating, frequency counts, ranking method, percentages and the analysis were presented using tables and charts.

Sampling Size and Sampling Techniques

Due to large size of the target population, the researcher used the Taro Yamani formula to arrive at the sample population of the study.

$$n = \frac{N}{1 + N(e)^2}$$

n: describes the sample size.

N: describes total number of population of the area

e: describes maximum variability or margin of Error = 0.09.

l: describes the probability of the event occurring.

$$n = \frac{240}{1 + 240(0.05)^2}$$

$$n = \frac{240}{1 + 240(0.0025)}$$

$$n = \frac{240}{1 + 0.6} = \frac{240}{1.6} = 150$$

The sampling technique used is a simple random sample (SRS).

The questionnaires that were distributed in each estate that were used for the study area is as follows:

National Hospital Estate has the total population of 1,260 with 210 buildings within the estate and the total number of questionnaire distributed in the Estate is 20 questionnaires.

Friendship Estate has the total population of 1,470 with 250 buildings in the estate and the total number of questionnaire distributed in the Estate is 25 questionnaires.

Nigeria Police Force Estate has the total population of 1,600 with the total number of 297 buildings and the total number of questionnaire distributed in the Estate is 25 questionnaires.

Navy Quarters Estate has the total population of 3,150 with the total number of 331 buildings in the estate and the total number of questionnaire distributed in the Estate is 35 questionnaires.

Nigeria Army Scheme Estate has the highest population which is 3,600 with 465 buildings within the estate and the total number of questionnaire distributed in the Estate is 45 questionnaires.

Results and discussion

Evaluation of Housing Estates in Kubwa using Housing Quality Indicators (HQIs).

The following shows the tables of the housing quality indicator of each five estate in the study;

Ranking of Nigeria Police Force Estate in Kubwa using housing quality indicators

Following the responses from the respondents, it was observed that NPFE has 60% good housing quality while 40% responses were poor. From the displayed data in the table1, 1 out of 10 indicators fall into poor categories (open space), therefore the estate requires some level of housing quality improvement.

TABLE 1: Nigeria Police Force Estate (NPFE)

		Number of Respondents for each option						
S/N	HQI	HA	A	U	I	PI	MODEL OPTION	REMARKS
1.	Location	30	70	20	10	20	A	Adequate
2.	Landscape	30	40	50	15	15	U	Undecided
3.	Open space	40	10	25	30	45	PI	Poorly inadequate
4.	Road	80	20	10	20	20	HA	Highly adequate
5.	Layouts	90	10	-	30	20	HA	Highly adequate
6.	Size	80	40	-	20	10	HA	Highly adequate
7.	Services	25	50	30	45	-	A	Adequate
8.	Accessibility	20	-	20	90	20	I	Inadequate
9.	Sustainability	30	20	100	-	-	U	Undecided
10.	External Environment	100	30	-	10	10	HA	Highly adequate

Source: Author's Field Survey 2024.

Ranking of Nigeria Army Scheme Estates in Kubwa using housing quality indicators

Nigerian Army Scheme Estates (NASE)

From the table below it shows that 80% of the estates are located in a conducive environment while 20% of the indicators are in a bad shape. Also from this table, 2 out of the 10 indicators (5&7) are poorly inadequate. Therefore, the estate needs some required attention.

Table 2: Ranking of Nigeria Army Scheme Estates in Kubwa

		Number of Respondents for each option						
S/N	HQI	HA	A	U	I	PI	MODEL OPTION	REMARKS
1.	Location	30	70	20	10	20	A	Adequate
2.	Landscape	30	40	50	15	15	U	Undecided
3.	Open space	40	10	25	30	45	PI	Poorly inadequate
4.	Road	80	20	10	20	20	HA	Highly adequate
5.	Layouts	90	10	-	30	20	HA	Highly adequate
6.	Size	80	40	-	20	10	HA	Highly adequate
7.	Services	25	50	30	45	-	A	Adequate
8.	Accessibility	20	-	20	90	20	I	Inadequate
9.	Sustainability	30	20	100	-	-	U	Undecided
10.	External Environment	100	30	-	10	10	HA	Highly adequate

Source: Author's Field Survey 2024.

Ranking of Nigeria Navy Quarters Estates in Kubwa using Housing Quality Indicators

From the remarks column, out of the 10 indices, 80% are poorly inadequate, 20% are adequate. Therefore, it shows that there are huge problems there in the Estate regarding housing qualities.

From the table above, 8 out of the 10 indicators are poorly inadequate and require urgent attention for a better living in the housing estate

TABLE 3: Nigerian Navy Quarters Estates (NNQE)

S/N	HQI	Number of Respondents for each option					MODEL OPTION	REMARKS
		HA	A	U	I	PI		
1.	Location	15	20	5	50	60	PI	Poorly inadequate
2.	Landscape	30	-	-	50	70	PI	Poorly inadequate
3.	Open space	40	40	-	60	10	I	Inadequate
4.	Road	30	20	5	15	80	PI	Poorly inadequate
5.	Layouts	20	100	-	-	30	A	Adequate
6.	Size	40	50	-	60	-	I	Inadequate
7.	Services	5	45	15	10	75	PI	Poorly inadequate
8.	Accessibility	90	30	-	10	20	HA	Highly Adequate
9.	Sustainability	-	40	-	40	70	PI	Poorly inadequate
10.	External Environment	20	10	80	40	-	U	Undecided

Source: Author's Field Survey 2024.

Ranking of National Hospital Estates in Kubwa using housing quality indicators

From this table below it shows that 80% are inadequate therefore from the analysis the problems need urgent attention. In this estate 8 out of 10 indicators also are poorly inadequate. It is clear that the estate needs a serious help from the government to put the estate in order.

TABLE 4: National Hospital Estates (NHE)

S/N	HQI	Number of Respondents for each option					MODEL OPTION	REMARKS
		HA	A	U	I	PI		
1.	Location	-	20	-	100	30	I	Inadequate
2.	Landscape	30	20	40	50	10	I	Inadequate
3.	Open space	70	50	-	20	10	HA	Highly adequate
4.	Road	-	10	10	40	90	PI	Poorly inadequate
5.	Layouts	40	-	-	95	15	I	Inadequate
6.	Size	70	10	-	50	20	HA	Highly adequate
7.	Services	40	10	10	10	80	PI	Poorly inadequate
8.	Accessibility	30	-	50	70	-	I	Inadequate
9.	Sustainability	40	20	30	50	10	I	Inadequate
10.	External Environment	-	-	50	70	30	I	Inadequate

Source: Author's Field Survey 2024.

Ranking of Friendship Estates in Kubwa using housing quality indicators

From table 5 shows that 100% of the housing qualities were in bad condition and require urgent intervention. From the data display in table 5, 10 out of the 10 indicators are seriously poorly inadequate therefore; the housing qualities are expected to be put in place massively and urgently.

TABLE 5: Friendship Estates (FE)

S/N	HQI	Number of Respondents for each option					MODEL OPTION	REMARKS
		HA	A	U	I	PI		
1.	Location	10	20	40	30	50	PI	Poorly inadequate
2.	Landscape	20	10	-	50	70	PI	Poorly inadequate
3.	Open space	10	50	-	60	40	I	Inadequate
4.	Road	-	20	20	40	70	PI	Poorly inadequate
5.	Layouts	50	20	60	20	-	U	Undecided
6.	Size	30	20	40	10	50	PI	Poorly inadequate
7.	Services	10	-	10	70	60	I	Inadequate
8.	Accessibility	30	10	10	10	90	PI	Poorly inadequate
9.	Sustainability	15	10	40	5	80	PI	Poorly inadequate
10.	External Environment	40	30	-	-	80	PI	Poorly inadequate

Source: Author's Field Survey 2024

From this table 6 below the government intervention in the housing quality indicators are 60% adequate, 40% poorly inadequate. Therefore, the government attention will be needed seriously in the Estates.

TABLE 6: Examination of Government & Housing Agencies Interventions in the Improvement of Housing Qualities in Kubwa Estates

S/N	ESTATES	GOVERNMENT INTERVENTION	AGENCY INTERVENTION	MODEL OPTION	REMARKS
1.	Nigeria Army Scheme Estate	Adequate	Poorly Inadequate	A	Adequate
2.	Nigeria Navy Quarter Estate	Inadequate	Poorly Inadequate	I	Inadequate
3.	Nigeria Police Force Estate	Adequate	Inadequate	A	Adequate
4.	Friendship Estate	Highly Adequate	Undecided	HA	Highly Adequate
5.	National Hospital Estate	Poorly Inadequate	Inadequate	P	Poorly Inadequate

Source: Author's Field Survey 2024.

Conclusion and Recommendations

The weaknesses of government planning controls and the haphazard developments associated with the informal sector have created disorderly and unhealthy urban environments. Therefore, in Federal Capital Territory Abuja where the research was carried out, the activities that was conducted is to evaluate the Housing Estates in Kubwa using housing quality indicators. Unfortunately the architectural designs and planning processes of many public housing estates seem not to take into cognizance the need for adequate spaces, proper ventilation, and number of rooms that would adequately meet resident's socio-economic status and family sizes that are in tandem with their cultural characteristics. The following recommendations are made:

1. The Government should try as much as possible to specify the standards sustainability and for external environment of buildings in the Estates and there should be provisions for proper lay out plans of housing in Kubwa.
2. There is a need for adequate and proper building sizes and open spaces in the Estates, also the services and road networks Cultural should be major considerations in the design of the buildings in the estates.
3. It is recommended that the appropriate data and information needed for proper evaluation of the housing estates in Kubwa using housing quality indicators should include the profiling and statistical analysis of the household size, housing prices, land supply, housing loan subsidies among others.

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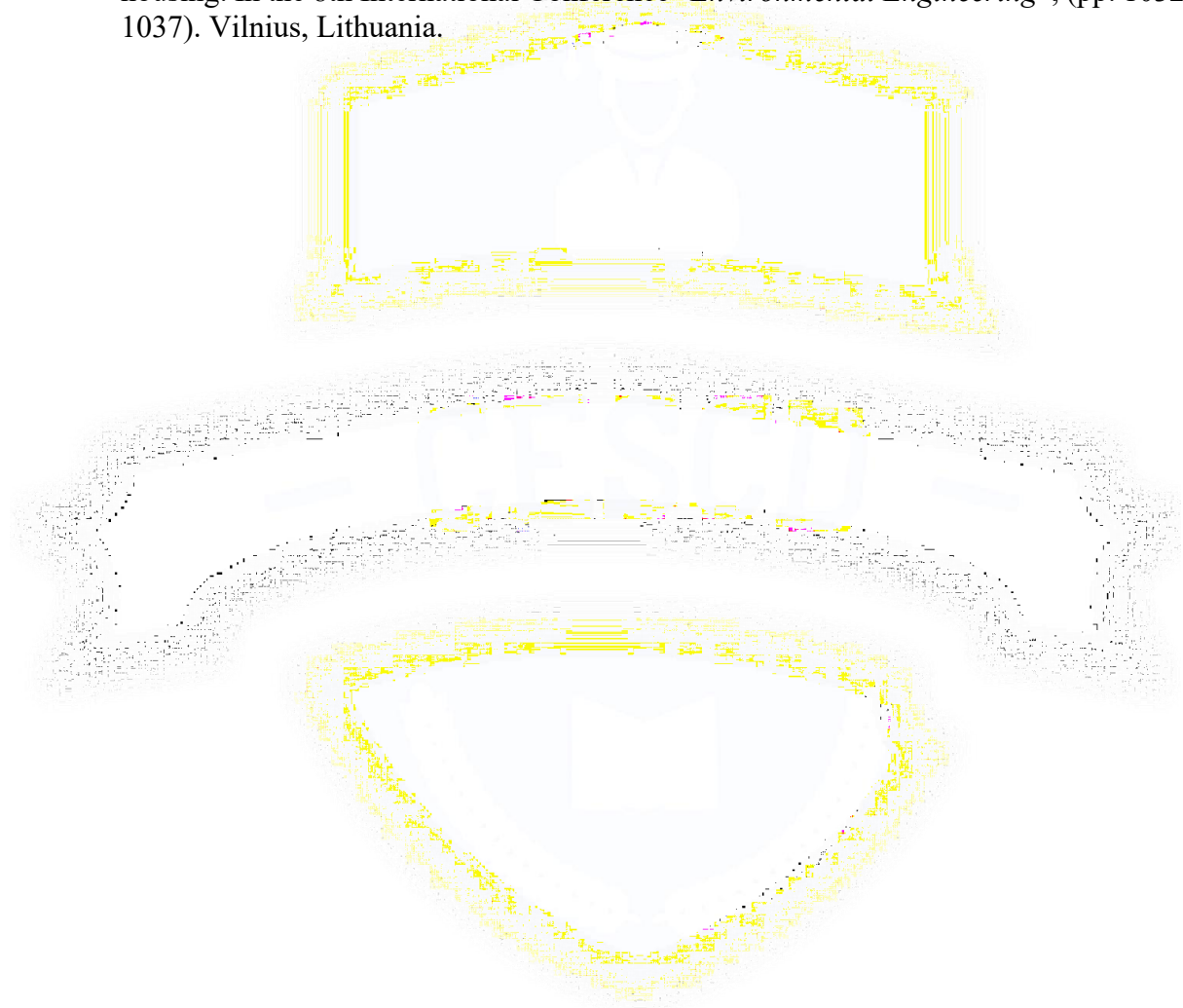
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INNOVATIVE APPROACHES TO RESOURCE ALLOCATION FOR QUALITY BASIC EDUCATION IN NIGERIA

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Dr. JEGEDE Adepitan Adebawale

ABSTRACT

This study explores innovative approaches for resource allocation in basic education within the Nigerian context. Recognizing the role of quality basic education in fostering educational excellence, the study identified and evaluate innovative strategies such as technology integration which can optimize the utilization of resources to enhance the quality of basic education across diverse regions and communities in Nigeria. It investigates the challenges such as Inadequate Funding which influenced the implementation and effectiveness of innovative resource allocation approaches. The study proposed solutions such as, increased budgetary allocation. The study concluded that embracing the innovative strategies has the potential to enhance the efficiency, equity, and overall quality of basic education in Nigeria. The distribution of funds for education should adhere to the UNESCO guideline of allocating 26% of the country's yearly budget, each educational programme in schools should have sufficient financial allocation to allow school administrators to acquire suitable and necessary instructional resources for successful teaching and learning and government should use innovative strategies to improve the efficiency, fairness, and overall quality basic education in Nigeria.

KEYWORDS: Innovative Approach, Resource Allocation, Quality, Basic Education

Introduction

Education drives social and economic progress, as is well known. Quality elementary education is a constitutional requirement and a key driver of sustained prosperity in Nigeria. However, resource allocation issues have hindered excellent education and the nation's educational aspirations. Nigeria, Africa's most populated nation, requires excellent education to fulfil its rising population. Inefficient resource allocation mechanisms and bureaucratic barriers have caused regional educational inequities. Despite Nigeria's commitment to universal basic education, access remains difficult. Poverty, cultural values, and geography keep many youngsters out of school.

The UNESCO Global Education Monitoring Report (2020) estimates 6.95 million out-of-school children in Nigeria, the largest figure worldwide. This worrying rate is due to poor infrastructure and educational resources. Ajayi & Ekundayo (2018) state that Nigeria's National

Policy on Education (NPE) emphasizes quality education, but insufficiently trained teachers, outdated curriculum, and a lack of teaching materials hinder education. According to Ojo (2017), Nigeria has a shortage of qualified teachers, particularly in rural areas, and the lack of professional development opportunities and inadequate remuneration contributes to the decline in teacher quality. Addressing these issues is crucial to improving student education and ensuring a well-rounded education. Adesoji & Olatokun (2018) also noted that many Nigerian schools have poor infrastructure, which hinders education. Library, lab, and restroom facilities are few in congested classrooms. Poor learning environments hinder student growth and learning.

Okebukola (2019) states that the Nigerian education system's curriculum is outdated and not aligned with the needs of the modern workforce, so there is a growing call for a curriculum review that incorporates technology, entrepreneurship, and vocational skills to prepare students for the 21st-century job market. E-learning platforms and interactive teaching methods can help make learning more engaging and relevant. Oni (2020) said that the Nigerian government has taken steps to improve basic education. The 2004 Universal Basic Education (UBE) Act mandates free and obligatory basic education for all Nigerian children. The government also created the National Mass Education Commission and SDG 4 to improve education access and quality. Despite these efforts, more financing, effective execution, and persistent commitment to results are needed. Okoli & Agwunobi (2016) found that basic education achievement requires community engagement. Parents, community leaders, and NGOs may help identify local issues and develop context-specific solutions. Government agencies, commercial sectors, and civil society must unite to handle basic education's complex difficulties. Sustainable educational growth requires effective resource allocation, according to Chibueze and Aluede (2018). The research by Ogunmade and Adebowale (2020) also highlight the limitations of Nigeria's resource distribution system and the need for new solutions.

Oduaran & Osunbor (2016) state that resource allocation is crucial to creating a learning environment, supporting well-trained educators, and equipping educational facilities. According to Oduaran & Sule (2017), many developing countries, including Nigeria, have budgetary constraints that limit education sector funding, which reduces the availability of textbooks, teaching materials, and infrastructure, lowering education quality. Additionally, urban and rural populations sometimes have uneven access to excellent education. Urban schools have greater money and better facilities, whereas rural schools have inadequate resources, limiting education quality (World Bank, 2019). Embezzlement, bribery, and other forms of corruption in the education sector reduce resource allocation and efficiency, lowering education quality (Bruns, Mingat, & Rakotomalala, 2003).

Hanushek & Woessmann (2015) found that administrative expenses outweigh student benefits in education budgets. Bureaucratic inefficiencies, excessive administrative personnel, and a lack of financial transparency may lead to misallocation of resources like teacher training and classroom equipment, which might improve education. Majgaard & Mingat (2018) noted that countries experiencing economic downturns may reduce government spending on education, affecting the quality and availability of educational resources. Addressing the impact of economic instability requires long-term planning and strategies to protect education budgets.

This study aims to investigate innovative resource allocation methods, analyse successful models, and identify potential implementation barriers to provide actionable recommendations for policymakers, educators, and stakeholders shaping Nigeria's education future.

Literature Review

The Concept of Quality Basic Education

Quality refers to the ability of a thing or system to efficiently accomplish its intended function or goal. Customer satisfaction refers to the capacity to meet the wants and wishes of customers, whether via the provision of appropriate products or the delivery of satisfying services (Aina and Oyetakin, 2015). It encompasses a range of values, extending from the highest levels of excellence or perfection. Every institution must ensure the delivery of a high-quality education. Quality is the condition of being appropriate for a certain purpose, delivering value in relation to the money invested, and attaining a level of perfection and excellence (Ekhaguere, 2005). High-quality elementary education is crucial for the comprehensive development of individuals and communities. It goes beyond the mere transmission of knowledge and encompasses a full methodology that promotes critical thinking, inventiveness, and essential life skills. The concept of exceptional basic education revolves on guaranteeing that every kid obtains an education that is readily achievable and effective in preparing them for the requirements of modern society (Adeyemi, 2011).

The main goal of quality basic education is to provide equitable educational opportunities for all children, regardless of their socio-economic status, gender, or geographical location. To tackle socioeconomic disparities and foster a fairer society, it is crucial to emphasise the inclusion of all persons. Accessible and universally accessible education is a potent means to disrupt the cycle of poverty and foster upward social mobility (UNESCO, 2019). Nevertheless, the notion of great primary education goes beyond simple availability. It underscores the need of providing education that adheres to certain criteria of excellence. This necessitates teachers who possess advanced expertise and are exceptionally driven, together with sufficient physical infrastructure, and a curriculum that is both up-to-date and captivating, with a particular focus on promoting comprehensive growth in pupils. Educators have a vital role in ensuring the quality of education. Teachers have the duty of not only imparting knowledge, but also of motivating and directing pupils along their academic path (World Bank, 2011).

Moreover, the crucial feature of an exceptional primary education is in its emphasis on comprehensive development. This statement acknowledges that education encompasses more than the rote memorization of information and encompasses the cultivation of abilities such as analytical reasoning, innovation, and a commitment to societal obligations. An ideal education system fosters inquisitiveness, logical thinking, and the practical application of information in real-life scenarios. This enables individuals to not only achieve academic excellence but also actively engage in civic matters. Moreover, the notion of lifelong learning is intimately tied to the delivery of great core education. In an ever-evolving environment, the capacity to adjust and consistently acquire knowledge is vital. A high-quality education provides people with the necessary skills and mentality to effectively adapt to change, handle uncertainties, and make substantial contributions to society throughout their lifetime. This approach guarantees that education is not seen as an isolated occurrence, but rather as an ongoing voyage of exploration and development (OECD, 2015). A comprehensive and inclusive global viewpoint is a crucial element of a high-quality foundational education. In an increasingly linked world, it is crucial to provide students with a comprehensive comprehension of many cultures, viewpoints, and global matters. Cultivating a comprehensive grasp of global issues fosters inclusivity, comprehension, and a collective need to tackle universal difficulties, such as climate change, poverty, and inequality (World Bank, 2011).

Historical Context of Basic Education in Nigeria

The development of fundamental education policy demonstrates a dynamic interaction between society demands, educational ideologies, and evolving global circumstances. Throughout the years, governments and educational institutions throughout, including Nigeria, have modified their policies to tackle developing difficulties and promote inclusive, fair, and high-quality education for everyone. The origins of contemporary elementary education policy may be traced to the 19th century, when several nations began the implementation of mandatory schooling legislation. The implementation of public education systems was intended to provide universal access to fundamental education, therefore resolving issues of social disparity and fostering economic progress. Significant instances include the Elementary Education Act of 1870 in the United Kingdom and the Elementary and Secondary Education Act of 1965 in the United States, both highlighting the need of ensuring education is accessible to everyone (Buchmann, 2002). During the mid-20th century, there was a growing emphasis on basic education programmes that aimed to provide equitable opportunities and increase the availability of education. The Universal Declaration of Human Rights, established in 1948, established the fundamental principles of the right to education, emphasising that education should be provided without cost, mandatory, and accessible to everyone. In this era, several nations initiated educational expansion initiatives, aiming to provide basic education to groups who were previously neglected (Heyneman, 2003). Furthermore, with the successful attainment of access objectives in several areas, the focus switched towards enhancing the quality and applicability of fundamental education. The Education for All (EFA) initiative, initiated in 1990, sought to guarantee that every child receives a high-quality elementary education. The World Conference on Education for All in Jomtien (1990) and the Dakar Framework for Action (2000) emphasised the need of a comprehensive approach to education that encompasses gender equality, learning outcomes, and lifelong learning (UNESCO, 2000). In recent years, there has been an increasing focus on inclusive education and the cultivation of global competences in the 21st century. The United Nations Sustainable Development Goals (SDGs), particularly Goal 4, advocate for comprehensive and fair education of high standard for all individuals, with a focus on ensuring that no one is excluded. Current policies have the objective of tackling various learning requirements, reducing educational inequalities, and equipping students for the difficulties of an interconnected world (UNESCO, 2015).

The Roles of Quality Basic Education

Quality basic education is the cornerstone of societal development, serving as the bedrock upon which individuals build their intellectual capacities and skills. It is a fundamental right and an indispensable tool for personal empowerment, social progress, and economic growth.

Foundation for Lifelong Learning:

Basic education lays the foundations for a knowledgeable and informed society. The acquisition of essential skills in reading, writing, and mathematics during the early years of education forms the basis for more advanced learning. As individuals progress through the educational system, they gain the tools necessary for critical thinking, problem-solving, and effective communication – skills that are vital in navigating an increasingly complex and interconnected world. In an influential report, the United Nations Educational, Scientific and Cultural Organization (UNESCO) highlighted the importance of quality basic education in achieving sustainable development. The report emphasized that basic education is the key to empowering individuals, eradicating poverty, and fostering social inclusion (UNESCO, 2015).

Economic Development:

Numerous studies emphasize the direct correlation between quality basic education and economic development. The UNESCO Global Education Monitoring Report (2016) highlights that investing in basic education is not only a fundamental human right but also an economic imperative. A well-educated workforce enhances productivity, innovation, and overall economic prosperity, contributing to poverty reduction and sustainable development. Education has a direct correlation with economic development, as an educated workforce is crucial for innovation, productivity, and overall economic growth (Barro, 2001). Quality education is a key tool in breaking the cycle of poverty, as it empowers individuals to secure better employment opportunities and improve their living standards (Psacharopoulos, 2018). Nations with a well-educated population are more likely to be competitive in the global economy, as education is a key driver of innovation and technological advancements (Hanushek & Woessmann, 2015). According to the World Bank, investing in quality education yields substantial economic returns by increasing labor productivity and promoting long-term economic growth (World Bank, 2018).

Social Cohesion and Equity:

Quality basic education promotes social cohesion by fostering a sense of inclusivity and understanding among diverse populations. The UNESCO Education for Sustainable Development Goals (2017) stresses the role of education in building social cohesion, reducing inequalities, and promoting a culture of peace. When education is accessible and of high quality, it becomes a powerful tool for breaking the cycle of poverty and addressing social disparities. Education promotes social development by fostering tolerance, understanding, and social cohesion, contributing to the creation of inclusive and harmonious societies (UNESCO, 2015). A study by the Brookings Institution emphasized that investing in education is a key strategy for reducing inequality and promoting inclusive growth (Chetty et al., 2014).

Health and Well-being:

Education is closely linked to health outcomes, as highlighted by the World Health Organization. Quality basic education not only imparts knowledge about healthy living but also enhances cognitive abilities, leading to better decision-making regarding healthcare. Educated individuals are more likely to adopt healthy behaviors, resulting in improved overall well-being for themselves and their communities. Education is linked to better health outcomes, as educated individuals tend to adopt healthier lifestyles and have access to essential health information (Cutler & Lleras-Muney, 2010).

Empowerment and Gender Equality:

Basic education is instrumental in empowering individuals, particularly women and marginalized groups. The United Nations Girls' Education Initiative (UNGEI) emphasizes the transformative impact of education on gender equality. Quality basic education serves as a catalyst for dismantling gender stereotypes, empowering women, and creating a more inclusive and equitable society. Quality basic education empowers individuals by providing them with critical thinking skills, problem-solving abilities, and a broad knowledge base, enabling them to make informed decisions (Sen, 1999).

Citizenship and Democratic Values:

A well-rounded basic education system instills civic values and nurtures responsible citizenship. According to the Civic Mission of Schools report, quality education contributes to

the development of informed and active citizens who can engage meaningfully in democratic processes. This, in turn, strengthens the foundations of a democratic society and promotes civic participation. The United Nations Sustainable Development Goals (SDGs) recognize the role of education in promoting global citizenship and fostering a sense of shared responsibility for the well-being of the planet and its inhabitants (United Nations, 2015).

Innovative Approaches for Resource Allocation in Basic Education

Innovative approaches for resource allocation in basic education are essential for optimizing the use of available resources and improving educational outcomes. Here are several innovative strategies:

Technology Integration: Integrating technology for resource allocation in basic education can enhance efficiency, transparency, and overall effectiveness of educational systems. Educational technology enhances teaching and learning. Educational technology is sometimes called learning or instructional technology (Wikipedia: Educational technology). Educational technology addresses educational processes (Paulinus, 2006). Human and material actions in education are included. Without resources, actual skill instruction is ineffective. If resources are lacking, instructors and kids will struggle. As Banu (1994) and Awoyele (1992) argue, insufficient study material and poor administration and use of instructional tools contribute to low student performance. Adedijo (2000) also underlined that good school resource use ensures subject success. Altbach & de Wit (2015) stated that technological platforms have significantly impacted educational resource allocation by providing new learning avenues and changing the dynamics of traditional education, democratising education across geographical boundaries. This has helped isolated and disadvantaged people. E-learning also reduces the requirement for textbooks, infrastructure, and other instructional materials, saving money (Watson & Watson, 2007). E-learning efficiently distributes educational materials to more people (Picciano, 2017).

Community Engagement: Local communities possess a deep understanding of their unique social, cultural, and economic contexts. Involving them in decision-making allows for a more nuanced understanding of the challenges and opportunities within the education system (Epstein, 2001). Communities can provide insights into the specific needs of students and the community at large. This input is essential for tailoring educational programs and resource allocation to meet the diverse needs of learners (Shaeffer & Salganik, 2006). Involving communities fosters a sense of ownership and accountability. When community members actively participate in decision-making processes, they are more likely to hold educational institutions accountable for the effective use of resources (Hart, 1997). Collaboration between schools, parents, local businesses, and other community stakeholders can lead to more effective resource allocation. This collaborative approach can result in a shared vision for education and a stronger commitment to achieving common goals (Kingdon, 2005). Local communities can contribute to the development of culturally relevant curricula and teaching methods. This ensures that education is more engaging and meaningful for students, as it is aligned with their cultural backgrounds and experiences (Fox, 2015). Involving communities empowers individuals to actively contribute to decision-making processes, fostering a sense of civic engagement and community development. This empowerment can extend beyond education to other aspects of community life (Bruns & Luque, 2015). Community input can help identify the most pressing needs and priorities, allowing for more effective and targeted allocation of resources. This can lead to improved infrastructure, teacher training, and access to educational materials (Mansuri & Rao, 2004). Community engagement can lead to the community mobilizing community resources for educational development and effective resource allocation in education are crucial aspects of enhancing the quality of education. Utilizing community

resources involves engaging local stakeholders, including parents, businesses, NGOs, and community leaders, to contribute to educational initiatives. Effective resource allocation ensures that available resources are used efficiently and appropriately to meet educational goals (Henderson & Mapp, 2002).

Outcome-Based Funding: Outcome-based funding is a financing model that allocates resources to educational institutions based on the achievement of specific outcomes or performance metrics. This approach shifts the focus from input-based funding (such as enrollment numbers or teacher salaries) to measurable results in student learning and success (Barr & McClelland, 2017). The success of outcome-based funding relies on well-defined key performance indicators (KPIs) that measure the effectiveness of education delivery. These KPIs may include standardized test scores, graduation rates, literacy levels, and other indicators of student achievement (National Center for Education Statistics, 2019). Outcome-based funding should be aligned with the broader educational goals and priorities of a region or country. This alignment ensures that schools are incentivized to contribute to the overall improvement of the education system (OECD, 2016).

Flexible Budgeting: Allocate resources based on student needs, allowing schools to receive funding proportional to the number and characteristics of students they serve (Grissom & Harrington, 2010). Implement a weighted student funding model that assigns different weights to students with varying needs (e.g., English language learners, students with disabilities), ensuring more resources for those who require additional support (Odden & Picus, 2004). Empower individual schools or local education authorities to have more control over budget decisions, allowing them to allocate resources according to their unique circumstances (Leithwood & Jantzi, 2000). Conduct regular needs assessments to identify areas requiring additional resources, ensuring that funds are directed to address specific challenges (Waters et al., 2003).

Public-Private Partnerships: Public-Private Partnerships (PPPs) in basic education involve collaborations between government entities and private organizations to enhance resource allocation, infrastructure development, and overall educational quality (Rosenblum & Chabbott, 2008). Outsource the management of public schools to private entities while retaining government ownership. Private partners bring expertise in administration, curriculum development, and teacher training World Bank. (2009). Engage private partners in the construction and maintenance of educational infrastructure. The private entity operates the facility for a specified period before transferring it back to the government (Balaguer & Cantavella-Jordá, 2002). Implement contracts that link the financial incentives of private partners to specific educational outcomes, such as improved student performance and increased enrollment (Rosenblum & Chabbott, 2008)

Social Impact Bonds (SIBs) Model in Education: Utilize SIBs to attract private investment in education. Investors are repaid based on the achievement of predetermined educational outcomes, incentivizing efficiency and effectiveness.

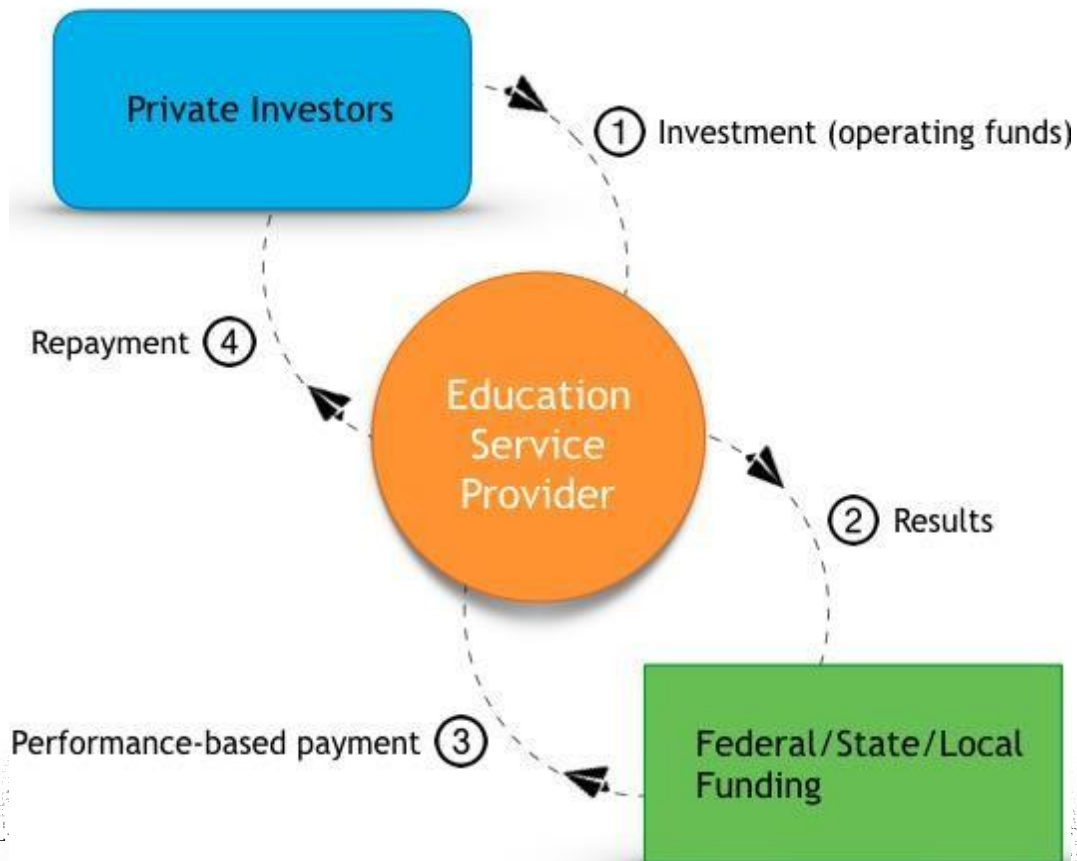


Fig. 1: Social Impact Bonds (Hausmann et al., 2014)

In the event that the service provider does not meet the performance objectives, the government will not give payment. Payments may be adjusted upwards for exceptional performance that surpasses the anticipated results, up to a defined upper limit. This upper limit ensures that the initial investment and any planned return on investment (ROI) are fully compensated.

Approaches to Resource Allocation for Quality Education in Nigeria

Resource allocation to education is the act of providing a reasonable percentage of the nations or states, annual budget for the education sector of the economy. There do not seem to exist a clear-cut policy on resource allocation to education; otherwise referred to budgetary allocation for education in Nigeria, in view of the noticeable inconsistencies in figures or percentages annually. Consequently, there is a noticeable characteristic of resources in education which are not always enough to provide for all the educational services (Babalola, 2003). These are the various approaches adopted for educational resource allocation in Nigeria

Universal Basic Education (UBE) Program: The Universal Basic Education program in Nigeria was introduced to ensure free and compulsory education for all children at the basic education level. This initiative aimed to improve resource allocation for primary and junior secondary education across the country.

Education Trust Fund (ETF): The Education Trust Fund was established to provide additional funding for the development of tertiary education in Nigeria. This fund was designed to address the challenges facing higher education institutions and enhance the quality of education at that level.

Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs): Nigeria, like other countries, committed to achieving the Millennium Development Goals and later the Sustainable Development Goals. These international frameworks influenced resource allocation strategies to improve education, especially in terms of access, quality, and gender equality.

Private Sector Involvement: The Nigerian government has encouraged private sector participation in education through Public-Private Partnerships (PPPs). This approach involves collaboration between the government and private entities to enhance resource allocation and improve education infrastructure and services.

National Planning and Budgeting: Nigeria's national planning and budgeting processes play a crucial role in resource allocation for education. Government budgets, development plans, and policies outline the priorities and strategies for allocating resources to the education sector.

Nigeria Education Spending (2010-2020)

The proportion of total general government spending allocated to education, including current, capital, and transfers, is measured as a percentage of the overall general government expenditure across all sectors, such as health, education, and social services. It encompasses government spending that is financed by transfers from overseas sources. General government often encompasses the many levels of government, including municipal, regional, and federal authorities.

Nigeria Education Spending - Historical Data

Year	Education Spending (% of GDP)	Annual Change
2020	5.13%	-0.72%
2019	5.86%	-0.09%
2018	5.94%	-0.18%
2017	6.12%	-0.53%
2016	6.65%	-2.60%
2015	9.26%	0.22%
2014	9.04%	0.36%
2013	8.68%	0.13%
2012	8.55%	0.67%
2011	7.88%	1.71%
2010	6.17%	1.71%

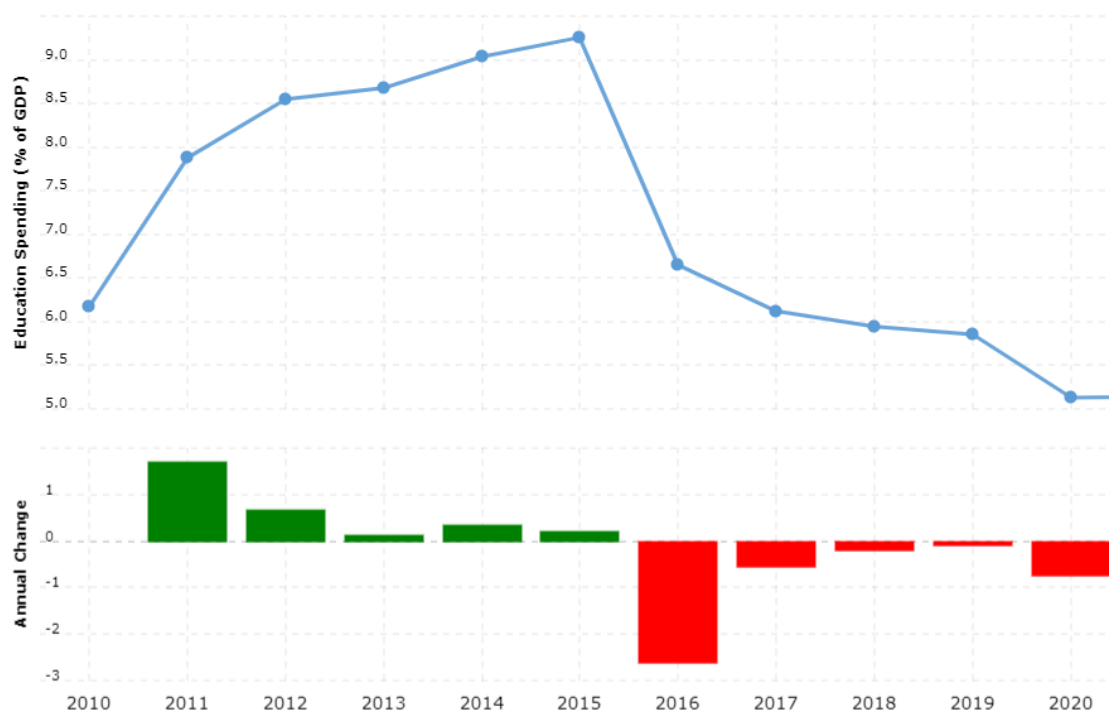


Fig 2: Nigeria Education Spending (2010-2020)
Data Source: World Bank

In 2021, Nigeria allocated 5.14% of its budget towards education, which is a slight increase of 0.01% compared to the previous year. In 2020, the education spending was 5.13%, showing a decline of 0.72% from 2019. Similarly, in 2019, the education spending was 5.86%, indicating a decrease of 0.09% from 2018. Finally, in 2018, Nigeria allocated 5.94% of its budget towards education, experiencing a decline of 0.18% from the previous year.

Challenges Of Resource Allocation for Quality Basic Education in Nigeria

In Nigeria, the challenges of resource allocation for quality basic education have hindered the realization of this right. Nigeria's commitment to providing quality basic education is evident in its National Policy on Education, which outlines the government's vision for an inclusive, accessible, and effective educational system. Despite this commitment, the challenges of resource allocation pose formidable obstacles to achieving these goals (Douglas & Ezeugwu 2017).

Inadequate Funding: One of the primary challenges in Nigeria's education sector is the insufficient allocation of funds. Despite the importance of education, the budgetary allocation for the sector often falls short of the required amount. This leads to a lack of infrastructure, inadequate teacher training, and insufficient learning materials, all of which hinder the delivery of quality education (Akpan & Undie 2007).

Inequitable Distribution of Resources: Another challenge is the uneven distribution of educational resources across different regions of the country. Urban areas tend to receive more attention, leaving rural and remote areas with limited access to quality education. This disparity exacerbates existing inequalities, hindering the overall development of the nation (Ene, 2007).

Teacher Shortages and Poor Quality: The shortage of qualified teachers in Nigeria is a significant impediment to quality education. Additionally, the available teachers often lack proper training and motivation. This results in a substandard learning experience for students, impacting their academic performance and overall development (Osim, 2016).

Infrastructure Deficiency: Many schools in Nigeria lack basic infrastructure, such as classrooms, libraries, and laboratories. The absence of these facilities hampers effective teaching and learning. Students in such environments face challenges in acquiring practical knowledge and skills, hindering their holistic development Onuoha cited in (Osim, 2016).

Outdated Curriculum: The curriculum in Nigerian schools is often outdated and does not align with the dynamic needs of the modern world. This mismatch affects the relevance of education and limits students' preparedness for the challenges of the 21st century (Douglas & Ezeugwu 2017).

Proposed Solutions to Address Challenges of Resource Allocation for Quality Basic Education in Nigeria

The proposed solution for resource allocation in Nigeria's basic education system aims to address the critical challenges hindering the delivery of quality education. Nigeria, being a populous nation, faces significant disparities in educational infrastructure, teacher quality, and overall learning outcomes. The key focus of this proposed solution is to ensure an equitable distribution of resources to enhance the quality of basic education across the country (Douglas & Ezeugwu 2017).

Increased Budgetary Allocation: The Nigerian government must prioritize education by allocating a higher percentage of the national budget to the sector. Adequate funding will enable the construction of new schools, provision of modern learning materials, and the training and motivation of teachers (UNESCO, 2021).

Equitable Distribution Strategies: To address regional disparities, the government should implement policies that ensure the equitable distribution of educational resources. Special attention should be given to rural and remote areas, with a focus on building schools, providing learning materials, and training teachers (Federal Ministry of Education, Nigeria, 2019).

Teacher Training and Motivation: Initiatives should be launched to improve the quality of teachers through comprehensive training programs. Motivational schemes, such as performance-based incentives, can be implemented to attract and retain qualified educators (Adeyemi, 2020).

Infrastructure Development: Investing in school infrastructure is crucial. The government should embark on a comprehensive plan to build and renovate schools, ensuring that they have adequate classrooms, libraries, laboratories, and other essential facilities (World Bank. 2018).

Curriculum Review and Innovation: A periodic review of the national curriculum is necessary to ensure it remains relevant. Emphasis should be placed on incorporating technology, practical skills, and contemporary knowledge to prepare students for the demands of the modern workforce (Federal Ministry of Education, Nigeria, 2020).

Conclusion

In conclusion, the study on innovative approaches to resource allocation for quality basic education in Nigeria underscores the critical need for a transformative shift in the current

practices. The study revealed that traditional resource allocation methods have proven insufficient in addressing the complex challenges faced by the education system in Nigeria.

By exploring innovative approaches such as technology integration, community engagement, and outcome-based funding, this study advocates for a more holistic and adaptive framework for resource allocation. Embracing these innovative strategies has the potential to enhance the efficiency, equity, and overall quality of basic education in Nigeria.

Moreover, it is evident that a multi-stakeholder approach involving government bodies, educational institutions, communities, and private sector entities is paramount for the successful implementation of these innovative approaches. Collaborative efforts can foster a sustainable educational ecosystem that not only allocates resources effectively but also promotes continuous improvement and adaptability to evolving educational needs.

Recommendations

The study recommended that:

1. The distribution of funds for education should adhere to the UNESCO guideline of allocating 26% of the country's yearly budget.
2. Each educational programme in schools should have sufficient financial allocation to allow school administrators to acquire suitable and necessary instructional resources for successful teaching and learning.
3. Schools should have robust security measures in place to prevent infiltration by militants.
4. Professionals and educationists with expertise in education should be responsible for formulating effective policies and planning education at all levels.
5. Individuals responsible for managing and executing the education budget should possess qualities of honesty, probity, and responsibility.
6. The government should use innovative strategies to improve the efficiency, fairness, and overall quality of primary education in Nigeria.

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INFLATIONARY PRESSURES AND THEIR DIPLOMATIC CONSEQUENCES: A GLOBAL PERSPECTIVE

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ABSTRACT

The study discussed on the global perspective of inflationary pressures and their diplomatic consequences. It was observed that price variations in goods and services over time are reflected in inflation as key economic indicator. Inflationary pressure arises due to various factors; Demand-pull and Cost-push inflation etc. The study also discussed inflationary pressures and bilateral transaction as it impacted on trade dynamics. It also provides values for Inflation Rate reported in several countries. Furthermore, the study explored how external borrowing affect economy that resulted in inflationary pressures as well as various types of inflation was highlighted. It was concluded that as nations of the world were grapple with the multifaceted implications of inflationary pressures, a united global effort remains the key to preserving economic stability, fostering diplomatic harmony, and building a resilient international economic order. Hence, the researcher suggested various recommendations that; Governments should strive to maintain fiscal discipline, avoid excessive deficits, and invest in productivity-enhancing projects rather than resorting to inflationary financing. And Governments should also tackle underlying structural issues that contribute to inflationary pressures, such as inadequate infrastructure, corruption, and inefficiencies. Sustainable development policies can create a foundation for stable economic growth, reducing the likelihood of inflationary spikes.

KEYWORDS: Inflationary Pressures, Demand-pull Inflation, Trade Dynamics, Inflationary Financing, Economic Growth.

Introduction

Inflation, a crucial economic indicator, mirrors the fluctuations in prices of goods and services over time. Due to its significant economic consequences and the resulting uncertainty, authorities worldwide are placing a high emphasis on implementing strict measures to control inflation (Omotosho 2013). Inflation is a widely discussed subject among central banks, governments, economists, and other stakeholders worldwide. The trajectory of inflation rates has had a significant influence on policy decisions, particularly in recent times. Most economists and monetary officials support maintaining a low and stable inflation rate. This is because it facilitates faster adjustments in the labour market during economic downturns and reduces financing costs for manufacturers, hence enhancing profitability (Banerjee 2013). Consequently, this leads to a rise in investments, a decrease in unemployment, and an increase in economic activity.

The key goals of the Monetary Policy Committee (MPC) are to exercise control over inflation and maintain a stable environment for exchange rates. A multitude of experts and stakeholders are now advocating for the Monetary Policy Committee (MPC) to adopt a more lenient stance on the promotion of economic development. The announcement of the MPC meeting and the monthly inflation data occurs with a one-month interval, posing challenges for policymakers to effectively synchronise their strategies. Statistical forecasts and assessments may assist decision-makers in formulating their strategy in such situations (Grier et al., 1998 as referenced in Ekpeyong, 2023).

Inflationary pressure emerges as a result of several variables; Demand-pull inflation arises when the total demand for goods and services exceeds the total supply, resulting in price increases as customers vie for scarce products and services. Cost-push inflation occurs when increasing production costs, such as salaries and raw materials, compel enterprises to raise prices in order to sustain profitability. Currently, Central banks have a crucial responsibility in controlling inflationary pressure by implementing monetary policies. Their objective is to achieve price stability and maintain economic stability via the manipulation of interest rates and the regulation of money supply. Furthermore, fiscal policies, including taxes and government expenditure, have an indirect impact on inflationary patterns by influencing both aggregate demand and supply (Hall, 2022 & Blanchard, 2017).

In a globally integrated economy, external variables such as variations in currency rates, international commodity prices, and interruptions in the global supply chain may intensify local inflationary pressure (Krugman & Obstfeld, 2018). For example, when a currency loses value, it may lead to higher import expenses, which in turn contributes to cost-push inflation. Therefore, the ongoing inflationary pressure presents difficulties for policymakers, companies, and families. Hence, the presence of ambiguity over forthcoming pricing might discourage investments, diminish consumer buying ability, and skew economic decision-making (Li, et al, 2023). Furthermore, instances of hyperinflation, as seen in some nations in the past, may result in economic instability, societal turmoil, and reduced trust in the financial system. Elevated inflation rates have the potential to exert pressure on diplomatic relations between states, particularly when countries are mutually reliant as a result of trade deals or alliances. Oatley's (2011) research in the International Organisation journal revealed that countries facing substantial inflationary pressures often use protectionist strategies, such as tariffs and quotas, to safeguard their own sectors. These acts have the potential to trigger trade disputes and

intensify tensions between trading partners (Oatley, 2011). Furthermore, inflation has the potential to diminish a nation's ability to buy goods and services, thereby modifying its geopolitical sway. When a country's currency loses value because of widespread inflation, its capacity to engage in global commerce, fund projects, or provide overseas assistance decreases. The decrease in economic power may influence how a country's strength and dependability are seen internationally, which may result in changes in diplomatic alliances and partnerships (Bordo & Rockoff, 1996 in Ekpeyong, 2023).

When inflation causes economic difficulties, it may lead to domestic turmoil, causing governments to distract attention by using assertive foreign policy tactics. According to Frieden (1991) in the World Politics magazine, leaders who are dealing with economic problems inside their own country may use foreign conflicts or aggressive behaviour to gather popular support and distract attention from their own internal failures (Frieden, 1991). Inflationary pressures may have an impact on international discussions, especially in multilateral venues such as the International Monetary Fund (IMF) or World Trade Organisation (WTO). Countries facing inflationary issues may take more assertive positions during talks, aiming to get concessions that ease internal economic pressures. This conduct has the potential to impede diplomatic conversations and obstruct global cooperation projects that are intended to tackle common concerns (Kenen, 2019).

Inflationary Effect on International business Transaction

Inflation refers to the persistent rise in the overall price level of products and services in an economy, which has a substantial influence on international commercial operations. It is crucial for companies to comprehend and minimise the impact of inflation on their foreign operations due to the volatile nature of currency values, shifting buying power, and uncertain economic circumstances. The main issue stemming from inflation is the ambiguity it brings to foreign currency values. As inflation occurs, the currency's value diminishes, resulting in less worth in the global market. Depreciation of currency may result in higher expenses for enterprises engaged in importing products or services, since they need a greater amount of their local currency to buy the same quantity of foreign items. On the other hand, exporters may experience advantages when their products become relatively more affordable for international purchasers (Dornbusch, 2016).

Nevertheless, as highlighted by Krugman and Obstfeld (2009), this variation presents some difficulties. The volatility of currency exchange rates may undermine pricing tactics, making them ineffective. Businesses may have difficulties in establishing competitive pricing, sustaining profit margins, or effectively predicting revenue. This might result in higher transaction expenses and additional hedging measures to safeguard against unfavourable fluctuations in currency rates. Inflation impacts the actual worth of contracts and agreements established among multinational entities. If inflation diminishes the purchase power of a certain currency, contracts that are based on that currency may lose their worth. This scenario has the potential to give rise to conflicts and the need for further talks, resulting in delays and even legal entanglements for firms (Froot, & Stein, 1991). Furthermore, inflation has the ability to impact consumer behaviour and preferences. With the increase in costs inside the country, people may choose for more affordable options, such as products or services produced elsewhere. The change might have an effect on local sectors and need modifications in market strategies for foreign enterprises operating in such locations (Feenstra, & Taylor, 2017).

Types of Inflation

Inflation is the phenomenon characterised by a widespread rise in prices and a decrease in the buying power of currency. Inflation encompasses several categories, each distinguished by distinct origins, effects, and durations. These are the main categories of inflation:

1. **Demand-Pull Inflation:** This kind of inflation arises when the total demand in an economy exceeds its total supply. In essence, demand-pull inflation occurs when there is an excessive amount of money in circulation relative to the limited supply of goods and services.

Causes: Factors such as heightened consumer expenditure, expansionary fiscal measures (such as government spending), or accommodative monetary policies (such as low interest rates) may stimulate demand, resulting in this kind of inflation.

2. **Cost-Push Inflation:** Cost-push inflation occurs when the expenses associated with producing products and services grow, prompting companies to increase prices in order to preserve their profit margins.

Causes: Several variables may lead to cost-push inflation, such as escalating salaries, elevated raw material expenses, augmented taxes, or supply shocks, including disturbances in oil supplies that amplify manufacturing costs.

3. **Built-In Inflation (also called Wage-Price Spiral):** Built-In inflation is a self-reinforcing loop in which employees request increased salaries in response to escalating prices, prompting firms to subsequently raise prices in order to compensate for the higher pay. This cycle has the potential to persist eternally until it is disrupted by external forces or actions.

Causes: It stems from the mechanics of adjusting pay contracts and the behaviour of determining prices. As inflation drives up salaries, companies often respond by increasing prices, prompting workers to seek more pay hikes, thus prolonging the cycle.

4. **Hyperinflation:** Hyperinflation is an acute kind of inflation characterised by very fast and uncontrollable rises in prices. It leads to a total erosion of trust in a currency, resulting in a collapse of the economy.

Causes: Hyperinflation often occurs as a consequence of substantial government deficits that are supported by printing money, leading to an unsustainable expansion in the money supply. Notable historical cases may be seen in nations such as Zimbabwe, Venezuela, and Germany after World War I.

5. **Creeping or Mild Inflation:** this refers to a gradual and consistent increase in the overall price level over a period of time, often resulting in an annual rise of a few percentage points.

Causes: Mild inflation can be a result of moderate growth in money supply, regular adjustments in wages, and moderate economic growth. Some economists argue that a low level of inflation can be beneficial for economic growth as it encourages spending and investment.

6. **Galloping Inflation:** Galloping inflation is defined by very elevated inflation rates, yet not as severe as hyperinflation. Inflation accelerates, gradually diminishing the ability to buy goods and services and leading to substantial economic disturbances.

Causes: Galloping inflation may arise from several sources, such as substantial expansion in the money supply, supply-side disruptions, or a decline in confidence over the stability of the economy.

Inflationary Pressures on Economic Growth

Inflation, the gradual rise in the overall price level of goods and services within an economy, has been a prominent topic of economic discussion for a considerable period. Although moderate inflation is generally seen as beneficial for economic development since it encourages consumer spending, excessive inflationary pressures may hinder economic advancement. We are concerned about the negative effect of inflationary pressures on buying power.

- (a) **Prices Rise:** Consumers exhibit decreased purchasing of products and services, resulting in diminished consumer confidence and expenditure. As a result, companies see a decrease in income, which prompts them to curtail production, potentially resulting in layoffs and a decrease in economic output. The process of economic decline may significantly impede the expansion of the economy and worsen the rates of unemployment (Fischer, 2013).
- (b) **Distort Economic Decision-Making Processes:** Consumers exhibit decreased purchasing of products and services, resulting in diminished consumer confidence and expenditure. As a result, companies see a decrease in income, which prompts them to curtail production, potentially resulting in layoffs and a decrease in economic output. The process of economic decline may significantly impede the expansion of the economy and worsen the rates of unemployment (Fischer, 2013).
- (c) **Exert A Disproportional Burden On Fixed-Income:** As the value of savings decreases, these people face a decrease in their quality of life, resulting in social discontent and political instability. The socio-economic issues that arise may discourage foreign investment and impede domestic production, leading to a harmful cycle of economic stagnation (Alesina & Summers, 2013).

It is crucial to distinguish between mild and hyperinflationary conditions. Although modest inflation rates might encourage borrowing and investment by reducing real interest rates, hyperinflationary situations present significant risks to economic stability. During periods of hyperinflation, firms have difficulties in determining precise pricing strategies, which hampers the allocation of resources and the smooth functioning of the market (Cagan, 1956 quoted in Fischer, 2013). In addition, hyperinflation undermines the confidence of the general public in

monetary institutions, resulting in the devaluation of currency and the outflow of capital. This, in turn, worsens the inflationary forces and contributes to economic instability.

Inflationary Pressures and Bilateral Transactions

Comprehending the dynamics of bilateral interactions between nations requires a thorough grasp of inflationary forces. Inflation, which refers to a persistent rise in the overall price level of goods and services, may have a substantial impact on trade connections, capital flows, and policy choices made by countries. In addition to its impact on the global economy.

- (i) **Impact on Trade Dynamics:** Inflation has the potential to disrupt the competitive advantage that nations has in global commerce. When a country encounters inflation rates that are greater than those of its trade partners, the cost of its exports increases in comparison to its imports. Hence, nations experiencing greater inflation rates may see a decline in their trade balances, which might further worsen their current account deficits (Mankiw, 2014).

Furthermore, the variability of inflation rates across trade partners might create difficulties in price agreements and contracts. Importers and exporters may have difficulties when negotiating extended agreements because of volatile inflation patterns, resulting in higher transaction expenses and risk premiums (Rogoff, 2019).

- (ii) **Capital Flows and Investment Decisions:** Inflationary pressures have an impact on the movement of capital across nations. Significant inflation rates often diminish the ability of a country's currency to buy goods and services, leading investors to search for other investment opportunities in nations with steady pricing (Fisher, 2013). Consequently, countries dealing with inflationary pressures may see capital flight, which involves local investors transferring their assets elsewhere in order to protect their worth.

In contrast, nations that maintain lower inflation rates have the potential to attract international capital inflows, which may strengthen their financial markets and stimulate economic development. The significance of cautious monetary policy in controlling inflationary pressures and promoting investor confidence is highlighted by this phenomenon (Blanchard, 2017).

- (iii) **Policy Implications and Coordination:** Due to the interdependence of the global economy, authorities must carefully manage inflationary pressures in order to sustain stable bilateral relations. Implementing severe monetary tightening measures as a sole attempt to address inflation might unintentionally disrupt trade ties and incite retaliatory actions from trading partners (Krugman & Obstfeld, 2009).

Efficient coordination and communication across countries are crucial in order to collectively manage common inflationary concerns. International organisations such as the IMF and WTO foster communication and collaboration between nations, encouraging consistency in policies and ensuring economic stability (Eichengreen & Irwin, 2010). Moreover, bilateral agreements and trade discussions provide opportunities for nations to effectively tackle problems

connected to inflation. Nations may reduce the negative impact of inflationary pressures on bilateral trade by increasing openness, implementing dispute resolution systems, and building mutual understanding (Baldwin & Wyplosz, 2016).

Therefore, the impact of inflationary pressures on bilateral transactions is significant, as it influences trade dynamics, capital flows, and policy choices of states. The interdependence of the global economy requires nations to collaborate in order to successfully tackle common inflationary issues. Nations may achieve economic stability and prosperity by facilitating communication, ensuring policy consistency, and encouraging collaboration to address the challenges posed by inflationary pressures.

Inflationary Pressures in other Countries of the World

Country	Last	Previous	Reference	Unit
Argentina	211	161	Dec/23	%
Australia	5.4	6	Sep/23	%
Brazil	4.62	4.68	Dec/23	%
Canada	3.4	3.1	Dec/23	%
China	-0.3	-0.5	Dec/23	%
Euro Area	2.9	2.4	Dec/23	%
France	3.7	3.5	Dec/23	%
Germany	3.7	3.2	Dec/23	%
India	5.69	5.55	Dec/23	%
Indonesia	2.61	2.86	Dec/23	%
Italy	0.59	0.67	Dec/23	%
Japan	2.6	2.8	Dec/23	%
Mexico	4.66	4.32	Dec/23	%
Netherlands	1.2	1.6	Dec/23	%
Russia	7.4	7.5	Dec/23	%
Saudi Arabia	1.5	1.7	Dec/23	%
Singapore	3.7	3.6	Dec/23	%
South Africa	5.1	5.5	Dec/23	%
South Korea	3.2	3.3	Dec/23	%
Spain	3.1	3.2	Dec/23	%
Switzerland	1.7	1.4	Dec/23	%
Turkey	64.77	61.98	Dec/23	%
United Kingdom	4	3.9	Dec/23	%
United States	3.4	3.1	Dec/23	%

Source: Bureau of Labor Statistics

The table above presents the precise numbers, consensus estimates, projections, and statistical data for the Inflation Rate. Additionally, it furnishes data on the Inflation Rate as reported in various nations. The table displays the latest numbers for the Inflation Rate, as well as prior releases, historical highs and record lows. It also provides information on the frequency of releases, the unit and currency in which the data is published, and links to historical data charts. In December 2023, the United States saw an increase in its annual inflation rate, rising from

3.1% to 3.4%. Conversely, during November 2023, the United Kingdom observed a decrease in its annual inflation rate, dropping from 4.6% to 3.9%.

Monetary Policy and Inflationary Pressures

Monetary policy encompasses the measures used by a nation's central bank to manage the availability of money and interest rates, with the goal of attaining macroeconomic targets such as price stability, maximum employment, and enduring economic expansion. Of these goals, the most important one is to provide price stability, since ongoing inflationary pressures may diminish the value of money and disrupt economic decision-making. This is how central banks manoeuvre through this intricate landscape:

1. The Mechanism of Monetary Policy: Central banks primarily influence the economy through open market operations, reserve requirements, and the discount rate. Open market operations involve buying or selling government securities to adjust the money supply. When a central bank buys securities, it injects money into the economy, leading to lower interest rates and increased borrowing and spending. Conversely, selling securities reduces the money supply, raising interest rates and curbing spending (Mishkin, 2019).

Reserve requirements dictate the proportion of deposits that banks must hold as reserves, influencing the amount of money banks can lend. By adjusting reserve requirements, central banks can stimulate or contract lending activities. Lastly, the discount rate refers to the interest rate at which banks borrow reserves from the central bank. Changes in this rate can influence banks' borrowing costs and, consequently, their lending rates.

2. Inflationary Pressures and Monetary Policy: Inflationary pressures arise when the overall price level in an economy increases, reducing the purchasing power of money. Several factors contribute to inflation, including demand-pull inflation, cost-push inflation, and built-in inflation. Monetary policy plays a pivotal role in addressing these inflationary pressures.

Demand-pull inflation: Demand-pull inflation occurs when aggregate demand exceeds aggregate supply, leading to upward pressure on prices. Central banks can counteract this type of inflation by tightening monetary policy, reducing money supply growth, and raising interest rates to dampen demand. By making borrowing more expensive, consumers and businesses are incentivized to reduce spending and investment, thereby moderating demand-pull inflation (Blanchard, 2017).

Cost-push inflation: Cost-push inflation, on the other hand, results from supply-side shocks such as increases in production costs. While monetary policy may have limited efficacy in directly addressing cost-push inflation, it can mitigate its secondary effects. By stabilizing inflation expectations and preventing second-round effects, central banks can contain the spread of cost-push shocks throughout the economy (Woodford, 2003).

Built-in inflation: Built-in inflation refers to inflationary expectations embedded in wage and price-setting behavior. Once these expectations become entrenched, they can be self-fulfilling, perpetuating a cycle of rising prices and wages. Central banks must proactively manage inflation expectations by maintaining credibility and signaling a commitment to price stability. Effective communication and transparent policymaking are essential tools in anchoring expectations and preventing built-in inflation (Draghi, 2014).

Monetary policy serves as a critical tool in managing inflationary pressures and maintaining price stability. By influencing the money supply, interest rates, and financial conditions, central banks can address demand-pull, cost-push, and built-in inflation. However, the effectiveness of monetary policy hinges on timely and appropriate actions, credible communication, and a comprehensive understanding of economic dynamics.

External Borrowing and Inflationary Pressures

External borrowing, often pursued by governments and private sectors alike, can offer immediate financial relief and facilitate growth. However, it is accompanied by a set of potential challenges, with inflationary pressures being a prominent concern.

➤ Mechanisms of Inflation from External Borrowing

1. *Increased Money Supply:* When a country borrows externally, it often results in an influx of foreign currency. If the central bank decides to convert this foreign currency into domestic currency, it can lead to an expansion in the money supply. An increased money supply, when not matched by a corresponding increase in goods and services, can fuel inflationary pressures (Fischer, 2013).
2. *Exchange Rate Dynamics:* External borrowing can influence exchange rates. If the borrowed funds are converted to domestic currency, it can exert downward pressure on the exchange rate. A weaker domestic currency can increase the cost of imports, thereby raising the prices of imported goods and contributing to inflation (Edwards, 2019).
3. *Expectations and Confidence:* Persistent external borrowing may erode investor and consumer confidence. Concerns about a country's ability to service its external debt can lead to capital outflows and currency depreciation. This, in turn, can raise inflation expectations, prompting businesses to raise prices in anticipation of higher costs (Calvo & Vegh, 2019).

➤ Implications for Policy and Economic Stability

1. *Fiscal Discipline:* Excessive reliance on external borrowing can undermine fiscal discipline. Governments may prioritize short-term spending over long-term fiscal sustainability, leading to budget deficits. Persistent deficits financed through borrowing can result in unsustainable debt levels, exacerbating inflationary pressures and macroeconomic instability (Reinhart & Rogoff, 2009).
2. *Monetary Policy Challenges:* Central banks face challenges in conducting effective monetary policy amidst external borrowing. An influx of foreign currency may necessitate sterilization efforts to mitigate inflationary pressures. However, sterilization operations can be costly and may not always be effective, especially if capital flows are volatile (Aizenman & Marion, 2003).
3. *Vulnerability to External Shocks:* Countries heavily reliant on external borrowing are more susceptible to external shocks. A sudden reversal in capital flows or a global financial crisis can strain balance of payments, exerting downward pressure on the currency and exacerbating inflationary pressures (Krugman, 2018).

➤ Empirical Evidence and Case Studies

1. *Latin American Debt Crisis:* According to the study by Eichengreen & Hausmann, (2009) who revealed that in 1980s Latin American debt crisis serves as a poignant example of the inflationary consequences of excessive external borrowing. For instance, countries like Mexico, Brazil, and Argentina borrowed heavily from international markets, leading to unsustainable debt levels. Inflation surged as governments monetized debt, eroding purchasing power and destabilizing economies.
2. *Asian Financial Crisis:* The 1997 Asian financial crisis highlighted the vulnerabilities associated with short-term external borrowing. Countries like Thailand and Indonesia faced severe economic downturns due to unsustainable external debt levels. Inflationary pressures escalated as currencies depreciated, raising the cost of imports and domestic production (Krugman, 2018).
3. *Recent Developments:* In the aftermath of the global financial crisis of 2008, many emerging market economies ramped up external borrowing to stimulate growth. While some countries managed debt levels prudently, others grappled with rising inflationary pressures and macroeconomic imbalances. Countries like Turkey and Venezuela faced significant inflationary challenges, reflecting the perils of unsustainable external borrowing (Obstfeld et al., 2019).

However, external borrowing offers a double-edged sword for economies seeking to finance growth and development. While it can provide immediate financial resources, it also poses significant inflationary risks and macroeconomic challenges. Effective policymaking, grounded in fiscal discipline, prudent monetary management, and external debt sustainability, is crucial to navigate the complexities associated with external borrowing. By understanding the mechanisms and implications of external borrowing on inflationary pressures, policymakers can adopt strategies that foster economic stability and sustainable growth.

The Implication of External Borrowing on the Economy

External borrowing has emerged as a significant tool for countries to finance their developmental projects, meet fiscal deficits, and stabilize their economies during challenging times. However, while it offers short-term solutions, the long-term implications of such borrowing can be profound and multifaceted for an economy. Here are some implications of external borrowing on an economy;

1. **Macroeconomic Stability:** the immediate implications of external borrowing are its impact on macroeconomic stability. Countries resort to borrowing externally when they face fiscal deficits, which might arise due to excessive government spending relative to revenues. However, the increased debt can lead to macroeconomic instability if not managed properly. As indicated by Reinhart and Rogoff (2010) in their seminal work, high levels of external debt can lead to reduced economic growth, inflationary pressures, and currency depreciation.
2. **Interest Payments and Debt Service:** External borrowing necessitates regular interest payments and principal repayments. High debt service obligations can strain a country's fiscal resources, leading to reduced public spending on essential sectors such as health,

education, and infrastructure. According to Easterly, et al., (2013), the debt overhang problem can lead to a vicious cycle where countries borrow to service existing debts, thereby exacerbating their indebtedness and compromising long-term growth prospects.

3. **Crowding Out Effect:** Another significant implication of external borrowing is the crowding out effect. As governments borrow externally, they may absorb a significant portion of available funds, thereby crowding out private sector investments. Stiglitz (2000) highlighted that this phenomenon could hinder the growth of the private sector, reduce competitiveness, and impede innovation and technological advancement.
4. **Exchange Rate Dynamics:** External borrowing often exerts pressure on a country's exchange rate. Large inflows of foreign capital can lead to an appreciation of the domestic currency, making exports less competitive and imports cheaper. Conversely, sudden reversals of capital flows can lead to sharp depreciations, exacerbating inflationary pressures and external vulnerabilities. Obstfeld, Shambaugh, and Taylor (2005) underscored the importance of exchange rate flexibility and prudent management of external borrowing to mitigate the risks associated with volatile capital flows.
5. **Sovereign Risk and Creditworthiness:** Excessive external borrowing can erode a country's sovereign risk profile and creditworthiness in the international financial markets. A deteriorating credit rating can lead to higher borrowing costs, making it more expensive for the government and private sector to access international capital markets. Eichengreen and Hausmann (2019) emphasized the importance of maintaining a sustainable debt profile and implementing prudent fiscal policies to preserve a country's reputation and credibility among international investors.
6. **Policy Autonomy and Conditionality:** External borrowing often comes with strings attached in the form of policy conditionality imposed by international financial institutions such as the International Monetary Fund (IMF) and the World Bank. These institutions may require borrowing countries to implement specific macroeconomic and structural reforms as a precondition for financial assistance. Rodrik (2000) argued that such conditionality can undermine a country's policy autonomy, limit its policy space, and impede its ability to pursue development strategies tailored to its unique circumstances.

In order to navigate the complexities associated with external borrowing, it is pertinent that policymakers must strike a balance between leveraging external financing opportunities and implementing prudent fiscal and monetary policies. By fostering transparency, accountability, and sustainable debt management practices, countries can harness the benefits of external borrowing while safeguarding their economic resilience and long-term growth prospects.

Policy Conditionality of Borrowing and Inflationary Pressures

Policy conditionality refers to the set of requirements, reforms, or actions that borrowing countries must undertake as a precondition for receiving financial assistance or loans from international financial institutions (IFIs) such as the International Monetary Fund (IMF) and the World Bank. These conditions are designed to ensure that recipient countries implement specific macroeconomic, structural, and institutional reforms aimed at achieving economic stability, growth, and development. While conditionality is intended to promote responsible

fiscal and monetary policies, it has sparked debates about its impact on national sovereignty, policy autonomy, and development outcomes.

1. **Macroeconomic Policy Reforms:** These conditions typically require countries to adopt specific fiscal and monetary policies aimed at achieving macroeconomic stability. This may include measures to reduce budget deficits, control inflation, maintain exchange rate stability, and build foreign exchange reserves.
2. **Structural Reforms:** Structural conditions focus on long-term institutional and structural changes to enhance the efficiency and competitiveness of the economy. This may involve reforms in sectors such as taxation, public expenditure management, financial sector regulation, trade liberalization, privatization, and labor market flexibility.
3. **Social and Governance Reforms:** Some conditionality may also include requirements to improve social safety nets, enhance governance and transparency, combat corruption, strengthen rule of law, and promote human rights and social inclusion.

This mechanism aims to ensure fiscal responsibility and economic stability, it can inadvertently contribute to inflationary pressures within borrowing economies. The conditions typically imposed may include reducing fiscal deficits, curtailing public expenditure, and implementing tight monetary policies. These measures, though intended to stabilize the economy, can have contractionary effects, leading to reduced aggregate demand and potential supply-side constraints. As a result, the imbalance between reduced demand and constrained supply can drive up prices, contributing to inflationary pressures (Fischer, 2013).

These stringent policy conditions may limit governments' ability to implement countercyclical fiscal measures during economic downturns, thereby exacerbating inflationary tendencies (Alesina & Tabellini, 1990). The combination of reduced public spending, monetary tightening, and restricted policy flexibility can create a volatile economic environment prone to inflationary fluctuations. As policy aims to foster economic discipline and stability, but its rigid implementation can inadvertently intensify inflationary pressures by constraining economic growth, reducing demand, and limiting policy flexibility. While policy conditionality aims to promote sound economic policies and governance practices, it has faced criticism on several fronts:

- (i) **Sovereignty and Autonomy:** Critics argue that conditionality undermines national sovereignty by imposing external prescriptions on domestic policy choices. Rodrik (2000) emphasized that excessive conditionality can limit a country's policy autonomy and hinder its ability to pursue development strategies tailored to its unique circumstances.
- (ii) **Social Impact:** Some scholars contend that structural adjustment programs associated with IFI conditionality have exacerbated social inequalities, increased poverty, and undermined social welfare systems. Easterly (2005) highlighted the adverse social consequences of externally imposed reforms, calling for greater consideration of social dimensions in policy conditionality.
- (iii) **Effectiveness and Ownership:** The effectiveness of policy conditionality has also been questioned, with concerns about ownership, implementation capacity, and

sustainability of reforms. Woods (2005) argued that conditionality often lacks country ownership, leading to inadequate implementation and sustainability of reforms.

Policy conditionality by international financial institutions represents a complex and contentious issue in the realm of international development finance. While designed to promote economic stability, growth, and development, conditionality raises fundamental questions about national sovereignty, policy autonomy, social impact, and effectiveness. As highlighted by various scholars who argued that there is a need for greater transparency, accountability, flexibility, and country ownership in the design and implementation of conditionality to ensure that it aligns with national development priorities, respects sovereignty, and contributes to sustainable and inclusive growth.

Conclusion

The intricate relationship between inflationary pressures and diplomatic consequences demands nuanced global attention. As explored throughout this discussion, inflationary pressures possess the potential to disrupt economic stability, alter trade dynamics, and strain international relations. The global perspective on this issue underscores the interconnectedness of economies and the imperative for collaborative solutions.

Addressing inflationary pressures necessitates coordinated efforts among nations, fostering open communication and policy coherence. Failure to manage inflation effectively may lead to currency devaluations, trade imbalances, and geopolitical tensions. Furthermore, the potential for asymmetric impacts across nations underscores the need for a cooperative and inclusive approach to mitigate adverse diplomatic consequences.

International organizations and diplomatic forums play a crucial role in facilitating dialogue and cooperation. Coordinated monetary policies, exchange rate mechanisms, and transparent communication channels are essential components of a comprehensive strategy to address inflationary pressures globally. Moreover, fostering financial resilience and flexibility at the national level can contribute to minimizing the diplomatic fallout from inflationary challenges.

In navigating the complex landscape of inflation and its diplomatic repercussions, a commitment to shared goals, mutual understanding, and collaborative policy frameworks emerges as imperative. As nations grapple with the multifaceted implications of inflationary pressures, a united global effort remains the key to preserving economic stability, fostering diplomatic harmony, and building a resilient international economic order.

Recommendations

Inflationary pressures pose a significant challenge to economies worldwide, influencing not only domestic policies but also triggering diplomatic consequences in an interconnected global landscape. The researcher made the following recommendations for managing inflationary pressures and mitigating their diplomatic consequences:

1. There should be regular dialogues among nations through international organizations such as the International Monetary Fund (IMF) and the World Bank. These forums can

provide a platform for sharing experiences, coordinating policies, and developing joint strategies to address common inflationary challenges.

2. Central banks are encouraged to coordinate monetary policies to maintain global economic stability. Open communication channels can help prevent competitive devaluations and foster a collective approach to managing inflation.
3. Regional economic integration should be encouraged to create more resilient economic blocs. Foster the negotiation and implementation of trade agreements that enhance economic cooperation, reduce trade barriers, and promote sustainable growth within regions.
4. Specific region should be encouraged to explore the possibility of regional currency cooperation or common currency arrangements to mitigate exchange rate fluctuations and enhance monetary stability within specific geographical areas.
5. Governments should strive to maintain fiscal discipline, avoid excessive deficits, and invest in productivity-enhancing projects rather than resorting to inflationary financing.
6. Governments should tackle underlying structural issues that contribute to inflationary pressures, such as inadequate infrastructure, corruption, and inefficiencies. Sustainable development policies can create a foundation for stable economic growth, reducing the likelihood of inflationary spikes.
7. Both creditor and debtor nations should assess the sustainability of borrowing arrangements to prevent diplomatic tensions arising from debt-related crises.

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ENVIRONMENTAL IMPACT OF AIR POLLUTION FROM QUARRY ACTIVITIES ON AGRICULTURE AND BIODIVERSITY OF PLANT

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ABSTRACT

Nigeria has around 400 quarries and 2000 stone-cutting enterprises, with an annual output of 200 million metric tonnes of unprocessed stone and 30 million square metres of excellent stone. Regrettably, this industry is often linked with air pollution. In this study, two methods were employed to evaluate the impact of such acts on agricultural and plant biodiversity: particulate matter (PM) measurement and a social survey. Significantly high levels of particulate matter, dust, and total suspended solids (TSP) were found in the three sites studied in Ebonyi State, Nigeria. This suggests that there is a lot of dust and air pollution in the locations under study, much more than what is permissible by international guidelines. Additionally, it is shown that quarrying has a significant detrimental effect on plant survival, habitat degradation, and biodiversity. According to the results of the questionnaire, many different plants were impacted or even went extinct as a result of the stone-cutting and quarrying businesses. The most affected plant was the olive, which had an average response rate of 33%. According to the findings, it is strongly suggested to create a green belt around the quarrying area using pollutant-tolerant trees (often with broad leaves) to limit the spread of quarrying dust by intercepting, filtering, and absorbing pollutants.

KEYWORDS Agriculture, Air Pollution, Biodiversity, Plant, Quarries

1. Introduction

Quarrying is the process of removing nonmetallic rocks and aggregates from land as a kind of land use and a component of the local history [1]. The end products of this enterprise are crushed stones and dimensions, which are utilised in various aspects of daily living [2]. The stone and marble industries, known as "white-gold" in the local dialect, are regarded as prosperous ventures in Nigeria. In addition, this industry is being developed, expanded, and given priority by both the public and private sectors. Nigeria currently has 2000 companies, workshops, and more than 400 quarries, producing over 200 million tonnes of raw stone and 30 million square metres of good stone annually. About 4.5% and 5.5% of the gross national product (GNP) and gross domestic product (GDP) respectively are contributed by this industry. The industry has received an estimated 600 million US dollars in investment overall [3]. Nigeria accounts for 5% of the global production of marble and stone. Regrettably, these actions have a negative influence on the environment [4]. The extraction method actually relies heavily on large machinery and explosives, both of which are typically linked to soil and water

contamination, air and noise pollution, habitat destruction, and harm to biodiversity [5–7]. From an agricultural perspective, discharged dust falls not only on land, vegetation, and trees, but also on surface waterways [6], having a variety of detrimental effects on the ecosystem as a whole. Fertile soil is also disturbed and interrupted, and following excavation, holes are either abandoned or left empty, creating a large, chasm-like landscape. This is dangerous for people, animals, and cattle in addition to being ugly [8]. Damage to biodiversity [9], where plants (vegetation cover) constitute the primary element of the ecosystem and are crucial in preserving the equilibrium of carbon dioxide and oxygen in the atmosphere through photosynthetic activity [6], is another noteworthy adverse effect of quarrying on the environment. Environmental botanists and ecologists have recently expressed concern about these changes in plants and have recommended a cautious and cautious approach to activities that promote such changes [10]. The primary objective of this research was to evaluate the effects of the stone-cutting and quarrying sectors on the ecosystem in Abakaliki, Ebonyi State, Nigeria, in general, and plant biodiversity in particular.

2. Materials and Methods

2.1. The Study Area

The study was conducted in Nigeria's Ebonyi state capital, Abakaliki (Fig. 1). It is situated at latitude 6° 19' N and longitude 8° 6' E in southeast Nigeria's Savannah region. It has a total area of 5,670 square kilometres and 141,438 inhabitants. Typically, the setting is on a hilly plateau. Its temperature, which ranges from 270 to 310 degrees Celsius, is comparatively high. The study area experiences two distinct rainfall patterns in August, both of which are brief (April to July and September to November). The soil of the study area is ultisol.

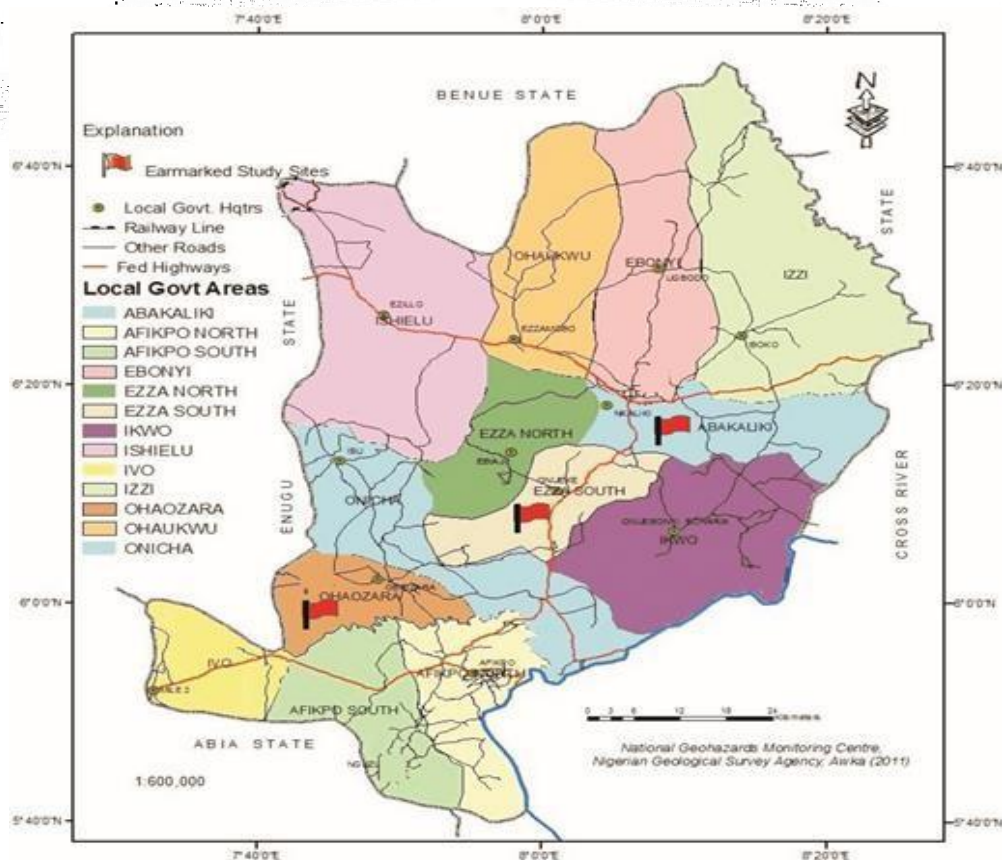


Fig 1. A map of Ebonyi State showing the study site

2.2. Data Collection

The effects of the stone-cutting and quarry industries on the agriculture and biodiversity of plants in Abakaliki, Ebonyi State, were evaluated using two primary techniques. First, particulate matter (PM) was measured using a laser-operated portable computer (OPC; Aerocet 531, MetOne, USA) equipped with five channels (PM_1 , $PM_{2.5}$, PM_7 , PM_{10} , and TSP). This instrument is automatic and can estimate PM in the following ranges: $PM \leq 0.5$ and $PM \leq 10$ in count mode, and 1, 2.5, 7, and 10 μm in aerodynamic diameters in mass mode. At three distinct locations, four measurements were carried out at a ground distance of 400 to 600 metres from the operation areas. Every location had its equipment positioned 1.5 metres above the floor, and each location saw an hour of sampling time. The second approach was created specifically for this purpose and was based on a social survey (structured questionnaire and interview).

2.3. Data Analysis

Chi-square tests for significantly different data ($p < 0.05$) were used in the Statistical Package for Social Sciences (IBM, SPSS, version 15) to analyse the data.

3. Results and Discussion

Anthropogenic activities such as stone-cutting businesses and quarries have caused significant harm to plant survival and biodiversity in recent decades. In light of this, quarrying has a well-documented negative impact on the environment [9], as it produces significant amounts of air pollution that negatively impact plants, or vegetation cover, which is the primary component of the ecosystem and plays a key role in maintaining the equilibrium between the amount of oxygen and carbon dioxide through photosynthetic activities [6]. Table 1 illustrates the elevated levels of particulate matter/dust (PM) and total suspended solids (TSP) observed in the three locations under study. This suggests that there is a lot of dust and air pollution in the locations under study, much more than what is allowed by international guidelines. For instance, total suspended solids (TSP) have WHO requirements of $60 \mu g/m^3$, however in the three locations under investigation, TSP showed highly significant levels of $0.4188 (mg/m^3)$, $1.5359 (mg/m^3)$, and $1.4204 (mg/m^3)$ in comparison to the standards. Furthermore, locations 3 ($1.4204 mg/m^3$) and 2 ($1.5359 mg/m^3$) showed highly significant values in relation to the first location. In contrast to the first location, where grasses and shrubs predominate, the obtained significances in locations 2 and 3 may be attributed to the intensive different types of trees that impose vegetation cover, blocking and suspending existing particulate matter and dust (fewer barriers). In addition, these two areas run parallel to the typical wind direction, which is from the northwest and carries dust and particulate matter from the industries in the direction of the fruit trees. The other four employed channels (PM_1 , $PM_{2.5}$, PM_7 , and PM_{10}) all showed a similar pattern in particulate matter/dust (PM), with high amounts of PM found in the three studied locations (Table 1). When compared to other measured PM, it is evident that PM_{10} has the largest concentrations. This could be explained by the fact that small PM are typically driven to higher altitudes by wind and then deposited by various sink processes.

Table 1. Mean Concentration of Particulate Matter (Dust) at Three Sampling Locations

Parameters	Location I	Location II	Location III	STDEV
PM ₁ (mg/m ³)	0.0036	0.0042	0.0069	0.0012
PM _{2.5} (mg/m ³)	0.0344	0.0615	0.0792	0.0145
PM ₇ (mg/m ³)	0.2367	0.6516	0.6264	0.1336
PM ₁₀ (mg/m ³)	0.3259	1.0797	0.9440	0.2471
TSP (mg/m ³)	0.4188	1.5359	1.4204	0.3621

Regrettably, this massive form of air pollution has a detrimental effect on the environment around it [4], particularly on plant biodiversity and habitat degradation [5], foliar injury [11], pollination and plant pest control [12], and crop yield loss [13]. In order to evaluate the influence of this type of pollution on plant biodiversity and agriculture, roughly 200 questionnaires were dispersed throughout the study location. The large diversity of extinct plants caused by the stone-cutting and quarrying industries was indicated by the collected results. In fact, 12.3% (citrus trees, wheat, wild flowers, vegetables, garden, wild lettuce, gundelia); 10.2% (wild plants); 10.2% (African star apple); 4.3% (thyme); 2.7% (pineapple); 1.1% (olive); and were susceptible to the extinction from the farmers point of view. African star apple was found to be the fruit tree most impacted by quarries and the stone-cutting industry, with an average response rate of 31%. Conversely, 8.6% of respondents claimed that all African star apple and pineapple species had gone extinct. Other respondents stated that quarrying was responsible for the disappearance of 6.4% of African star apple and pineapple. Only 2.7% of respondents said that these activities had caused the extinction of all fruit trees.

Concerning the impact on crop yields, a vast majority of the respondents (95%) stated that the crop yields decreased by at least 30% annually. Physiological mechanisms behind these causes could be attributed to one or combinations of the following factors: dusts might cover the leaves with white layer decreasing thereby the total chlorophyll cells exposed to light and thus reducing the total photosynthetic activity [14]; dusts also reduce plant growth (number of leaves, leaf surface and size) affecting therefore photosynthesis, respiration and transpiration [15]; some released toxic compounds (fluoride, Magnesium, Lead, Zinc, Copper, Beryllium, Sulphuric acid and Hydrochloric acid) are injurious to the vegetation [5]; leaf trichomes (hairs) are affected negatively by dust decreasing therefore the natural defence mechanisms of the plant against pests and diseases [6, 14, 15]. Apart from the previously mentioned adverse effects, quarrying and crushing also lead to soil erosion and water pollution (80% and 70% of the respondents, respectively). These two issues exacerbate the negative effects on agriculture, since the properties of the soil and water are impacted by the wet and dry deposition of particulate matter. This being said, and in accordance with [7], quarrying has caused changes in the properties of the soil, leading to the discovery that the soil in and surrounding the mining area (0–1 km) is alkaline (pH 11.2–11.7). This was explained by the high concentrations of hydroxyl, carbonate, and bicarbonate found in the minerals of the mined materials.

4. Conclusions and Recommendations

The study area's agriculture was adversely impacted by the high amounts of particulate matter (dust) produced by the quarrying and stone-cutting entities. Dust deposition decreased crop production and caused the extinction of several tree species and plant cover. In addition, by affecting soil and water, two essential resources for agriculture, these actions exacerbated the issue. However, further research is needed to explore the impact of such enterprises on plant

physiology and the physicochemical qualities of soil and water. According to the findings, it is strongly suggested to create a green belt around the quarrying area using pollutant-tolerant trees (often with broad leaves) to limit the spread of quarrying dust by intercepting, filtering, and absorbing pollutants.

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SUSTAINABLE DEVELOPMENT OF PETROLEUM RESOURCES IN NIGERIA

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ABSTRACT

The production and exploration of oil has caused significant oil spills and long-lasting environmental harm to the Niger Delta Region (NDR). This article examines how natural resources can be exploited in a sustainable manner while protecting the environment. The article also examines pertinent sections of the Petroleum Industry Act (PIA), 2021 to determine whether the act provides guidelines for the effective implementation of sustainable resource development as poorly formulated laws and weak institutions, result in poor implementation and enforcement methods, which are substantially responsible for the Niger Delta oil disaster crisis.

KEYWORDS: Sustainable Development, Oil Spill, Petroleum Industry Act (PIA) 2021, Niger Delta.

INTRODUCTION

The quality of environment is essential to the development of the people of the NDR of Nigeria in view of their major occupation of crops and fish farming.¹

A recent report by the United Nations Environment Program (UNEP) a United Nations Organization, collaborating with the Presidential Committee on Environment Survey and Clean Up of Ogoni Land, arranged by the Nigerian government, confirms the gravity of the damage and destruction of Ogoni land, a community in the NDR.² Samples of soil, water and air were taken by the committee from two hundred locations in Ogoni land. It was found that

¹ Lisa Stevens, 'Illusion of Sustainable Development: How Nigeria's Environmental Laws Are Failing the Niger Delta' (2011) 36 Vermont Law Review 387 <<http://heinonline.org/HOL/Page?handle=hein.journals/vlr36&id=391&div=&collection=journals>>.

² O.K Edu, 'Corporate Social Responsibility: The Case of Multinational Oil Companies in the Niger Delta of Nigeria' (2011) 23 Sri Lanka Journal of International Law 101 <<http://heinonline.org/HOL/Page?handle=hein.journals/sljinl23&id=107&div=&collection=journals>>.

hydrocarbon materials were present and the layers of oil floating in the air could make the area inhabitable for human beings and also that the drinking water wells were contaminated with benzene and families had no choice but drank from them.³

In the course of research it is found that the attitude of the major stakeholders (the government and IOCs) has contributed to the pollution of the environment and this has impacted negatively on the people and their environment. These challenges and many other adverse impacts of oil and gas industry operations in Nigeria have prompted the need to look for solution. In this article, the concept of sustainable development would be examined and how its effective utilization can assist in the operation of petroleum industry in Nigeria.

THE CONCEPT OF SUSTAINABLE DEVELOPMENT

The first soft law on environment and the development of the environment was the Stockholm Declaration.⁴ The central point of the declaration at that time was on the conservation of the environment than creating environmental development policies.⁵ But in 1987, the World Commission on Environment and Development (also known as the Brudtland) was set up to address among other objectives, the dilemma of the developing countries in choosing between environmental protection and economic development.⁶

The Brudtland Commission reported that economic development and the environment are inextricably linked together and also, the economy of a nation should not be developed at the expense of the environment.⁷ Further emphasis was placed on the finiteness of petroleum resources and their impact on human activities in the long run in respect to policy development and implementation,⁸ making reference to posterity. The commission was created to promote the principle of sustainable development which is defined as the "*development that meets the needs of the present without compromising the ability of the future generations to meet their own needs*".⁹ To attain this, the commission stated that "human laws must be reformulated to keep human activities in harmony with the unchanging and universal laws of nature."¹⁰

The commission's principle was widely adopted by governments and non-governmental agencies.¹¹ After the Brundtland Commission, a group of legal experts was formed and its report on the Legal Principles on Environmental Protection and Sustainable Development contains twenty-two legal and fundamental human right principles to environmental conservation and sustainable development of petroleum resources.¹²

³ Ibid.

⁴ Emeseh, Engobo, 'Limitations of Law in Promoting Synergy between Environment and Development Policies in Developing Countries: A Case Study of the Petroleum Industry in Nigeria;' (2006) 24 J. Energy Nat.ResourcesL.574

<http://heinonline.org/HOL/Page?handle=hein.journals/jenrl24&div=40&collection=journals&set_as_cursor=21&men_tab=srchresults&terms=frynas&type=matchall> accessed 16 June 2014. United Nations Conference on the Human Environment (UNCHE), held at Stockholm, Sweden in June 1972

⁵ Ibid.

⁶ Ibid.

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

¹¹ Ibid.

¹² Marong, B.M. (n 104).

These principles were to form part of a draft convention that was negotiated at the 1992 United Nations Conference on Environment and Development (the Rio "Earth Summit") where states adopted a non-binding declaration of the Principles on Development of the Environment.¹³

The principles laid in the above conferences stipulate how sustainable development based on its pillars can be achieved.¹⁴ Principle 11 of the Rio Conference recommends that states should pass laws that would be effective in the regulation of the environment in the context that respects the purpose of its creation.¹⁵ Principle 13 of the Rio Conference calls for compensation regime for victims of pollution and other environmental degradation to be made urgently.¹⁶ Also, Agenda 21 in chapter 8 (which provides for the methods of integrating the environment and its development into governmental policies) states that to implement environmental and development policies, it is necessary for legislation drafted to this effect to specifically provide for the conditions prevalent in a particular country.¹⁷ In addition, Chapter 39 of the Rio Conference provides for continuous development of law on sustainable development and that special consideration should be directed towards balancing the environment and development.¹⁸

The World Summit on Sustainable Development (WSSD) was constituted to review the effectiveness of the Rio Conference's finding implementation. From the latter's observations, the Johannesburg Summit expanded the definition of sustainable development to include social development as an equal pillar of sustainable development alongside economic development and environmental protection.¹⁹ It further acknowledged that for sustainable development to be achieved, there has to be (a) eradication of poverty, (b) a digress from unsustainable means of production and development as well as (c) protection and management of natural resources.²⁰

Sustainable development has also acknowledged economic growth as a means of alleviating poverty. Such growth is however limited by the concern that the environment (which provides for sustenance of the human and non-human life) demands better treatment from the society and that the development of the economy should remain within the purview of environmental sustainability.²¹ The interdependence of the three pillars require efforts to understand its complex connections and these efforts have to be constant.

APPLICATION OF SUSTAINABLE DEVELOPMENT IN NIGERIA

Nigeria, just like most developing countries, is in a dilemma of accepting development of its economy at the expense of the environment being degraded or undertaking strict environmental regulatory practice said to slow down the pace of development.²²

It seems the government had realized that economic development could not be achieved without a form of protection of the environment.²³ Consequently, the 1999 Constitution of the Federal Republic of Nigeria (as amended) in section 20 directs that "The State shall protect and

¹³ Ibid.

¹⁴ Emeseh, Engobo (n 268).

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ Marong, B.M. (n 104).

²⁰ Ibid.

²¹ Ibid.

²² Ogbodo, Dr S. Gozie, 'The Paradox of the Concept of Sustainable Development under Nigeria's Environmental Law' (2010) 3 Canadian Centre of Science and Education <www.ccsenet.org/jsd> accessed 18 March 2014.

²³ Ibid.

improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria".²⁴ This section of the constitution is written in a manner that reflects that the provision is obligatory.²⁵ However, the section of the constitution under reference is a part of Chapter II on Fundamental Objectives and Directive Principles of State Policy which is not enforceable and therefore, not justiciable.²⁶ This decision was held in the case of *Bishop Anthony Okogie (Trustee of Roman Catholic Schools) & Ors v. Attorney General Lagos State*²⁷ to the effect that the provisions contained under the Fundamental Objectives of the constitution were unenforceable in Nigerian courts.²⁸

In addition to Nigeria's sustainable tendency, the National Environmental Standards and Regulations Enforcement (NESREA) Act (the country's principal environmental law) in section 2 provides that "the Agency, shall, subject to the provisions of this Act, have responsibility for the protection and development of the environment, biodiversity conservation and *sustainable development* of Nigeria's natural resources in general and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines."²⁹

Section 7 (e) of the NESREA Act also "enforces compliance with guidelines and legislation on sustainable management of the ecosystem, biodiversity conservation and the development of Nigeria's natural resources."³⁰

Although the NESREA Act mentions "sustainable development", it has excluded the oil and gas industry from its jurisdiction. This is surprising for the fact that oil and gas industry in Nigeria is one of the major causes of environmental degradation in the country. We agree with Lisa Stevens that these legal provisions put together make sustainable development in Nigeria an illusion.³¹

The question now is how can the concept be used to achieve sustainable development in the NDR of Nigeria by ensuring that the activities of oil companies are actually regulated to guarantee sustainable development of the oil and gas resources, and in deed that the country's economy is within the bounds of a sustainable environment. Such action will really alleviate the suffering of the people.

PETROLEUM INDUSTRY ACT 2021 AND SUTAINABLE DEVELOPMENT OF RESOURCES.

The Petroleum Industry Act, 2021 (PIA), on the other hand, was signed into law in August 2021. The PIA significantly changed the legal and governance structure, regulatory framework,

²⁴Egede, Edwin, 'Human Rights and the Environment: Is There a Legally Enforceable Right of a Clean and Healthy Environment for the Peoples of the Niger Delta under the Framework of the 1999 Constitution of the Federal Republic of Nigeria;' (2007) 19 Sri Lanka J. Int'l L <http://heinonline.org/HOL/Page?handle=hein.journals/sljnl19&div=6&collection=journals&set_as_cursor=1&men_tab=srchresults&terms=Corporate|and|state|responses|to|anti%20%90oil|protests|in|the|Niger|Delta&type=matchall> accessed 20 June 2014.

²⁵ Ibid.

²⁶ Ogbodo, Dr S. Gozie (n 22).

²⁷ Ibid. (1981) 2 NCLR, 337 CA.

²⁸ Ibid.

²⁹ Ibid.

³⁰ Ibid.

³¹ Lisa Stevens (n 5).

host community engagement, administrative and budgetary arrangements in the oil and gas industry.

The following laws were repealed by the Act: the Petroleum Products Pricing Regulatory (Establishment) Act, the Petroleum Equalization Fund Act, the Petroleum Profit Tax Act ("PPTA"), the Deep Offshore and Inland Basin Production Sharing Contract Act, the Associated Gas Reinjection Act, the Hydrocarbon Oil Refineries Act, the Motor Spirit (Returns) Act, the Nigerian National Petroleum Corporation ("NNPC") (Projects) Act, and the NNPC Act.³² While some of the repeals will go into effect on the Act's effective date, others will only become effective if specific conditions are met.³³ Until all current mining and oil prospecting leases and permits expire, the terms of certain laws remain in effect. The PIA preserves the Petroleum Act and, in order to ensure the continuation of the latter's legal framework, the following legislation was preserved: the Petroleum Profits Tax Act (PPTA); the Oil Pipelines Act; the Deep Offshore and Inland Basin Production Sharing Contracts Act; and any other law consistent with the preservation of the terms and conditions of any oil prospecting licence (OPL) or oil mining lease (OML) until the expiration or termination of all OPLs and OMLs.³⁴

Under the PIA act the Minister of Petroleum Resources (the Minister) retains oversight of the oil and gas industry, but his regulatory responsibilities and functions have been delegated to two primary regulatory organizations – The Nigerian Upstream Regulatory Commission (the Commission) and the Nigerian Midstream and Downstream Regulatory Authority (the Authority) are the two regulatory bodies in Nigeria.³⁵

The PIA introduced significant change to the oil and gas industry and according to Marong,³⁶ the understanding of legislative practices is a continuous enterprise. It helps us to appreciate the place of law in the achievement of a sustainable environment.³⁷ This confirms the fact that the concept of sustainable development is not static,³⁸ it evolves as economies advance. In accordance with the World Commission on Environment and Development,³⁹ "the process of change' in human activities should be such that the base of natural resource upon which the current and future generations of humanity depend for the satisfaction of their needs and aspirations is not undermined".⁴⁰

In addition, the three necessary principles relevant to the realization of the concept of sustainable development through laws are: a) the precautionary principle, b) environmental

³² Aluko & Oyebo, An Overview of the Petroleum Industry Act, 2021(2021) <https://www.oyebode.com/insights/an-overview-of-the-petroleum-industry-act-2021/>

³³ Ibid

³⁴ Streamsowers & Köhn's Ibukun Konu and Otome Okolo, Nigeria's Petroleum Industry Act: Two Legal Regimes for One Industry (2023) <https://chambers.com/legal-trends/analysing-nigerias-petroleum-industry-act-and-legal-implications>

³⁵ Aluko & Oyebo, An Overview of the Petroleum Industry Act, 2021(2021) <https://www.aluko-oyebode.com/wp-content/uploads/2021/08/An-Overview-of-the-Petroleum-Industry-Act-2021-1.pdf>

³⁶ Marong, B.M., 'From Rio to Johannesburg: Reflections on the Role of International Legal Norms in Sustainable Development' (2004) 16 Geo. Int'l Env'tl. L. Rev. 21 <http://heinonline.org/HOL/Page?handle=hein.journals/gintenlr16&div=9&collection=journals&set_as_cursor=30&men_tab=srchresults&terms=sustainable|development|niger|delta&type=matchall> accessed 18 June 2014.

³⁷ Ibid.

³⁸ Ibid.

³⁹ Ibid. WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE 46 (1987)

⁴⁰ Ibid.

impact assessment and c) public participation in administrative decisions.⁴¹ We have discussed these principles briefly below.

The precautionary principle succinctly “ensures that a substance or activity that poses a threat to the environment is prevented from adversely affecting the environment, even if there is no conclusive scientific proof linking that particular substance or activity to environmental damage”.⁴² This principle envisages harm even before it occurs and therefore requires decision makers to consider the likelihood of the harm happening and take preventative measure against the adverse effects.⁴³ The principle was also formulated in the Rio Declaration on Environment and Development. Principle 15 states that “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation”.⁴⁴ The commitment of states to this Rio principle was reaffirmed at the end of Johannesburg summit in the adopted Plan Implementation, not only in Agenda 21 but also in Agenda 22 which specifically calls on states to consider precautionary approach as stated in principle 15 of the Rio conference.⁴⁵ The precautionary principle has now been accepted as a good standard of conduct that is necessary for the achievement of sustainable development.⁴⁶ This can be achieved “by basing regulatory action on the potentiality of environmental harm, rather than on proof that harm will occur, and by presuming that the environment is vulnerable to a wide range of human activities. The precautionary principle therefore introduces an anticipatory approach to development planning”.⁴⁷ The PIA provides that a license for midstream and downstream petroleum operations may be granted where it meets the following according to **Section 111(3)** of the Act; *It meets the technical standards required for petroleum operations based on good international petroleum industry practices; The location and size of the area occupied by the facilities or right of way is acceptable to the Authority; It meets the health safety and environmental standards as determined by the Authority and; it provides for the efficient and economic use of facilities and pipelines.*⁴⁸

Under Nigerian law, it is the operator's responsibility to take all possible procedures and use internationally accepted standards and practices to prevent oil leaks.⁴⁹ Pipelines of higher specification, according to the API codes, should be used in high risk/high consequence areas where pipeline sabotage and vandalism are expected or foreseen.⁵⁰

With regards to gas flaring, The PIA establishes a framework for regulating and gradually eliminating gas flaring in the country. Section 104 of the PIA makes gas flaring illegal for any licensee, lessee, or marginal field operator, except in three cases: emergencies, exemption from the Nigerian Upstream Petroleum Regulatory Commission, and when it is considered acceptable as a safety practice under established regulation.⁵¹ These sections attempt to show

⁴¹ Ibid.

⁴² James Cameron, Juli Abouchar, ‘The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment’ (1991) 14 B.C. INT’L & COMp. L. REV. 1 <<http://lawdigitalcommons.bc.edu/iclr/vol14/iss1/2>> accessed 20 June 2014.

⁴³ Ibid.

⁴⁴ Marong, B.M. (n 36).

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ Petroleum Industry Act, 2021

⁴⁹ The Petroleum (Drilling and Production) Regulations s 37

⁵⁰ API 1160 - Managing system integrity for hazardous liquid pipelines, defined in the US Code of Federal Regulation, Title 49 CFR 195.2.

⁵¹ Ibid

precaution before license is issued and no tolerance to gas flaring except in the above-mentioned area. The PIA further provides for a more stringent prohibition of gas flaring by not only penalizing it but by also making the fines payable, as it is ineligible for cost recovery and is no longer tax deductible.⁵² The fines are furthermore targeted towards environmental remediation and relief for host communities through the settlers for which the penalties were levied.⁵³ Section 105 of the PIA penalizes anyone who violates Section 104. These penalties are outlined in the Flare Gas (Waste and Pollution Prevention) Regulations 2018 (The Regulation).⁵⁴

To this end, the laws regulating the development of resources in Nigeria must ensure that certain precautionary measures are taken before, during and until a particular petroleum operation is determined.

The second principle makes it obligatory for promoters of developmental projects⁵⁵ to provide timely and sufficient information on the probable environmental and social consequences of their projects and the likely substitute measures to mitigate the adverse effects.⁵⁶ Environmental Impact Assessment ensures that development is consistent with the capacity that the earth can take and not unduly disrupting the social systems.⁵⁷ The petroleum industry is considered to have a high risk of negative environmental impacts, and as such, a plan to manage such impacts is required. According to the provisions of the PIA, operators will be obligated to submit for approval an environmental management plan for projects that need environmental impact assessment.⁵⁸ The plan must be submitted within six months after the grant of the necessary license or lease.⁵⁹

Prior to the NUPRC's approval of the environmental management plan, such licensees or lessees will be required to pay a stipulated financial contribution to the NUPRC's environmental remediation fund for the repair or management of negative environmental impacts related to the license or lease.⁶⁰ Therefore, the concept of integrating environmental impact assessment into the Nigerian legal system, employing the best environmental scientists available and ensuring compliance always would go a long way to contribute to sustainable development of the environment and mitigate further degradation of the environment.

The third principle on public participation is relevant to the efficiency of not only the Environmental Impact Assessment procedure but can also function to aid in decision making⁶¹ in respect of issues that relate to the environment; development of petroleum resources; and concerning the development of the host communities, both socially and

⁵²Funmilayo Odude, how does the Petroleum Industry Act protect our environment? (2021) <https://www.financialnigeria.com/how-does-the-petroleum-industry-act-protect-our-environment-blog-646.html>

Ibid

⁵⁴ Ibid

⁵⁵ Emeseh, Engobo, 'Limitations of Law in Promoting Synergy between Environment and Development Policies in Developing Countries: A Case Study of the Petroleum Industry in Nigeria;' (2006) 24 J. Energy.

⁵⁶ Marong, B.M. (n 36).

⁵⁷ Ibid.

⁵⁸ Lanre Afuye and Damilare Abdulai, Petroleum Industry Act, 2021: The Road to Compliance For Upstream Companies (2002) <https://www.mondaq.com/nigeria/oil-gas--electricity/1191336/petroleum-industry-act-2021-the-road-to-compliance-for-upstream-companies>

⁵⁹ Ibid

⁶⁰ Ibid

⁶¹ Ibid.

economically.⁶² This principle is in line with Orford's position who⁶³ stated that the principle of public participation must acknowledge "the right of the people to determine their model of development".⁶⁴

This principle that calls for the views of the public to be taken into consideration in decisions that affect their lives and the environment⁶⁵ was endorsed by the Rio Declaration in principle 10 which states that "environmental issues are best handled with the participation of all the concerned citizens, at the relevant level."⁶⁶

Therefore, public participation is important as participants (which include members of the host communities) would have a sense of belonging to the project because they are involved from the preliminary stage of setting up the project.⁶⁷ This principle requires governance to be broad enough to include members of the civil society that will monitor and critique the actions of government and IOCs when the agreement reached during consultation is not upheld by the major stakeholders.

However, the PIA includes measures for host communities as well. While the most recent is the Host Communities Trust Fund, which is to be funded by 3% of upstream petroleum operators' annual operating expenses, the Act also requires operators to conduct a community needs assessment, which includes social, economic, and environmental needs, and to develop and implement a development plan subject to Commission or Authority approval.⁶⁸ They will also ensure that the major stakeholders comply with best practices.⁶⁹ This would particularly be useful in the Niger Delta Region of Nigeria, where the belief is that oil companies and government are unconcerned about the ongoing adverse impacts of degradation of the environment. Here, there is mutual doubt by leaders and even the ordinary citizens of the host communities on the development activities of government and the IOCs to enhance sustainable development⁷⁰ of their communities that discourages sabotage, especially when the oil companies have not re-structured their oil pipelines.

CONCLUSION

In conclusion, the concept of sustainable development has evolved over time. It is now defined by three pillars in compliance with the plan made at the World Summit on Sustainable Development held in Johannesburg. Sustainable development can therefore be achieved by utilizing the precautionary principle, environmental impact assessment and public participation.⁷¹

On this note we advise that Nigerian government can aid sustainable development of its resources by ensuring that its laws are precautionary in nature and reviewed regularly in

⁶² Duruigbo, Emeka, 'Managing Oil Revenues for Socio-Economic Development in Nigeria: The Community-Based Trust Funds;' (2005) 30 N.C. J. INT'L L. & COM. <[http://heinonline.org/HOL/Page?handle=hein.journals/ncjint30&div=10&collection=journals&set_as_c](http://heinonline.org/HOL/Page?handle=hein.journals/ncjint30&div=10&collection=journals&set_as_c&men_tab=srchresults&terms=frynas&type=matchall) &men_tab=srchresults&terms=frynas&type=matchall> accessed 16 June 2014.

⁶³ Ibid. Anne Orford, *Globalisation and the Right to Development, in PEOPLE'S RIGHTS* (2001) 139 P. Alston ed.

⁶⁴ Ibid.

⁶⁵ Marong, B.M. (n 104).

⁶⁶ Duruigbo, Emeka (n 313).

⁶⁷ Marong, B.M. (n 104).

⁶⁸ Funmilayo Odude (n 50).

⁶⁹ Ibid.

⁷⁰ Duruigbo, Emeka (n 313).

⁷¹ Marong, B.M. (n 36).

response to its economic development. It is recommended that the Nigerian Upstream Regulatory Commission (the Commission) and the Nigerian Midstream and Downstream Regulatory Authority (the Authority) which are the two regulatory bodies in Nigeria ensure that precautionary measures are taken to ensure that where an activity or substance would adversely affect the environment even without scientific proof it would be prevented.

With regards to environmental impact assessment, According Worika, ... the lack of technical knowhow and adequate funding is the reason the agencies could not carry out the job efficiently.⁷² Therefore, it is advised that the best environmental scientists available should be employed, adequate finance should be provided so that the IOCs will be monitored and compliance strictly adhered to ensure sustainable development of the resources in our environment.

The PIA stipulating a needs assessment of the host committee by the operator is a welcomed development. However, their views can be made mandatory before an award of any license to start a project as such is in compliance with international best practice.

⁷² Worika, IL., Etemire, U., and Tamuno, PS., 'Oil Politics and the Application of Environmental Laws to the Pollution of the Niger Delta: Current Challenges and Prospects' (2019) 17(1) OGEL 1, 14-15



THE INFLUENCE OF CARTOGRAPHIC DESIGN ON PUBLIC PERCEPTION OF GEOSPATIAL INFORMATION

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ABSTRACT

This research explores the influence of cartographic design on public perception of geospatial information. Cartography plays a crucial role in representing and communicating geographic and spatial data effectively, and the design choices made in this field have a significant impact on how people perceive and understand such information. The study focuses on the relationship between cartographic design and public perception, highlighting that effective design enhances communication and ensures that geospatial information is accurately interpreted. It examines how design choices affect the clarity, readability, and accessibility of maps, as well as the potential for misinterpretation or bias. By analysing various aspects of cartographic design, including aesthetics, visual hierarchy, colour choice, typography, and map symbols, the research aims to provide insights into how these factors shape public perception of geospatial data. The findings of this research can inform cartographers, map designers, and decision-makers in creating maps that effectively convey information, engage the audience, and promote accurate understanding of geospatial concepts.

KEYWORDS: Cartography, public perception, GIS, Geography, Geospatial information.

Introduction

In Nigeria, cartography is now seen as an emerging field of study. However, due to a significant lack of awareness among a large segment of the population, public participation in this subject is mostly deemed unneeded. Cartography is the amalgamation of creative, technical, and scientific procedures involved in the production of maps. Cartographers use a diverse range of visual instruments, such as maps, charts, and spreadsheets, to effectively communicate complex information. The industry is seeing an increase in the use of digital mapping technology and geographic information systems (GIS). Cartographers are essential in several businesses, including printing, administration, surveying, and the military. Although they may not have the official designation of cartographer, several individuals with cartographic expertise are employed by utility companies, local government planning agencies, and utility providers, including electricity, telephone, gas, and water.

Since the dawn of human civilization, mapping, including both the scientific and artistic elements of mapmaking, has been a crucial tool for representing the globe. In the digital age, maps have become more important and popular as tools for comprehending and traversing the globe. Recent studies have examined the impact of cartographic design on individuals' perceptions of geographic data. The objective of this research is to enhance comprehension of how decisions made throughout the process of map construction influence individuals' perception and interpretation of geographic information.

The core concept behind cartography is that depictions of reality may efficiently convey spatial and geographic information. In order to facilitate users' tasks, cartographers have devised a collection of guidelines and optimal methodologies that assist them in producing maps that are practical, pertinent, and devoid of recurring design flaws. Cartographic design is the process of creating a map that displays geographical and spatial information. Although the primary emphasis is on the technical aspects of creating maps and representing geographic information, the underlying ideas and techniques are applicable to design in general. There is a common belief that by closely following the principles of cartographic design, one may create a map that is both highly functional and visually appealing, beyond what could be accomplished otherwise. Wood (2003) suggests that contemporary cartography design may exhibit less rigidity compared to its historical counterpart.

The correlation between graphical analysis and visual communication underscores the significance of aesthetics and design in map presentation, beyond their mere practical use. While the primary objective of any published map should be efficient communication, it is equally crucial to take into account its visual appeal. A high-quality map adeptly communicates its intended message with efficiency and effectiveness (MacEhren, 1997). Poor design hampers the quality of communication, whereas excellent design improves it. Hence, design includes a pragmatic aspect that extends beyond only aesthetic considerations. The aesthetic value of GIS cartographic design is often seen as secondary, if not entirely insignificant. The ability to captivate and maintain the reader's attention is one of the fundamental ways in which map design influences map functionality. Poorly crafted maps may either discourage readers before they acquire all the essential details or become so challenging to decipher that they completely fail to engage their attention. If the primary objective of the map is to convey information, it falls short of captivating the reader due to ineffective communication. The concept that minor design elements may collectively have a significant impact on how people perceive the calibre of a map can similarly be extended to how individuals perceive the quality of research and data (Tufte, 1990). Individuals who just see the ultimate outcome of a GIS project's mapping might assess the quality of the work simply by examining the map. Maps that provide incorrect information might be more troublesome than maps that provide no information at all. Failure to adhere to certain visual design principles may have a detrimental effect on the readability and comprehension of the content. Each person's cultural and visual preconceptions shape how they interpret an image. Failure to consider these assumptions while creating maps may lead to a misinterpretation of the message.

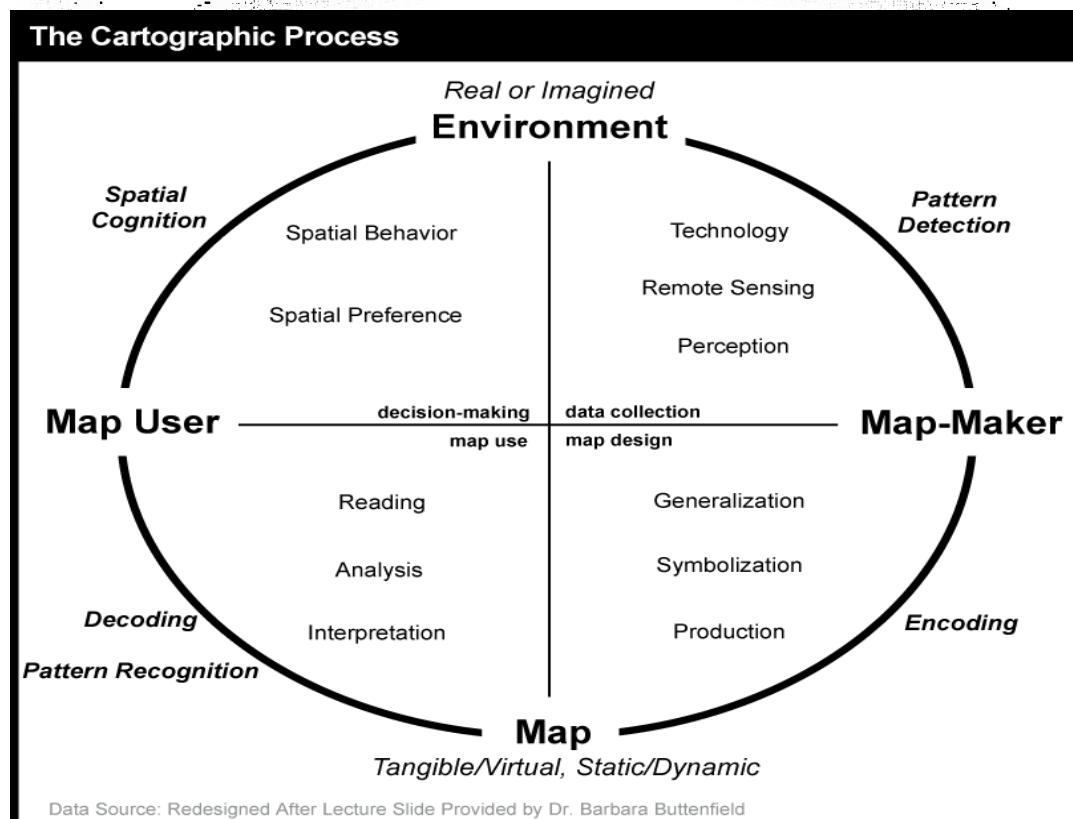
Overview of Cartography

Cartography is an interdisciplinary field that examines the scientific, technological, and artistic aspects involved in the construction and production of maps. Cartography is a complex and sequential procedure that produces practical and aesthetically pleasing maps. Data collection is the first phase in the cartography process, when contemporary technology and remote sensing technologies are used to get valuable information about the environment. The collected data serves as the foundation for map creation. After the data is obtained, it undergoes a preparatory

phase where cartographers analyse and interpret it, uncovering patterns and representing them in a user-friendly manner for map users. This step is crucial for ensuring that the map accurately represents the geographic information it is meant to convey. The last stage is map abstraction, which involves the selection, categorization, simplification, exaggeration, and symbolization of map features. Cartographers use these techniques to accentuate significant characteristics, streamline intricate information, and underscore certain patterns or events. The use of map abstraction is crucial in creating visually comprehensible maps that effectively convey information to their target audience. In essence, cartography is a constantly evolving and repetitive procedure that requires a combination of scientific, technical, and artistic skills. By adhering to the processes of data gathering, preparation, and map abstraction, cartographers may create maps that effectively convey geographic information and also captivate and educate map viewers, resulting in a more profound understanding of the globe.

Cartographic Process

Currently, anybody with Internet access may easily create maps using a range of online tools. Nevertheless, the majority of activities continue to rely on maps, which are often created by specialists in either cartography or the phenomena they represent. These activities include urban planning, geological research, navigation, transport planning, and environmental management. Cartography involves both scholarly and vocational endeavours. According to the International Cartographic Association, cartography is an academic discipline that focuses on the conception, production, dissemination, and examination of maps. Cartography may be conceptualised as a comprehensive process that encompasses several stakeholders, including map creators, map users, the mapped environment, and the map itself. Presented below is a diagram illustrating a potential method for categorising this methodology.



The cartography process might begin with either a physical or conceptual setting. Mapmakers use technology and/or remote sensing to gather data from the environment. They then analyse

the data to detect trends and prepare it for map creation. This involves analysing the data and its trends, as well as developing effective visualisation techniques for displaying the information on a map. Afterwards, the mapmaker uses the data to graphically represent it on a map (encoding). This is achieved by using generalisation, symbolization, and production procedures, which ideally provide a representation that the map viewer can comprehend according to the mapmaker's intended purpose. The user deciphers the symbols and identifies patterns in order to read, study, and understand the map. Individuals eventually develop viewpoints and participate in actions based on the information they discover on the map. Maps shape our spatial choices, conduct, and perception of our immediate surroundings by providing a comprehensive perspective of the world.

Map abstraction is the primary process used in cartography to delineate the globe. Subsequently, we will proceed to deliberate on the aforementioned issue.

Map Abstraction

Despite the loss of many features, it is now feasible to cartographically represent the whole planet on the surface area of a pinhead or inside an even smaller space. Map abstraction is crucial for creating a computerised representation of a screen-sized map of the world to effectively convey information in a clear and understandable way. The process of map abstraction consists of five important and interconnected processes: selection, classification, simplification, exaggeration, and symbolization.

Selection

Cartographers, who are responsible for creating maps, make deliberate choices about which information to include and exclude based on the intended use of the map. According to Phillip Muehrcke, an Emeritus Professor of Geography from the University of Wisconsin, the cartographer has to address two fundamental questions: Where? When? What? Why? As an example, a cartographer might, for instance, produce a map of Lagos (where) showing current (when) traffic patterns (what) so that an ambulance can travel the quickest route to an emergency (why).

Classification

Classification is accomplished by categorising items into groups or groupings. By categorising characteristics into a restricted number of distinct groups, it is possible to uncover new visual patterns in the data, which might provide valuable insights. The graphic provided categorises highways into two separate groups: those without traffic detectors (grey) and those with traffic detectors (coloured). The second category is also separated into driving circumstances classified as slow (red), moderate (yellow), and fast (green). Maps likewise use analogous data categorization techniques. A more thorough analysis of numerical map data classification will be presented in a subsequent section of this chapter. An example dataset displaying the occurrence of prostate cancer in different counties of Pennsylvania, shown on a map using a variable number of categories, provides a demonstration of the factors that map readers should consider while categorising the data. Clearly, the selection of classes by the cartographer has a significant impact on the diversity of patterns shown. Exercise caution while analysing maps, since any changes made to their classification may lead to a distortion of perceived accuracy. In "How to Deceive With Maps," Mark Monmonier elucidates how cartographers use deliberate and inadvertent means, such as map classification, to fool.

Simplification

In addition to selecting and classifying features, cartographers must also simplify the details on a map to enhance its comprehensibility. This encompasses the selection of entities to be deleted, refined, standardised, and grouped together under certain categories. When eliminating entities, envision constructing a map of cities inside the United States. As seen in Figure 3.7, the inclusion of every city in the United States would result in a map that is unreadable. To optimise the functionality of a map, cartographers often exclude towns with populations below a certain threshold, as seen in the image on the right. If the objective was to display the most densely populated cities, using a predetermined population threshold would provide a very suitable outcome. If the intention, however, was to display the most significant cities in the area, then using arbitrary population criteria is inadequate.

Exaggeration









Cartographers often use intentional magnification of map elements to ensure the visibility of certain features. As an example, on a typical paper highway map of Lagos (the kind that can be folded and stored in the glove compartment of a vehicle, measuring around 3 feet when unfolded), interstate roads are shown with a width of approximately 0.035 inches. Does it seem diminutive to you? However, if the ratio between the width of the printed road and the width of the map was equivalent to the ratio between the width of the real highway and the extent of Pennsylvania, it would imply that the Interstate was around 2000 feet wide. This is a classic example of hyperbole used to construct a conceptualization that is advantageous for the purpose of travel.

Symbolization

As the last stage of the mapmaking process, the cartographer uses symbols to depict the selected features on the map. These attributes may be artistically shown with realism, such as using a curving blue line to represent a river. However, many depictions are far more ambiguous, such as a star or circle symbolising a city. Symbolic components, referred to as essential "graphic variables," are used in the creation of map symbols. After providing a brief summary of these essential graphic elements, we will proceed to analyse the proper use of colour.

Graphic Variables

Despite the vast array of maps at our disposal, it is remarkable to discover that the visual appearance of all maps originates from a very small collection of basic elements, which serve as the foundation for creating all the many variations. The term "graphic variables" is used to describe these primitives since they represent the visual properties of a map symbol that may be altered. Although different cartographers have discovered somewhat different sets of primitives, the general consensus is that there are around 7 to 12 of them, which serve as the foundation for creating all map symbols. The primary attributes that may be modified for map symbols are position, size, form, orientation, texture, and three colour components: colour hue (red, green, blue, etc.), colour brightness (how light or dark the colour is), and colour saturation. According to tradition, each of these "graphic variables" symbolises a certain kind of variance in data.

Graphic Variable Examples	
<p>Location</p> 	<p>Texture</p> 
<p>Size</p> 	<p>Color Hue</p> 
<p>Shape</p> 	<p>Color Lightness</p> 
<p>Orientation</p> 	<p>Color Saturation</p> 

Credit: Jennifer M. Smith, © The Pennsylvania State University; Redesignated after lecture slide provided by Barbara Buttenfield, University of Colorado; Department of Geography.

Colour Schemes

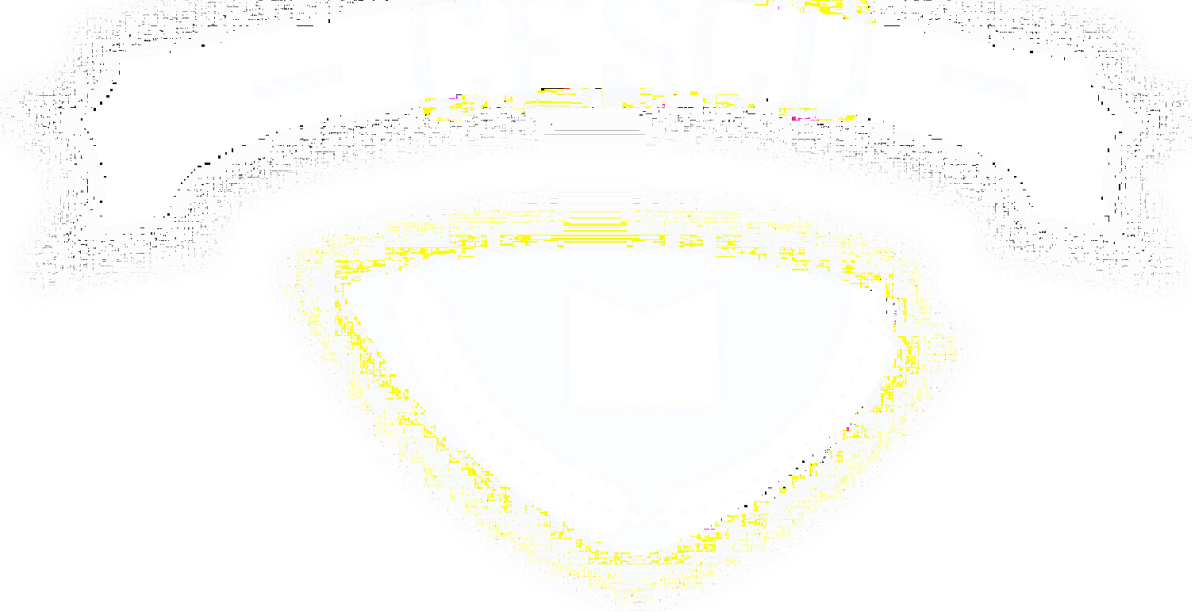
The preceding section demonstrates that there are three visual factors that constitute colour. Given the abundance of internet maps, where colour is readily available and consistently used, colour plays a notably important role in the representation of maps in today's society. Many maps fail to effectively employ colour in a logical way to reflect the data they are displaying, even though most maps use colour to portray data (in addition to aesthetic purposes). Well-designed maps use variations in the three colour variables to accurately portray the data they depict. In the following paragraphs, we will provide you with a handful of straightforward guidelines that will empower you to discern maps that use colour in both rational and irrational manners. Recognising the latter is particularly vital to preventing being deceived by encountered maps.

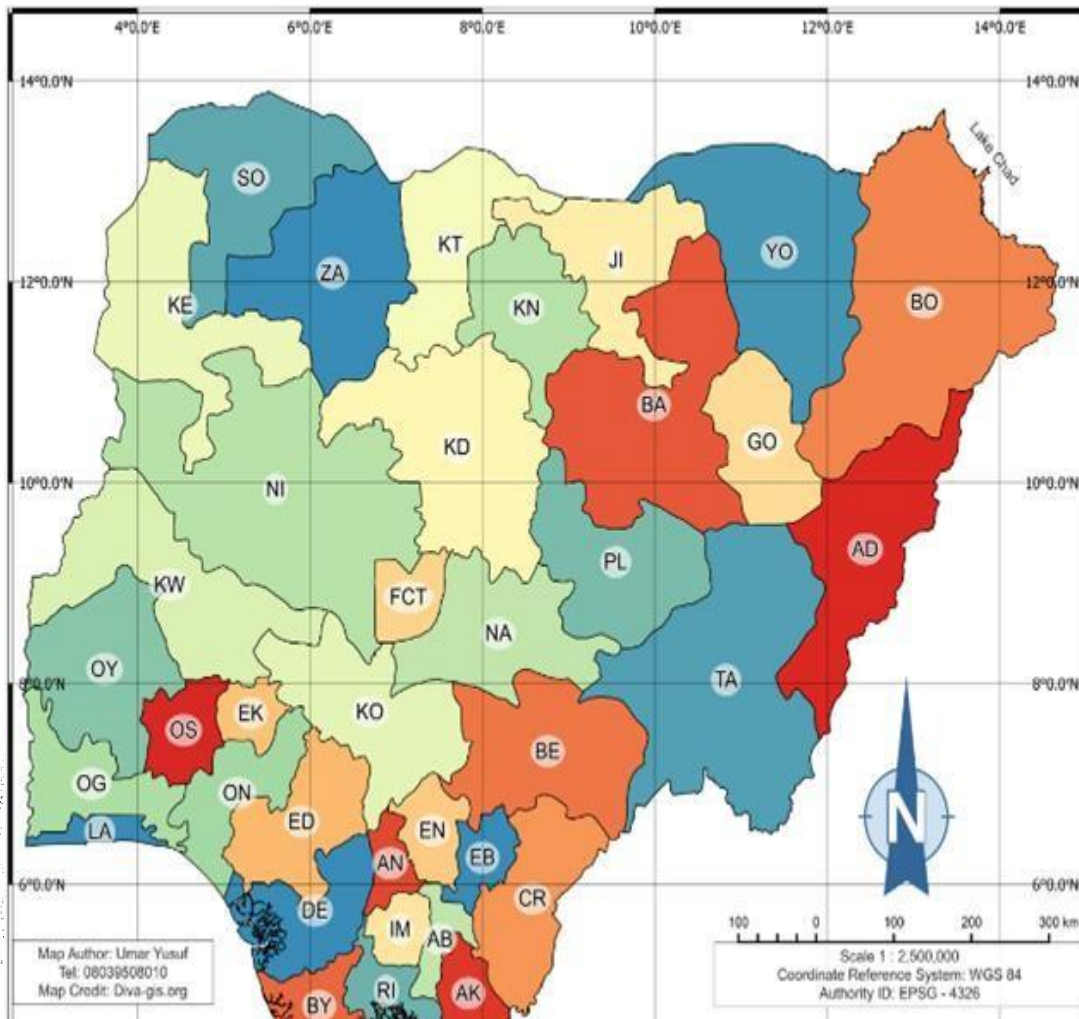
Colour Brewer is an online tool created by Dr. Cynthia Brewer and Dr. Mark Harrower to aid cartographers and others in choosing suitable colours for maps. Colour Brewer (ColourBrewer2.org) is an online tool that helps users choose colours depending on the data type, number of data classes, and map display method (e.g., printing or photocopying). Approximately eight percent of the population is affected by colour deficiency, with the most common symptom being an inability to distinguish between the colours red and green. The colour schemes have undergone testing with people who suffer from colour deficiency. Users may manipulate factors such as topography, borders, and colours to change a map template using the online application. The three main choices users have for colour schemes are sequential, divergent, and categorical forms. Each is appropriate for certain sorts of data, which will be further discussed in the following sections.

Sequential colour schemes are advised for displaying data that is arranged in ascending order of values. For instance, the data pertaining to the average annual income by county in Pennsylvania should be arranged in this fashion. In this progressive arrangement, colours are organised in a gradual sequence, starting with vibrant hues (representing low data values) and concluding with deep shades (representing high data values). Sequential schemes may rely just on the brightness of colours. Alternatively, individuals may use colour hue fluctuation to highlight the differences between groups while preserving the clear visual arrangement, as seen on the right.

Cartographic Design Layout and Public Perception

The layout of a map is a crucial aspect of its design. The primary focus is not on the actual design of the map but rather on the presentation of the map and its many elements, including titles, legends, scale bars, north arrows, and text blocks. The manner in which a map is constructed impacts the smoothness of the reader's visual navigation and the visibility of its elements (Krygier and Wood, 2005). To create a visually pleasing map, it is important to consider issues such as the balance and alignment of different elements, whether you want to achieve a harmonious arrangement or one that intentionally disrupts the visual flow. According to Krygier and Wood (2005), if the arrangement of a map is effective, it will go unnoticed by the reader. Nevertheless, if the arrangement is poor, the reader will be distracted from the intended purpose and objectives of the map.





Cartographic design layout

Cartographic Design Visuals and Public Perception

Each image has a discernible arrangement or hierarchy, progressing from the nearest part to the furthest part. Certain elements of a map may get greater attention and visibility, while others are given less importance and are placed in the background (Krygier and Wood, 2005). When a feature is positioned in the visual hierarchy, it signifies the relative significance of that component within the map. Conversely, the proximity of elements in the visual hierarchy will reveal their relationship to one another. Similar attributes should be organized inside the same hierarchy or in a hierarchy that deviates slightly from it, but unrelated features should be placed across multiple levels of the hierarchy. An elevated visual hierarchy is advantageous for differentiating the primary information from the secondary information or the surrounding context. The use of the figure-ground distinction enables faster map reading and is a crucial technique for directing readers to the most pertinent features of a map related to the stated subject matter. In contrast, a deficient visual hierarchy presents all map components at the same visual level, necessitating the reader to exert effort in distinguishing between significant and insignificant visual information within the map. When examining a highly detailed map, the reader may quickly get fatigued since they need to visually analyse the background features in order to understand the main map information.

Jaques Bertin (1974) first introduced the concept of visual variables, which elucidate the many methods by which graphic elements may be modified to reveal changes in the information perceptible to the human eye. A specialised tool has been created specifically for mapping purposes, aiming to aid cartographers in optimising symbol alterations based on the kind of data they are representing. The characteristics of the data (whether it is qualitative or quantitative) and the geometric shape (point, line, or area) both influence the alterations that take place in the symbology. Utilising a reference to visual variables ensures that changes in symbology and data are accurately aligned. Particular visual attributes are more appropriate for particular types of data, and the guide ensures that this alignment is maintained.

Visual perception refers to the cognitive process by which the brain interprets and makes sense of visual information received via the eyes. The number 1 serves as the fundamental basis for the development of map perception. This process entails the interaction between the eye and a certain part of the nervous system that is responsible for relaying information to the brain centres that regulate attention and the perception of memory. The density of photoreceptors on the surface of the retina varies. The visible light waves with various lengths and amplitudes that reflect from the surface have an impact on the photoreceptors. The ability of rods and cones to absorb light with various wavelengths and intensities distinguishes them from one another. The cones exhibit a substantial sensitivity to light. The three various types of cones respond to the wavelength ranges of long, medium, and short wavelengths. The wavelength ranges mentioned correspond to the primary colours: green, red, and blue. The macula has a high concentration of tightly packed cones, which are known for their ability to see fine details and distinguish colours accurately (P.H. Lindsay, D.A. Norman, 1984; M. Ostrowski et al., 1992). The beam that is reflected from the point of fixation, which is a small area in the field of vision where sight is focused, lands on the macula. Rods replace cones as one advances farther out from the macula, and rods are responsible for detecting contrasts in the peripheral parts of the visual field during this progression. Ganglion cells facilitate the connection between photoreceptors and the optic nerve, sending neural impulses from the photoreceptors to higher levels of the nervous system. Research has shown that impulses originating from cells connected to adjacent areas of the retina may either enhance or suppress each other, depending on the strength of the stimuli present in both areas (P.H. Lindsay and D.A. Norman 1984). The eye's reflexes are sent via the receptive field of the visual brain. Within this domain, "modules," consisting of specialised processing cells, detect certain attributes, including dimensions, form, hue, and alignment. Subsequently, the information is sent to the visual associative field, which is accountable for discerning the forms and spatial configurations of the different components comprising the picture. Currently, there is already a degree of advanced information processing involved in the perception process. There is a significant correlation between the attributes of the visual system and the perception of the map's image by the user. C. Bonnet et al. (2003) identified several factors that contribute to visual perception, including visual resolution, visual adaptation, signal reinforcement and inhibition, detection of unique image qualities, and the phenomenon of grouping. The visual axis, which is a reflection of light rays from an object, determines the angle of view, also known as the field of vision. The abundance of receptors on the retina affects visual acuity, or the sharpness of vision. The macula is often the site of peak visual acuity, which diminishes rapidly as one advances away from this area.

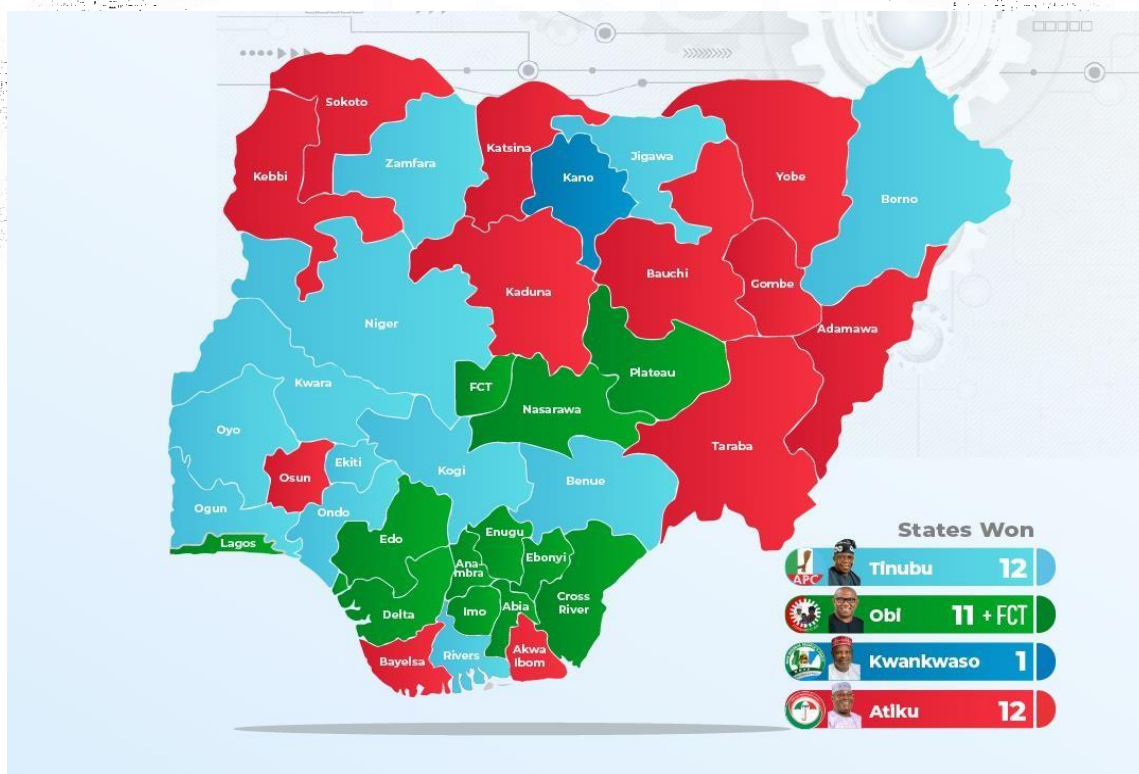


Map Highlighting Visuals of Third Mainlain Bridge

Cartographic Design Colours Combination and Public Perception

Colour has significant visual weight and is very convenient to use in computer mapping, making it susceptible to misuse in a geographic information system (GIS). Utilising vibrant and intense hues on a map may first seem like an effective strategy to capture attention. However, it carries the risk of overwhelming the reader's senses and concealing the subtler elements of the data. To establish a strong visual hierarchy, a small amount of colour may be used over a subdued background, eliminating the need for any further distractions (Tufté, 1990). Krygier and Wood (2005) argue that a grayscale map may be very effective, especially in instances where colour is not absolutely necessary. The use of intense, vivid, or excessively saturated hues on every element of a map results in the map reader experiencing confusion about the focal point of their attention and the intended distinction between front information and background or contextual information. Colour can be both overpowering and confusing when used incorrectly. Tufté (1990) asserts that colour serves as a natural quantifier, making it an ideal instrument for thematic and analytical mapping. Nevertheless, it is crucial to apply colour to the data in a suitable manner. One may modify the colour of a map by altering either its hue, which pertains to the precise colours we sense, or its value, which indicates the brightness or darkness of a single colour. Regarding qualitative data, shifts in colour hue align with changes in data categories, shown as diverse hues denoting distinct land classifications. The most effective approach for representing quantitative data or data with varying values for a certain data type, such as population density estimates that range from bright red to dark red, is via the use of colour values. When using colour hue to represent quantitative data, the reader must refer to the caption for each change in colour in order to ascertain the relative values on the map. Utilising distinct colours based on their respective values facilitates quick interpretation and comparison of relative values within the map, rather than relying on comparisons between the map and the accompanying explanation. GIS maps sometimes use predicted or customary colours to represent certain attributes, such as using blue to depict water. Failure to comply with the acceptable colour standard may lead to confusion and attention. On several occasions, colour connotations inadvertently transmit unintended meanings, such as the implicit associations of "good" and "bad" with a red-green hue gradient.

Even before the advent of colour printing techniques, the need to include colour in cartography was well acknowledged. The use of colours played a vital role in the development of themed and hipsometric maps, as it not only aided in the display of diverse information but also enhanced their overall effectiveness. In the field of cartography, brightness and saturation are seen as easily measurable characteristics when it comes to colour. The colour variable should only be used as a distinguishing variable for qualitative data, unless it is diverse in terms of brightness. The presence of the hue variable indicates the existence of a distinction among symbols. The human eye perceives saturation as brightness as long as there is a component of white light. Therefore, saturation is not often distinguished as a separate dimension, as it typically would be. The saturation of colour, often known as chroma, is a graphic component that is closely related to brightness and tone, as described by Morrison (1984), MacEachren, and Taylor (1994). Kraak and Ormeling (1998) argue that saturation may be used to broaden the range of hues. Conversely, according to Żyszkowska (2000), colour may be seen as a multifaceted variable. The phenomenon's intensity is shown by its use as an independent variable, and it also serves to strengthen other variables, notably the dimensions and form of the observed event. The study conducted by J.C. Patton and T.A. Slocum in 1985 found that although using different colours helps in recognising spatial structure, it remains unclear whether any specific wavelength is more effective than others in accomplishing this task. According to the authors, Doslak and Crawford (1977), However, as stated by MacEachren (1995), the eye's sensitivity to the colour blue is comparatively lower than its sensitivity to the other primary hues.



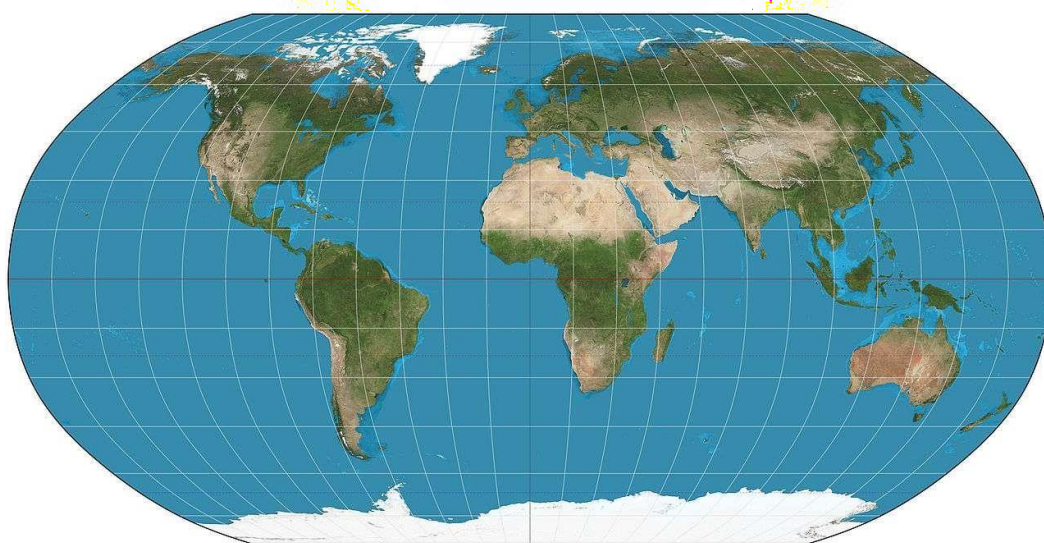
Map Showing the Voting Distribution of States in the 2023 Presidential Elections In Nigeria by colors.

Cartographic Design Projection and Public Perception

Projections can convert the spherical shape of the globe into a two-dimensional map, but this process introduces distortions that affect certain characteristics of the map. These attributes include characteristics such as size, form, measurement, and orientation. While the impact of

map projection may be negligible when used in smaller regions, it becomes substantial when used in larger areas, greatly influencing the perception and comprehension of the map. Comparing densities across various places becomes challenging when projections are used since they introduce distortions to the area. For the map layout, it is crucial to adjust the projection of insets and locators to match the most suitable projection for the inset's placement. This is in contrast to just extending the projection of the primary map onto the insets. Furthermore, inset projections must be aligned with the central meridian of the inset and rotated such that the north is oriented towards the top.

When seen from space, the planet appears as a spherical orb consisting of three spatial dimensions: length, width, and depth. For centuries, cartographers have grappled with the task of representing the whole globe or certain sections of the world on a two-dimensional surface with just length and width. It is impossible to represent all the attributes of the world simultaneously on a two-dimensional map using geometric, trigonometric, or computer software. The predicament may be likened to the timeless task of affixing an orange peel to a flat surface. To do this, it is necessary to manipulate the orange peel by either stretching, shrinking, or tearing it. By using different projections, it is feasible to generate representations that possess certain favourable characteristics aligned with the intended objective. It is crucial to preserve the four distinct sorts of beneficial qualities that have been maintained. The set comprises four concepts: equivalency, conformality, equidistance, and constant bearing. Equivalency is the term used to describe the act of trying to accurately represent a region. In other words, the feature of equivalence in a projection accurately represents the area of a portion of the world in the same way it appears on the surface of the globe. In the realm of accurately depicting forms, the concept of conformality or orthomorphism is the appropriate method of representation. Equidistance pertains to the practice of maintaining an accurate measurement of distance on both the map and the globe. Consistent bearing is the term used to describe the act of maintaining a straight line in a certain direction on the earth's surface. Equivalency, conformance, and equidistance are mutually exclusive notions. It is possible to find lines of constant bearing on the same projection that possess any of these characteristics. It is possible to construct a projection that may include some of these properties, but it will never encompass each of them individually. Such a phenomenon can only be found on the planet.



Globe map projection

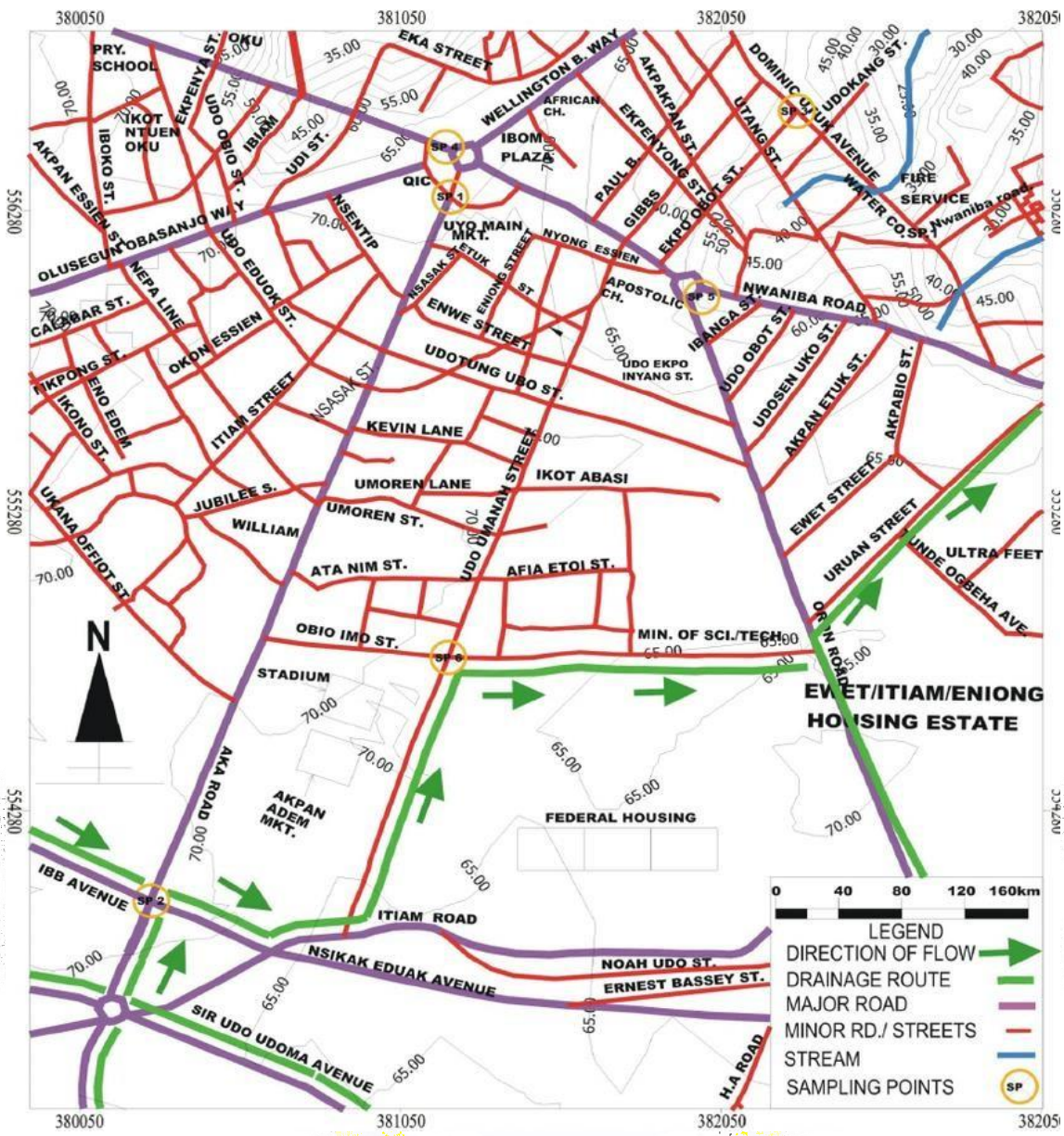
Cartographic Design Labels and Public Perception

Map text is a crucial element in the functioning of a map. Labels, often representing distinct characteristics and symbols, are commonly affixed to maps to designate and identify important elements present. A map user is prone to experiencing frustration and confusion when labels are placed in a disorganised way, while labels that are meticulously positioned and styled help direct the user's attention.

The optimal positioning of labels is contingent upon the specific environment. Numerous factors, such as the quantity of geographical features on the map or the number of characters in the place names, will determine the most effective method for placing labels. However, it is advantageous to possess knowledge of the criteria that are relevant to the most effective methods for tagging maps. The objective of this section is to provide us with knowledge about the most efficient technique for placing map labels for point, line, and area (polygon) features. As a cartographer, you will apply these ideas by using both the automatic labelling tools included in GIS software and the manual editing of visual text. Regarding the positioning of point labels, two crucial factors are of paramount importance: (1) legibility and (2) correlation. It is important to ensure that the labels on your map are easily legible and that the connection between each label and its corresponding site is always clear, wherever feasible.

It is crucial to remember that the act of adding point labels is distinct from creating a bulleted list. Instead, it is advisable to vertically adjust the position of your labels in relation to the corresponding point feature. Aside from establishing the orientation of the point labels, you will also need to ascertain the extent to which you will arrange them in accordance with the attributes of the points. In the left photo, labels are placed in close proximity to the points, but in the right image, labels are positioned at a greater distance from the corresponding point symbols. The closeness of map components, such as labels and points, should generally be avoided when they seem too densely packed. However, the specific arrangement of these components will depend on the size, shape, and density of the labels, points, and map. Ensuring consistency across the whole map design is crucial.

Another crucial aspect to consider is the precise time and place at which you will implement line breaks in the text shown on your map. If the label is visible on the map, it is permissible to provide the whole label on one line. However, this is often impractical due to the abundance of map features and the lengthy names associated with these elements.



Uyo Metropolitan Map Showing Labelling

Conclusion

Cartography is an interdisciplinary science that has a vital function in accurately describing and efficiently transmitting geographic and geographical information. It encompasses the scientific, technical, and artistic elements of map creation. Cartographic design is a method that emphasises the creation of visually attractive and useful maps according to established criteria and optimal methods. Efficient design optimises communication and guarantees that maps achieve their intended objectives. The interaction between visual communication and analysis in cartography emphasises the significance of aesthetics and design in the look and functionality of maps. Effective design not only captivates the reader's attention but also enables the concise and effective transmission of information. Conversely, inadequate design might impede understanding and result in misunderstanding. The cartographic process entails the extraction of map characteristics via the acts of choosing, categorising, streamlining, magnifying, and representing. The following procedures are essential for producing maps that are clear and informative. Cartography has a significant impact on spatial behaviour, spatial preferences, and our perception of the world.

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SORPTION PROPERTIES FOR VARIED TEMPERATURES OF BITTER KOLA: A REVIEW

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ABSTRACT

*This review emphasizes the significance of moisture sorption isotherms in assessing shelf-life extension for fruits, particularly *Garcinia kola*, with a focus on bitter kola. Experimental studies on sorption isotherms often explore the static gravimetric method at various temperatures and water activity ranges as it is the cheapest and easiest. Equilibrium moisture content was observed to increase with increased water activity at constant temperature and decrease with temperature elevation. Three models (BET, GAB, and Oswin) were employed and found to adequately predict bitter kola's equilibrium moisture content. Monolayer moisture content, determined by BET and GAB models, aligned with values seen in other food and fruit materials. Sigmoidal sorption isotherm curves (typical type II isotherm) were obtained. The study suggests that these models are suitable for analyzing observed data, with optimal results at lower temperatures indicating extended shelf life for bitter kola under such conditions.*

KEYWORDS: Bitter Kola, Physicochemical, Sorption, Isotherms, Static Gravimetric Method

INTRODUCTION

1.1 Background of the Study

The Clusiaceae or Guttiferae family comprises bitter kola, also known as '*Garcinia kola*,' found in African countries like Benin, Cameroon, Democratic Republic of the Congo, Ivory Coast, Gabon, Ghana, Liberia, Nigeria, Senegal, and Sierra Leone, thriving in subtropical or tropical moist lowland forests. The plant's various parts, including fruit, seeds, nuts, stem, and bark, have been utilized in traditional medicine for centuries to address health conditions and for tooth care. Bitter kola trade remains vital to indigenous communities in Nigeria, driven by its medicinal attributes, such as anti-viral, anti-inflammatory, anti-diabetic, bronchio-dilator, and anti-hepatotoxic properties (Okunji *et al.*, 2002).

The uses of bitter kola often depend on principles of adsorption. Extensive research has reported findings on its nutritional and phytochemical compositions (Adegboye *et al.*, 2008; Adesuyi *et al.*, 2012; Odebunmi *et al.*, 2009).

Sorption isotherms, which describe equilibrium moisture content and water activity under constant temperature and pressure, play a crucial role in various aspects of food science. As outlined by Ricardo *et al.* (2011), these isotherms are instrumental in modeling the drying process, designing and optimizing drying equipment, predicting shelf-life stability, calculating moisture changes during storage, and selecting appropriate packaging materials. The five main forms of sorption isotherms are often categorized based on their shape, with most foods exhibiting nonlinear and typically sigmoid-shaped isotherms (Ricardo *et al.*, 2011).

In this review, the sorption isotherms and physicochemical properties of bitter kola are reported with respect to temperature, method of determining sorption isotherms and models for interpretation of sorption data.

REVIEW OF RELATED LITERATURE

2.1 Taxonomy of *Garcinia Kola*

The *Clusiaceae* family consists mainly of woody perennials, trees, shrubs, and lianas divided into 18 genera. Among them *Calophyllum*, *Clusia*, or *Garcinia* are pantropically the most popular (Gustafsson, 2018).

Garcinia is a large genus consisting of more than 250 species of dioecious woody plants that are a common understory component of lowland tropical forests (Guedje *et al.*, 2002). The genus was named after Laurent Garcin (1683–1757), a Swiss botanist within the Dutch Indies Company who published the first description of mangosteen (*G. mangostiana*), the most popular fruit species from the *Garcinia* genus. In the region of West and Central Africa, about 21 species of *Garcinia* can be found (Guedje and Fankap, 2001; Agyili *et al.*, 2007). One of these, *Garcinia kola* (bitter kola), appears to be the most researched species.

2.2 Proximate Analysis of Bitter Kola

Proximate analysis produces results of the physicochemical properties of food and fruit materials. Examples of these properties include; Moisture content, crude fibre, fat content, ash content and carbohydrate content Owuamanam *et al.*, 2010 and Nwanekezi *et al.*, 2010.

2.3 Water Activity

Water activity is a physical measure of active water available in foods. Thus, it is the state of water rather than the total water content, which is important as far as microbial proliferation is concerned. The greater the proportion of free water present, the greater the vapour pressure and vice versa. Increased bound water reduces vapour pressure (Sahu and Das, 2010; Sawhney *et al.* 1991; Scott, 1957).

2.4 Equilibrium Moisture Content (EMC)

The vapor pressure of a food at a specific temperature and moisture content is a characteristic feature, and porous food materials, when exposed to moist air, undergo adsorption or desorption of water molecules until reaching equilibrium moisture content (EMC). EMC strongly depends on the partial pressure of water vapor in the air and less so on the ambient air temperature typical during drying and storage of foods. If a food material's

moisture content stabilizes over time for a given combination of water vapor pressure and air temperature, it is considered to have reached EMC under those conditions (Iji *et al.*, 2021).

2.5 Moisture Sorption Isotherms

The moisture sorption isotherms show the equilibrium amount of water sorbed onto a solid as a function of steady state vapour pressure at a constant temperature (Roos, 1995; Bell and Labuza, 2000). There are many empirical equations that attempt to describe this behaviour, but the water sorption properties at various relative humidities should be experimentally determined for each material (Swaminathan and Kildsig, 2001).

2.5.1 Effect of Temperature on Sorption Isotherms

The effect of temperature on the sorption isotherm is of great importance given that foods are exposed to a range of temperatures during storage and processing and water activity changes with temperature. Temperature affects the mobility of water molecules and the dynamic equilibrium between the vapour and adsorbed phases (Iji *et al.*, 2021).

2.6 Measurement of Sorption Isotherms

The methods can be classified into three categories: (i) gravimetric; (ii) manometric; and (iii) hygrometric.

Gravimetric Method: This involves the measurement of weight changes. Weight changes can be determined both continuously and discontinuously in dynamic or static systems (i.e., air may be circulated or stagnant). Continuous methods employ the use of electro-balances or quartz spring balances. In the discontinuous systems, salt or sulphuric acid solutions are placed in vacuum or atmospheric systems with the food material, to give a measure of the equilibrium relative humidity (Al-Muhtaseb *et al.*, 2002).

Manometric Method: This measures the vapour pressure of water in the vapour space surrounding the food. To improve accuracy the fluid selected for the manometer is often oil instead of mercury. The whole system is maintained at constant temperature and the food sample will lose water to equilibrate with the vapour space. This will be indicated by the difference in height on the manometer (Al-Muhtaseb *et al.*, 2002).

Hygrometric Method: This measures the equilibrium relative humidity of air in contact with a food material, at given moisture content. Dew-point hygrometers detect the condensation of cooling water vapour. Electric hygrometers measure the change in conductance or capacitance of hygrosensors. Most hygrosensors are coated with a hygroscopic salt, such as LiCl, which absorbs moisture from the food sample (Al-Muhtaseb *et al.*, 2002).

Static gravimetric technique is the cheapest and easiest method of measuring weight changes in food and that is the reason for its continuous use in the determination of sorption isotherms for various classes of materials (Iji *et al.*, 2021).

2.7 Mathematical Description of Moisture Sorption Isotherms

Although several mathematical models exist to describe water sorption isotherms of food materials, no one equation gives accurate results throughout the whole range of water activities, and for all types of foods (Iglesias and Chirife, 1976). It has been observed that the best models for analyzing sorption results are Brunauer-Emmet-Teller (BET), Guggenheim-Anderson-de Boer and Oswin models. These are the models considered in this review.

2.7.1 The Brunauer-Emmett-Teller (BET) Equation

The Brunauer, Emmett and Teller (BET) sorption equation, formulated in 1938, represents a fundamental milestone in the interpretation of multilayer sorption isotherms, particularly Type II and III (Timmermann, 1989); it provides an estimation of the monolayer value of moisture adsorbed on the surface. The monolayer moisture content of many foods has been reported to correspond with the physical and chemical stability of dehydrated foods. However, in almost all cases the so-called BET plots are only linear over the lower relative pressure region (a_w) of the sorbate ($0.05 < a_w < 0.35$).

The BET equation is generally expressed in the formula as shown in Equation 2.1.

$$\frac{M}{M_0} = \frac{Ca_w}{(1-a_w)(1-a_w+Ca_w)} \quad \text{Equation 2.1}$$

Where M is the moisture content (kg/kg dry solid), M_0 is monolayer moisture content (kg/kg dry solid), a_w is the water activity, and C is a constant related to the net heat of sorption.

2.7.2 Oswin Equation

Oswin (1946) developed an empirical model which is a series expansion for sigmoid shaped curves, and can be expressed as shown in Equation 2.2.

$$M = A \left[\frac{a_w}{1-a_w} \right]^B \quad \text{Equation 2.2}$$

Where M is the moisture content (kg/kg dry solid), A and B are constants. Boquet, *et al.* (1978) considered the Oswin equation to be the best one for describing the isotherms of starchy food, and a reasonably good fit for meat and vegetables.

This equation was also used by Labuza *et al.*, 1972 to relate the moisture contents of non-fat dry milk up to $a_w=0.5$.

2.7.3 Guggenheim-Anderson-de Boer (GAB) Equation

The three parameters GAB equation, derived independently by Guggenheim (1966), Anderson (1946) and de Boer (1953), is a semi-theoretical, multi-molecular, localized, homogeneous adsorption model. It has been suggested to be the most versatile sorption model available in the literature and has been adopted by a group of West European food researchers (Van de Berg and Bruin, 1981 and Bizot, 1983). It can be written as Equation 2.3.

$$M = \frac{M_0 G K a_w}{(1 - K a_w) (1 - K a_w + G K a_w)} \quad \text{Equation 2.3}$$

where M is the moisture content (kg/kg dry solid), M_0 is the monolayer moisture content; G and K are constants related to the energies of interaction between the first and further molecules at the individual sorption sites.

Theoretically they are related to the sorption enthalpies (Van den Berg *et al.*, 1981) as shown in Equations 2.4 and 2.5.

$$G = G_b \exp \left[\frac{H_m - H_n}{RT} \right] \quad \text{Equation 2.4}$$

$$K = k_0 \exp \left[\frac{H_1 - H_n}{RT} \right] \quad \text{Equation 2.5}$$

where G_0 and k_0 are entropic accommodation factors; H_m , H_n and H_1 are the molar sorption enthalpies of the monolayer, multi-layers and bulk liquid, respectively (KJ/mol).

2.8 Model Evaluation Methods

The models which incorporate the temperature effect have been adopted as standard equations by the American Society of Association Executives (ASAE) for the description of sorption isotherms (ASAE, 1997). The constants were estimated by fitting the mathematical model to the experimental data, using a non-linear regression analysis with Microsoft Excel 2013 software. The quality of the fit of different models was evaluated by calculating the correlation coefficient (R^2), the mean relative percentage deviation modulus E in percentage (%) and the root mean square error (RMSE) between the experimental and predicted equilibrium moisture content (Boquet *et al.*, 1978 and Basu *et al.*, 2006). The deviation modulus and root mean square error and correlation coefficient are expressed as Equations 2.6, 2.7 and 2.8 below.

$$E = \frac{100}{N} \sum_{i=1}^N \frac{|X_{eq,exp} - X_{eq,pre}|}{X_{eq,exp}} \quad \text{Equation 2.6}$$

$$RMSE = \left[\frac{1}{N} \sum_{i=1}^N \frac{(X_{eq,exp} - X_{eq,pre})^2}{X_{eq,exp}} \right]^{\frac{1}{2}} \quad \text{Equation 2.7}$$

$$R^2 = \frac{(X_{eq,exp})}{X_{eq,exp} + X_{eq,pre}} \quad \text{Equation 2.8}$$

Where N is the number of observations; $X_{eq,exp}$ and $X_{eq,pre}$ are the experimental and predicted values of the equilibrium moisture content, respectively. The mean relative percentage deviation modulus is widely adopted throughout the literature, with a modulus value below 10 % indicative of a good fit for practical purposes (Lomauro *et al.*, 1985; Kaymak-Ertekin and Gedik, 2004).

According to Kaleemullah and Kallappan (2004), Aviara *et al.*, 2004) and Basu *et al.*, 2006, statistical parameters like R^2 , E and RMSE may not be sufficient evidence for the goodness of fit of a moisture sorption model based on experimental data, but the nature of the residual plots should be considered in addition. A model was considered acceptable if the residuals ($X_{eq,exp} - X_{eq,pre}$) are uniformly scattered around the horizontal value of zero, showing no systematic tendency towards a clear pattern.

RESULT OF SOME RESEARCHERS ON SORPTION ISOTHERMS OF BITTER KOLA

3.1 Physicochemical Properties of Bitter Kola

Odebunmi *et al.* (2009) carried out research on the physicochemical properties of *garcina kola* on wet basis and Table 3.1 shows the result.

Table 3.1: Physicochemical properties of *garcina kola* on wet basis

Components	Percentage (%)
Moisture content	60.480
Crude protein	2.480
Crude fibre	5.230
Fat content	4.510
Ash	0.790
Carbohydrate	35.640

Source: Odebunmi *et al.* (2009)

Mazi *et al.* (2013) carried out research on the physicochemical and nutritive properties of bitter kola. The result of the experiment is as shown in Table 3.2.

Table 3.2: Physicochemical properties of *garcina kola* on dry basis

Components	Percentage (%)
Moisture content	9.280
Crude protein	11.270
Crude fibre	3.940
Fat content	4.510
Ash	4.173
Carbohydrate	70.310

Source: Mazi *et al.* (2013)

Manourova *et al.* (2017) also conducted research on the characterization of *garcina kola* on wet basis; this is as shown in Table 3.3 below.

Table 3.3: Physicochemical properties of *garcina kola* on wet basis

Components	Percentage (%)
Moisture content	42.300
Crude protein	6.480
Crude fibre	2.270
Fat content	1.480
Ash	0.330
Carbohydrate	47.140

Source: Manourova *et al.* (2017)

Oloko and Oyedele (2019) conducted a study on the determination of physicochemical properties of bitter kola. The data in the Table 3.4 shows the result.

Table 3.4: Physicochemical properties of *garcina kola*

Components	Percentage (%)	
	Dry basis	Wet basis
Moisture content	13.780	51.970
Crude protein	5.320	1.295
Crude fibre	3.970	1.450
Fat content	3.370	1.060
Ash	0.740	0.310
Carbohydrate	72.840	43.940

Source: Oloko and Oyedele (2019)

Iji *et al.* (2021) conducted a study on the determination of the physicochemical properties of bitter kola on wet basis. The data in Table 3.5 shows the result.

Table 3.5: Proximate composition for *garcina kola*

Components	Percentage (%)
Moisture content	52.500
Crude protein	2.510
Crude fibre	5.120
Fat content	4.160
Ash	0.860
Carbohydrate	34.850

Source: Iji *et al.* (2021)

Tables 3.1 through 3.5 shows the physicochemical properties of *garcina kola* on the wet and dry basis. Fresh *garcina kola* has high moisture content making it prone to bacterial damage with increase in temperature.

3.2 Equilibrium moisture content of Bitter Kola

Iji *et al.* (2021) was able to calculate experimentally the EMC of *garcinia kola* powder. Table 3.6 below shows the summary at varied a_w and temperature.

Table 3.6: Summary of the EMC and a_w at varied temperatures for *garcina kola*

30 °C		40 °C		50 °C		60 °C	
a_w	EMC	a_w	EMC	a_w	EMC	a_w	EMC
0.113	0.050	0.112	0.049	0.111	0.048	0.111	0.045
0.324	0.070	0.316	0.068	0.305	0.066	0.293	0.065
0.432	0.081	0.432	0.080	0.432	0.079	0.432	0.077
0.560	0.110	0.532	0.100	0.509	0.097	0.497	0.095
0.679	0.112	0.661	0.120	0.645	0.117	0.631	0.114
0.691	0.127	0.673	0.125	0.657	0.120	0.643	0.118
0.751	0.200	0.747	0.199	0.744	0.197	0.745	0.190
0.836	0.330	0.823	0.310	0.812	0.290	0.803	0.285
0.970	1.835	0.964	1.830	0.958	1.790	0.952	1.750

Source: Iji *et al.* (2021)

From Table 3.6, as temperature increases with increase in a_w for *garcina kola* powder, the EMC decreases. This agrees with the theory of physical sorption (Iglesias *et al.*, 1975; Hassian *et al.*, 2001). Implying that *garcina kola* became less hygroscopic with increasing temperature.

3.3 Moisture Sorption Isotherm of *Garcinia Kola* at Varied Temperatures

The research carried out by Iji *et al.* (2021) led to the generation of experimental data for equilibrium moisture content (EMC) and water activities as shown in Table 3.6 above. The data were plugged into nonlinear regression graphs using Microsoft Excel 2013. Figures 3.1 through 3.4 below were the adsorption isotherms; this shows that the moisture sorption isotherms were temperature dependent. The equilibrium moisture at a given water activity, decreased with increase in temperature. This agrees with the theory of physical sorption

(Iglesias *et al.*, 1975; Hassian *et al.*, 2001), implying that *garcina kola* became less hygroscopic with increasing temperature.

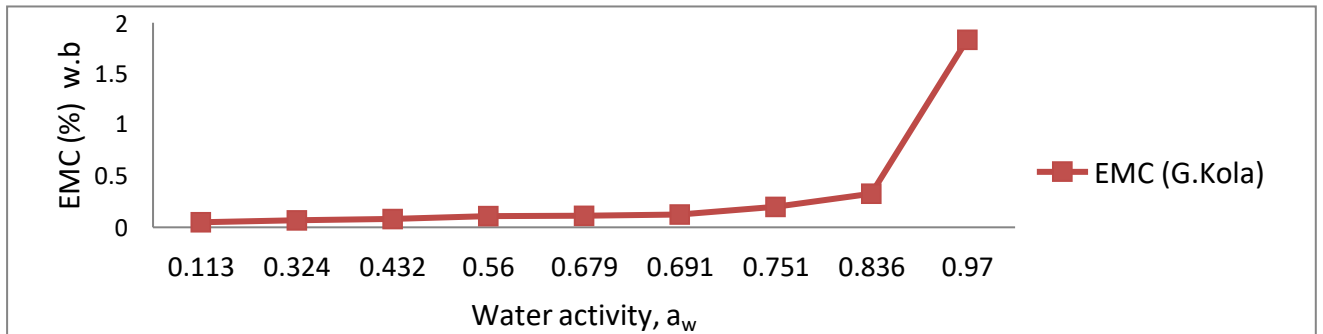


Figure 3.1: Adsorption isotherm of *garcina kola* at 30 °C

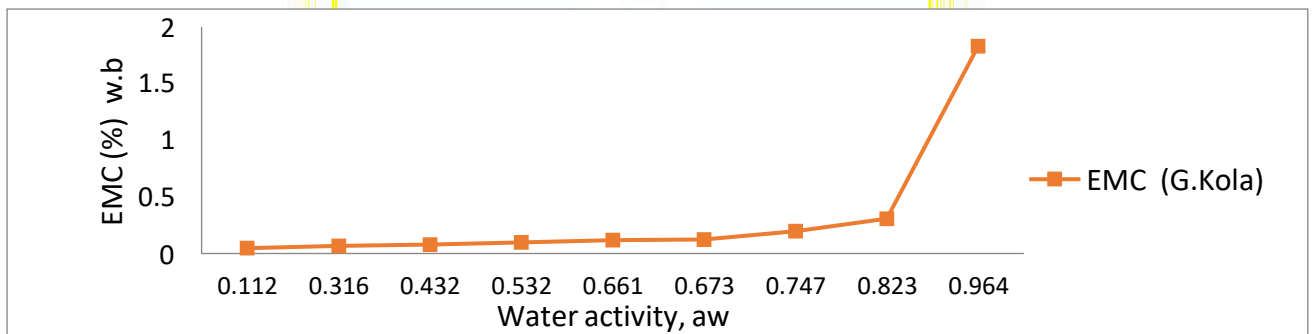


Figure 3.2: Adsorption isotherm of *garcina kola* at 40 °C

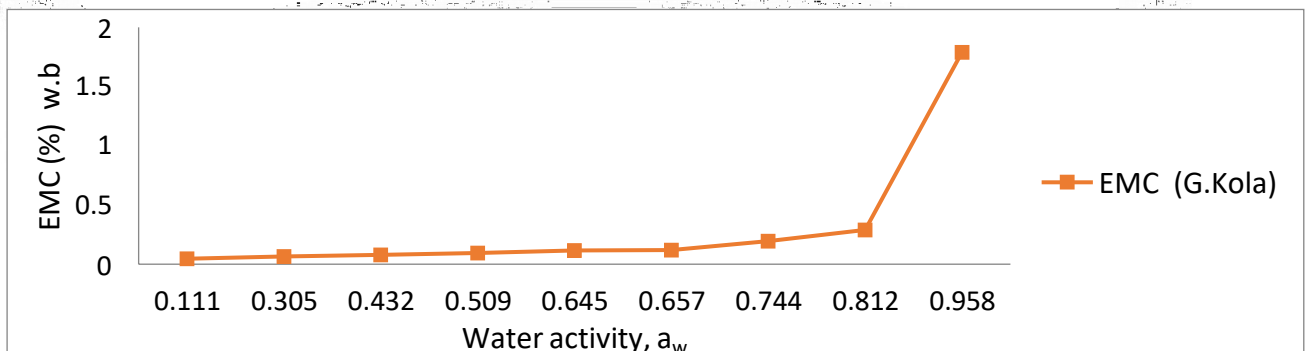


Figure 3.3: Adsorption isotherm of *garcina kola* at 50 °C

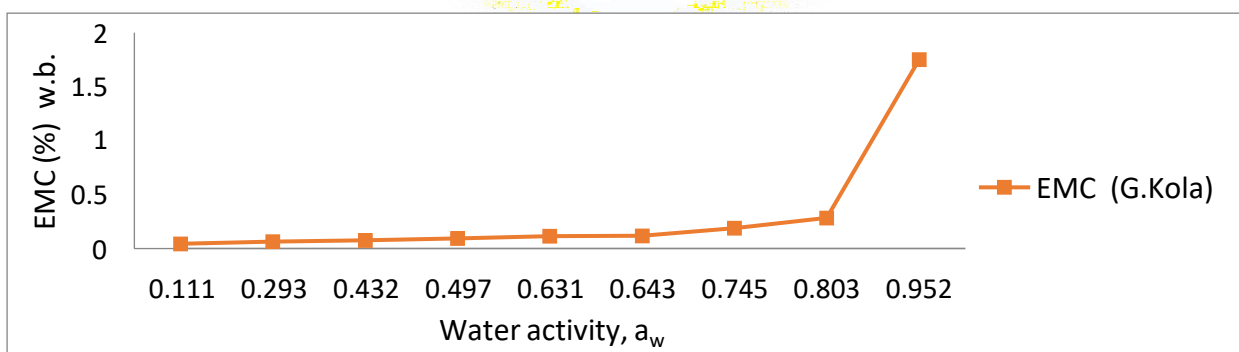


Figure 3.4: Adsorption isotherm of *garcina kola* at 60 °C

3.4 Fitting Models to Moisture Sorption Isotherms *Garcina Kola*

Table 3.7 below shows the model constants and statistical errors for adsorption isotherms for *garcina kola*. It was observed that the relationship between monolayer for BET

and GAB were not totally consistent. GAB monolayer values almost fell within the monolayer for starchy foods which generally range from 0.032 – 0.16 (kg water/kg dry matter) (Siripatrawan and Jantawal, 2006) except for Timmermann *et al.*, (2001). BET monolayer values were less than the GAB'; but at 30 and 40 °C, the constant C values for BET were lesser than the constant K values of GAB in the adsorption isotherms at the temperatures.

Also, the GAB constant (K) values for adsorption were less than unity. This shows that they all fell within the recommended range of $0.7 < K < 1$ (Timmermann *et al.*, 2001). Provided that the water activity level of 0.6 corresponds with equilibrium moisture content of 0.11 (kg water/kg dry-matter) and equivalent to 10% (w.b) on the adsorption isotherm at 30 and 40 °C, the GAB monolayer values satisfy the condition. This implies that the equilibrium moisture content for microbiologically shelf-stable dried *garcina kola* was equal to 10% (w.b) at 30 and 40 °C.

The three models used to describe both the adsorption isotherm for *garcina kola* were: BET, GAB and Oswin. The models with $R^2 > 0.95$, $E \leq 10\%$ and low values of RMSE were considered to be the best fitting models to describe *garcina kola* moisture isotherm. The results for statistical errors used to evaluate the best fitting models together with model constants were given in Table 3.7 below. It was observed from tables that all models fitted had low values for RMSE, which indicated that all models could be used to describe adsorption moisture isotherms for *garcina kola*.

The computed values of E % indicated that none of the three models E-value was lesser than 10.%. This indicated that although the RMSE had low values, R^2 values were less than unity, for all models, The E-values eliminated the models as the values were greater than 10 %. On the basis of monolayer, BET and GAB model best describe the adsorption moisture isotherm at 30 and 40 °C.

Table 3.7: Estimated parameters by nonlinear regression for BET, GAB and OSWIN Models for *garcina kola*

Models	Constants	Temperatures (°C)			
		30	40	50	60
BET	M _o (g/g dry solid)	0.181576	0.080867	0.041238	0.032293
	C	0.552673	0.917647	1.386102	1.706528
	R ²	0.99835	0.998261	0.997453	0.993035
	RMSE	0.02211	0.022701	0.026876	0.045547
	E (%)	12.56221	16.31022	17.69961	10.38048
GAB	M _o (g/g dry solid)	0.072897	0.050659	0.029747	0.023466
	K	0.989682	0.999365	0.974841	1.007904
	G	1.002062	1.174062	1.666545	1.796874
	R ²	0.996416	0.998076	0.997479	0.997517
	RMSE	0.032727	0.023936	0.026832	0.026348
	E (%)	16.50219	21.07163	20.83303	25.12812
OSWIN	A	0.079592	0.068519	0.065333	0.062802
	B	0.903281	0.999387	1.058778	1.114019
	R ²	0.99678	0.998234	0.99791	0.997649
	RMSE	0.030881	0.022931	0.02446	0.025406
	E (%)	11.87691	18.26048	21.06275	23.0462

Source: Iji *et al.* (2021)

3.5 Monolayer Moisture Content (Mo)

The monolayer moisture content of *garcina kola* were obtained using BET and GAB models and the results are as shown in Table 3.7 above. In the adsorption model, M_0 ranged from 0.181576 to 0.032293 g water/ g dry basis and 0.072897 to 0.023466 g water/ g dry basis for BET and GAB models respectively. It was observed that the relationship between monolayer for BET and GAB for all cases was consistent with Timmermann *et al.*, (2001). The decrease in monolayer moisture contents with increase in temperature as observed may be due to a reduction in the total number of active sites for water binding as a result of physical and/or chemical changes in the product induced by temperature (Iglesias and Chirife, 1976).

4.1 Conclusion

This review has specifically provided the following information on moisture sorption isotherm for bitter kola (*garcina kola*) and the following has been revealed:

- i. Bitter kola isotherms exhibited type II curves behavior which is characteristic of foodstuffs and fruits as reported by Johnson and Brennan, 2000 and Yan *et al.*, 2008.
- ii. The equilibrium moisture content decreases with increase in temperature at a given water activity, indicating that bitter kola becomes less hygroscopic with increase in temperature giving a clear stability domain after drying leading to extensive shelf life. This complements Muranga, (1998), who attributed the extensive shelf life to low sugar and fat.
- iii. For shelf stability of dried *garcina kola*, it is recommended to dry it to moisture content below or equal to 0.11 (g water/g dry matter) which is equivalent to 10 % (w.b).
- iv. On the basis of monolayer, BET and GAB models best describe the adsorption moisture isotherm for *garcina kola* at lower temperatures.
- v. The three models properly described all the adsorption and moisture isotherms for *garcina kola*.
- vi. The data obtained from this review are useful in characterization, selection of appropriate packaging material, design of processing machines and generally in a post-harvest handling of bitter kola.

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AGILE PRODUCTION: A SYNTHESIS FOR CAPACITY EFFECTIVENESS OF AGRO FIRMS IN RIVERS STATE NIGERIA

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ABSTRACT

The study examined how agile production correlates with capacity effectiveness of agro firms in the Rivers state. The aim and objective of the study was to empirically determine how variables of the study relate with each other and to determine cause and effect relation considering the outcome of each variable studied. The study was necessitated as a result of the apparent suboptimal ineffectiveness in their operation capacity given the high demand for their product in the state. The study adopted a correlation research design with the use of primary data. Spearman statistical tool was used to analyze responses elicited from respondents in the structured questionnaires administered, and regression analyses was further used to identify the cause and effect relationship between variables studied. Finding revealed a positive significant correlation, and isolating variables that are of high tendency to maximize capacity optimality among studied firms. Conclusions and recommendations were drawn amongst was, agile production is a flexible customers driven strategy that enables firms optimize their productive activity in sync with limited resources available.

KEYWORDS: Agile, Capacity, Effectiveness, Production

1.1 Introduction

Customers are very selective in the goods or services they exchange their money for simply for the purposes of deriving actual or real value for every money spent on the product they consume. Waribo, et al. (2023), accreted that, this has increased their ability to change or been selective from one product to the other in order to maximize value for satisfaction. Conversely, it was also seen in the work of Melvin, & Batistuta, (2022) that, organization must increase or adjust to the increase change in the taste drift of consumers by ensuring that their capacity to produce what they should must adequately satisfy and need the demand of customers' preference. Hence, Aduma, & Shaldule, (2023) posited that, productive factors such as materials, machines, knowledge, technology and the required information need to be in right combination to stimulate speed and accuracy.

Elumon, & Ariolu, (2022) avowed that, the agility needed is the systematic approach to drive productive activity, by been flexible to changing demand, needs, of customers and as well maintaining quality, price and production coast constant. Also, Achiomo, & fashiola, (2023), contributed that, in our fast evolving world, organization are in constant search for knowledge,

required skill, technology that is appropriate for conversion to tangible or intangible value necessary to meet standard capable to instill customers retention and to increase their market share. Consequently, Egile, et al., (2023), observed that, based on agile development introduced by software development industry, it seeks to draw inspiration into the realm of production and operations management. Lee. Et al., (2023), identified that, the core objective of this strategic approach was to craft the manufacturing sector that is efficient and responsive to the dynamic changes in customer preferences, market trends and its external constrains. Its dimensions are flexibility, rapid response, collaboration and continuous improvement (Marshal, et al., 2023)

1.2 Problem of the Study

Changes arising as a result of customers’ consumption preference, purchasing habit and drift from one product to the other has immensely contributed to firms ability to be electronically responsive in their capability to remain in business as well as to adequately meet and satisfy customers want timely. In the bit of such responsiveness, some factors has posed delineating constrains to their productive capabilities, such as supply variability of rain dependent agricultural inputs which forms a lager stock of agro manufacturing firms raw material. This is most challenging giving the poor state of storage facility that are capitally intensive for these firm to strategically adopt back ward integration in order to sustain market demand. It is contingent on this that the researcher seeks to empirically determine the correlation that existed between agile production and capacity efficiency of agro manufacturing firms in Port Harcourt Rivers State, Nigeria.

1.3 Conceptual Framework

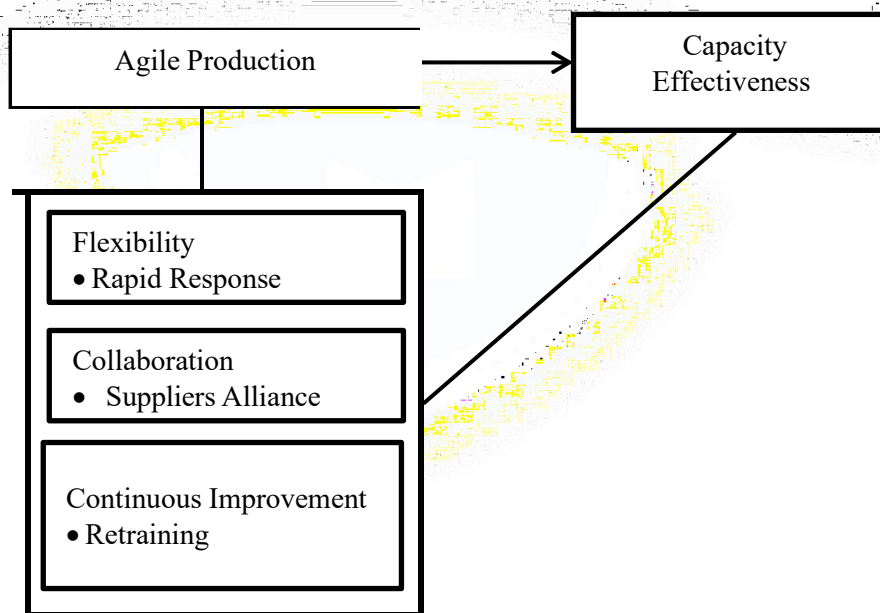


Figure 1: Adopted Conceptual Frame Work

Source: Marshal, et al., (2023), and Researcher’s Conceptualization (2023)

1.4 Objective of the Study

The specific objectives of the study were identified as:

1. To ascertain the extent to which flexibility relates with capacity effectiveness in the studied organization

2. To ascertain the extent to which collaboration influences capacity effectiveness in the studied organization
3. To ascertain the extent to which continuous improvement influences capacity effectiveness in the studied organization

1.5 Research Questions

The research questions identified below were formulated to guide the researcher in carrying out the study.

1. To what extent does flexibility relates with capacity effectiveness in the studied organization?
2. How does collaboration influences capacity effectiveness in the studied organization?
3. To what extent does continuous improvement influences capacity effectiveness in the studied organization?

1.6 Research Hypotheses

The hypotheses stated below were formulated in the null form

H₀₁: There is no significant relationship between make flexibility and capacity effectiveness in the studied organization

H₀₂: There is no significant relationship between collaboration and capacity effectiveness in the studied organization.

H₀₃: There is no significant relationship between continuous improvement and production capacity in the studied organization

1.7 Conceptual Review

Capacity effectiveness is a core priority index for organizational growth and viability. Mafidor, et al., (2023) argued that, it encompasses the production system or mechanism of an organization into its inventory structure, and the readiness or availability of resources (material, human capital, machine and method) to enable productivity. In the study of Samuel. & Walson, (2023), it was seen that, the right understanding of customers wants and need and the ability for the organization to optimally satisfy these customers' wants and needs at the right time, price and place is a function of capacity effectiveness. Again, Ofor, & Okwu, (2023) posited that, production managers need to concisely evaluate the dynamic of the external environment in relation to marketing activities, feedback in form of recommendation and the expectations of the customers' base of their consumption pattern. The concept of electronic behavior (EB) is that readiness or an organization of a manager to respond to customers' preference or changes in the external environment (Opuwari, et al 2021). Atubo, & Traatule, (2022) alluded that, the responsiveness is for the organization to structure its production activities in a flexible manner will determine their capability to satisfy the changing taste of her teeming customers.

Flexibility: agile production is hinged on the concept of organizational flexibility. Ogbe, & Ekpelu, (2022), identified that, where an organization combines technology, productive means and method in responding to the changing demand of customers in the production of goods and services.

Collaboration: Oftentimes, organizations depend on the activity or the involvement of middle men or suppliers in the provision of raw or production material. Adel, (2020) observed that, this is most practicable in the agro sector as a result of poor infrastructure ranging from bad road network, poor storage facilities, and fast deteriorating state of agro products. Thus, White, & Wagba, (2023), emphasized that, the engagement of suppliers gained much influence in collaborating with production firms in the industry. Hence, the collaboration with suppliers is a strategic alliance that would increase the readiness to product at the right time (Pakirima, et al., 2023).

Continuous Improvement: The right combination of skill, technology, machine, method and process are essential for agile productive of an organization. Thus, Showers, et al., (2023), posited that, human capital would require relevant updating of skill through training means, relevant machines need to be replace for fast and accurate utilization, technology adoption must give space to information requirement that would enable methods and process in maximizing production capability.

1.8 Theoretical Models of Agile Production

To reach adequately response to customers' wants, needs and increasing the space of flexibility in producing goods, would require integrating "push" and "pull" production models, which are the most popular production systems nowadays, for controlling a hybrid and automated manufacturing processes in an organization. Thus, Bahalad, et al., (2022) conceptualized that, it is this integrated production model that is most effective for agile manufacturing environment. Shegbasa, et al., (2023) noted that, the in the application of push method, involving material requirement planning (MRP) in its calculations, since it is the basis for distributing materials to the plant. Pull methods is often know as just-in-time (JIT) systems. Ogbe, & Ekpélu, (2022) observed that, the concept is based on the threshold of produce products that adequately satisfy or meet customers' wants, needs and requirements. Glad, & Tagel, (2023), avowed that, the integrated production model is made possible by bring in the theory of constraints (TOC) and optimized production technology (OPT). Shitima, et al., (2022), alluded that, optimized production technology, according to the theory of constraints is a very important theory for understanding constraint resources in a production line by employing both the push and pull concepts. In real terms, bringing in TOC and OPT, an integrated push and pull production model is developed (Pascal, et al., 2023).

1.9 Empirical Review

Ukari, et al., (2023), carried out a study on the capacity optimization and productivity od paint manufacturing firms in South South Nigeria. The objective was to ascertain if one best approach of production system can sustain stakeholder's objective. This was as a result of the continuous pressure to maintain equilibrium in markup margin and quality of goods produce. The study adopted survey design and the use of multiple regression analyses for hypotheses testing. Among variables measured, finding revealed a moderate positive significant relationship, while conclusion and recommendation posed that, paint manufacturing firm are more at advantage competitively when one or two method of transformation method is adopted in the production line.

Okechukwu, & Egbo, (2023), examined lean production and organizational performance. This study was aimed at exploring the perception employees have toward the training and development program already provided by the organization and to investigate employees' satisfaction with training programs in their organizations.

Lee. et al., (2023), conducted a study on manufacturing strategies and its relationship with organizational optimization among the employees working at Saudi Industrial Development Fund. The aim of this study is to examine employee perception of training provided by Saudi Industrial Development Fund (SIDF) and its relationship with organizational commitment.

Thompson, et al., (2023), examined the association between capacity production and organizational performance of deposit money banks in Abia State, Nigeria. A cross-sectional research survey was employed. Target population comprises all deposit money banks in Abia State, Nigeria. Forty top level managers were surveyed.

1.10 Research Design

The study adopted correlation design, with the use of a structured questionnaire as primary source of Spearman Correlation Co-efficient analytical and Regression. A total number of 90 (https://www.directory.org.ng/list-agriculture_and_agro-alied?st=rivers) agro manufacturing manufacturing firms are in Rivers State served as the total population of the study, while 57 firms was used as a sample size. The judgmental or purposive sampling technique of non-probability was adopted for the study. The total respondents of the study was 117, which consisted of 1 (one) production manager and 1 (one) production supervisor from the 57 studied firms. The research instrument was validated at the measure of 0.75, with the use of half split validity test instrument.

1.11 Data Analyses

Table 1. Correlation Matrix on all Variable (Bivariate)

		Flexibility	Collaboration	Continuous Improvement	Capacity Effectiveness
Flexibility	p-Value				
	2t-Value				
Collaboration	p-Value	.65**			
	2t-Value	0.00			
Continuous Improvement	p-Value	.87**	.79**		
	2t-Value	0.00	0.00		
Capacity Effectiveness	p-Value	.72**	.62**	.82**	
	2t-Value	0.00	0.00	0.00	
N		117	117	117	117

Source: SPSS 25.00 Output. Field Survey, (2023)

Table 1 revealed that all variable tested and analyzed were positively correlated

Table 2 Linear Regression on all Independent Variables

Model	B	Beta	t	Sig.
(Constant)	0.64		5.3	0.63
Flexibility	-0.64	-0.52	-7.14	0
Collaboration	-0.69	-0.73	6.85	0
Cont. Improvement	-0.81	-0.79	7.93	0

Source: SPSS 25.00 Output. Field Survey, (2023)

a. Dependent Variable: Capacity Effectiveness

Table 2 showed how the predictor variables influenced the criteria variable in the study. Thus, the regression values are \leq significant value.

1.12 Discussion of Finding

In accomplishing objective one, findings from Table 1 showed that flexibility correlated with capacity effectiveness at $0.00p < 0.72$; $0.64b$; $-7.14t$ respectively. Thus, the predictor variable had a strong positive significant correction with the criteria variable among agro manufacturing industry in Rivers State. This was a direct collaboration with the assertion of Aduma, & Shaldule, (2023), that design of production system should be in a form that could rapidly respond to the changing dynamics of the external environment, with high consideration to meet customers' needs at the right time and place. Table 2 was clear in its findings. The regression value of flexibility was $-0.64b$ and -7.14 . These regression values showed a cause-effect relationship, signifying that capacity effectiveness was negatively influenced at the measure of -0.64 . This implied that, if flexibility in production mechanism is decreased to -0.64 , capacity effectiveness will not be attained in the studied industry. The result suggested that agro firms should maintain a level of positive value flexibility measure, in order to adequately satisfy their customers.

Objective two was satisfied also with the use of Table 1 and Table 2. The variables measured, collaboration and capacity effectiveness significantly correlated at a positive measure of $0.00 < 0.62p$; $-0.69b$; $6.85t$. From the values, it signified that collaboration as a strategic alliance between agro manufacturing firms and suppliers endangered a strong positive correlation with capacity effectiveness at the measure of 0.62 . the regression value also signified that, at the rate of -0.69 collaboration negatively affected capacity effectiveness of agro firm. Thus at any unit decrease below -0.69 would definitely low down productivity threshold, hence causing scarcity of agro products in the market. This findings conforms with the assertion of Egile, et al., (2023). They posited that, the need to selectively determine suppliers as middlemen for your productive material, management should develop a just in time inventory system. This would guarantee loss of idle time and responsive production system that is conformable to external paradigm. Regression values as shown in table 2 revealed accusatory effect between collaboration and capacity effectiveness amongst the studied firms. The value showed that, at the negative measure of -0.69 , capacity effectiveness experienced a decline at a unit increase above -0.69 .

The accomplishment of objective 3 as shown in Table 1 and Table 2 revealed that, continuous improvement and capacity effectives were sign at $0.00 < 0.82p$; $-0.9b$; $7.93t$. This signified a very strong positive correlation between variables studied. This suggested that retraining of human capital, redesigning product after customers opinion, automated or hybrid machine for productive activity are indicator for optimizing capacity effectiveness Lebari, et al., (2023). Also, the measured regression value signified that, at the unity increase in the negative value

above -0.79 affected firms capability for adequately satisfy or meet the needs and want it her teeming customers

1.13 Recommendations

1. Firms in the industry should develop a lean manufacturing approach, where total material is optimized
2. The concept of electronic behavior should be adequate studied, understood and applied to create or enable internal-external environment flexibility.
3. Firms in the industry should adopt a combinational manufacturing model that is of best suit for their production chain.

1.14 Conclusions

From the findings of the study, it was identified that continuous improvement had a high correlation value amongst variable measured. Thus, its most imperative that firms in the industry prioritize human capital development, investing on multipurpose machines and technological innovation to give space to the concept of electronic behavior. Thus, agile manufacturing makes it possible for organization to respond electronically in the satisfaction and meeting of consumers' needs and wants.

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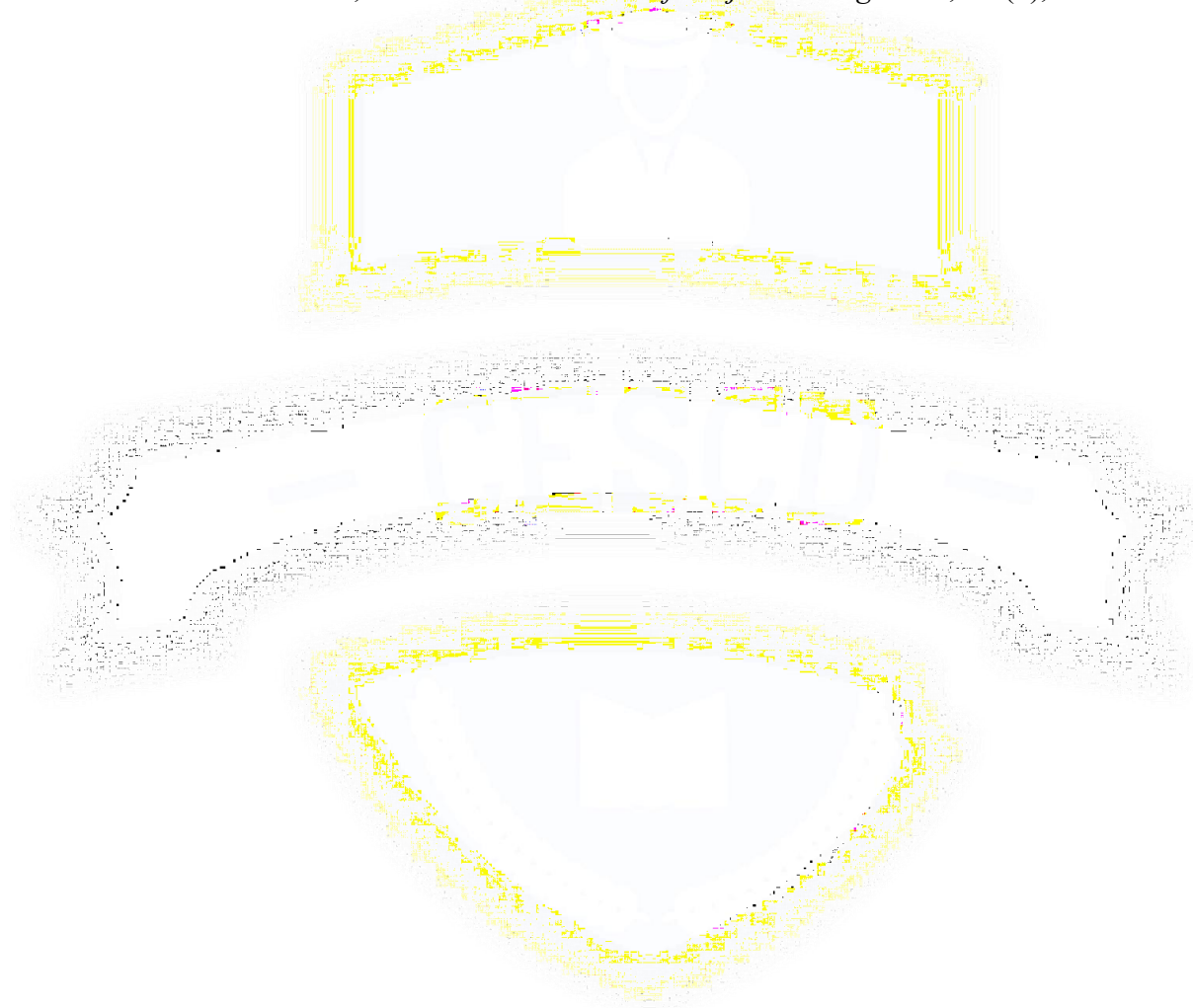
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**RE-ENGINEERING FINANCIAL INCLUSION FOR VALUE CHAIN IN COCOA
PRODUCTION IN UMUEBO COMMUNITY, IKWUANO L.G.A., ABIA STATE**

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ABSTRACT

The empirical study examined reengineering of financial inclusion for value chain in cocoa production in remote community of Umuebo in Ikwuano L.G.A., Abia State. Descriptive survey method was adopted based on quantitative research method elements such as interview and questionnaire. Purposive random sampling technique was used to select 40 cocoa farmers in Umuebo community. Descriptive statistics using frequency simple percentage was adopted while inferential statistics with the use of Analysis of Variance (ANOVA) and Multiple Regression Analysis were used for the data analysis. The study revealed that financial inclusion lubricates value chain in cocoa production, liberate financial exclusion from farmers in the hinterlands, which in turn contributes to economic growth and development of the nation. The study recommended that financial inclusion that is built on sustainable value chain models with mainstream financial entities bringing low income earners into an environment where they can flourish and be part of broader formal economy, etc. Further research on value chain and financial inclusion on sustainable industrialization can enhance the economic contribution in this area of study.

KEYWORDS: Financial Inclusion, Value Chain, Value, Umuebo Community

Introduction

Value chain in production of agricultural products is an important aspect of economic growth, which can only be made possible if the financial system benefit the poorer and the rural sections of the nation. Cocoa production is one of the agricultural products found in the rural communities, including Umuebo in Ikwuano L.G.A. of Abia State. This community cannot add value to cocoa production due to lack of financial inclusion. Umuebo has been excluded from financial system due to lack of banking services in the area and inadequate network connectivity, which supposed to enhance other financial transaction e-channels like Point of Sale (PoS), transfer, etc.

Reengineered banking system, therefore, has not reached a significant number of rural and peasant farmers that require fund for value chain. Hence, there is need for financial inclusion initiatives that will cover more and more of the excluded population by the financial system

(Obiamaka, Imo, Manasseh & Onwumere, 2020). While finance is not obviously the only problem militating against value chain in cocoa production among the people of Umuebo community, but globally, efficient and responsive financial inclusive system that could serve the economy and the introduction of delivery mechanisms of financial support is desirable for economic growth via value chain. Value creating innovations attract imitators as quickly as they attract customers and this lubricates economic activities of such nation. But area such as Umuebo that is starved of financial resources cannot participate in creating value or value chain addition. Value chain and financial inclusion becomes interwoven.

However, the body of knowledge on values has a long history within the realm of ethics and religion while value chain rest purely on the domain of economic and political economy. Each time resources are deployed in making new combinations, a new source of potential value is created and added to the economic system of the nation. But, new combinations can add no wealth to the nation if the financial resources required for value chain addition is starved to that those that need them. Therefore, for wealth to increase we need some potential value to be exploited, value must be generated, appropriated and eventually consumed. This process of generating and appropriating wealth is 'value realization', which will bring glory to the production of cocoa in Umuebo community. For an economic system to be in dynamic balance in cocoa production, both processes of value creation and value realization are needed and financial inclusion is the vehicle for conveying such values.

The experience of many nations indicates that value chain in cocoa production can meaningfully contribute to the attainment of many economic and national development objectives (Obiah & Nwaneri, 2020). Any nation that is desirous of speedy sustainable industrialization and development including the rural areas cannot afford to neglect its active potential Umuebo people financially. Capital formation in this segment largely determines the productive capacity of the economy and the pace of economic growth. Okuma (2018) opined that the traditional idea of financial inclusion mostly regards to developing nations is to ensure the involvement of the financial activities of all classes of the economy especially the low income earners of Umuebo extraction and similar classes as it relates to mopping up their excess funds and provision of credit to them for investment.

Financial inclusion has been considered as one of the main indicators of financial sector's expansion globally (Obiamaka et al, 2020). In such expanded nature, reengineered financial inclusion boosts the income of the poorest quintile, reduces income inequality and enhances people's capability. Therefore, financial inclusion and value chain are critical driver of economic growth and development, mostly by fostering agricultural productivity.

Statement of Problems

Scholars have suggested the financial inclusion and value chain are fundamental methods for robust economic growth. Since the early 1990s, academics and consultants have promoted the idea that financial inclusion practice should focus upon identifying and serving the low income earners and the poor segment of the economy. Solo (2008) penned that having access to finance is an important macroeconomic requirement for economic growth as it leads to higher investment and income, empower households and free them from poverty circles. But, in Umuebo community access to finance has been a hindrance in value chain of cocoa.

A recent survey by Enhancing Financial Innovation and Access (EFInA) indicates that although improving 40% of adult Nigerians are still financially excluded, 60% of the adult populations are financially served, only 48.6% are formally included i.e., included in the formal financial services sector (Enebeli-Uzor, 2016), which means the remaining 51.4% are provided

by the informal financial services sector, which Umuebo falls within these segments that access fund in a very expensive means. Therefore, the financial inclusion programme has been identified as an important strategy to reduce poverty and vulnerability by including persons from all strata into the mainstream banking system (Obiamaka et al, 2020). It will also raise the capacity for value chain in cocoa production in Nigeria, particularly in Umuebo community. Financial inclusion, development and integration are indispensable to ensure value chain in cocoa production, increase economic growth rates and national development.

Researchers have considered financial inclusiveness and sustainable industrialization for national development (Obiah & Nwaneri, 2020); financial inclusion (Obiamaka et al, 2020); financial inclusion-taking banking to hinterland (Enebeli-Uzor, 2011); effects of financial inclusion on the growth of cottage firms in Nigeria (Okuma, 2018); among others. These researchers fail to integrate financial inclusion with value chain. The authors, therefore, tend to empirically consider financial inclusion and value chain using Umuebo community in Ikwuano L.G.A., Abia State as a case study. What is the relationship or the significant effect of financial inclusion and value chain in cocoa production.

Review of the Related Literature

Conceptual Framework

Financial inclusion is an expansion that results in a wider access to finance/fund to sustainable socio-economic opportunities for the majority, while protecting the vulnerable, all being done in an environment of fairness, equality, accessibility and political plurality, which can be achieved by transforming Nigeria's predominantly low income earners into market-oriented value chains that provide green cocoa products to domestic and global markets (Obiah & Nwaneri, 2020). According to Okuma (2018) financial inclusion is the delivery of financial services and products more especially the disadvantaged, low income class and cottage farmers in the society. For Obiamaka et al (2020), it is the provision of affordable financial services, viz., access to payments and remittance facilities, savings, loans and insurance services by the formal financial system to those who tend to be excluded. In other words, financial inclusion entails accommodating excluded individuals from and the ability of these individuals to access financial products and services in order to meet their value chain needs. It includes in its entirety a range of products or services that are either financial or non-financial made accessible to low income earners or the rural poor populations.

Financial inclusion is vital because inclusive national growth and sustainable industrialization are only possible if there is active participation of the excluded segment in the overall growth process. It requires holistic, sustainable and multi-sector interventions in microcredit or microfinancing for small-scale income generating activities like value chain in cocoa production.

Value is a central desire or belief regarding final states or desirable conducts that transcends specific situations, the guide the choice and evaluation of our decisions and, therefore of our conduct becoming an integral part of our way of being and acting to the point of shaping our character. It is the capacity of a product, good or service or activity to satisfy a need or provide a benefit to an individual or legal entity. Value is also a conception, explicit or implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means and ends of action.

Value chain therefore, includes the activities that take place within an entity in order to deliver a valuable product or service to their market. As each stage of the value chain adds more value,

it provides a tool to visualize an entity's productivity by identifying the available discrete activities involved. International Labour Organization (ILO) (2011) describes value chain as the full range of activities that are required to bring a product or service from conception, through the intermediary phases of production (...), delivery to final consumers, and final disposal after use. This includes activities such as design, production, marketing, distribution and support services up to the final consumer (and often beyond, when recycling processes are taken into account). The activities constituting a value chain can be contained within a single entity or divided among different entities, as well as within a single geographical location or spread over wider areas. For World Business Council for Sustainable Development (WBCSD) (2011), value chains are an integral part of strategic planning for many businesses today, which refers to the full life cycle of a product or process, including material sourcing, production, consumption and disposal/recycling processes. To International Development Research Centre, it is the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

However, the idea of the value chain is based on the process view of entities, the idea of seeing a manufacturing (or service) entity as a system made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and effects profits. Most entities engage in hundreds, even thousands, of activities in the process of converting inputs to outputs (Porter, 1985).

Theoretical Framework

A theory is an attempt to give reason for some observed regularity among things are complex and often changing (Chang, 2005). But Mustafa (2009) opinion is that if you want to understand what a science is, you should look in the first instance not at its theories or its findings, and certainly not at what its apologists say about it; you should look at what the practitioners of it do. Based on this, the paper adopts value configuration theory as a framework

Value Configuration Theory

The dominant paradigm for the analysis of small and medium scale enterprises – level competitive advantage in the strategy literature in the recent past years has been the value chain model developed by Michael Porter in 1985. The basic idea is that competitive advantage cannot be understood or managed by looking at the SME as a whole. It is necessary to consider the myriad of activities that they does in the process of creating value for its customers. The value chain is here a simple activity template that can be used to identify, represent and analyze value activities.

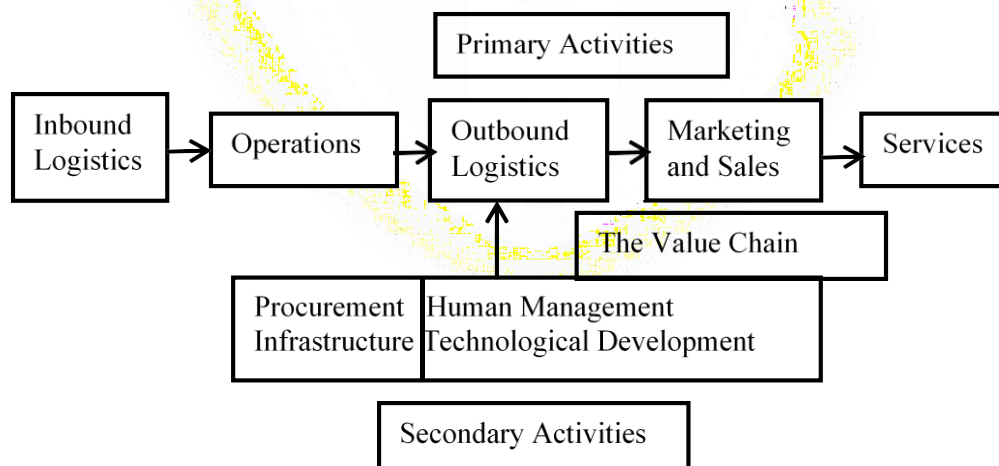
Hence, value configuration theory builds on, extends and transforms Porter's value chain framework (1985) for the analysis and development of competitive advantage. The theory was initially motivated by problems in applying the value chain activity template to SMEs selling services. While Porter's initial formulation assumed that the value chain activity template was applicable in all sectors and all SMEs, value configuration theory proposes that the value chain is a good representation of one of three basic value creation technologies.

Value configuration theory, therefore, starts from the premise that the activities of the SME are the appropriate focus if we are to understand and manage from a strategic perspective both

value created and costs incurred. The theory distinguishes between two main classes of activities in the SME. Primary activities are directly involved in creating the value that is purchased by the buyer. Support activities, on the one hand, are activities that impact value purchased only through their impact on primary activities. Value configuration analysis is designed to assess and understand the current and future competitive position of the SME. It also serves to determine how activities can and need to be reconfigured in order to attain a position of competitive advantage in line with the competitive strategy of the SME.

Value chain activities has numerous processes, which requires finance to execute, so it is only financial inclusion that allowed low income earners to access credit facilities or financial services can guarantee such value chain particularly in cocoa production among Umuebo community populous. However, value configuration theory proposes not only that operationalization of driven differs across SMEs – and sectors, but that these differences follow a systematic pattern. The pattern defines the set, role and interdependence of critical drivers and thus strategic positioning options. The fundamental determinant of patterns in drivers are differences in value creation, technology configuration. The concept of value applies at all the level of the strategic value chain unit. A value chain can have several strategic unit and as such contain more than one value configuration. Value configuration theory extends the repertoire of value configurations with distinct patterns in terms of both the logic value creation, the nature of relationship between entities in the larger value system, and the nature and role of critical drivers (financial inclusion). Value configuration theory has a strong prescriptive orientation, primarily in terms of how the concepts and propositions should be used to do analyses and for financial inclusion.

For this study, value chain can be seen as all aspects of upstream, downstream, offshore and onshore activities related with the operations of the reporting entity from extraction to consumption, including the use of sold products by consumers, application of soft skills by the workers and the end-of-life treatment of the sold products after consumer use inform of recycling.



Source: Porter (1985)

Umuebo Community is a small town in Amuro Ibere Ikwuano Local Government Council of Abia State. It is a predominantly cocoa and peasant farmers, though with young and vibrant intellectuals from different professional disciplines ranging from Accounting, Engineering, administrators, political scientists, medical scientists, legal practitioners, etc. The dominant families are Ugboaja Obiah, Awadibia Obiah, Job Chibueze, Umekwe, among others. Being mainly cocoa farmers without financial inclusion, the value chain is needed to enhance their economic contribution to Abia State and Nigeria as a whole and to achieve financial inclusion

in their economic wellbeing. The intellectuals in the community can help in the transformation of cocoa from primary product to secondary products, thereby adding value to the product as well as transform the community into a global player in agricultural value chain and ensure sustainable industrialization.

Methodology

Descriptive survey method was adopted based on quantitative research method elements such as interview and questionnaire to generate the data. The population of the study consists of all the cocoa farmers in Umuebo community Ikwuano LGA of Abia State. Purposive random sampling technique was used to select forty (40) farmers in the community. Descriptive statistics using frequency, simple percentage was adopted, while inferential statistics with the use of Analysis of Variance (ANOVA) was used to analyze hypothesis one and multiple regression analysis was used to analyze the hypothesis two using stata II tool of data analysis

Hypothesis: Two hypothesis were stated in null form for this study

Ho1: There is no significant effect of financial inclusion and value chain in cocoa production

Ho2: There is no significant relationship between financial inclusion and value chain in cocoa production in Umuebo community

Data Presentation, Analysis and Discussion of Findings

Hypothesis One: There is no significant effect of financial inclusion and value chain in cocoa production in Umuebo Community

Table 1: ANOVA table showing effect of financial inclusion and value chain in cocoa production in Umuebo Community

Model	R. Square	Adjusted R. Square	Root MSE
1	0.9493	0.9332	

Source	Sum of Square	DF	Mean Square	F	Sig.
Model	9.3666667	11	1.33809524	58.88	0.0000
Residual	.5	28	.022727273		
Total	9.8666667	39	.340229885		
Source	SS	DF	MS	F	Sig.
With finance I can add value to cocoa production	6.98310811	3	2.3277027	102.42	0.0000
With finance I can purchase the required equipment for production	.6666667	2	.333333333	14.67	0.0001
Finance can help increase cocoa yield for production	.25	1	.25	11.00	0.0031
With finance I can enhance value chain	1.5818e-28	1	1.5818e-28	0.00	.0000

Source: Researcher's analysis (2023) using STATA version II (Statistically significant at 5% level)

The result of the hypothesis tested with ANOVA shows that there is statistically significant effect of financial inclusion and value chain in cocoa production in Umuebo community as the $f.value = 0.00000 < 0.05$, (coefficient of determination) $r^2 = 0.9493$ or 94.93%. The result showed further that all the questions asked relating to the financial inclusion and value chain in cocoa production in Umuebo community are statistically significant with the $f.value$ of .0000, .0001, .0032 and .0000 that is less than 0.05% it can be said therefore that financial inclusion and value chain have significant effect in cocoa production in Umuebo community. The null hypothesis is hereby rejected and the alternative hypothesis not stated is accepted.

Hypothesis Two: There is no significant relationship between financial inclusion and value chain in cocoa production in Umuebo community.

Table 2: Multiple linear regression showing significant relationship between financial inclusion and value chain in cocoa production in Umuebo community.

Model	R.Square	Adjusted R.Square	Root MSE
1	0.9246	0.9089	.17603

Source	R.Sqaure	DF	Adjusted R.Square	F	Root MSE
Model	9.12294807	9	1.82458961	(5.24)=58.88	0.0001
Residual	.743718593	30	.030988275		
Total	9.86666667	39	.340229885		

Variable	Coef.	Std. Error	T	P>/t/	(95%) Conf. interval
With production equipment made available through credit facility I can add value to cocoa production	.6281407	.158829	3.95	0.001	.3003339 .9559475
With finance I can be self reliance in cocoa production	.9346734	.206749	4.52	0.000	.5079645 1.361382
Value chain cannot be enhanced without finance	.3015075	.1209863	- 2.49	0.020	.5512109 .0518041
Value chain promotes the economy	.2261307	.1737346	1.30	0.005	-.13244 .5847013
Financial inclusion reduces poverty in the rural areas	.9447236	.3573016	- 2.64	0.014	- 1.682158 .2072894

Source: Researcher's analysis (2023) using STATA version II (statistically at 5%)

Multiple linear regression analysis result shows that there is significant relationship between financial inclusion and value chain in cocoa production in Umuebo community, as the $f-value = 0.0001 < 0.05$ and $r^2 = (0.9246)$ which is coefficient of determination. The result further showed that each of the questions tested shows relationship between financial inclusion of cocoa production in Umuebo community with $f-value$ of .0001, .0000, .0200, .0050 which is less than 0.05 significant level. The null hypothesis is therefore rejected and the alternative

hypothesis which is not stated is accepted, meaning that there is relationship between financial inclusion and value chain of cocoa production in Umuebo community.

Conclusion

The paper has examined the re-engineering of financial inclusion for value chain of cocoa production in Umuebo community Ikwuano LGA of Abia State. The study showed that financial inclusion lubricates value chain in cocoa production, which in turn contributes to sustainable industrialization and economic growth of the nation. It is therefore, the observation of the paper that economic growth and development will not be possible if the large segment of the people in the rural areas are denied access to credit facilities. As a set of products and services linked together in a sequence of value – adding economic activities. Because value chain is value addition at different stages of transformation, different stakeholders add value to the product to increase the end product value and reap the benefit thereof. These stages will create employment opportunities for different categories of people in the market and reduce poverty in the rural community as well as drive the sustainable industrialization and economic growth of the nation.

Recommendations

The following recommendations are made for policy action:

- ❖ Governments at all levels should encourage agricultural production in our communities especially value chain production like cocoa, which will generate employment and reduce poverty in such communities most of which are in the rural areas. Such encouragement should incorporate financial system that will drive the primary and secondary products.
- ❖ Financial inclusion that is built on sustainable value chain models with mainstream financial service entities, which brings low income earners into an environment where they can flourish and be part of the broader formal sector of the economy, this can happen when all stakeholders do the needful in creating a good financial ecosystem.

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EFFECT OF REGIONAL CONFLICTS ON NATIONAL CONSCIOUSNESS AND UNITY OF NIGERIA

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ABSTRACT

The study conducted to examine the effect of regional conflicts on consciousness and unity of Nigeria. The population of the study consisted of the resident of the five states of south east geopolitical zone in Nigeria. The study adopted survey design, while random sampling technique was used in selecting three hundred and eighty three (383) respondents. The structured questionnaire was used to elicit information from the respondents. Data collected were analyzed using Pearson analysis. The data was then organized, tabulated and analysed in frequency tables; and percentages with the help of the statistical package for social sciences (SPSS) software. It was concluded that the effect of regional conflicts on Nigeria's national consciousness is an ongoing narrative that demands continuous attention and proactive measures. By fostering a climate of understanding, tolerance, and equitable development, Nigeria can transcend regional differences and strengthen its national unity, paving the way for a more prosperous and harmonious future. While it was also recommended that, a concerted effort should be made to address economic disparities between regions. Implementing policies that promote equitable distribution of resources and opportunities will alleviate tensions arising from perceived marginalization, thereby fostering a more unified nation. Also, that, the government must invest in effective communication strategies to counter divisive narratives propagated by regional conflicts. Utilizing mass media and social platforms to promote stories of national cooperation and success will help reshape public perceptions.

KEYWORDS: Effect, Regional Conflicts, National Consciousness, Unity and Nigeria

Introduction

Nigeria, a nation known for its rich cultural diversity and complex history, has faced numerous challenges in its quest for national unity. One significant factor influencing this unity is the existence of regional conflicts. To understand the current impact of regional conflicts on Nigeria's national consciousness, one must delve into the historical context of the nation. Nigeria gained independence from British rule in 1960, and since then, it has grappled with internal struggles stemming from ethnic, religious, and regional differences. These differences have often led to conflicts, hindering the development of a cohesive national identity.

Regional conflicts have exacerbated ethnic polarization in Nigeria. The country is home to over 250 ethnic groups, each with its own cultural heritage and traditions. Regional conflicts tend to deepen these ethnic fault lines, fostering a sense of "us versus them" among different groups. This hampers the development of a unified national consciousness as individuals identify more strongly with their ethnic or regional affiliations than with the nation as a whole (Smith, 2008). According to Suberu, (2001) regional conflicts often translate into political fragmentation, with different regions vying for autonomy or dominance. The struggle for political power at the regional level can overshadow national interests, leading to a weakened sense of national consciousness. Political leaders may prioritize their regional constituencies over national unity, further perpetuating divisions. Regional conflicts contribute to economic disparities across Nigeria. On the opinion of Aigbokhan, (2000); when certain regions are plagued by conflict, economic development is stunted, hindering the overall progress of the nation. Economic imbalances can breed resentment and contribute to a lack of national unity, as citizens from marginalized regions may feel neglected by the central government. Regional conflicts can erode social cohesion by fostering distrust and animosity among different communities. The breakdown of social bonds impedes the development of a shared national identity, as citizens become more preoccupied with protecting their regional interests. This erosion of social cohesion poses a significant challenge to achieving national unity (Mustapha, 2011).

The effect of these conflicts on national consciousness is a subject of great importance, as it sheds light on the challenges and opportunities that arise from Nigeria's rich tapestry of ethnic, religious, and cultural diversity. The independence from British colonial rule in 1960 brought together a multitude of ethnic groups with distinct languages, traditions, and cultural practices. The amalgamation of Northern and Southern Nigeria in 1914 laid the foundation for a nation that would grapple with regional tensions for decades to come. The Biafran War (1967-1970) stands out as a significant moment in Nigeria's history, as the Igbo-dominated Eastern region sought secession, leading to a devastating conflict. While the war ended, the scars it left behind continued to influence regional dynamics (Smith, 2008).

The persistent regional conflicts in Nigeria have had profound implications for the development of national consciousness. One major consequence has been the emergence of ethnocentrism, where individuals identify more strongly with their ethnic or regional affiliations than with the nation as a whole. This fragmentation poses a significant challenge to the creation of a unified Nigerian identity, hindering efforts to build a cohesive society. The Niger Delta crisis, fueled by socio-economic disparities and environmental degradation, is another example of a regional conflict that has strained national unity. The struggle for control over oil resources has led to tensions between the government and local communities, exacerbating feelings of marginalization and discontent. As these regional conflicts persist, they contribute to a sense of alienation among different ethnic groups, impeding the formation of a shared national identity (Smith, 2008; Suberu, 2001; Isiugo-Abanihe, 2010).

As observed by Smith, (2011) and Obi, (2009) National consciousness, defined as the shared sense of belonging and identity among a nation's citizens, plays a crucial role in fostering unity and promoting national development. In the Nigerian context, the challenge lies in reconciling the diverse cultural and ethnic identities within the broader framework of a unified nation. Efforts to cultivate a strong national consciousness must address the root causes of regional conflicts and promote inclusivity. Government policies, educational initiatives, and cultural programs can all contribute to the development of a shared national identity. Investing in inclusive educational curricula that celebrate Nigeria's cultural diversity while emphasizing common values can bridge the gap between regional differences and cultivate a sense of national pride. Additionally, fostering a sense of civic responsibility and participation can help

citizens identify with the larger national project, promoting unity and solidarity (Falola, 2018 & Mustapha, 2011).

A country with ethnic and cultural diversity like Nigeria has faced persistent challenges stemming from regional conflicts that threaten its national consciousness and unity. The recurring clashes between various ethnic groups and regions have raised concerns about the overall cohesion and solidarity of the nation. The prolonged history of inter-ethnic tensions and regional disparities has not only strained the social fabric but also has potential repercussions on the economic and political stability of the country. Understanding how these conflicts influence the collective identity and sense of unity among Nigerians is crucial for developing effective strategies to promote national integration and resilience in the face of adversity.

This research draws upon a range of academic literature, including works by Smith (1991) on national identity and Anderson (2013) on imagined communities, to explore theoretical frameworks for understanding the dynamics of national consciousness. Additionally, insights from studies on conflict resolution, such as Galtung's (1990) structural violence theory, will be employed to analyze the impact of regional conflicts on the unity of a nation. By shedding light on the nuanced interplay between regional conflicts and national consciousness, this study aims to provide valuable insights for community leaders seeking sustainable solutions to foster a stronger and more unified Nigeria. It is in this light that this study investigates the effect of regional conflicts on national consciousness and unity of Nigeria.

Objectives of the Study

The major purpose of this study is to examine the effect of regional conflicts on national consciousness and unity of Nigeria. Other general objectives of the study are:

1. To examine the impact of regional conflicts on national unity of Nigeria.
2. To examine the impact of regional conflicts on national consciousness of Nigeria.

Research Questions

The study sought to provide answers to the following research questions:

1. Is there significant impact of regional conflicts on national unity of Nigeria?
2. Is there significant impact of regional conflicts on national consciousness of Nigeria?

Research Hypothesis

The following hypotheses were raised for this research:

1. There is no significant impact of regional conflicts on national unity of Nigeria.
2. There is no significant impact of regional conflicts on national consciousness of Nigeria.

REVIEW OF LITERATURE

Regional Conflicts

Regional conflicts have been a persistent feature of the global geopolitical landscape, influencing the course of history and shaping the destiny of nations. These conflicts, often characterized by political, economic, and territorial disputes, can have far-reaching

consequences, affecting not only the involved regions but also the broader international community (Smith 2011). Understanding the underlying factors contributing to regional conflicts is crucial for devising effective strategies to prevent and resolve them. Many regional conflicts have deep-rooted historical origins, with disputes over borders, resources, or sovereignty dating back centuries. Historical grievances can create a fertile ground for contemporary tensions and conflicts. Smith (2016) sees the importance of historical narratives in perpetuating regional animosities and shaping the perceptions of involved parties.

Ethnic and religious diversity within regions can be both a source of strength and a catalyst for conflict. Clashes between different ethnic or religious groups often stem from competing identities, unequal distribution of resources, or discriminatory policies. Huntington's (2013) seminal work on the clash of civilizations underscores how cultural and religious differences can fuel regional conflicts. Regions marked by political instability, weak governance, or authoritarian rule are susceptible to conflicts. The absence of inclusive political processes and institutions can lead to power struggles, rebellion, and violence. A study by Fearon and Laitin (2003) emphasizes the role of political institutions in mitigating or exacerbating regional conflicts.

Collier and Hoeffler's (2004) opined that economic disparities, whether within a country or across borders, can contribute to regional conflicts. Unequal access to resources, economic marginalization, and disparities in development can breed resentment and spark confrontations. The research went on to state that economic causes of civil wars shed light on the relationship between economic factors and regional conflicts. According to Anderson (2019) and Byman (2005) highlight consequences of regional conflicts to include;

- (i) **Humanitarian Crises:** Regional conflicts often result in humanitarian crises, with civilian populations bearing the brunt of violence, displacement, and economic collapse. It is also observed that the impact of conflict on civilian populations underscores the urgent need for international efforts to address humanitarian challenges arising from regional conflicts.
- (ii) **Global Security Threats:** Regional conflicts can have far-reaching implications for global security. They may serve as breeding grounds for terrorism, arms proliferation, and the spread of extremist ideologies. The interconnectedness of regional conflicts and global security, calling for a comprehensive approach to addressing the root causes of such conflicts.
- (iii) **Economic Consequences:** Regional conflicts disrupt economic activities, impeding trade, investment, and development. The economic consequences extend beyond the conflict zone, affecting neighboring regions and even the global economy. Through a detailed analysis of regional conflicts, Collier and Hoeffler (2002) provide insights into the economic repercussions of violence and instability.

Many scholars have made suggestion for potential solutions to regional conflicts (Bickerton, 2009; Luck, 2008; Bellamy and Williams (2010)

- (i) **Diplomacy and Conflict Resolution:** Diplomacy remains a cornerstone for resolving regional conflicts. Dialogue, negotiations, and conflict resolution mechanisms can help address underlying issues and build consensus among involved parties. The Oslo Accords, facilitating negotiations between Israel and

Palestine, serve as a prominent example of diplomatic efforts to resolve a long-standing regional.

- (ii) **International Mediation and Peacekeeping:** International organizations and peacekeeping missions play a crucial role in mitigating regional conflicts. The United Nations and regional organizations often deploy peacekeeping forces to monitor ceasefires, protect civilians, and facilitate the implementation of peace agreements. The case of UN peacekeeping efforts in Bosnia and Herzegovina illustrates the potential of international mediation in post-conflict reconstruction.
- (iii) **Conflict Prevention Strategies:** Proactive measures to prevent conflicts from escalating are essential. Early warning systems, diplomatic interventions, and addressing root causes such as economic disparities and political instability can contribute to preventing the outbreak of regional conflicts. Bellamy and Williams (2010) explore the effectiveness of conflict prevention strategies in averting violence and promoting stability.

The concept of regional conflicts is a complex phenomenon with deep-seated causes and wide-ranging consequences. Historical grievances, ethnic and religious differences, political instability, and economic disparities all contribute to the complexity of regional conflicts. Understanding these factors is crucial for developing effective strategies to prevent and resolve such conflicts. The consequences of regional conflicts, from humanitarian crises to global security threats and economic repercussions, underscore the urgency of finding sustainable solutions. Diplomacy, international mediation, peacekeeping, and conflict prevention strategies all play integral roles in addressing regional conflicts.

Concept of National Consciousness

National consciousness is a complex concept that lies at the heart of understanding the identity, unity, and shared values within a nation. This article aims to delve into the intricate layers of national consciousness, exploring its historical roots, psychological underpinnings, and contemporary significance. The concept of national consciousness has deep historical roots, often intertwined with the emergence of nation-states and the evolution of political and cultural identities. Anderson, (2013) in his seminal work "Imagined Communities," posits that nations are socially constructed entities, and national consciousness is the result of shared imaginings and a sense of belonging among diverse individuals within a defined geographical space. Anderson argues that print capitalism, through the dissemination of newspapers and literature, played a significant role in creating a shared narrative that facilitated the development of national consciousness.

Ernest Renan, a 19th-century French philosopher, offered another perspective in his essay "What is a Nation?" Renan, (2011) argued that the essence of a nation lies not in common ethnicity or language but in a shared will to live together, a collective consent to remember and forget together. According to Renan, the continuous act of reaffirming this collective will forms the basis of national consciousness. The psychological dimension of national consciousness involves examining how individuals form a connection with their nation on an emotional and cognitive level. Social psychologists emphasize the role of social identity theory in understanding this phenomenon. Tajfel and Turner's theory in Hobsbawm, & Ranger, (2013) posits that individuals categorize themselves and others into social groups, and a sense of belonging and self-esteem is derived from positive comparisons between the in-group (national identity) and out-group (other nations). Moreover, the concept of collective memory, as

proposed by Maurice Halbwachs, contributes to the psychological understanding of national consciousness. Collective memory refers to the shared representations of the past that bind individuals together. In the context of national consciousness, the collective memory of historical events, traditions, and shared experiences serves as a unifying force that strengthens the sense of belonging to a nation (Assmann, 2012).

In the contemporary globalized world, the concept of national consciousness continues to play a crucial role in shaping political, social, and cultural landscapes. As nations navigate the challenges of an interconnected world, the question of how to balance a strong national identity with global cooperation becomes increasingly pertinent. Benedikt Korf and Timothy Raeymaekers, cited in Assmann, (2012) explore how national consciousness can be manipulated by political elites to serve their interests. They argue that the construction of a common enemy, whether internal or external, is a strategy employed by leaders to foster a sense of unity and purpose among citizens. This highlights the dynamic and often instrumental nature of national consciousness in contemporary geopolitics. Furthermore, studies such as Appadurai, A. (2016) "The Intimate Enemy: Loss and Recovery of Self under Colonialism" shed light on the impact of colonialism on national consciousness. Appadurai discusses the psychological implications of colonial rule, emphasizing how the colonized often internalize the values and norms of the colonizer, leading to a complex relationship with their own national unity.

The concept of national consciousness is a dynamic phenomenon with deep historical roots, intricate psychological underpinnings, and contemporary significance. Scholars like Anderson and Renan have provided valuable insights into the construction of national identity and the role of shared imaginings in fostering a sense of belonging. Social identity theory and collective memory contribute to our understanding of the psychological aspects of national consciousness, highlighting the role of emotions and cognition in forming a connection with one's nation. Contemporary research, such as that by Hobsbawm, & Ranger, explores how national consciousness can be manipulated for political purposes, emphasizing its instrumental nature in shaping geopolitical dynamics. Additionally, studies on the impact of colonialism, like Appadurai's work, underscore the complexities of national identity in the face of external influences. As the world becomes increasingly interconnected, the concept of national consciousness remains a critical lens through which we can analyze the evolving nature of identity, unity, and shared values within nations. Recognizing the multidimensional nature of national consciousness is essential for fostering a nuanced understanding of the forces that shape the collective identity of diverse societies (Gellner, 2013; Bourdieu, 2016; Assmann, 2012; Smith, 1995).

Regional Conflicts and National Unity of Nigeria

Nigeria as a diverse nation with over 250 ethnic groups, has faced numerous challenges to its national unity since gaining independence in 1960. Regional conflicts have played a significant role in shaping the country's socio-political system. Nigeria's colonial legacy left a fragmented nation with distinct regional identities. And also the Biafran War (1967-1970) marked a critical period when the southeastern region sought secession, leading to a devastating conflict. While the war ended, its repercussions continue to influence the country's unity. The impact of regional conflicts on national unity cannot be overstressed. The scars of the Biafran War heightened ethnic consciousness and deepened mistrust among Nigeria's major ethnic groups. A study by Adewumi and Aluko (2015) published in the *Journal of African History* highlights the persistence of ethnic divides as a consequence of historical conflicts. In the same vein, Ojo (2018) underscores the link between regional conflicts and political instability. Regional

conflicts have often translated into political instability. The struggle for power and resources among regions has fueled corruption and governance challenges. Other scholars like Ibrahim et al. (2017) and Akinola and Oyebade (2019) emphasize the economic consequences of regional conflicts, hindering national progress and unity and social implications of regional conflicts, revealing challenges in fostering a shared national identity. The impact of regional conflicts on the economy is evident in the disparities in development across regions as well as contributed to the social fragmentation, affecting societal cohesion.

Despite these challenges, Nigeria has made concerted efforts to promote national unity. Constitutional reforms, the establishment of federal character principles, and the creation of national symbols aim to foster a sense of belonging among diverse ethnic groups. The impact of regional conflicts on the national unity of Nigeria is a complex and ongoing challenge. Addressing historical grievances, promoting equitable development, and fostering inclusive governance are crucial steps toward building a more united and resilient nation. Scholars continue to explore these dynamics, providing valuable insights for policymakers and researchers alike. As Nigeria navigates its path forward, understanding the historical and contemporary impact of regional conflicts is essential for fostering a stronger, more unified nation.

Regional Conflicts and National Consciousness of Nigeria

Regional conflicts, often rooted in ethnic, religious, or resource-based tensions, have left lasting imprints on the collective psyche of the Nigerian people. To comprehend the current state of national consciousness in Nigeria, it is imperative to examine the historical roots of regional conflicts. The Nigerian Civil War (1967-1970), also known as the Biafran War, stands out as a notable event in the annals of Nigeria. The conflict, primarily between the Igbo-majority secessionist state of Biafra and the Nigerian government, resulted in immense human suffering and deep-seated regional animosities.

The impacts of the Civil War continue to affect Nigeria's national consciousness, fostering a sense of regionalism. The notion of "us versus them" persists, hindering efforts to forge a cohesive national identity. Studies like Adepegba et al. (2018) emphasize how historical conflicts have contributed to the fragmentation of national consciousness, with regional loyalties often taking precedence over a unified Nigerian identity. Similarly, Okeke (2019) argue that economic disparities deepen the divide between regions, undermining the collective pursuit of national prosperity. Regional conflicts also exert a profound economic toll, impeding national development. The Niger Delta crisis, characterized by struggles over oil resources, has disrupted economic activities and fueled a sense of marginalization among the region's inhabitants.

According to Akinola (2020) the impact of regional conflicts is palpable in the ethno-religious landscape of Nigeria. Frequent clashes between ethnic and religious groups exacerbate divisions, fostering mistrust and hindering efforts to foster a shared national identity. The study further highlights how these conflicts contribute to the emergence of exclusive identities, hindering the formation of a unified national consciousness. The effectiveness of good governance has a crucial role to play in mitigating the impact of regional conflicts on national consciousness. Ibrahim (2021) underscore the importance of inclusive policies that address regional grievances, promote social cohesion, and create a sense of belonging among diverse populations.

However, the impact of regional conflicts on the national consciousness of Nigeria is profound and multifaceted. Historical legacies, economic disparities, ethnic and religious tensions, and

governance dynamics all contribute to the collective mindset of the nation. To build a stronger and more unified Nigeria, there is a pressing need for comprehensive efforts to address historical grievances, promote economic equity, and foster inclusive governance. Only through such measures can Nigeria hope to transcend the divisive legacy of regional conflicts and forge a truly cohesive national unity of Nigeria.

METHODOLOGY

Research Design

This study employed ex-post facto design as a method of collecting information by administering a questionnaire to a sample of individuals. This type of research design is useful when collecting information about people's attitudes, opinions, and habits Orodho, (2009). This approach was considered most appropriate because it helped the researcher to describe, examine, record, analyze and interpret the variables that were found in the study.

Population of the study

The population of this study consisted of the resident of the five states in the south east geopolitical zone in Nigeria.

Sample and Sampling Techniques

The Sample sizes of 383 respondents were in the study area. The sample size was statistically determined using the sample fraction of Krejcie, and Morgan, (1970). A sample is any group on which information is obtained (Frankel et al., 2000).

Instrumentation/Research Instrument

The research instrument used for the study was self-structured questionnaire. The questionnaire was used to obtain data on the independent and dependent variables presented in both sections A and B of the questionnaire. While section A measured the demographic data of the respondents such as name, gender, age, educational qualification and marital status, section B measured the independent variables. Likert (1932) scale was used in the study.

Procedures for Data Collection

The procedure for data collection in this study was through use of questionnaires with relatively higher degree of subjectivity thus, to minimize its effects; the researcher triangulated the answers with other sources, and also posed clear questions using simple language in the whole process.

Method of Data Analysis:

The data was then organized, tabulated and analysed in frequency tables; percentages and independent t-test analysis with the help of the statistical package for social sciences (SPSS) software. Thus, the data obtained were analyzed using Pearson moment correlation analysis was used to analysed the hypotheses.

DATA PRESENTATION AND ANALYSES

Table 1: Distribution of Respondents by sex

Sex	No. of Respondents	% of Respondents
MALE	194	50.65
FEMALE	183	47.78
Total	383	100

Source, field Survey 2023

Table 1 shows that one hundred ninety four (194) respondents representing 50.65% of the sample population were male while one hundred and eighty three (183) respondents representing 47.78% of the population were female.

Table 2: Age Distribution

Age	No. of respondents	% of Percentage
20 – 25	106	27.67
26 – 30	77	20.10
31 – 35	56	14.62
36 – 40	88	22.97
41 – Above	56	14.62
Total	383	100

Source, field Survey 2023

Table 2 shows that hundred and six (106) respondents representing 27.67% of the sample were between the age bracket of 20 – 25 years, seventy seven (77) respondents each representing 20.10% were between the age bracket of 26 – 30 years, fifty six of the respondents representing 14.62% were 17% were 31 – 35 years respectively, also eighty eight (88) respondents representing 22.97% of the sample were between the age limit of 36 – 40 years and fifty six (56) respondents representing 14.62% were within the age limit of 41 and above years.

Table 3: Marital Status Distribution

Status	No. of Respondents	% of Respondents
Single	158	41.25
Married	134	34.98
Divorced	55	14.36
Widow/Widowers	36	9.39
Total	383	100

Source, field Survey 2023

Table 3 above shows that one hundred and fifty eight (158) respondents representing 41.25% of the sample were single, one hundred thirty four (134) respondents representing 34.98% of

the sample were married, only fifty five (55) respondents representing 14.36% of the sample were divorced as well as only thirty six (36) respondents representing 9.39%

Table 4: Educational Qualification Distribution

Qualification respondents	No. of Respondents	% of Respondents
WAEC/NECO	162	42.29
OND	101	26.37
HND/BSC	53	13.83
MSC	21	5.48
PHD	46	12.01
Total	383	100

Source, field Survey 2023

Table 4 shows that one hundred and sixty two (162) respondents representing 42.29% of the sample were WAEC/NECO holders, one hundred and one (101) respondents representing 26.37% were OND/NCE certificate holders; fifty three (53) respondents representing 13.83% were holders of HND/BSC certificates holders, while twenty one (21) respondents representing 5.48% were MSC certificate holders and only forty six (46) respondents representing 12.01% of the population were PHD holders.

RESEACRH QUESTIONS

Research Question One

Is there significant impact of regional conflicts on national unity of Nigeria?

Table 5: percentage analysis of the impact of regional conflicts on national unity of Nigeria

Extent	Frequency	Percentage
Very high extent	122	31.85
High extent	77	20.10
Low extent	96	25.06
Very low extent	88	22.97
Total	383	100

Source, field Survey 2023

The above table 5 present the percentage analysis of the impact of regional conflicts on national unity of Nigeria, the table show that there is very high impact of regional conflicts on national unity of Nigeria. Therefore, the result causes the research question to be significant.

Research Question Two

Is there significant impact of regional conflicts on national consciousness of Nigeria?

Table 6: Percentage analysis of the impact of regional conflicts on national consciousness of Nigeria

Extent	Frequency	Percentage
Very high extent	137	35.77
High extent	89	23.23
Low extent	78	20.36
Very low extent	79	20.62
Total	383	100

Source, field Survey 2023

The above table 6 presents the percentage analysis of the impact of regional conflicts on national consciousness of Nigeria, the table shows that there is high impact of regional conflicts on national consciousness of Nigeria. Therefore, the result causes the research question to be significant.

HYPOTHESES TESTING

Hypothesis One

There is no significant impact of regional conflicts on national unity of Nigeria.

In-order to test the hypothesis independent t-test analysis was used in comparing the mean score of the two groups.

T ABLE 7

Independent t-test analysis of the impact of regional conflicts on national unity of Nigeria

Variable	N	X	SD	t
High	234	12.01	1.30	21.45*
Low	149	15.15	0.71	

Significant at 0.05 level; df= 381; N= 383; critical t-value = 1.96

The above table 7 presents the obtained t-value as (21.45). This value was tested for significance by comparing it with the critical t-value (1.96) at 0.05 level with 381 degree of freedom. The obtained t-value (21.45) was greater than the critical t-value (1.96). Hence, the result was significant. The result therefore means that there is significant impact of regional conflicts on national unity of Nigeria.

Hypothesis two

There is no significant impact of regional conflicts on national consciousness of Nigeria.

In-order to test the hypothesis independent t-test analysis was used in comparing the mean score of the two groups.

TABLE 8**Independent t-test analysis of the impact of regional conflicts on national consciousness of Nigeria**

Variable	N	X	SD	t
High	201	12.07	1.34	18.31*
Low	191	15.00	1.09	

Significant at 0.05 level; df= 381; N= 383; critical t-value = 1.96

The above table 8 presents the obtained t-value as (18.31). This value was tested for significance by comparing it with the critical t-value (1.96) at 0.05 level with 381 degree of freedom. The obtained t-value (18.31) was greater than the critical t-value (1.96). Hence, the result was significant. The result therefore means that there is significant impact of regional conflicts on national consciousness of Nigeria.

Discussion of the Findings

The result of the data analysis in table 7 is significant due to the fact that the obtained t-value (21.45) was greater than the critical t-value (1.96) at 0.05 level with 381 degree of freedom. This result implies that there is significant impact of regional conflicts on national unity of Nigeria. The finding is linked with study conducted by Ojo (2018) who underscores the link between regional conflicts and political instability. Regional conflicts have often translated into political instability. The struggle for power and resources among regions has fueled corruption and governance challenges. The significance of the result caused the null hypothesis to be rejected while the alternative one was accepted.

The result of the data analysis in table 8 is significant due to the fact that the obtained t-value (18.31) was greater than the critical t-value (1.96) at 0.05 level with 381 degree of freedom. This result implies that there is significant impact of regional conflicts on national consciousness of Nigeria. The finding is in agreement with the work of Ibrahim (2021) who underscore the importance of inclusive policies that address regional grievances, promote social cohesion, and create a sense of belonging among diverse populations. The significance of the result caused the null hypothesis to be rejected while the alternative one was accepted.

Conclusion

In conclusion, the impact of regional conflicts on the national consciousness and unity of Nigeria is an important issue. The historical context of ethnic and regional tensions has undeniably shaped the nation's identity and collective consciousness. While instances of conflict have at times exacerbated divisions, they have also prompted crucial dialogues and efforts towards reconciliation. Nigeria's diverse ethnic and cultural landscape remains both a source of strength and a challenge, requiring a delicate balance to foster a sense of shared national unity.

The realization that the nation's progress hinges on unity and cooperation has driven efforts to bridge divides and promote inclusivity. It is imperative for the government and civil society to address the root causes of regional conflicts, addressing issues of inequality, resource distribution, and historical grievances.

Ultimately, the effect of regional conflicts on Nigeria's national consciousness is an ongoing narrative that demands continuous attention and proactive measures. By fostering a climate of understanding, tolerance, and equitable development, Nigeria can transcend regional differences and strengthen its national unity, paving the way for a more prosperous and harmonious future.

Recommendations

1. The impact of regional conflicts on the national consciousness and unity of Nigeria is a critical concern that demands immediate attention. To strengthen national cohesion, it is imperative that the government, civil society, and the media actively work towards fostering a sense of shared identity and purpose among Nigerians.
2. There is a need for comprehensive educational reforms that promote a unified national narrative while respecting and celebrating the diversity of Nigeria's regions. Introducing a standardized curriculum that incorporates the rich history, cultures, and traditions of all ethnic groups will contribute to a more inclusive sense of national pride.
3. Also, a concerted effort should be made to address economic disparities between regions. Implementing policies that promote equitable distribution of resources and opportunities will alleviate tensions arising from perceived marginalization, thereby fostering a more unified nation.
4. Moreover, the government must invest in effective communication strategies to counter divisive narratives propagated by regional conflicts. Utilizing mass media and social platforms to promote stories of national cooperation and success will help reshape public perceptions.
5. While, diplomatic initiatives should be pursued to resolve regional conflicts peacefully, emphasizing the shared interests and common goals that bind Nigerians together. By prioritizing national unity, Nigeria can navigate the challenges posed by regional conflicts and emerge stronger as a united and resilient nation.

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**BUSINESS EDUCATION PROGRAMME: A PRACTICAL APPROACH FOR
ATTAINMENT OF SOCIAL SECURITY IN NIGERIA**

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ABSTRACT

It has been expatiated that social security is a social insurance programme, providing social protections including poverty, unemployment, disability, old age and others. On this basis, to realize any meaningful development in the society, it requires acquisition of skills by the citizen of the society. This called for the type of education that will empower people to be self-reliant. Business education is the programme that guarantees social development because it is designed to inculcate skills and competencies required to be self-reliant. This paper discussed the concept of business education, objectives of business education, concept of social security and contributions of business education to the development of the society through the establishment of following factors such has creation of job opportunities, elimination youth restiveness, promote national development and poverty reduction.

KEYWORDS: Education, Business Education and Social security

Introduction

Globally, one of the government's responsibilities is the provision of security for its citizen. Security is concerned many areas of human endeavor. It could be economic, health, environmental, food and social. The main reason behind this is that adequate provision of security by the government could be used to justify the development of any nation. Umaru in Amoor (2019) indicated that security is the absence of danger to a person, assets and infrastructure where they are located. This could be inferred that any secured society creates a free environment where inhabitants interact without fear. Nwanegbo and Odigbo (2013) state that security is the pillar upon which every meaningful development rests and is sustained. In the social context, the attainment of security is directly linked to the standard of education provided for the citizens by the government.

Generally, education is regarded as a means of training people out of ignorance which also a systematic process through which people acquire knowledge, experience, skills, values and sound attitudes. It is certainly a means of socializing, refining and culturing people resulting into change of behaviour from negative to positive, perfect individual and social harmony. Consequently, every society strives to attain enviable heights in the enlightening its citizenry, especially as it has the potentials of acting as panacea for social ills and antidote for various problems of life.

Therefore, attaining stability in any society, there is need for skillful type of education that will empower people with necessary skills which will make them to contribute significantly to the development of the society in which they live. Business education has been identified as type of education that prepare every individual with required knowledge, skills, competencies, values and business attitudes which could be used as a yardstick to create a better society for the people to live.

Concept of Business Education

Business education is a component of vocational and technical education which purposely meant for the development of self-reliant. Business education is designed with the prime purpose of upgrading skills or providing individual with the necessary skills required to obtain gainful employment. Business education is a programme of instruction that offers various skills in accounting, marketing, and office technology and management (Ajisafe, Bolarinwa & Edeh 2015). Okiridu and Ogwunte (2018) argued that business education is an aspect of learning that prepares individuals for roles in business and offers them knowledge about business that is a programme of instruction that consists of two parts, namely office education and general business education.

Office education is a programme of vocation for office careers and general business education which provides the recipient with competencies and skills needed in managing personal business affairs and using the services of the business world. Ido and Asugwo (2014) explained that an individual who receives training in business education can easily develop potentials for entrepreneurship pursuits especially in this era of economic meltdown and unemployment.

Okiridu (2017) defined business education as a tripartite programme of instruction which prepares the recipient or the learner to be a teacher, an operator or to be self-reliant. The author further expressed that business education which is offered at the universities and colleges of education is concerned mainly with the development of relevant and saleable skills and knowledge that would enable an individual to function effectively in the world of work. Iwu (2016) opined that business education is a course of study that equips the individual with the occupational skills and knowledge that will enable him/her fit into a job and find satisfaction in the labour market. It also a programme that prepares students with skills and competencies needed for self-reliant and employment. Nwokike et al (2018), described Business education programmed is concerned with teaching the skills, attitudes and knowledge necessary for a successful career in office and business world. The author also posits Business education is one of the vocational courses offered in Nigerian tertiary institutions. It equips the recipients with relevant and saleable skills for effective self and social development.

Objectives of Business Education

Business education is a programme of study which concerned with the skills and knowledge that guide its recipient to be relevant in business field of study either to be its instructor or to be the guidance of the business in order to be self-reliant. According to NUC (2022) Business

Education programme provides individuals with relevant knowledge, skills and competencies to be self-reliant and economically self-sufficient for gainful employment, meaningful living, and to contribute to the development of the society. The programme is designed in consonance with the needs of the business community to ensure that education and training offered are consistent with the competencies for the present and emerging job requirements and opportunities. The objectives of Business Education are to:

- i. Provide opportunity for practical job preparation or vocational studies in order to make students render effective and efficient services in office, distributive and service occupations.
- ii. Prepare students, based on interest and aptitudes needed to enter into a business occupation, advance and profit in it.
- iii. Provide opportunities for students to develop an understanding of business and economic system of the nation so as to enable them to participate actively as producers and consumers of goods and services
- iv. Develop in students the basic awareness of the contribution which business and office employee makes to the nation's economy.
- v. Develop and improve personal qualities and attitude of students as required in personal and employment situation
- vi. Serve as a guide for individual student for suitable placement in business and office employment
- vii. Enable students to have career consciousness and economic understanding of the free enterprise system
- viii. Prepare student to assume the role of building a future generation through teaching and knowledge impartation.

Hence, the aims/objectives of Business Education, as contained in section 6, sub-section 49 of the National Policy on Education (2004) are to:

- i. Provide the business knowledge and vocational skills necessary for industrial, commercial and economic development.
- ii. Provide trained manpower in applied technology and commerce, particularly at sub professional grades.
- iii. Provide people who can apply scientific knowledge to the improvement and solution of economic and environmental problems for the use and convenience of man.
- iv. Enable our young men and women to have an intelligent understanding of the increasing complexity of technology.

Akinola (2006) identified the objectives of Business Education as to:

- i. prepare students for employment after graduation;
- ii. meet the manpower needs of the society;

- iii. present a laboratory in which practice skill, knowledge and attitude are learnt to make the classroom instruction more meaningful and relevant;
- iv. provide an opportunity through the use of local business for the student to acquire additional skills and knowledge;
- v. give the students background of training this will contribute to rapid advancement on the job;
- vi. make students' development of such personality traits as punctuality, dependability, accuracy, for effective and good sense of responsibility that makes for effective work;
- vii. help develop the right attitude towards and the habit of mind conducive to the proper use of technology;
- viii. provide the knowledge and skill necessary for industrial, commercial and economic development;
- ix. provide people who can apply scientific knowledge to the improvement, solution and convenience of man;
- x. give training, and impart the necessary skills leading to the promotion of craftsmanship, technicians and other skilled personnel who will be encourage creativity and to enable young men and women to have an intelligent understanding of the increasing complexity of technology; and
- xi. Stimulate and encourage creativity and to enable young men and women, to have an intelligent understanding of the increasing complexity of technology.

It is glaring that Business Education plays an important role by considering the above objectives in the preparation of the citizenry both vocationally and professionally for divergent careers in business. The numerous roles of Business Education in a dynamic business environment are as obvious as they prepare educators to cultivate creative behaviour to become proud business operators and problem solvers. The knowledge provided by business education programme is enough keep society secured from societal problems such as environment, health, food and social related problems.

Concept of Social Security

International Labour Organisation (2021) defined social security as a system of contribution to the citizen of a state based on unemployment protection, pension, health etc. Globally social security refers to collective care arrangements to meet contingencies. It is also known as social protection, is concerned with preventing, managing and overcoming situations that adversely affect people's well-being. ILO (2021) also defined it as all measures providing benefits in cash or in kind and program to guarantee income security and access to health care. Comprehensively social protection systems secure protection from, among other things, unemployment, lack of work-related income caused by sickness, disability, maternity, employment injury, old age or death of family member, and general poverty and social exclusion; they also ensure access to basic health care, and provide family support, particularly for children and adult dependents. Social protection is the alternative term for social security.

Friedrich, (2018) viewed social protection as all public and private initiatives that provide income or consumption transfers to the poor, protect the vulnerable against destitution, and enhance the social status and rights of the marginalised; with the overall objective of reducing the economic and social vulnerability of the poor and marginalised groups. Ramakrishann (2011) described social security as primarily a social insurance program, providing social protections including poverty, unemployment, disability, old age and others. While Social protection is, therefore, concerned with preventing, managing, and overcoming situations that adversely affect people's wellbeing. It consists of policies and programmes designed to reduce poverty and vulnerability. Friedrich, (2018) explained that social security policies promote efficient labour markets and reduce people's exposure to shocks. They enhance people's capacity to manage economic and social risks, including unemployment, exclusion, sickness, disability, maternal and child care, old age challenges and emergencies such as flood and violent conflicts. Such interventions may be carried out by the state, non-governmental actors, the private sector, or through informal individual or community initiatives. Therefore social protection can be define as a mix of policies and programmes designed for individuals and households throughout the life cycle to prevent and reduce poverty and socio-economic shocks by promoting and enhancing livelihoods and a life of dignity.

Business Education and Social Security

The philosophy of business education programme aims at a complete development of the individual student teacher to make them effective business teachers and high caliber professionals in business establishments. The link between the Business education and society is established based on the relevance of the programme to empower every individual with the necessary knowledge, skills, competence and business attitudes for self-reliance which is the need of the present society. Discussed below are the areas of relevance of the programme contribution for the development of the society:

1. Creation of Job Opportunity: Business education is capable to provide job opportunities for its recipients. This is because it enables the students to acquire the necessary skills and competencies that are necessary in today's business environment. Social security is referred to the provision of training that is capable to prepare every individual to become a significant contributor to the development of the society through the acquisition of relevant knowledge, skills, competencies and values which are useful for self-reliant. Business education is an aspect of vocational and technical education that is specialized of instruction designed to provide individual with knowledge, skills and attitudes leading to employability and teaching of business subjects and be permanent self-reliant. According to Udo and Bako (2014) Business education programme is designed to inculcate following skills in its recipients:

- a. Accounting Education Skills:** Accounting is one of the major occupational areas of vocational Business education (VBE) that can prepare the Nigerian workers and students for a job or employment with in a wide range of business career such as pay-roll clerks, purchasing clerks, audit clerks, book-keepers, cashiers and business teachers who undertake the teaching of accounting to other learners
- b. Economics Education Skills:** This component provides VBE students with the skills and competencies which they are able to use to enhance sustainable development in the country. In brief, the Economics curriculum objectives emphasize economic literacy, prudent management of resources, respect for the

dignity of labour and acquisition of economic knowledge for solving the economic problems of the society.

- c. **Marketing/Distributive Education Skills:** Udo (2012) noted that distributive education is a programme of vocational instruction in marketing, merchandising and related management, which is designed to meet the needs of persons who have entered or are preparing to enter a distributive occupation. According to Osuala (2004), the general objective of distributive education is to prepare students for gainful employment in distribution and marketing.
- d. **Office Technology and Management (OTME) Education Skills:** The general objective of office technology education is to prepare students for work as secretaries in the offices. According to Udo and Bako, (2014) in Odike et al (2019), it was formerly known as secretarial education. The present day secretaries are exposed to the use of information and communication technology (ICT) in their day-to-day training and working lives. Students are equipped with the ICT skills to enable them know how to successfully operate (ICT) facilities.
- e. **Entrepreneurship Education Skills:** The general objective of entrepreneurship education is to prepare students for gainful self-employment and employer of labour. With entrepreneurial skill the students can establish small or medium scale businesses. These skills of entrepreneur are inculcated in Business education students through the various courses offered in the Business education programme of schools, colleges and the universities.
- f. **Teaching Skills:** The objectives of vocational Business education programme at the tertiary level are to train teachers who can occupy teaching and leadership positions in the secondary schools, technical colleges of education, universities and training programme. The Business education students also acquire skills in pedagogy of teaching that will enable them effectively impart the knowledge they acquired in their students as teachers.

1. Eliminating Youth Restiveness: Youth occupy a prominent place in any society. Apart from being the owners and leaders of tomorrow, they outnumber the middle-aged and the aged (Onyekpe, 2007). Besides numerical superiority, youth have energy and ideas that are society's great potentials (Onyekpe, 2007). Conversely, the degree of disorderliness and instability in society is also determined in part by youth. With the provision of relevant skills and competences by Business education to the youths, this can lead them to understand their developmental roles in the society. The National Youth Development Policy (2001) asserts that Youth are the foundation of a society. Their energies, inventiveness, character and orientation define the pace of development and security of a nation. Through their creative talents and labour power, a nation makes giant strides in economic development and socio-political attainments.

2. Promote National Development: This refers to the improvement of a country in all areas, including the political, economic, social, cultural, scientific, and material spheres. The capacity of a nation to enhance its citizens' standard of living is an indicator of the nation's level of development. Business education as a programme that focuses on self-reliance and self-sustenance, it contributes immensely to the development of the nation's political, economic, social and man-power needed in all sectors of economy.

3. Poverty Reduction: Poverty is a multidimensional problem that goes beyond economics to include, among other things, social, political, and cultural issues. It is also inability of individual to provide all the basic things of life for himself or for his/her family. Business education programme plays a good role in this aspect by providing necessary tools in terms of knowledge, competencies and business related values and attitudes that could be of assistance for every individual to fend for themselves thereby raising peoples' standard of living.

Conclusion

Business education programme is an indispensable tool in attaining social security. It's relevance in providing work and self-reliant oriented needed to improve the standard of living cannot be over-emphasized. For society to be secured from any forms of deficiency, such society should be ready to prepare its citizen with the knowledge that can make them to contribute to development of their immediate society. Business education has been proved to be a programme that can forestall self-reliance among the youths through the provisions and acquisitions of relevant skills, competences and attitudes which improve their standard of living (ending poverty, unemployment and promoting the well-being of individual and society at large).

Suggestions

Based on the literature reviewed on this work, the following suggestions are made:

1. Business education programme must be more practical oriented. This means that business education graduates should be given small loan to practice what they have been taught in the class during their schooling.
2. The Business education curriculum must be redesigned to incorporate business related technology components which would guide the students to earn their living through online business activities.
3. The association of business educators should emphasize on the need for professionalism. This would help the business graduates to benefit maximally from the programme thereby assisting them to play a good role in the society.

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HUMAN RESOURCE MANAGEMENT AND THE BASIC PROVISIONS OF THE TRADE UNIONS ACT

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ABSTRACT

Trade unions in Nigeria play a normative role in promoting industrial peace and harmony. They act to maintain equilibrium in the bargaining powers between employers and employees. Without trade unions, employers' natural exploitative tendencies of employees will be heightened without any obstacles. Given the positive implication attached to trade unions in promoting industrial peace and harmony, the laws relating to trade unions in Nigeria should be such that registered trade unions are compulsorily recognized by employers and adequately supported to maintain an equilibrium in the bargaining process to promote industrial peace and harmony, this paper examined the Nigerian Trade Union Act and highlighting the positive normative implications of the Act. The National Industrial Court (hereinafter referred to as NIC) has, in several decisions, held that recognition of a registered trade union by an employer is obligatory. Even though this position by NIC is statutory.

KEYWORDS: Trade union, labor relations, National Industrial Court, recognition of trade unions, and membership of trade unions.

INTRODUCTION

Trade unions are organizations that represent people at work. Their purpose is to protect and improve people's pay and conditions of employment. They also campaign for laws and policies which will benefit working people. Trade unions exist because an individual worker has very little power to influence decisions that are made about his or her job. By joining together with other workers, there is more chance of having a voice and influence. Trade union members are both rank-and-file members and negotiate labor contracts through collective bargaining with

employers. This may include the negotiation of wages, workers, benefits, workforce safety, and policies. The agreements negated by the union leaders are binding on the rank-and-file members and the employer and in some cases on other non-member workers. O.V.C. Okene (2005).

Trade unions in Nigeria and elsewhere represent important institutions through which collective labor relation is practiced. They regulate relations between employers on the one hand and employees (through their elected representatives) on the other. Since the two parties to a contract of employment do not operate at arms-length i.e. the employee being the weaker of the parties, the only way through which the interests of the employees can be collectively and adequately protected is through vibrant trade unions which are the umbrella bodies of workers in particular organizations.

MEANING OF TRADE UNION

Statutorily, the trade union is defined according to section 1(1) of the Trade Unions Act 2004 as a combination of workers or employers, whether temporary or permanent, the purpose of which is to regulate the terms and conditions of employment of workers, whether the combination in question would or would not, apart from this Act, be unlawful because of any of its purposes do or do not include the provision of benefits for its members. This definition has two important criteria for determining a trade union.

1. The combination must be of workers or employers, and conditions of the employment of workers.
2. It must have a proper purpose, to regulate the terms.

The fact that a combination of workers or employers has purposes or powers other than the purpose of regulating the terms and conditions of employment of workers shall not prevent it from being registered under this Act; and accordingly, subject to the provisions of this Act, as to the application of funds for political purposes, a trade union may apply its funds for any lawful purpose for the time being authorized by its rules, including in particular, if so authorized, that of providing benefits for its members. The combination must either be of workers or employers. 'Worker' has been defined by section 54 of the Trade Unions Act, section 91 of the Labour Act 3, and section 73 of the Employees' Compensation Act 4. The Trade Unions Act for example defines a 'worker' to mean: any employee, that is to say, any member of the public service of the federation or a state or any individual (other than a member of any such public service) who has entered into or works under a contract with an employer, whether the contract is for manual labor, clerical work or otherwise, expressed or implied, oral or in writing, and whether it is a contract.

MEMBERSHIP OF TRADE UNIONS.

Who may be a member of the trade union, how junior and senior staff may become members of a trade union, certain restrictions placed on union membership, the legal status of the union rules book, expulsion from union membership and the remedies for wrongful expulsion from a trade union.

1. Who may be a Member of a Trade Union?

Any person who is 16 years and above may be a member of a trade union. As for union officials, a person must be 21 years and above before he will be capable of being an official of a trade union. However, a person who is 16 years and above but below the age of 21 may be precluded from being a member of a trade union where the union rules so provide. Any

staff recognized as a projection of management is prohibited from being a member of a trade union or holding office in a trade union if such membership or holding of office in the trade union will lead to a conflict of loyalties to either the union or to management.

2. How may Junior Staff and Senior Staff Become Members of a Union?

The law regarding the unionization of junior staff was succinctly put by the National Industrial Court in *Nest Oil Plc v NUPENG* thus: TUA section 20(1), TUA section 20(2), TUA section 3(3).

As far as our law is concerned, junior staff are deemed to be members of a union until they individually and in writing opt not to be. This means that if in truth the defendant is the proper union to unionize junior staff of the defendant, the question of them having to agree and express their interest before they can join the defendant's union will not arise. All that will be required of them is that if they do not want to be members, they can opt-out. It can, therefore, be seen from the above pronouncement that for junior workers, membership in a trade union is based on eligibility. Thus, the deduction of check-off dues is not based on membership but on eligibility. They are deemed to be members of their relevant trade unions and can only opt-out. They can therefore benefit from a collective agreement in the absence of evidence of 'opting out' of the union. The rationale for deeming junior staff to be members of their respective trade unions was succinctly captured by Kanyip, J (as he then was) in *Eyiaromi Oladele v Attorney General, Lagos State* thus:

The orthodox view is that labor law itself is meant to protect more vulnerable workers. Even at this, some workers are certainly more vulnerable than others (the reason why the law has been couched in this way presuming membership of trade unions for junior staff to enable them to be protected by the union thereby allowing them to 'opt-out' for those who do not want to be members and senior employees/staff whom the law does not deem to be members of any trade union unless they specifically opt to be members thereby allowing them to 'opt-in').

REASONS WHY WORKERS JOIN UNION

Trade Unions perform some vital functions for their members that make other workers always willing to join. According to Chand (2016), workers join trade unions because of some expected benefits which include job security wages and benefits, working conditions, fair and just supervision, powerlessness, and the need to belong. Job security: Every worker wants the security of their employment. No one wants management to wake up one day and indiscriminately announce the termination of his or her appointment or employment. As a result of this, workers join unions to ensure that their jobs are securely protected against indiscriminate and unjustified terminations. Adequate Wages and Benefits: Trade unions are known for championing the campaign for better and equitable wages and associated work benefits for their members. They engage management in discussions about the need to pay good wages. Workers therefore join unions with the belief that the union will ensure that management pays what is just and fair in wages and salary. Unions are also believed to negotiate with management on other work benefits such as personal, vacation, medical facility, paid sick leave, and other things that the union may see as expedient for their members. Power in groups: Most employees have realized that it is very difficult for an individual to successfully bargain terms and conditions of employment. Employees therefore join unions because they believe that there will be power in unity. They also perceive that they will be powerless and voiceless when dealing with management as individual workers. Therefore, joining unions provides a strong, collective, and powerful force to „challenge unfair and unjust management

policies, and to bargain with management where individual voices cannot be heard. Need to associate with others: No man can truly survive in isolation. No man is an island. Man by native love to relate and share with others, and also has a strong need to belong or associate with others. Association with others allows a worker to share his or her feelings and opinions. In the workplace, unions provide people the opportunity to come together to consider, pursue, and promote common job-related interests, and also help workers to socialize with others. Protection from Unjust Supervision: The fear of being unjustly and unfairly treated by managers and supervisors is another reason why workers join unions. Most often, some managers who lack the requisite human relations skills try to impose their opinions and desires on their subordinates and also mistreat them because of their influence over them. To avoid unjust supervisor's excesses. With employees in the union, the union is in a position to intervene with any unfair or unjust action of such manager. Bakke (1945) contends that: "The worker reacts favorably to union membership in proportion to the strength of his belief that the step will reduce his frustrations and anxiety and will further his opportunities relevant to the achievement of his standards of successful living. He reacts unfavorably in proportion to the strength of his belief that this step will increase his that this step will increase his frustrations and anxieties and will reduce his opportunities relevant to the achievement of such standards".

LITERATURE REVIEW

Definition of Trade Union. Different definitions have been given for labor unions by authors. According to Tokubvo (1985) in Collins (2013) a labor union is an association of workers, that consists of representatives that mediate between the workers and their employer to avoid any unfair treatment that could be meted out to them by the employers and to conversely ensure commitment to work by its members in a way that, it will result in a high level of productivity and organization efficiency in general. It also refers to organized groupings of workers that relate with employers on various issues related to the condition of employment of their members (Adefolaju, 2013). According to Hyman (2001), it is the continuous association of wage earners to sustain and enhance their workplace conditions. The Nigerian Trade Union Act of 1973 defines it as; "Any combination of workers or employees whether temporary or permanent, the purpose of which is to regulate the terms and conditions of employment of workers whether the combination by any reason of its purposes being in restraint of trade and whether its purpose do or do not include the provision of benefits to members". Uvioghara (2001) observed that the two significant criteria of this definition for determining whether an association is a trade union are: the combination must be of workers or employers and, that it must have the proper purpose, which is that of regulating the terms and conditions of employment of workers. The labor union is also seen as an organization whose membership consists of wage earners and union leaders, who are united to promote and pursue their common interest and welfare and regulate terms and conditions of their employment through collective bargaining and consultations with employers. In the words of Webb and Webb (1894), it is a continuous association of wage earners to maintain or improve the conditions of their working lives. In this sense, employees in a union seek to use the union to protect and promote their interest in the workplace, mainly using collective bargaining and consultations with employers. Labor union thus, is a platform utilized by workers in organizations to seek understanding as well as to influence management decisions that could be detrimental or contrary to the terms and the contract of agreement which the management entered into with the workers. In this sense, a labor union can be seen as an organization of wage earners or salary workers established to protect members' collective interests in their dealing with employers and the wider society using the process of rule-making and collective bargaining in industrial settings or workplaces. A labor union is therefore vital for the improvement of the worker's quality of life.

HISTORY OF TRADE UNION LAWS IN NIGERIA

Before discussing the history of trade union laws in Nigeria, it is necessary to mention here that the first trade union in Nigeria was the Southern Nigerian Civil Service Union which was formed in 1912. Thereafter, there were the Railway Workers Union and Nigeria Union of Teachers formed in 1931, as for the trade union laws, the first trade union statute in Nigeria was the Trade Union Ordinance No 44 of 1938. This Ordinance allowed a minimum of five workers to form a trade union. The Railway Workers' Union was the first union to register under the 1938 Ordinance. Thereafter, there was the Trade Union Ordinance Cap 200 Laws of the Federation and Lagos, in 1958. In 1973, the Trade Unions Decree No. 31 of 1973 was promulgated which repealed the Trade Union Ordinance of 1938. The 1973 Decree provided for more stringent requirements for the registration of trade unions. For the definition of 'employer', see as given by section 73 of the Employees' Compensation Act, to include any individual, body corporate, federal, state or local government or any of the government agencies who have entered into a contract of employment to employ any other person as an employee or apprentice. In 1976, as a result of the proliferation of trade unions which were over 1000, an Administrator was appointed to re-structure the existing trade unions of over 1000. This culminated in the Promulgation of the Trade Unions (Amendment) Act No. 21 of 1978. Under the Trade Unions (Amendment) Act of 1978, the existing trade unions were reduced and re-structured into 70 trade unions. The Third Schedule to the Act had two parts: Part 'A' contained the list of 42 trade unions of junior staff while Part 'B' contained the list of 19 senior staff unions and 9 employers' associations respectively. Trade Unions in Part 'B' were prohibited from affiliating with the Nigeria Labour Congress (NLC). One of the decisions in which the 1978 Act was challenged as being unconstitutional was the celebrated case of *Osawe v Registrar of Trade Unions*. The appellants applied for the registration of their trade union which was rejected by the Registrar of Trade Unions. They sought the writ of mandamus at the High Court which was granted. The Registrar appealed to the Court of Appeal which set aside the High Court order and on further appeal to the Supreme Court, the Court of Appeal decision was upheld. One of the issues for determination was whether section 3(2) of the Trade Unions (Amendment) Act, 1978 which provided that no trade union shall be registered to represent workers or employers in a place where there already exists a trade union' was an infringement on section 37 (now section 40) of the 1979 constitution which guaranteed freedom of association.

- (i) The right of association guaranteed in section 37 of the 1979 Constitution like other rights in chapter iv was not absolute but qualified which could be derogated from by section 41 (now 45) of the 1979 Constitution.
- (ii) The Trade Unions Act 1978 was a law passed in the interest of public order. It was necessary to ensure order in the chaotic proliferation of trade unions which was the practice before the promulgation of the law. The legislation was therefore not unconstitutional. Accordingly, the appeal was dismissed. In 1990, when the laws of the federation were reviewed, the Trade Unions Act became known as Cap 437, Laws of the Federation of Nigeria, 1990.

THE BASIC OBJECTIVE PROVISIONS OF THE TRADE UNIONS ACT IN NIGERIA

The first step towards collective bargaining between employers and employees is for an employer to recognize a trade union of which persons in the employment of an employer as members. This is very important because such recognition will lead to collective bargaining

by the parties thereby paving the way for industrial peace and harmony. Recognition of a trade union involves the acceptance by the employer that the union has negotiating rights over certain issues i.e. bilateral agreement is substituted for unilateral decision-making by the employer in respect of the issues covered by the recognition agreement. The objective of trade unions acts as provide is to make provisions concerning the following.

- I. The right to form and join a trade union is guaranteed under the Act.
- II. This Act provides that trade unions can be formed by a minimum of seven or more persons engaged in the same trade, occupation, or industry.
- III. The Act provides that the registration of trade unions is mandatory in Nigeria, and only registered trade unions can operate in the country.
- IV. The Act provides that the registrar of trade unions is responsible for registering and regulating trade unions in Nigeria
- V. The Act requires trade unions to submit their constitution, rules, and regulations to the registrar for approval before registration.
- VI. Trade unions are required to maintain proper accounts and records of their finances and activities, which are subject to inspection by the registrar.
- VII. The Act provides for the right to strike, but with certain limitations and conditions.
- VIII. The Act also provides for the settlement of trade disputes through conciliation, mediation, and arbitration.
- IX. The Act prohibits the registration of trade unions that promote discrimination, violence, or any other illegal activity.
- X. The Act prohibits the use of trade unions for political purposes.

DISCUSSION

Trade Unions Act and its Applications from the historical perspective, culminating into the current position of the law

The issue here is whether Nigerian labor statutes have been able to address this issue of recognition adequately and satisfactorily. In addressing this issue, it may perhaps be necessary to look at the issue from the historical perspective, culminating into the current position of the law on the issue to ascertain whether the extant provisions of the law on the issue are adequate. The Act had as its objective, to make provisions concerning the formation, registration, and organization of trade unions. The 1990 Act later went through a series of amendments.

- a. The first amendment was the Trade Unions (Amendments) Decree No. 4 of 1996 whose main objective was to amend the Trade Unions Act and to provide for the restructuring of trade unions in Nigeria from 41 to 29.
- b. The second amendment was the Trade Unions (Amendment) Decree No. 26 of 1996. The objective of this was to amend the Trade Unions Act as amended by the Trade Unions Decree No. 4 of 1996. One of the important provisions of the Decree was that deductions from the wages of union members and the remittance of the sum so deducted to the registered office of the trade union shall be subject to a 'no strike' clause in the relevant collective bargaining agreement between the workers and their employers. It may be remarked here that despite this provision, strikes continued unabated.
- c. The third amendment was the Trade Unions (International Affiliation) Decree No. 29 of 1996. The objective of the amendment was to prohibit international affiliation

by any trade union except as provided in the Act. By this amendment, the Central Labour Organisation could affiliate only with two international associations to wit: the Organisation of African Trade Union Unity (OATUU) and The Organisation of Trade Unions of West Africa (OTUWA). It may be remarked here that this was a direct violation of Article 5 of ILO Convention No. 87 of 1948 concerning the Freedom of Association and Protection of the Right to Organize Convention which Nigeria had ratified. Article 5 provides that “. workers’ and employers’ organizations shall have the right to establish and join federations and confederations and any such organization, federation or confederation shall have the right to affiliate with international organizations of workers and employers”.

- d. In 2004, the laws of the Federation 1990, were further reviewed and the Trade Union laws were not left out. The current laws on trade unions are to be found in the 2004 laws of the federation and the subsequent amendments. The first TUA under the 2004 laws is the Trade Unions Act Cap T14 Laws of the Federation of Nigeria, 2004. the objective of which is to make provisions concerning the following.

(i) Formation Trade Union (ii) Registration Trade Union (iii) Organization of Trade Unions. (iv) A federation of Trade Unions, and (v) The central labor organization.

In 2005, there was a further amendment to the Trade Unions Act. This Act is referred to as Trade Unions (Amendment) Act, 2005. The objective of this Act was to amend the Principal Act which was Trade Unions Act 14, Cap 437, Curiously, this Act amended the 1990 Trade Unions Act while the 2004 laws were in existence but not yet operational. It was much later that the 2004 laws became operational and reference ceased to be made to the 1990 laws of the federation. This explains the confusion with Cap T14 Laws of the Federation of Nigeria, 2004.

THE FUNCTIONS OF THE TRADE UNION’S ACT IN NIGERIA

A trade union is an organization made up of members (a membership-based organization) and its membership must be made up mainly of workers. One of a trade union's main aims is to protect and advance the interests of its members in the workplace. Most trade unions are independent of any employer. However, trade unions try to develop close working relationships with employers. This can sometimes take the form of a partnership agreement between the employer and the trade union which identifies their common interests. Trade Union Right in the Work Place (nibusinessinfo.co.uk website)

1. Negotiate agreements with employers on pay and conditions
2. Discuss major changes to the workplace such as large-scale redundancy
3. Discuss members' concerns with employers
4. Accompany members in disciplinary and grievance meetings
5. Provide members with legal and financial advice
6. Provide education facilities and certain consumer benefits such as discounted insurance

OBJECTIVES AND PURPOSES OF THE TRADE UNION'S ACT IN NIGERIA

Every association is formed to achieve certain goals. According to Uvieghara (2001), “the purpose for which association is formed is the distinguishing characteristics of a trade union from other association”. Heneman et al. (1983) posit that the goals of unions are to increase total membership through the improvement of economic and other conditions of employment for present and potential members. The principal objective of a labor union is the regulation of the terms and conditions of employment of workers and to present a strong and united front in collective bargaining activity. In other words, trade union objectives are to fight for the interest of all members in matters relating to terms and conditions of employment in industrial settings. In addition, other objectives of trade unions are to regulate relations between its members (workers) and the employers, raise new demands for better conditions of work on behalf of its members, and help with industrial grievances, between members and their respective organizations. In fighting for the interest of its members, a trade union seeks to optimize the working conditions at the workplace and guarantees job security protecting their members against inhumane, unjust, and unfair treatment from management at the workplace. In other words, the major objectives of trade unions include the following: negotiation, representing the body, personnel policies, employee-employee relations, employee welfare, and employee protection. Labor unions have the objective of carrying out negotiations on behalf of members: Unions seek to achieve this objective through a collective bargaining process put in place in the organization. Union uses collective bargaining to negotiate and cover work rules and procedures, grievance procedures, health and safety policies, promotion, and retirement, among others. This is so because individual workers find it difficult to negotiate every term of contract that has to do with work relationships with their employers. Since there is „power in numbers, labor unions seek to utilize and mobilize their members and present a common front in their negotiation and demands from management. Representation of members is another major objective of labor unions: Labour unions seek to represent their members when approached during disciplinary or grievance hearings. In such situations, the union representative will support the employee in the meeting with the management. In this regard, unions are utilized as representing voices when dealing with employers. Closely allied to this objective is the maintenance of employee-employer relations: The achievement of both the employer and employee’s goals depends on a peaceful and harmonious relationship. This state of relationship is possible when a trade union strives to achieve these objectives. For example, when conflict arises between workers and management, trade unions try to resolve the conflict by initiating negotiations with the management to achieve a harmonious relationship that will help to enhance effectiveness.

When there are conflicts and disharmony, the achievement of organizational and individual worker's goals and objectives becomes very difficult. Labour Unions also seek the promotion of member’s welfare. This is one of the major objectives of trade unions. In this regard, trade unions work as both a guide and counselor to workers in giving them the necessary advice about any work-related problem. It also provides its members with legal advice and financial assistance when it is most needed. By ensuring that the terms and conditions of employment of its members are just and fair, it seeks to promote their general welfare. Another objective of the Labour Union is to ensure good personnel policies. Union seeks to ensure that good personnel policies are in place for workers in the workplace. As a result, may oppose management over poor or improper respect to recruitment, selection, training, promotion, health and safety, and retirement and death policies. Most often, unions advise personnel managers above the best industrial standards on personnel matters through union representatives. Ubeku (1983) has noted that the aims and objectives of labor unions are to obtain better conditions of service and employment for their members. To achieve these

objectives of trade unions requires that union leaders should be proactive and knowledgeable about the labour laws of the country, and also have the appropriate negotiating skills needed to win the sympathy and heart of the management during any collective bargaining meeting. However, for collective bargaining to be effective, trade unions and employers need to agree on how grievance and disciplinary procedures, as well as personnel policies of the organization, need to be effective. Most of these points depend on the union leaders negotiating and leadership skills, knowledge of relevant labor and industrial laws, and their ability to mobilize and coordinate every union member to follow given instructions. The purpose and objectives of the Trade Union Act is to regulate the terms and conditions of employment of workers. It appears this is the predominant purpose but it need not be the only purpose of the union since section 1(2) of the Act permits a trade union to apply its funds for any lawful purpose authorized by its rules. (Ashenfelter, O., & Pencavel, J. H., American 1960)

1. Wages and salaries. Wages and salaries are the most important subjects of Trade Unions. In the organized industry, wages and benefits are determined through processes such as collective bargaining, wage boards, conciliation, and adjudication. Working on all these processes deserves systematic inquiry. Union power and objective facts hopefully influence the wage scene through these forums.
2. Working conditions. Another major objective of the Trade Unions is to ensure the safety of workers. While working every worker must be provided with basic facilities. Drinking water, minimum working hours, paid holidays, social security, safety equipment, lights and others.
3. Personnel policies. Any personal policy of the employer concerning promotion, transfer, and training may be challenged by Trade Unions if arbitrary.
4. Discipline. Trade Unions also protect the workers from arbitrary disciplinary action taken by management against any worker. No worker should be victimized by management in the form of arbitrary transfer or suspension.
5. Welfare. The main objective of the Trade Union is to work for the welfare of the workers. This includes the welfare of the family members or children of the worker.
6. Employee and Employer Relations. For an industrial peace, there must be harmony between employer and employee. Due to the superior power of the management sometimes conflict arises in this situation Trade Union represents the whole group of workers and continues negotiations with management.
7. Negotiating Machinery. Trade Unions may also put proposals before management, as this policy is based on the principle of Give and Take. Trade Unions protecting the interest of workers through collective bargaining.
8. Safeguarding Organisational Health and the Interest of the Industry-Trade Unions also help in achieving employee satisfaction. Trade unions also help in better industrial relations by creating procedures to resolve industrial disputes. Alone workers feel weak. Trade Union provides him a platform to join others to achieve social objectives.

THE NORMATIVE IMPLICATIONS OF THE TRADE UNIONS IN NIGERIA

Trade Unions Act's implications are to represent people at work by protecting and improving people's pay and conditions of employment. The Act aids the campaign for laws and policies which will benefit working people. The unions exist because an individual worker has very little power to influence decisions that are made about his or her job. Trade union members are both rank-and-file members and negotiate labor contracts through collective bargaining with employers. However, the normative implications of the Trade Unions Act include the following:

1. **Protection of Workers Right.** The unions represent workers at work, by protecting and improving worker's wages and conditions of employment.
2. **Balance of Powers:** Unions help to balance the power between employees and employers by protecting employees' rights while also recognizing the legitimate interest of employers. This balance is essential to creating a fair and productive workplace.
3. **Collective Bargaining:** The Trade Unions Act recognized and provided for collective bargaining between trade unions and employers. This means that workers through their trade union representatives can negotiate with employers for better wages, working conditions, and benefits
4. **Industrial Peace:** The Act aims to create industrial peace by providing a framework for settling industrial disputes between workers and employers. This helps to prevent strikes and lockouts that can disrupt economic activity.
5. **Union Democracy:** The Act promotes democracy within trade union officials and ensures that trade unions are run democratically and transparently. This helps to prevent abuse of power by union officials.

CONCLUSION

An attempt has been made to analyze some of the salient provisions of the Trade Union Laws and the issues arising therefrom. The areas analysed include the meaning of trade unions; the history of trade union laws in Nigeria; recognition of trade unions for purposes of collective bargaining; application of union funds and membership of trade unions. One area of interest is the recognition of trade unions. It has been noted that several statutory amendments in this regard have left the issue in a more confused state and hanging. It is when society sees and realizes that there are true democratic processes in trade union activities that the unions will be taken seriously. In all, for a union to be successful, it must attend primarily to its member's needs and not be overly concerned about taking a particular political approach and side. Moreover, members of trade unions should take a devoted interest in their affairs. They should understand what unionism is all about and what demands it makes on individual members as well as feel the need to give the group the required support for a common cause. Where this is not the case; trade unionism cannot be expected to make much progress.

RECOMMENDATIONS

1. It is recommended that a further amendment of the Trade Unions Act is desirable to address the lacuna created by the Trade Unions (Amendment) Act, 2005 in this regard.
2. Trade unions should create a level playground for all members to take part in the decision-making machinery of the unions.

3. They must present a strong united front since multiple unions dilute the power of unions and reduce their effectiveness. In this regard, trade unions should come together to present a strong united voice in matters affecting their members and the general society.
4. Freedom should be given to members to freely participate in all union programs and all-important decisions. It is when society sees and realizes that there are true democratic processes in trade union activities that the unions will be taken seriously.
5. Subsequently, for the union to be successful, it must attend primarily to its member's needs and not be overly concerned about taking a particular political approach and side. Due to the challenge of poor and non-proactive leadership, union members should ensure that only qualified, tested, and trusted leaders who are truly workers should be voted into positions of office both at the local, state, and national levels. It is only leaders with integrity will have the courage to say no to various financial inducements the government and captains of industry will offer them.
6. In addition union leaders should be properly trained and educated to know the basic labor laws to plan their actions within the confide of the laws to avoid pursuing shadows while leaving the substance, especially during collective bargaining and conflict-resolving meetings.
7. Labour unions should educate workers about their rights and duties develop in them a sense of responsibility, and also provide training and adequate education for their members to give room for the advancement of their members.
8. On their part, employers (business owners and managers) should support the involvement of a union representative and workers in some of the decisions regarding work conditions because some of the workers can be better informed about ways of raising productivity in their departments, and can help to accelerate agreed-upon decision. This is because, when issues arise at the workplace between managers and the employees, union representatives can be used to secure a "win-win" in which both sides feel as if they each attained something from the deal

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DECEPTIVE PACKAGING, CUSTOMER APATHY AND VALUE LOSS IN SUPPLY CHAINS OF FMCG INDUSTRIES IN NIGERIA

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ABSTRACT

This study focuses on the phenomenon of deceptive packaging, customer apathy and value loss in the context of supply chains of Fast Moving Consumer Goods (FMCG) in Nigeria. The study seeks to uncover the effects of deceptive packaging on Nigerian consumers and its boomerang effects on the FMCG industries. Specifically, the study examines the effects of: quantity, size and design deceptions of packaging on customer perceptions, loyalty and the FMCG industries' profit margins. The study adopted the qualitative research design method. Selected consumers of fast-moving consumer goods were interviewed to elicit their opinions on the subject matter. One of the findings suggests that deceptive packaging in quantity, size and design can lead to customer apathy. Furthermore, it was observed that customer apathy can reduce customer loyalty and commitment to a particular product leading to value loss in the supply chains of FMCG industries. The study concludes that engaging in deceptive packaging practices among some of the FMCG industries in Nigeria to pursue huge profits can be damaging. In addition, it seems that the FMCG industries that engage in unethical practices of deceptive packaging lack awareness of the possible negative implications on its corporate image and profitability. The study, therefore, recommends that FMCG industries re-organize and re-strategize their marketing mix to explore better channels of profit-driven strategies instead of customer deceptions among others

KEYWORDS: Deceptive packaging, customer apathy, value loss, supply chains, FMCGs

INTRODUCTION

Nigeria has one of the largest consumer and most dynamic markets in Africa. It plays a crucial role in the economic landscape. This conceptual paper delves into challenges facing Nigerian consumers because of deceptive packaging practices among the Fast Moving Consumer Goods (FMCG) industries. Packaging is a crucial aspect of marketing strategy that industries must carefully consider in creating value. Waheed, Khan, and Ahmad (2018) packaging has a strong influence on consumer purchase intentions. It significantly influences consumers to the extent that it determines whether a consumer comes back for more, acts multidimensional functions and plays a crucial role in product success (Chukwu & Enudu, 2018; Ahmed, Parmar & Amin, 2014 and Mohebbi, 2014). Companies decide on packaging to create values such as protection, economy, comfort, and storage support. However, in recent times, the good intentions of packaging have been whitewashed with the constant deceptive changes in consumer packaged

goods (CPGs). It is crucial to understand more about how consumers perceive and respond to these changes in product packaging (Ordabayeva, 2014).

Fast Moving Consumer Goods (FMCG) industries refer to the production, distribution and sale of consumer packaged goods. These goods are usually cheap, used daily, fast-selling with a quick turnover rate, and have a relatively short shelf life. Such goods are foods, beverages, household groceries, cosmetics, etc. In Nigeria, some of these FMCG industries are Dufil Prima Foods, Nexans Nigeria, Cadbury Nigeria Plc, Deli Foods, Vital Products and OK Foods. Others are Promasidor, Unilever Nigeria Plc, Vital Products Plc, Nestle, Yale Foods Ltd, Chi Limited and PZ Cussons.

The FMCG industry is an important sector of the Nigerian economy. It has contributed immensely to the economic growth and sustainable development of Nigeria. However, despite the remarkable contributions, some of the industries are engaging in deceptive packaging practices. These practices have become endemic. These are posing a threat among consumers, now that the removal of fuel subsidy and the escalation of the Dollar are hitting hard on Nigerians, coupled with the current hyperinflation and the hardship ushered by the Naira re-design policy. No wonder Ayozie (2013) averred that the consumer entity in Nigeria is hapless, hopeless, and helpless. The Nigerian consumers are suffering today like never before (Okpighe, 2020). By studying deceptive packaging and customer apathy, FMCG industries can gain insights into best practices for managing product packaging and customers for optimum performance.

Statement of the Problem

Customer is one of the reasons why the FMCG industry and every other industry in Nigeria and the world at large are in operation. The Nigerian consumer market is dominated by FMCG industries chasing the same customers with numerous brands. Over the years, some of these industries have succeeded in gaining market presence, high market share and astonishing profit margins. Recently, consumers' buying patterns and spending behavior on fast-moving consumer goods have changed drastically. They no longer enjoy their shopping experience. More importantly, most of these FMCG industries that had gained customer trust and loyalty over the years are now experiencing an unprecedented decline in patronage and profit margin. The decline in profit margin is becoming a recurring phenomenon in the FMCG sector. It is against this backdrop, that the researcher used deceptive packaging, customer apathy and value loss as a construct to examine the impact of packaging deceptiveness on consumers and FMCG industries in Nigeria.

Research Objectives

The following are the specific objectives of the study:

- i. To examine the relationship between quantity deception and value loss in supply chains of FMCG industries in Nigeria
- ii. To examine the relationship between size deception and value loss in supply chains of FMCG industries in Nigeria
- iii. To examine the relationship between design deception and value loss in supply chains of FMCG industries in Nigeria
- iv. To examine the relationship between customer apathy and value loss in supply chains of FMCG industries in Nigeria

Review of Related Literature

Conceptual Review

Deceptive Packaging in Practice

In Nigeria today, deceptive packaging is a widespread practice in the Fast Moving Consumer Goods (FMCG) industries that involves manipulating the quantity, size and design of products to mislead customers. Nowadays, marketers have become so deceitful in the act of packaging consumer goods that give less for more. FMCG industries continue to lure customers by showing something different than what they're selling, capitalizing on the consumers' trust and ignorance. Over the last few years, we have seen more and more of these swindles being perpetrated by these industries. These strategies can be described as "misleading packaging practices" (Lawrynowicz, 2012). However, the influence of deception on consumers is probably the worst feature of marketing. Customer deception is a shame on the marketing concept, a concept that advocates customer satisfaction. The marketing concept is a concept devoid of deceitful desires to exploit the consumers.

Companies using packaging deceptions to increase sales and earn more, fail to realize that these profits are only in the short term. Owonte (2020) organizations are in business to make a profit, and the only way to sustainable profitability is through sustainable customer satisfaction. Manipulating product quantity, size and design with beautiful package appearance does not attract consumers in the long run. The deceptions only create an impression that makes consumers buy products that are opposed to the real packaging of the products in the short run. Sook-Fern, Cheng-Ling, Kah-Boon and Yong-Hwi (2020) claimed that consumers will be attracted by the outward appearance of packaging that is large but if the item inside is small or low in quantity, the customer will not have a repurchase intention towards the particular product. Marketing deception has a negative influence on the relationship between businesses and consumers (Alqaysi and Zahari, 2022). However, everything about the customer is changing, customer makes unapprised and poor decisions about products and services if marketers don't tell the truth about the brand (KPMG, 2019, LaMarco, 2018).

Quantity Deception

Quantity deception refers to the practice of intentionally misleading customers about the quantity of a product by using terms like "jumbo pack" or "value pack" that suggest a larger quantity. Consumers are subsequently led into thinking that within the manufacturer's packaging, there is a greater quantity of the product. Packaging that is "generally recognizably excessively elaborate about content" is regarded as "deceptive packaging (Weinrich, Overbeck, Zühlendorf, Spiller, 2018). Deceptive practices in product quantity can negatively impact both consumers and businesses. It is unethical when the amount of a product in the package is not consistent with what is stated on it (Alemu and Kuma, 2021). Weinrich et al., (2018) packaging must be designed and filled in such a way that it does not feign larger fill quantities than are contained within it.

In a study, the respondents felt that the large space in the biscuit packaging was inappropriate. This ugly trend in today's marketing practice has become a subject of concern; these approaches tend to waste consumers' hard-earned money and create consumer dissonance after post-purchase behavior. Billions of packages are sent around the world every year and on average, about 40% of these packaging materials are empty spaces that could have been used for a better purpose (Packsize, 2023). Regrettably, consumer packaged goods keep reducing in quantities daily.

Size Deception

Size deception occurs in several ways, one such is the use of deceptive packaging that makes a product appear larger than it is or by using terms like "family size" or "economy size" that suggest a larger product than is provided. The size of a product's packaging has sometimes been misleading or confusing to the consumer about the actual content. Often package size has been increased, and actual product size reduced. Consumers often wonder why their household consumables do not last as long as they did in the past. Frustrating! Consumers feel that the packaging of products in large sizes gives them better value compared with product packaging that comes in small sizes (Sook-Fern et al., 2020). Unfortunately, when customers open a large package, they are often surprised and confused at the low content of the product.

According to Wilkins, Beckenuyte, & Butt (2016), package reduction is the practice of reducing the contents of a package or modifying the packaging to hide the reduced content while maintaining the size and shape of the package. Wilkins et al. (2016) argued that unless the selling price is lower, the small package represents an invisible increase in the product price that consumers do not usually see as a deception. Wilkins et al. (2016) consumers tend not to notice package downsizing at the time of purchase. Most consumers do not read the content information on the packaging, and rely on previous purchase experience. However, when consumers realize a product is downsized they are often disappointed and deceived.

Design Deception

Deceptions in product design refer to the intentional use of misleading design features to deceive customers into believing that a product has certain benefits, using terms like "New improved" or "New bigger size". Deceptions in product design have far-reaching consequences. Consumers are beginning to show concern about the products they buy because of the deceitful nature of contemporary marketers. Lammtks (2002) deceptiveness of packaging manipulated using two authentic package designs for M&Ms. In the early 1980s, M&M/Mars changed their package design to one that includes the true claim, "NEW, LARGER PACKAGE". However, the new package contained fewer M&Ms and the content weight was less than the original, smaller package.

According to Ismail, Yusoff, Isa, Manap, and Mokhtar, (2018), where the claim is false, there is no benefit to anyone except for the errant trader who makes it. False claims distort the market, and where a market is full of such claims, consumers may lose confidence in all traders within the marketplace. Recently, marketers have increasingly become deceitful in designing the packaging of products that give less for more. Nowadays, industries use over-packaging, indented bottoms, slack or under-filling, unnecessary empty spaces, and doubled wall thickness designs to fool consumers. All of these deceitful strategies are bound to trigger customer apathy.

Customer Apathy

Customer apathy is a lack of interest or enthusiasm towards a product or service. A deception of consumer packaged goods is a problem for consumers who may end up paying more than they should for a product that is not worth the price. It has resulted in customer apathy and disrupted business-customer relationships. When customers are apathetic towards a product or service, they are less likely to make repeat purchases, recommend the product to others, or engage with the brand. Ordabayeva (2014) package impressions play a part in consumption patterns, and when consumer impressions do not match expectations, disappointment and

dissatisfaction may not only have an immediate impact on sales and profitability but also lead to longer-term damage to brand credibility.

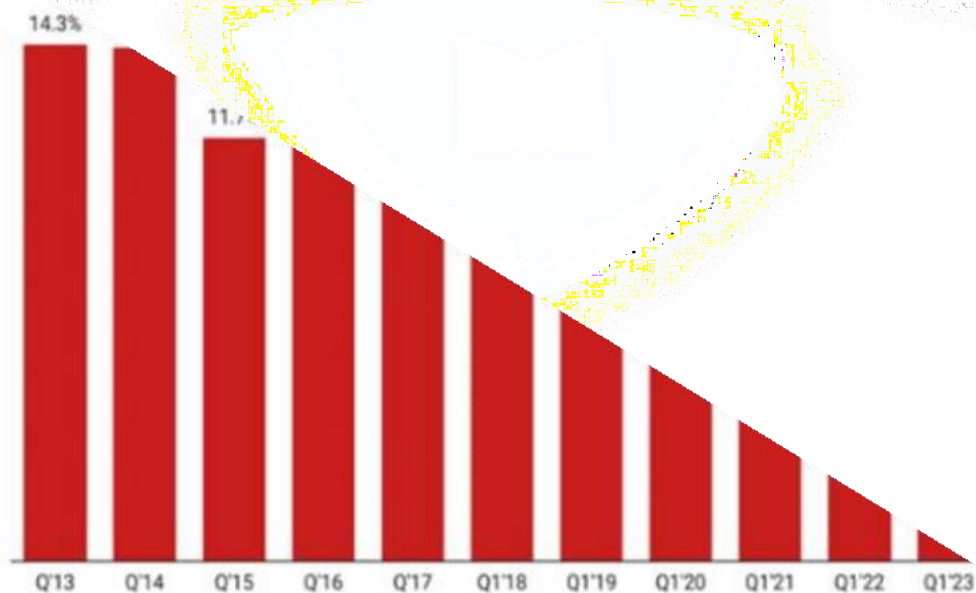
Moreover, when customers start to experience or perceive deceptiveness in the packaging of consumable goods, such businesses start facing value loss within the supply chains. Such business, Alqaysi et al. (2022), will get a terrible status as a deceptive business, which means declining in the future. The impact of consumer apathy on businesses, considering both the short-term and long-term effects is negative. The discovery by a consumer of perceived pack under-fill creates immediate and strong dissonance in the consumer, who might then engage in various negative behaviors that hurt the firm (Wilkins, 2016).

Value Loss in Supply Chains of FMCG

Value loss in the supply chains of Fast Moving Consumer Goods (FMCG) is a concern, especially in Nigeria where deceptive packaging practices are widespread. Understanding the impasse in the supply chain of FMCG is very important. Alqaysi et al. (2022) deceptive marketing practices influence business-customers relationships. Ray cited in Alqaysi et al. (2022) that any business involved in deceptive marketing is not a trustworthy business.

Supply chains are dynamic, complex systems that must be well managed to increase value, both for the customers and the business. Any decreases or lack of motivation on the part of customers as a result of changes in thoughts, moods, or behaviors, such changes affect customer patronage and loyalty. According to Business Day (2023), the profit margin of FMCG firms in Nigeria has hit its lowest level in 10 years.

Fig. 1:



Source: Business Day (2023), FMCG firms' profit margin drops to 10-year low

The current value loss of FCMG firms should be a major concern for marketing managers. The cause of the drop in the profit margin (Fig. 1) was attributed to the cash crunch policy that took place from 2022 into the first quarter of 2023. Besides, MH Magazine WordPress Theme (2024) pinpointed that low consumption is currently reducing the chances of survival and

shrinking the profit margin of companies in the FMCG sector. According to Guardian Newspapers (2024), the FMCG Company listed on the Nigerian Exchange Limited (NGX) declared a N14.54 billion loss in H1 of 2023.

It is germane to know that business firms involved in deceptive marketing practices without being obsessed with what it means and its impact on customers and responses, such firms are bound to experience value loss. Al-Heali (2020) marketers who use deception may achieve the results they aspire to in the short term but pay a price in the long term. Gaber, Labib and Salem (2018) claimed companies that have been engaging in deceptive practices for reasons lack the awareness of the possible damage to the organization's long-term profits.

Empirical Review

A study conducted by Wilkins et al. (2016) titled: Consumers' Behavioral Intentions after Experiencing Deception or Cognitive Dissonance caused by Deceptive Packaging, Package Downsizing, or Slack Filling in the UK, aims to discover the extent to which deceptive packaging and slack filling – which often result from package downsizing – lead to cognitive dissonance, and the extent to which feelings of cognitive dissonance and being deceived lead consumers to engage in negative post-purchase behaviors. The study analyzed respondents' reactions to a series of images of a specific product. The sample consisted of consumers of FMCG products. Five photographs served as the stimulus material. The first picture showed a well-known brand of premium chocolate in its packaging and then four further pictures each showed a plate with a different amount of chocolate on it, which represented different possible levels of package fill. The findings revealed that consumer expectations of pack fill were positively related to consumers' post-purchase dissonance and higher dissonance was negatively related to repurchase intentions and positively related to both intended visible and non-visible negative post-purchase behaviors, such as switching brands and telling friends to avoid the product.

Alemu et al. (2021) conducted a study in Addis Ababa, Ethiopia, titled: Unethical Packaging Practice and its effect on Consumer Perception with a case study of Packaged Foods and Beverages. The essence of the study is to investigate the relationship between unethical packaging practices and consumers' perceptions of packaged food and beverage products. A quantitative research design was applied with a 700 sample size. The data was analyzed using Pearson correlation and SEM having 558 valid data collected from packaged food and beverage consumers in Ethiopia with a special focus on Addis Ababa, Adama and Hawassa cities. The finding reveals that unethical packaging practices and consumer perception are significantly correlated with each other with Pearson value $-.435^{**}$ at $P < 0.001$. This means that the unethical packaging practice has a significant negative relationship with the perception of consumers. The study also identified that consumer's perception of packaged foods and beverages is significantly influenced by unethical packaging practices. The value obtained from the finding is $(\beta = -.467$ at $p < .001)$. It means that an increase in unethical packaging practices will cause a 47 % decrease in consumers' perception of packaged foods and beverages. This is quite a large extent of the impact exerted from the unethical packaging practice on the consumers' perception. Hence, firms should recognize this scenario and needs to be done carefully and ethically to safeguard and get trust from the consumer's side.

Methodology

The study adopted a qualitative research design method. The author relied on secondary sources of data such as journal articles, newspapers, newsletters, online articles, personal experiences

and observations of the authors. Selected consumers of fast-moving consumer goods were interviewed to elicit their opinions on the subject matter.

Conclusion

The study seeks to uncover the effects of deceptive packaging on Nigerian consumers and its boomerang effects on FMCG industries. Consumers are gradually avoiding patronage of deceptively packaged consumer goods, a reason for the drop in profit margin of FMCG industries in H1 of 2023. In conclusion, the FMCG industries lack awareness of the possible damage to its corporate image and profitability by engaging in deceptive packaging practices. When customer apathy increases, the negative consequences become enormous for instance, a decrease in consumer trust, a tarnishing corporate image and a decrease in sales performance. Others are drop in profit margins, experiencing financial constraints, downsizing of workforce and finally, wind up of business. Deceptive packaging of any sort is quite unlawful with consequences. Any organization that fails to desist from this practice will continue to experience low customer patronage and consistent value loss.

Recommendations

Based on the findings, it is crucial to take corrective measures to address the situation to improve customer patronage. On this note, therefore, recommendations are made as follows:

1. FMCG industries should adhere to product packaging standards to maintain customer trust and loyalty.
2. They should re-organize and re-strategize their marketing mix to explore better channels of profit-driven strategies.
3. Government regulatory agencies should educate and ensure FMCG industries comply with packaging regulations.
4. Government regulatory agencies should enforce strict sanctions on any erring FMCG industry.

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EFFECT OF CREDIT USE ON THE ECONOMIC EFFICIENCY OF COCOA SEEDS PROCESSING AND SEEDLINGS PRODUCING ENTREPRENEURS IN SOUTH EAST-NIGERIA

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ABSTRACT

This study examined Effect of Credit Use on the Economic Efficiency of Cocoa Seeds Processing and Seedlings Producing Entrepreneurs in South East-Nigeria. A multi-stage random sampling technique was used in choosing the sample. Primary data collected from 180 seeds and seedlings producing entrepreneurs were used for the study. Data collected were analyzed using descriptive statistics and Z-Test. Findings showed that majority (55.56%) of cocoa seed processing and cocoa seedlings producing entrepreneurs used the informal credit while the remaining (44.44%) cocoa seed processing and cocoa seedlings producing entrepreneurs used the formal credit. The Z-test result showed the mean seeds processing formal credit users and informal credit users to be 0.00408 and 0.00446 respectively, while seedling producing formal and informal credit users to be 0.02727 and 0.07227 respectively. The study recommends that formal institutions should make credit available to cocoa seeds processors and seedlings producers to enable them invest more so as to increase their income which will lead to development of the economy.

KEYWORDS: Cocoa, seeds processors, seedlings producers, credit, formal and informal credit, entrepreneurs.

Introduction

Botanically, cocoa is known as *Theobroma cacao*, which belongs to the Stericulinacea family. The origin of cocoa came from the upper Amazon region of the South America (Afolayan, 2020). Cocoa remains one of the foremost crops in some African countries, contributing significantly to rural employment, foreign exchange earnings and agriculture's Gross Domestic Product (GDP). Cocoa has a very high food value; it contains more than 15 percent protein, 35 percent carbohydrate and 35 percent fat. The largest producers of cocoa in Africa are Ghana, Nigeria and Cote d'Ivoire, the rest of productivity is from South American countries like Ecuador and mainly Brazil. The cocoa crop is traded on worlds' commodity markets (Abayomi, 2022).

For the sustainability and improvement of the cocoa sector, the Government introduced an exceptional programme to improve the cocoa producing entrepreneurs' productivity such as free distribution of cocoa seedlings to the various cocoa producing entrepreneurs, credit

from the Central Bank of Nigeria, and Cocoa Rebirth. The cocoa rebirth programme was mainly designed to create the awareness of the profit capabilities of cocoa, boost the rate of production and industrial processing, draw the attention of the youths into cocoa farming, raise funds for industrial development, and tackle most of the factors accounting for a decline in cocoa production. These factors includes little agricultural mechanization, inadequate credit, disease incidence and use of simple tools (Waliu and Akinmola, 2022). The cocoa sub-sector is characterized with entrepreneurs that major in Cocoa pod production, cocoa seeds processing, seedlings production, licensed marketers and exporters.

Credit is of paramount importance in simulating the adoption of improved farm practices by producing entrepreneurs. It is an important support service for increased agricultural productivity. Credit is required for improvement on the land, for the purchase of fertilizer, seeds and supplies of the payment of wages of labour, the purchase of implements, machinery such as tractor and breeding stock etc (Toriola, Adewale, Lawal, and Aberu, 2022). Credit constitutes the power or key that unlocks latent, talent, abilities, visions and opportunities which in turn acts as the mover of economic development. Credit enables the entrepreneur to train the right caliber of manpower, attract skilled ones where possible and provides them with a conducive environment for optimum performance , adoption of innovations leading to increased productivity and improves efficiency. Credit sources may be categorized into formal and informal (Toriola *et al.*, 2022; Muhammad, 2016).

Economic efficiency requires producing entrepreneurs to use resources in ways to attain the highest possible output given available inputs by using the lowest cost or attaining a maximum revenue through resource combinations based on the relative input prices. An increase in Economic efficiency improves livelihood through food availability, opening markets for higher farm income and encourages trade among value chain actors towards the growth and sustainable development of the economy (Dogba, 2020). According to Popoola *et al.* (2015), cocoa productivity levels can be enhanced by improving efficiency. The older the cocoa trees, the lower the efficiency. Increase in cocoa production in Nigeria has only been achieved by increasing land area and not increasing yield and efficiency. In addition, the lack of funds from the government to young cocoa entrepreneurs reduces the production of cocoa in Nigeria. These challenges have prevented the country from meeting the target set by the International Cocoa Organization (ICCO), and have affected productivity and efficiency (Eze, 2018). Its from these backdrop that the study seeks to examine Effect of Credit Use on the Economic Efficiency of Cocoa Seeds Processing and Seedlings Producing Entrepreneurs in South East-Nigeria.

Methodology

This study was conducted in South-east Nigeria. The South-east zone comprises five states namely: Abia, Anambra, Ebonyi, Enugu and Imo States. The states are within the South-east rainforest zone of Nigeria. The area has a population of 21,955,334 and this comprise of Abia State 3,727,347 people, Imo State 5,408,756 people, Anambra State 5,527,809 people, Enugu state 4,411,119 people while Ebonyi State has 2,880,303 people (NPC, 2019). Imo and Anambra are the most populous states of the zone and have high concentration of economic activities. The zone is located on latitudes 5006'N to 6034'N of the Equator and longitudes 6038'E and 8008'E of the Greenwich (Prime) Meridian. The location of the zone within the tropical rain forest belt gives it the ecological essentials for production of a wide range of tropical agricultural products such as cocoa, rice, yam, oil palm, maize, cassava and vegetables. The population of the study consisted of all cocoa seeds processing and seedlings producing

entrepreneurs in Abia state, Imo State and Ebonyi State. Multi-stage and purposive sampling technique was employed in the selection of cocoa seed processing and seedlings producing entrepreneurs in the study. Firstly, three States out of the five States in Southeast Nigeria was purposively selected. The selected States are Abia, Imo and Ebonyi State. These states was chosen based on their high-level activities on cocoa seed processing and seedlings producing activities. Secondly, two agricultural zones per state was randomly selected based on their intensity on cocoa seed processing and seedlings producing activities. Thirdly, two Local government areas was randomly selected from each of the agricultural zone. In the fourth stage, three communities was selected randomly from each Local Government Area giving a total of 36 communities. Finally, five entrepreneurs was randomly selected from the entire thirty six (36) communities making it a total of 180 respondents for this study. Primary data was used in this investigation. The data for this study was acquired by the administration of a questionnaire, observation and an oral interview. The instrument was validated prior to delivery, and item statements were checked to ensure that the respondents addressed the study objective, questions, and the appropriateness of the constructs employed in the questionnaire. The study's data was analyzed using descriptive statistics and Z- Test.

Results and Discussion

Categories of credit use by cocoa seeds processing and cocoa seedlings entrepreneurs

As shown in the Table 1, majority (55.56%) of cocoa seed processing and cocoa seedlings producing entrepreneurs (accounting for about 100 entrepreneurs) used the informal credit while the remaining (44.44%) cocoa seed processing and cocoa seedlings producing entrepreneurs (accounting for about 80 entrepreneurs) used the formal credit. The result is in line with the findings of John and Charlse (2015), who reported that majority (87.77%) of credit users used informal credit source while (12.23%) of credit users used formal credit source. This could be as a result of lack of collateral and delay in loan approval/ disbursement from the formal credit sources.

Z-test analysis of difference seedlings and seeds entrepreneurs using formal and informal credit sources

Findings in Table 2 showed a mean seeds processing formal credit users and informal credit users to be 0.00408 and 0.00446 respectively, while seedling producing formal and informal credit users to be 0.02727 and 0.07227 respectively. The result therefore entails that there is a significant difference in the mean seeds processing formal credit users and informal credit users, also in the mean seedlings producing formal and informal credit users.

Z-test analysis of difference in mean seeds processing entrepreneurs using formal and informal is statistically significant at 1% level implying credit use had an effect on economic efficiency of seeds processing entrepreneurs. While Z-test analysis of difference in mean seedlings producing entrepreneurs using formal and informal is not statistically significant implying credit use had no an effect on economic efficiency of seedlings producing entrepreneurs. This probably may be due seedlings production do not require much start- up capital.

Conclusion

Cocoa is one of the most important cash crops that play a vital role in uplifting the country's' economy. Cocoa contributes significantly to rural employment, foreign exchange earnings and agriculture's Gross Domestic Product (GDP). Credit increases the output of an enterprise significantly, hence help the producing entrepreneurs towards accumulating

wealth to invest in production. Formal credit is needed by entrepreneurs in other to invest more thereby increasing productivity.

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Table 1: Categories of credit use by cocoa seeds processing and cocoa seedlings entrepreneurs

Credit use	Frequency	Percentage
Formal	80	44.44
Informal	100	55.56
Total	180	100

Source: Field survey, 2022

Table 2: Paired sample statistic

	Mean	N	Std. Deviation	Std. Error Mean
Seeds Processing formal	.6488	60	.03160	.00408
Seeds Processing informal	.6071	60	.03455	.00446
Seedlings producing formal	.7588	60	.21121	.02727
Seeds producing informal	.8494	60	.55978	.07227

Source: Field survey, 2022

Table 3: Z-test analysis of difference seedlings and seeds entrepreneurs using formal and informal credit sources

	Mean	Std. Deviation	Std. Error Mean	T	Df	Sig.
Seeds form and infor	.04168	.04661	.00602	6.928	59	.000
Seedlings form and infor	-.09062	.62554	.08076	-1.122	59	.266

Source: Field survey, 2022



ENVIRONMENTAL IMPACT OF PETROL FILLING STATIONS ON WATER QUALITY FOR URBAN MINNA, NIGER STATE, NIGERIA

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ABSTRACT

This study is aimed at assessing the impact of Petrol Filling stations on water quality for urban Minna. The research adopted field survey and Geographic Information System (GIS) to identify the spatial pattern of the location of Filling Stations and their proximity to the vulnerable well water sources. The research identified 78 petroleum Filling Stations and thirty different hand dug wells, but ten different wells were randomly chosen and their water samples were compared. The parameters, such as water temperature, Total dissolved solid, pH, conductivity and Total petroleum hydrocarbon (TPH) were analysed. The selection of parameters and the determination of Maximum allowable limit were conducted by taking into consideration the WHO Standards for drinking water quality. In this study, Total petroleum hydrocarbon (TPH) concentration affects different aspects of the water quality. It can be concluded that eight (8) hand dug well water sources out of the ten (10) show the presence of Total Petroleum Hydrocarbons (TPH). Only one well (Well 5) with 4.8 TPH concentrations was within the permissible limit of 5.0 mg/l. The study further revealed that all the sample well water have their water temperature above the WHO requirement for water quality, the well with the least temperature is well number 5 which has a temperature of 28.3^o and the highest are wells number 1 and 3 with water temperature of 29.7^o respectively. The study indicates that none of the pH of well water samples exceed WHO Standard for drinking water quality of 8.5, the least is Well 1 with pH of 6.12 and the highest were well 3 with 8.14. It was also discovered that total dissolved solid; well 1 (638.5 ppm), Well 2 (686.8 ppm), well 3 (913.9 ppm) respectively have their limit above WHO. The findings show that well 3 has the highest concentration of conductivity with 1364 followed by well 2 with 1025. The study recommends wells used for domestic purposes should be sited far away from Petrol stations so as to reduce the number of Hydrocarbons that may get into the underground water sources and in unavoidable cases, water treatment should be embraced.

KEYWORDS: Filling Stations; water quality, Physicochemical Parameters, Spatial distribution, Total Petroleum Hydrocarbons (TPH).

Introduction

Newly established petroleum filling stations have been constructed within residential areas, commercial places and some water catchment areas vital for water filtering and purification thus, posing environmental problems and provoking public (Adedayo & Abdullahi, 2017). Petroleum filling Stations generally ought to be located at the periphery of cities and towns; however, with the passage of time, the residential and commercial areas study get surrounded by these petrol filling stations Akinsulire and Fadare (2020). A drive through major roads and within Minna city indicate that the Department of Petroleum Resources (DPR) does not comply with its own statutory requirements of the regulations and guidelines in the establishment of Petroleum filling stations in Minna, (Adedayo & Abdullahi 2017). This study mainly focused on the evaluation of water quality parameters of well water sources close to petrol filling Stations in some parts of Minna metropolis. The study covers Minna township, from Minna city gate along Minna – Paiko road, through Bosso road to Maikunkele City gate and also from Maitumbi, through the Eastern and Western bye pass. These areas were chosen because most of these vulnerable wells are within the premises of these Filling Stations.

However, there are relevant research done by various scholars on Petroleum Filling Stations and their Impact on the environment both local and international. Peprah (2018) investigated the level of compliance to standards set by the Ministry of Energy, and Town and Country Planning Department on existing oil and gas station in Tarkwa Ghana, using multi-criteria decision analysis and GIS approach. (Mshelia *et al.*, 2015) Assessed environmental effects of Petrol Stations at Close Proximities to residential buildings in Maiduguri and Jere, Borno State Nigeria. (Odekunle *et al.*, 2019; Yisa *et al.*, 2019), in their studies analysed the impacts of petroleum Filling Stations in Minna Metropolis using global position system (GPS) to determine their spatial locations, but their studies reported violations of the spatial regulations of the department of petroleum resources (DPR) and Urban planning standards.

All these studies reported violations of the spatial regulations of the department of petroleum resources (DPR) and Urban planning standards, their efforts were much concentrated on the spatial pattern and the possible hazards associated with their locations on built-up areas and nothing on ground water vulnerability. It is therefore against this background that the study fills this research gap by examining the spatial pattern of these petrol stations and the associated water. However, The specific objectives of the study are to: i. Examine the distribution of petrol retail stations within Minna; Analyse the physiochemical properties of water source samples to ascertain the effect of petrol Filling Stations; and Compare results with World Health Organisation Standard for drinking water specifications.

Literature Review

Literature on locations of Filling Stations or its synonymous names, petrol Filling Station, Fuel Station, gas Station, petroleum outlet are virtually scanty (Thomas *et al.*, 2016). What prevails in the global literature is the paucity of research documentation on the technological remediation of service sites closures due to the environmental risks associated with both soil and underground water pollution (Thomas *et al.*, 2016).

Rana & Garg (2014) noted that location of petrol Fuel Stations is a very significant issue and needs to consider impact of various relevant parameters such as distance, population and access time on a location. Zambia Bureau of Standards (2015), further reiterated that location of Filling Stations shall be approved by the Energy Regulation Board in accordance with the provisions of the Energy Regulation Act, Cap 436 of the Laws of Zambia. In addition, the size of the land to be dedicated to the fuelling facility shall be sufficient enough to allow

manoeuvring of vehicles within its premises and shall not be less than 1600 meter squared with a minimum frontage of 40 meters on the primary street.

Sneha *et al.* (2016) Pointed out that water quality is directly related to the physical, chemical, biological and radiological property of water and these properties of water are affected because of the pollution of water due to various human activities. According to Sneha investigation water bodies changes the standard quantity of parameters in water.

Similarly, Pawan & Pradeep (2015) carried out a study and collected water samples from 12 different sampling stations to evaluate water quality status of river Narmada, a total of 16 water quality samples were determined, minimum and maximum value of air temperature, water temperature, turbidity, pH, electrical conductivity, total dissolved solids, free carbon dioxide, total alkalinity, chloride, total hardens, Calcium Hardness dissolved oxygen, nitrate, orthophosphate, biochemical oxygen demand and chemical oxygen demand were noted from the study.

Dipankar *et al.* (2019) further investigated drinking water quality in some parts of Perak state, Malaysia, in this aspect of study a detailed physiochemical analysis of drinking water samples was conducted in different residential and commercial areas of the state.

Smutko *et al.* (2012) observed that ground water is vulnerable to contamination from numerous anthropogenic activities and these anthropogenic activities are controlled by the influence of man.

Materials and Methods

This research is designed to determine and analyse the vulnerability of residents living on water source within proximity to Filling Stations in Minna, Niger State Nigeria. In this study, GIS was used to examine spatial relations between water wells, their recharge zones, and the potential sources of groundwater contamination. The primary data employed in this research was collected directly from the field, that is, geographical coordinates of petroleum Filling Stations as well as the coordinate points of groundwater sources were obtained with the aid of a Garmin™ Etrex handheld Global Positioning System (GPS) receiver of 4.5m accuracy. For the purpose of this research work secondary were obtained through the following means; Journals, articles, conference proceedings. Purposive sampling was used to select seventy-eight (78) fuel station, selection was based on their close proximity to residential neighbourhoods especially those that falls within the criteria set, that is 50 meters proximity to the filling station. Water samples were collected in 500ml plastic bottles, the samples were labelled Well 1 to Well 10 and stored in ice chest prior to taking them to the laboratory. The sample frame for the study area is the total number of petroleum Filling Station within Minna town ship, the area coverage is estimated to have 78 petroleum Filling Stations and 30 hand dug wells which therefore form my sample frame. Sample points for this study include, Well 1. Bosso-mechanic junction, Well 2. Beger junction-Zungeru road, Well 3. Angwan Daji, Well 4. Saiko road, Well 5. Nnamdi Azikwe Western bypass, Well 6 Eastern bypasses, Well 7. Tunga, Well 8. sheroro, Well 9, Maitunbi, Well 10 Kpakungu, and Niger state Urban Development in charge of Development control activities in Minna metropolis

Results and Discussion

Distributional Pattern of the Petrol Filling Stations within Minna town

Out of 78 Filling Stations 36 were sampled for study making it 6 per stratified locations. However, the petrol stations are not equally distributed between the roads as can be observed

from figure 1. Nmamdi Azikwe road has the highest number of stations (21) followed by Bida road with (17), Bosso Road (15), Maitunbi-Eastern bypass (11), and Sheroro road, western bye pass each (14) respectively, these roads account for more than 70% of the Filling stations in the Study area.

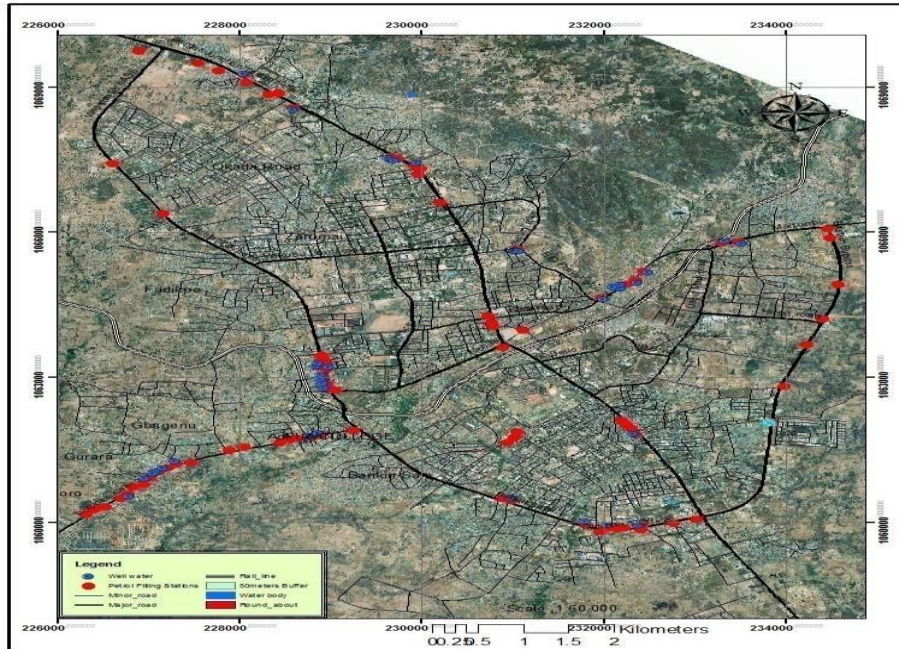


Figure1: Spatial location of Petroleum Filling Stations in Minna Township.

Proximity of well water sources to location of petroleum Filling stations

The study identified a total of 30 different domestic well water sources within the proximity of less than 50meters to petroleum Filling Stations in Minna. Most of the wells identified were within the premises of the petroleum Filling Station and the wells were made available for domestic uses by residents around the Filling Stations.

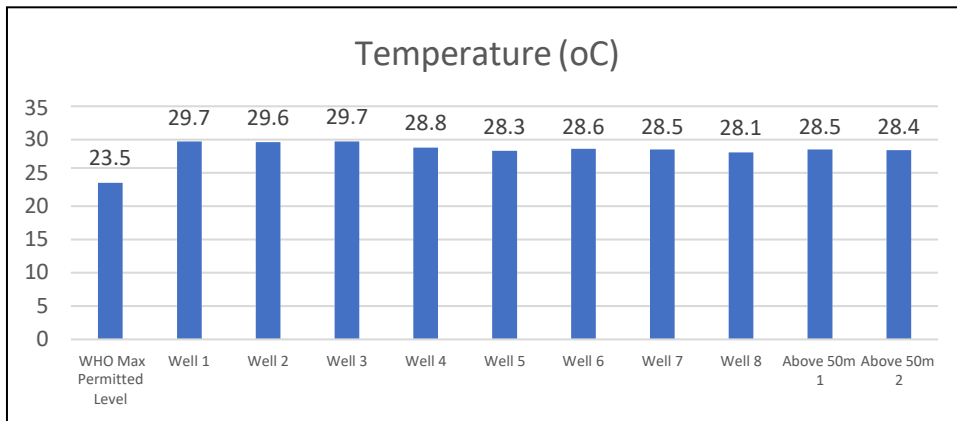


Figure 4: Level of Temperature of Sampled Well water in the study area.

pH level of acidity and alkalinity of well water sampled

The normal drinking water pH range mentioned by WHO and National standards for drinking water guidelines is between 6.5 – 8.0 (Qureshi *et al.*, 2021). Ojo *et al.* (2012) vigorously pointed out that pH influences the taste and odour of a substance significantly and especially when it controls the equilibrium concentration of the neutral and ionized forms of a substance in solution. A change in the pH can bring about a change in the forms of some chemicals in the water (Omer, 2020). Figure 5 shows that none of the well water sample is above the WHO standard of 8.5, the least in pH is Well 1 (located at Berger Junction, Zungeru road) with a pH of 6.12 and the highest was well 3 (located at Saiko road) with 8.14. Water with pH lower than 5.0 causes problem due to corrosion because many metals become more soluble in low pH water. A pH value of higher than 8.5 indicates that a significant amount of sodium bicarbonate will be present in the water.

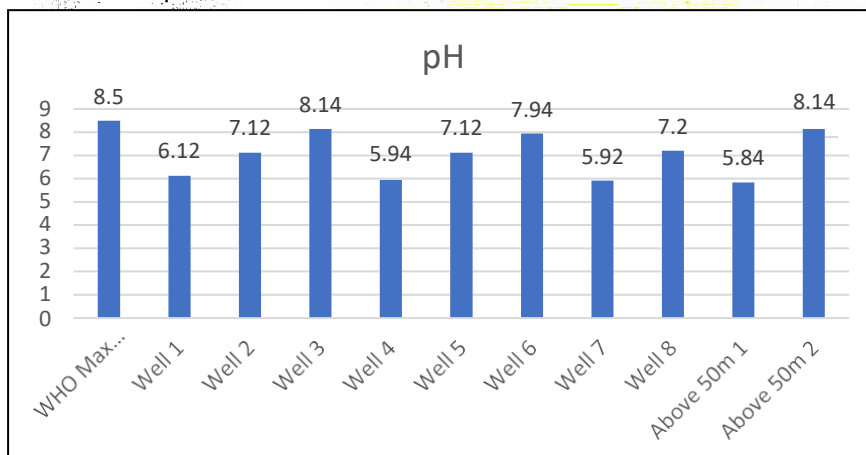


Figure 5: Level of pH in Sampled Well water in the study area.

Total dissolved solid (TDS)

Total dissolved solids are the term used to describe the inorganic salts and small amount of organic matter present in solution of water, although not a direct evidence of biodegradation. Permissive level value of less than 500 ppm (mg/L) and up to 1,000 ppm (mg/L) can be tolerated (WHO, 2008). Figure 5 shows the samples that have high concentration of total dissolved solid; well 1 (located at Berger Junction, Zungeru road) has 638.5 ppm, well 2 (also located at Berger Junction, Zungeru road) has 686.8 ppm, well 3 (located at Saiko road) has 913.9 ppm respectively which are the major well water samples. TDS have the tendency to absorb heat from the sun thereby raising the temperature and increasing the turbidity of water.

Since all these are within 500 ppm (mg/L) and 1,000 ppm (mg/L) they can be tolerated with little health effects.

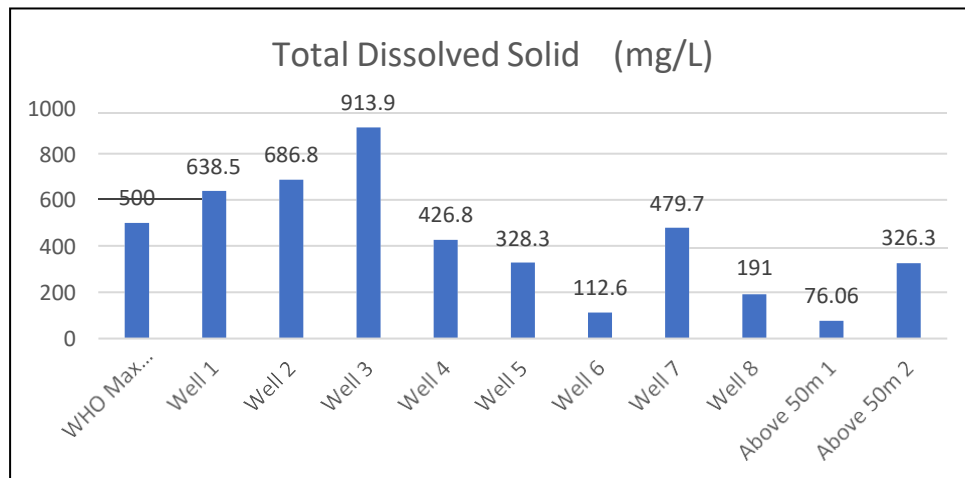


Figure 6: Level of TDS in Sampled Well water in the study

Conductivity Concentration

Electrical Conductivity can be described as a measure of the ability of water to pass an electric current which is affected by the presence of inorganic dissolved solids (Rahmanian *et al.*, 2015). The Conductivity concentration as recommended by WHO Standard in domestic water is 1000mg. Figure 7 shows well 3 that is located at Saiko road has the highest concentration of conductivity with 1364mg followed by well 2 (located at Berger Junction, Zungeru road) with 1025mg. The least well with conductivity concentration is well 6 (located at Nnamdi Azikiwe road) with 168 mg. the findings shows that well 2 and well 3 has conductivity above the WHO limit, while other sampled wells have the limit recommended standard.

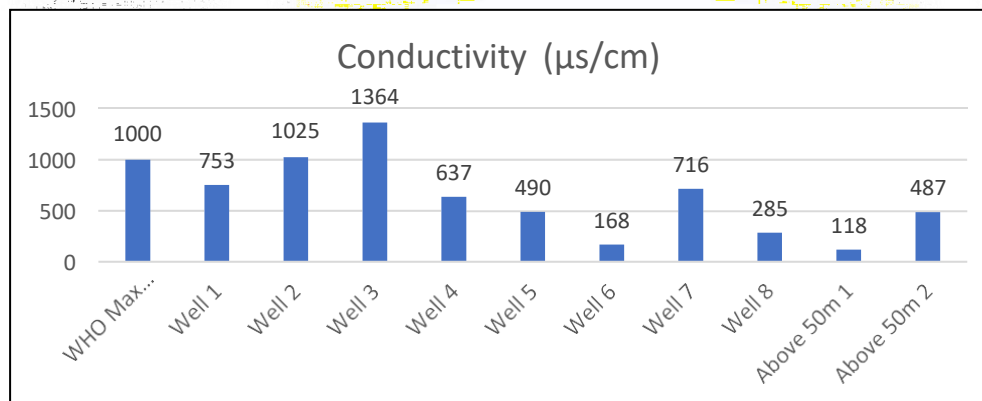


Figure 7: Level of conductivity in Sampled Well in the study area.

Total petroleum hydrocarbon (TPH)

The permissible limit for Total Petroleum Hydrocarbon (TPH) concentration for drinking water is 5.0 mg/l; Figure 8 shows all the sampled well water were above WHO permitted limit level of drinking water, it was discovered that the highest mean concentration of TPH was 8.2 mg/l recorded at Well 6 (located at Nnamdi Azikiwe road), followed by 7.1 at well 1, (located at Berger Junction, Zungeru road). The least was well 5 (located at Bosso, Zungeru road) with 4.8mg/l. The two sampled wells were above the 50meter setback and did not show the present of Total Petroleum Hydrocarbon. This analysis showed evidence of contamination of underground water due to the operation of petroleum Filling Stations in the study area.

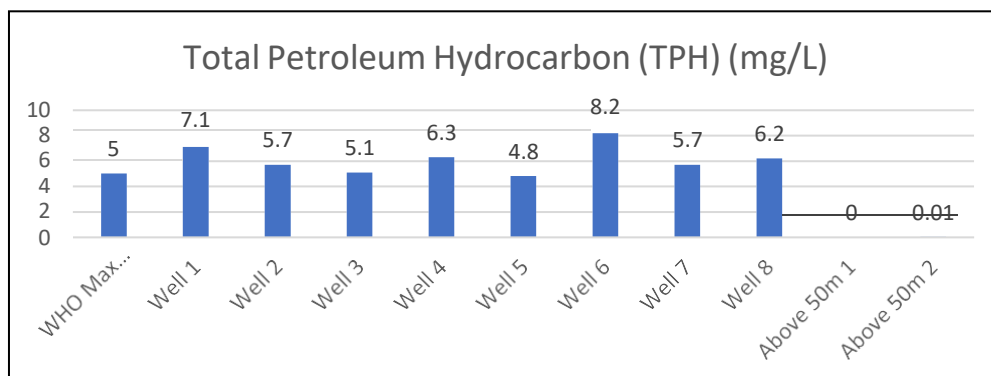


Figure 8: Level of TPH in Sampled Wells in the study area.

PARAMETER	WHO Max Permitted Level	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7	Well 8	Above 50m 1	Above 50m 2
Temperature (°C)	23.5	29.7	29.6	29.7	28.8	28.3	28.6	28.5	28.1	28.5	28.4
Conductivity (µs/cm)	1000	753	1025	1364	637	490	168	716	285	118	487
Total Dissolved Solid (mg/L)	500	638.5	686.8	913.9	426.8	328.3	112.6	479.7	191	76.06	326.3
Ph	8.5	6.12	7.12	8.14	5.94	7.12	7.94	5.92	7.2	5.84	8.14
Total Petroleum Hydrocarbon (TPH) (mg/L)	5.0	7.1	5.7	5.1	6.3	4.8	8.2	5.7	6.2	0	0.01

Table 1: Results of Physicochemical analysis

Comparising of results with WHO standards for drinking water.

The results obtained were compared with the World Health Organization (WHO) standard for drinking water quality. Table 1, revealed that all the sample well water has their water temperature above the WHO Standard's requirement. The well with least temperature is well number 5 which has a temperature of 28.3 °C and the highest are wells number 1 and 3 with water temperature of 29.7 °C respectively, this indicate that all of the well water sampled Temperature were above the WHO standard for drinking water quality. Also, the pH Study confirmed that all the water samples are in slight acidic range, I can say near about neutral, well 1 with pH of 6.12 and the highest were well 3 with pH of 8.14 and 7.94. It was also discovered that total dissolved solid; well 1(638.5 ppm), Well 2(686.8 ppm), well 3 (913.9 ppm) respectively which are majorly samples from well. Whereas, conductivity of Tested water was higher in well 3, with conductivity of 1364(µs/cm) followed by well 2 with 1025(µs/cm). However, the disparity in water temperature from WHO standard does not make the water to be unfit for drinking but will require purification. The results of the well water temperature analysed indicated that water temperature range between 28.3°C across the study location, there by exceed the WHO and National standard for water quality of 23.5°C.

The study showed that Total Petroleum Hydrocarbon is present in all the sampled well except for the two (2) sampled wells that were above 50 meters proximity to the petroleum Filling Stations.

Conclusion

In Conclusion, this study has analysed various Physicochemical Properties of water samples Collected from 10 major water sources and also presented the levels of physicochemical parameters such as Temperature, pH, Conductivity, Total dissolved solids (TDS) and Total Petroleum Hydrocarbons (TPH) contents in the wells.

Recommendations

The outcome of this study raises issues of public health and safety; therefore, the following recommendations are made.

1. Wells used for domestic purposes should be cited far away from Petrol retail stations so as to reduce the number of Hydrocarbons that may get into the underground water sources and in unavoidable cases, water treatment should be embraced.
2. Continue monitoring and enforcement of extant laws regarding petroleum Filling Station's location should be pursued.
3. Further study should consider additional water quality parameters such as heavy metal sand and their source, Turbidity, Velocity, Odour and Taste.

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KINETIC MODELS FOR SORPTION ISOTHERMS: A REVIEW

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ABSTRACT

Sorption isotherms describe the relationship between moisture content and water activity in food, fruits and other materials. This review presents the kinetic models which are often applied to describe the sorption isotherms from experimentally generated data with emphasis on food and fruits which are often used as adsorbents. This is expected to provide necessary information about the most commonly used kinetic models and provide the reasons for their experimental applications. Parameters in adsorption kinetics provide information on adsorption capacity of adsorbent. Nine models were considered; these were Brunauer-Emmet-Teller (BET), Hasley, Smith, Henderson, Oswin, Guggenheim-Anderson-de Boer (GAB), Lagmuir, Iglesias-Chrife and Peleg models. It was observed that the most commonly used models in food and fruits are Brunauer-Emmet-Teller (BET) and Guggenheim-Anderson-de Boer (GAB). The success of the Brunauer-Emmet-Teller (BET) model is rather qualitative, considering that almost all cases are linear only in a limited rank of water activity from 0.05 to 0.45, as its main applicability is the estimation of surface areas. The use of Guggenheim-Anderson-de Boer (GAB) model is generalized by its theoretical bases, mathematical simplicity and ease in interpretation; but it is not frequently used when the water activity is greater than 0.93 which forms the basis for its modification.

KEYWORDS: Sorption, Isotherms, Kinetics, Models, Water Activity, Guggenheim-Anderson-de Boer (GAB)

1.1 Background of Study

Adsorption is a mass transfer process where attractive forces associate an adsorbate (liquid or solid) to the surface of an adsorbent until equilibrium in the concentration of the adsorbate is attained and no further net adsorption occurs. It could also be defined as the formation of layer of adsorbate on the surface of an adsorbent by the attraction of Van der Waals' forces. The process involves the accumulation of adsorbate at an interface relative to its concentration in the bulk solution (Hu and Xu, 2020). The adsorbent used for adsorption consists of porous medium with a high surface area (Yousef et al., 2020). According to Da browsk (2001), adsorption of solute onto adsorbent takes the following stages: diffusion of molecules from the bulk phase towards the interface space (external diffusion); diffusion of molecules inside the pores (internal diffusion); diffusion of molecules in the surface phase (surface diffusion); and adsorption- desorption elementary processes.

This phenomenon could be physical (physisorption) or chemical (chemisorption). Physical adsorption is a result of weak, short range electrostatic attractive forces arising from dipole moment (Van der Waals); and chemisorption involves bond formation between the adsorbate and the adsorbent. It is important not to confuse adsorption with absorption. While adsorption is the attraction and/or bonding on the surface of adsorbent, absorption is the process by which solute is taken across a membrane or taken up into a structure. Adsorption technology has been widely applied in water and wastewater treatment due to its low cost and high efficiency, it is one of the most effective means of removing contaminants from solutions, separating components from each other and determining the shelf life of food and fruits alike.

Adsorption isotherms are useful in describing the interaction between adsorbate and adsorbent. They play important roles in determining the optimum adsorption capacity of adsorbent and indicate how efficient an adsorbent can adsorb, and also allows an estimation of the validity of adsorbent's application (Prasat et al., 2014). Isotherms also represent the amount of adsorbate that binds on the surface of adsorbent depending on the material available in the solution and are important requirements in designing a system for adsorption.

The food sorption isotherm describes the thermodynamic relationship between water activity and the equilibrium of moisture content at constant temperature and pressure. They are necessary for modeling the drying process, design and optimization of drying equipment, predicting shelf-life stability, calculating moisture changes which may occur during storage and in selecting appropriate packaging material. Also, sorption data are essentially useful in predicting microbiological, enzymatic and chemical stability of food materials. Sorption isotherms are usually classified according to their shape in five different types. The sorption isotherms for most foods and fruits are nonlinear and generally with sigmoid shape (Ricardo et al., 2011).

The adsorption kinetic models have been used to evaluate the performance of the adsorbent and to investigate the adsorption mass transfer mechanisms. Aiming to mathematically express the relationship between the water activity of food and its moisture content, diverse kinetic models have been developed such as nonlinear and linear regression models, constituted in their parameters by two, three, four and more partial regression coefficients, which explain each one of the three zones that the isotherm of sorption conforms. In many cases, the model that is suitable for certain food product is not suitable for a different one, what is more, the model only exhibits a suitable predictive ability for certain moisture activity ranges.

Several mathematical models have been proposed to describe sorption isotherms. Some of them were developed with a theoretical basis to describe adsorption mechanisms (Al-Muhtaseb et al., 2004; Brunauer et al., 1938); whereas the others are just empirical or a simplification of more elaborate models. In some ranges of water activity, sorption isotherms can be approximated to linear equations (Yan et al., 2008).

In this review, the kinetic models for sorption isotherms are discussed with emphasis on food and fruits. This is expected to provide necessary information about the most commonly used kinetic models and provide the reasons for their experimental applications.

REVIEW OF RELATED LITERATURE

2.1 Water Activity

Water is the main component of many food products and the storage stability of products depend upon the interaction of water with other components present in the product. The status of water in product plays a crucial role in the preservation of biological materials in both the raw and processed state. The simplest way of expressing such a status is the concept of water activity. Specific changes in colour, aroma, flavour, texture, stability, and acceptability of raw and processed food have been associated with relatively narrow water activity ranges (Labuza, 1975).

Water activity (a_w) is an important tool to predict available water in foods and the physical state of solid foods (Roos, 1995). is considered as one of the most important parameters in food preservation and processing, thus several food preservation techniques rely on lowering the water activity so as to reduce the rates of microbial growth and chemical reactions. Water activity and sorption behaviour are two powerful concepts available for understanding and controlling shelf life of foods (Labuza, 1968).

Water activity is a physical measure of active water available in foods. Thus, it is the state of water rather than the total water content, which is important as far as microbial proliferation is concerned. It has been observed that the state of water is related to the vapor pressure of food. The greater the proportion of free water present, the greater the vapor pressure and vice versa. Increased bound water reduces vapor pressure (Sahu and Das, 2010; Sawhney *et al.*, 1991; Scott, 1957).

The definition of water activity is based on the chemical potential of water within a food system, which at equilibrium must be same as the chemical potential of water in the surrounding of the food. Hence, water activity can be defined as the ratio of the vapour pressure of water in food to the vapour pressure of pure water at the same temperature and pressure conditions (Labuza, 1968). At equilibrium, the water activity is related to the relative humidity of the surrounding atmosphere which as shown in Equation 2.1.

$$a_w = \frac{P}{P_o} = \frac{ERH}{100} \quad \text{Equation 2.1}$$

where P is Vapor pressure of water in food material at any given temperature; P_o is vapor pressure of pure water at that temperature and ERH is Equilibrium relative humidity.

Thus, the water activity of food equals the relative humidity of the air above it divided by 100, which means that an equilibrium has been reached, constituting a form of measurement of the water amount available in food for a reaction series of biochemical and microbiological nature.

Due to its direct impact on product stability and quality, water activity is considered as one of the most significant intrinsic variables used to forecast the growth of microorganisms in food.

2.2 Equilibrium Moisture Content (EMC)

Every food exerts a characteristic vapor pressure at a certain temperature and moisture content. All porous food materials, when in contact with moist air, adsorb or desorb water molecules to attain equilibrium moisture content. This equilibrium moisture content depends very strongly on the partial pressure of the water vapor in the surrounding air and rather weakly

on the air temperature that are commonly experienced in drying and storage of foods. If the moisture content of the food material does not vary with time for a given combination of water vapor pressure and air temperature, it is then said that it has reached the equilibrium moisture content (EMC) of the material at that water vapor pressure and temperature. When left undisturbed, the natural end of any adsorption or desorption process is the attainment of EMC. This, though a natural process, is often very slow. Food materials may take several days or weeks to reach equilibrium.

2.3 Moisture Sorption Isotherms

At equilibrium, the relationship between water content and equilibrium relative humidity of a material can be displayed graphically by a curve as shown in Figure 2.1 which is called the moisture sorption isotherm (Al-Muhtaseb *et al.*, 2002).

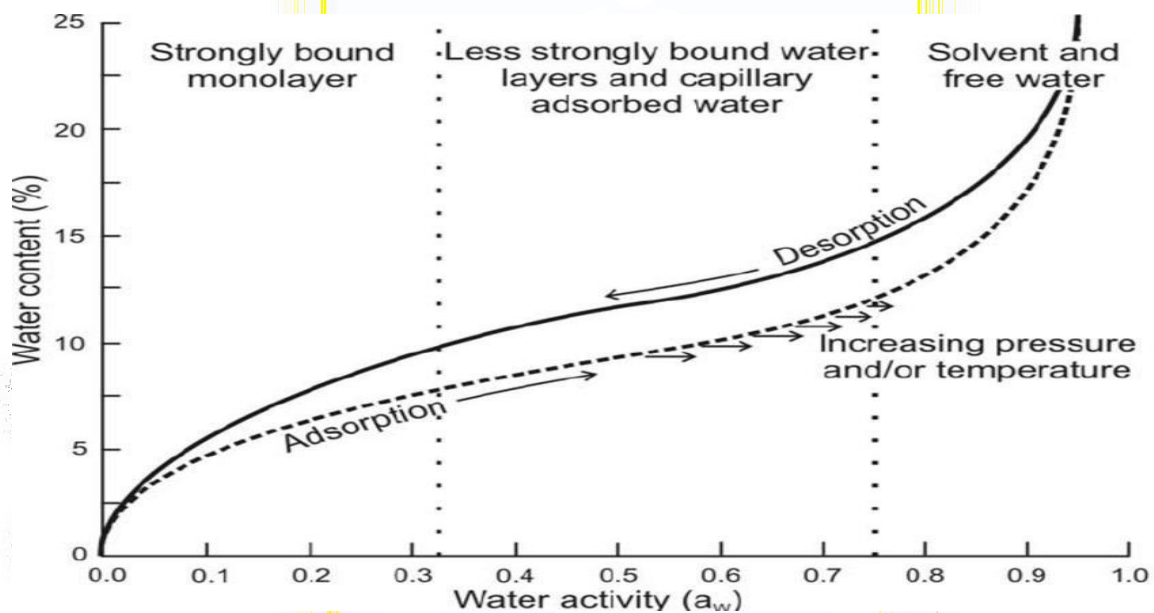


Figure 2.1: A schematic representation of a sorption isotherm with a hysteresis between the adsorption and desorption isotherms.

Source: Sari (2005).

The moisture sorption isotherms show the equilibrium amount of water sorbed onto a solid as a function of steady state vapour pressure at a constant temperature (Roos, 1995; Bell and Labuza, 2000). There are many empirical equations that attempt to describe this behaviour, but the water sorption properties at various relative humidities should be experimentally determined for each material. The general shape of the isotherm, specific surface area of the sample, reversibility of moisture uptake, presence and shape of a hysteresis loop provide information on the manner of interaction of the solid with water (Swaminathan and Kildsig, 2001). Knowledge of water sorption properties is important in predicting the physical state of materials at various conditions, because most structural transformations and phase transitions are significantly affected by water (Roos, 1995).

A lot of models for moisture sorption isotherms can be found in the literature (Van den Berg and Bruin, 1981). Langmuir (1917) developed an equation based on the theory that the molecules of gas are adsorbed on the active sites of the solid to form a layer one molecule thick (monolayer). The Brunauer-Emmett-Teller (BET) sorption model (Brunauer *et al.*, 1938) is often used in modelling water sorption of pharmaceutical material and particularly to obtain the monolayer value. Monolayer value expresses the amount of water that is sufficient to form

a layer of water molecules of the thickness of one molecule on the adsorbing surface (Bell and Labuza, 2000; Roos, 1995). The BET monolayer value has been said to be optimal water content for stability of low-moisture materials (Labuza, 1980; Roos, 1995). The BET equation was developed based on the fact that sorption occurs in two distinct thermodynamic states; a tightly bound portion and multi-layers having the properties of bulk free water (Zografí and Kontny, 1986).

Generally, food when kept in different relative humidity adsorbs or desorbs moisture depending on their water activity (Kapsalis, 1987). This isotherm curve can be expressed in two ways; adsorption or desorption. The adsorption and desorption processes are not fully reversible; therefore, a distinction can be made between the isotherms by determining whether the moisture levels within the product are increasing or decreasing. Brunauer *et al.* (1940) described five types of isotherms as can be seen in Figure 2.2. Type-I is the well-known Langmuir isotherm, obtained assuming monomolecular adsorption of gas by the porous solids in a finite volume of voids. Type-II is the sigmoid isotherm obtained for soluble products, which exhibits asymptotic trend as water activity approaches to one. Type-III, known as the Flory-Huggins isotherm, accounts for crystalline substance. Type-IV isotherm describes adsorption by a swellable hydrophilic solid until a maximum of hydration sites are reached. Type-V is the BET multilayer adsorption isotherm, observed for adsorption of water vapor on charcoal. Most food products generally show type-II isotherms having a sigmoid shape (Iglesias and Chirife, 1976a).

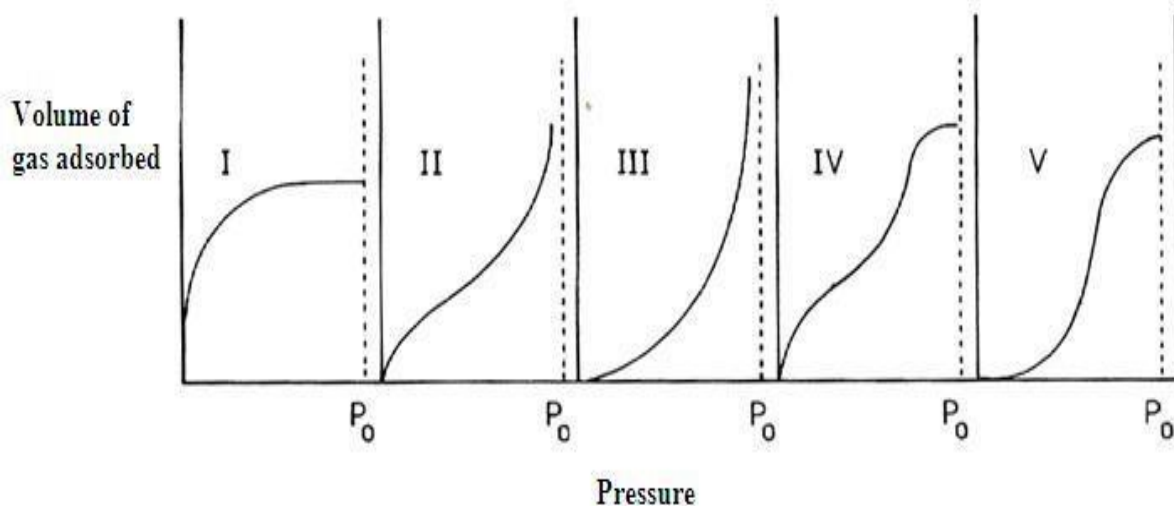


Figure 2.2: Types of adsorption isotherm according to Brunauer classification
Source: Mahuya, (Online).

2.3.1 Importance of Sorption Isotherm

Water sorption isotherms illustrate the steady-state amount of water held by the food solids as a function of a_w at constant temperature (Labuza, 1968). Thus, the moisture sorption isotherm is an extremely valuable tool for food scientists since it can be used to predict which reactions will decrease stability at a given moisture; it allows for ingredient selection to change the a_w to increase stability and can be used to predict moisture gain or loss in a package with known moisture permeability (Bell and Labuza, 2000). Water sorption isotherms in foods are of special interest in many aspects of food storage, drying, preservation by dehydration, especially for the prediction of the shelf life of a dried product in a packaging material or the prediction of drying times of foodstuffs (Iglesias and Chirife, 1976b).

The monolayer moisture content of a food product is an effective method of estimating the amount of bound water to specific polar sites in dehydrated food system and at this moisture product seemed to be stable against microbial deterioration (Rahman and Labuza, 1999). It helps in mixing operations and development of a new product formulation, determination of enthalpy of sorption and desorption of water at two different temperatures, determines critical water activity or moisture content limits for crispness, hardness, and flow properties optimize moisture contents at a safe water activity that maximizes moisture and avoids over drying. Also allow rapid moisture content determination from water activity analysis through isotherm curve (Bell and Labuza, 2000).

2.4 Measurement of Sorption Isotherms

Many methods are available for determining water sorption isotherms (Gal, 1981). These methods can be classified into three categories: (i) gravimetric; (ii) manometric; and (iii) hygrometric.

Gravimetric Method: This involves the measurement of weight changes. Weight changes can be determined both continuously and discontinuously in dynamic or static systems (i.e. air may be circulated or stagnant). Continuous methods employ the use of electro-balances or quartz spring balances. In the discontinuous systems, salt or sulphuric acid solutions are placed in vacuum or atmospheric systems with the food material, to give a measure of the equilibrium relative humidity (Al-Muhtaseb *et al.*, 2002).

Manometric Method: This measures the vapour pressure of water in the vapour space surrounding the food. To improve accuracy the fluid selected for the manometer is often oil instead of mercury. The whole system is maintained at constant temperature and the food sample will lose water to equilibrate with the vapour space. This will be indicated by the difference in height on the manometer (Al-Muhtaseb *et al.*, 2002).

Hygrometric Method: This measures the equilibrium relative humidity of air in contact with a food material, at given moisture content. Dew-point hygrometers detect the condensation of cooling water vapour. Electric hygrometers measure the change in conductance or capacitance of hygrosensors. Most hygrosensors are coated with a hygroscopic salt, such as LiCl, which absorbs moisture from the food sample (Al-Muhtaseb *et al.*, 2002).

A static gravimetric technique was developed and standardized in the Water Activity Group of the European COST90 project (Wolf *et al.*, 1985). Moisture sorption data for food products published in the literature have been obtained by applying this technique at various temperatures and water activities for its following advantages (Lomauro *et al.*, 1985; Carbonell *et al.*, 1986; Aguerre *et al.*, 1989).

- i. Determining the exact dry weight of the sample;
- ii. Minimizing temperature fluctuation between samples and their surroundings or the source of water vapour;
- iii. Registering the weight change of the sample in equilibrium with the respective water vapour pressures;
- iv. Achieving hygroscopic and thermal equilibrium between samples and water vapour source.

2.5 Kinetic Models for Sorption Isotherms

Although several kinetic models exist to describe water sorption isotherms of food materials (Labuza, 1968 and Iglesias *et al.*, 1975), no one equation gives accurate results throughout the whole range of water activities, and for all types of food (Iglesias and Chirife, 1976c). Some of them were developed with a theoretical basis to describe adsorption mechanisms (Rockland and Stewart, 1981; Brunauer *et al.*, 1938) whereas the others are just empirical or a simplification of more elaborate models. In some ranges of water activity, sorption isotherms can be approximated to linear equations (Yan *et al.*, 2008).

Labuza (1975) noted that no sorption isotherm model could fit data over the entire range of relative humidity because water is associated with the food matrix by different mechanisms in different water activity regions. There are some semi-empirical equations with two or three fitting parameters to describe moisture sorption isotherms. Of the large number of models available in the literature (Van den Berg and Bruin, 1981), the most common equations that are used for describing sorption in food products are the Brunauer-Emmett-Teller (BET) equation, Hasley equation, Smith equation, Henderson equation, Oswin equation, Guggenheim-Anderson-de Boer (GAB) equation, Langmuir equation, Iglesias-Chirife equation and Peleg model.

2.5.1 The Brunauer-Emmett-Teller (BET) Equation

The Brunauer, Emmett and Teller (BET) sorption equation, formulated in 1938, represents a fundamental milestone in the interpretation of multilayer sorption isotherms, particularly Type II and III (Timmermann, 1989); it provides an estimation of the monolayer value of moisture adsorbed on the surface. The monolayer moisture content of many foods has been reported to correspond with the physical and chemical stability of dehydrated foods. However, in almost all cases the so-called BET plots are only linear over the lower relative pressure region (a_w) of the sorbate ($0.05 < a_w < 0.45$). The theory behind the BET equation has been faulted on many grounds, including the assumptions that:

- i. The rate of condensation on the first layer is equal to the rate of evaporation from the second layer.
- ii. The binding energy of all of the adsorbate on the first layer is equal;
- iii. The binding energy of the other layers is equal to those of the pure adsorbate.

However, the equation has been useful in defining optimum moisture content for drying and storage stability of foods, and in the estimation of the surface area of a food. The BET equation is generally expressed in the formula as shown in Equation 2.2.

$$\frac{M}{M_0} = \frac{Ca_w}{(1-a_w)(1-a_w+Ca_w)} \quad \text{Equation 2.2}$$

Where M is the moisture content (kg/kg dry solid), M_0 is monolayer moisture content (kg/kg dry solid), a_w is the water activity, and C is a constant related to the net heat of sorption. The estimation of the constants is based on linearization of Equation 2.2. In their study on the reliability of the methods used to evaluate the constants, Iglesias *et al.*, (1977) proposed that a weighted least squares analysis is necessary and should be applied when the linear BET plot is studied.

The BET equation can be considered to be the most useful for determining the optimum moisture conditions for good storage stability, especially for dehydrated food products (Arslan and Togrul, 2006). It is used for fruits and food materials alike. The parameters of the BET equation for different food products are listed as shown in Table 2.1 below.

Table 2.1 Estimated parameters of the BET equation for various food products.

Product	Temp. °C	M ₀	C	R ²	Type	Reference
Corn flour	22	0.056	502.82	0.99	A	Vega <i>et al.</i> , 2006
Yam	45	0.706	2.908	0.91	D	Montes <i>et al.</i> , 2009
Dried potato	30	0.078	7.345	nr	D	Iguedjtal <i>et al.</i> , 2008
Dried potato*	30	0.055	9.226	nr	A	Iguedjtal <i>et al.</i> , 2008
Dried tomato	30	0.1624	14.06	nr	A	Goula <i>et al.</i> , 2008
Apples **	30	0.137	26.430	nr	A	Kaymak-Ertekin and Gedik, 2004
Apples **	30	0.234	20.166	nr	D	Kaymak-Ertekin and Gedik, 2004
Chhana podo ***	35	0.04834	4.464	0.994	D	Ayaraj <i>et al.</i> , 2006
Blueberry	40	0.067	5.743	nr	A	Vega <i>et al.</i> , 2009
Blueberry	40	0.100	101.45	nr	D	Vega <i>et al.</i> , 2009

Source: Ricardo *et al.* (2011)

In Table 2.1, nr means reported, D represents desorption, A represents adsorption, * a_w range: 0.1–0.5; ** a_w range: 0.11–0.5; and *** a_w range: 0.25–0.54.

2.5.2 Halsey Equation

The Equation (Equation 2.3) developed by Halsey (1948) provides an expression for condensation of multi-layers at a relatively large distance from the surface:

$$a_w = \exp\left(-\frac{A}{RT\theta^r}\right) \quad \text{Equation 2.3}$$

Where A and r are constants, $\theta = M/M_0$, R is the universal gas constant (8.314 kJ/mol K), and T is the absolute temperature (K). Halsey (1948) assumed that the potential energy of a molecule varies as the inverse rth power of its distance from the surface. He also stated that the magnitude of the parameter r characterizes the type of interaction between the vapour and the solid. This equation was shown by Halsey to be a good representation of adsorption data that conform to Type I, II, or III isotherm (Van den Berg, 1991). Iglesias *et al.*, (1975); Iglesias and Chirife 1976c, reported that the Halsey equation could be used to describe 220 experimental sorption isotherms of 69 different foods in the range of $0.1 < a_w < 0.8$.

Since the use of the RT term does not eliminate the temperature dependence of A and n, the Halsey equation was modified by Iglesias and Chirife (1976) into the following form, as it is described in Equation 2.4 below.

$$M_w = \left(-\frac{C}{\ln a_w}\right)^{\frac{1}{n}} \quad \text{Equation 2.4}$$

The Halsey model was used for various food products, as it is shown in Table 2.2 below.

Table 2.2: Estimated parameters of the Halsey model for various food products.

Product	Temp. °C	C	n	R ²	Type	Reference
Corn flour	22	0.002	2.516	0.96	D	Vega <i>et al.</i> , 2006
Pear osmotic dehydration	40	0.178	0.666	0.99	D	Park <i>et al.</i> , 2001
Pear	40	0.147	0.853	0.99	D	Park <i>et al.</i> , 2001
Banana pulp	20	0.185	0.756	0.9871	D	Gouveia <i>et al.</i> , 2004
Blueberry	40	0.108	0.890	nr	A	Vega <i>et al.</i> , 2009
Blueberry	40	0.056	1.672	nr	D	Vega <i>et al.</i> , 2009

Source: Ricardo *et al.* (2011)

In Table 2.2, nr means not reported; D and A represents desorption adsorption respectively.

2.5.3 Smith Equation

Smith (1974) developed an empirical model to describe the final curved portion of the water sorption isotherm of a high molecular weight bio-polymer. He theorized that there are two fractions of water sorbed onto a dry surface; the first exhibits a higher than normal heat of condensation and would be expected to follow the Langmuir model. Smith based his model on the second fraction, which can form only after the first fraction has been sorbed. He considered the second fraction to consist of multi-layers of condensed water molecules, which effectively prevent any possible evaporation of the initial layer. He theorized that the moisture content in the second fraction was proportional to the logarithm of the difference between the a_w of the sample and pure water. Equation 2.5 shows the Smith model.

$$M = A + B \log (1 - a_w) \quad \text{Equation 2.5}$$

Where M is the moisture content (kg/kg dry solid), A is the quantity of water in the first sorbed fraction, and B the quantity of water in the multilayer moisture fraction.

This equation could be used in the water activity range from 0.5 to 0.95 in the case of wheat desorption (Moraes *et al.*, 2008) and for various products, as it is shown in Table 2.3 below.

Table 2.3: Constants of the Smith model for some food products

Product	Temp. °C	A	B	R ²	Type	Reference
Yam	45	0.106	0.356	0.992	D	Montes <i>et al.</i> 2009
Dried tomato pulp	30	0.049	-0.754	nr	A	Goula <i>et al.</i> , 2008
Cashew Apple	30	0.7552	-33.69	0.9746	D	Alcântara <i>et al.</i> , 2009
Mango pulp	20	0.018	0.213	0.979	D	Da Silva <i>et al.</i> , 2002
Walnut kernels	25	1.684	4.108	0.960	D	Togrul and Arslan, 2007
Walnut kernels	25	0.617	4.325	0.9867	A	Togrul and Arslan, 2007
Blueberry	40	-0.848	-0.083	nr	A	Vega <i>et al.</i> , 2009
Blueberry	40	-0.516	0.072	nr	D	Vega <i>et al.</i> , 2009

Source: Computed by Researcher (2023)

Where nr: not reported; D: desorption; A: adsorption.

2.5.4 Henderson Equation

One of the most widely used models relating water activity to the amount of water sorbed is the Henderson equation as shown in Equation 2.6.

$$M = \left[\frac{\ln(1-a_w)}{-A} \right]^{1/B} \quad \text{Equation 2.6}$$

where M is the moisture content (kg/kg dry solid), A and B are constants. A linearized plot of $\ln[-\ln(1-a_w)]$ versus moisture content has been reported to give rise to three 'localized isotherms' (Rockland, 1969; Iglesias and Chirife, 1976c) which do not necessarily provide any precise information on the physical state of water, as was originally thought (Henderson, 1952).

According to this model, a plot of $\ln(-\ln(1 - a_w))$ versus $\ln M$ should give as a result a straight line. However, Rockland observed three localized isotherms that did not provide precise information on the physical state of water. The constants of the Henderson model in different food products are listed in Table 2.4 below.

Table 2.4: Parameters of the Henderson model for various food products

Product	Temp. °C	C	n	R ²	Type	Reference
Passion fruit peel	25	2.160	0.591	0.990	D	Oliveira <i>et al.</i> , 2006
Pineapple peel	25	2.04	0.601	0.993	D	Oliveira <i>et al.</i> , 2006
Yam	45	0.126	0.126	0.933	D	Montes <i>et al.</i> , 2009
Dry cashew, apple	30	0.0509	1.08	0.9926	A	Alcântara <i>et al.</i> , 2009
Walnut kernels	25	0.037	1.781	0.9854	D	Togrul and Arslan, 2007
Walnut kernels	25	0.123	1.267	0.9990	A	Togrul and Arslan, 2007

Source: Ricardo *et al.* (2011)

2.5.5 Oswin Equation

Oswin (1946) developed an empirical model which is a series expansion for sigmoid shaped curves, and can be expressed as shown in Equation 2.7.

$$M = A \left[\frac{a_w}{1 - a_w} \right]^B \quad \text{Equation 2.7}$$

Where M is the moisture content (kg/kg dry solid), A and B are constants. Boquet, *et al.*, 1978 considered the Oswin equation to be the best one for describing the isotherms of starchy food, and a reasonably good fit for meat and vegetables.

This equation was also used by Labuza *et al.*, 1972 to relate the moisture contents of non-fat dry milk up to $a_w = 0.5$ as shown in Table 2.5 below.

Table 2.5: Estimated constants of the Oswin model for several food products

Product	T (°C)	A	B	R ²	Type	Reference
Corn flour	22	0.106	0.299	0.99	A	Vega <i>et al.</i> , 2006
Yam	45	0.353	0.495	0.991	D	Montes <i>et al.</i> , 2009
Dried potato	30	0.125	0.461	nr	D	Iguedjtal <i>et al.</i> , 2008
Dried potato	30	0.103	0.548	nr	A	Iguedjtal <i>et al.</i> , 2008
Dried tomato pulp	30	0.303	0.441	nr	A	Goula <i>et al.</i> , 2008
Dried cashew apple	30	10.72	0.581	0.9979	D	Alcântara <i>et al.</i> , 2009
Banana pulp	20	0.164	1.122	0.9869	D	Gouveia <i>et al.</i> , 2004
Mango pulp	20	0.114	0.855	0.992	D	Da Silva <i>et al.</i> , 2002
Garlic	50	0.095	0.720	0.991	D	Moraes <i>et al.</i> , 2008
Apple	50	0.332	0.670	0.9786	D	Moraes <i>et al.</i> , 2008

Source: Ricardo *et al.* (2011)

In Table 2.5, T represents Temperature.

2.5.6 Guggenheim-Anderson-de Boer (GAB) Equation

The three parameters GAB equation, derived independently by Guggenheim (1966), Anderson (1946) and de Boer (1953), is a semi-theoretical, multi-molecular, localized, homogeneous adsorption model. It has been suggested to be the most versatile sorption model available in the literature and has been adopted by a group of West European food researchers (Van de Berg and Bruin, 1981 and Bizot, 1983). It can be written as Equation 2.8.

$$M = \frac{M_o G K a_w}{(1 - K a_w) (1 - K a_w + G K a_w)} \quad \text{Equation 2.8}$$

where M is the moisture content (kg/kg dry solid), M_o is the monolayer moisture content; G and K are constants related to the energies of interaction between the first and further molecules at the individual sorption sites.

Theoretically they are related to the sorption enthalpies (Van den Berg *et al.*, 1981) as shown in Equations 2.9 and 2.10.

$$G = G_o \exp \left[\frac{H_m - H_n}{RT} \right] \quad \text{Equation 2.9}$$

$$K = k_o \exp \left[\frac{H_1 - H_n}{RT} \right] \quad \text{Equation 2.10}$$

where G_o and k_o are entropic accommodation factors; H_m , H_n and H_1 are the molar sorption enthalpies of the monolayer, multi-layers and bulk liquid, respectively (KJ/mol). The GAB model represents a refined extension of the BET theory, postulating that the state of the sorbate molecules in the second and higher layers is equal, but different from that in the liquid-like state. This assumption introduces an additional degree of freedom (an additional constant, K) by which the GAB model gains its greater versatility.

Incorporation of the parameter K, however, assumes that multilayer molecules have interactions with the sorbent that range in energy levels somewhere between those of the monolayer molecules and the bulk liquid. If K is less than unity, lower sorption than that demanded by the BET model is predicted; this allows the GAB isotherm to be successful up to high water activities (i.e. $a_w \approx 0.9$). In the special case where $K=1$, the GAB equation reduces to the BET equation (if $K>1$, the sorption isotherm will become infinite at a value of a_w less than unity, which is physically unsound) (Chirife *et al.*, 1992).

The major advantages of the GAB model are (Van den Berg, 1984):

- i. Viable theoretical background since it is a further refinement of the Langmuir and BET theories of physical adsorption;
- ii. Good description of sorption behavior of almost all foods from a water activity of zero to 0.9;
- iii. Parameters (G_o , k_o , H_m , H_n , and H_1) have a physical meaning (as previously detailed) in terms of the sorption processes;
- iv. Describes the greater part of the temperature effect on isotherms by means of Arrhenius type equations.

The GAB model underestimates the moisture content values at high water activity levels ($a_w > 0.93$). The discrepancy underlines two facts: this type of model is unsuitable for a high humidity range, and the saturated salt solution method does not provide sufficient information to get a complete sorption curve.

The GAB model was found to be suitable for analyzing more than 50% of fruits, meat and vegetables, as it is shown in Table 2.6 below.

Table 2.6: Estimated parameters of the GAB model for various food products.

Product	T (°C)	M ₀	C	K	R ²	Type	Reference
Corn flour	22	0.082	23.23	0.622	0.98	A	Vega <i>et al.</i> , 2006
Passionfruit peel	25	0.094	2.488	1.015	0.997	D	Oliveira <i>et al.</i> , 2006
Pineapple peel	25	0.445	0.310	0.896	0.999	D	Oliveira <i>et al.</i> , 2006
Yam	70	0.136	0.448	2.111	0.90	D	Montes <i>et al.</i> , 2009
Dried tomato pulp	30	0.2102	8.85	0.823	nr	A	Goula <i>et al.</i> , 2008
Pear de-hydration	40	0.072	13.276	1.125	0.99	A	Park <i>et al.</i> , 2001
Banana pulp	20	0.142	1.251	1.052	0.9879	D	Gouveia <i>et al.</i> , 2004
Mangopulp	20	5.838	0.029	0.637	0.994	D	Da Silva <i>et al.</i> , 2002
Walnut kernels	25	0.03729	3.135	0.752	0.9999	A	Togrul and Arslan, 2007

Source: Ricardo *et al.* (2011)

2.5.7 Langmuir equation

Langmuir proposed the following physical adsorption model on the basis of unimolecular layers with identical and independent sorption sites, and which is expressed as it is shown in Equation 2.11 below.

$$a \left(\frac{1}{M_w} - \frac{1}{M_0} \right) = \frac{1}{CM_0} \quad \text{Equation 2.11}$$

where M_w is the equilibrium moisture content (kg water/kg dry matter), M_0 is the monolayer sorbate content (kg water/kg dry matter) and C is a constant.

The value of the monolayer (M_0) is of particular importance because it indicates the amount of water that is strongly adsorbed in specific sites, and it is considered to be the value at which a food product is the most stable.

Langmuir's isotherm is the most crucial equation among the theoretical models, which is based on the forces acting between the product surface and the water condensed from the vapour as a monomolecular layer. The extensions of the Langmuir's underpinning idea on multi-molecular layers result in the BET and GAB isotherms, which are able to describe sigmoidal shaped isotherms commonly observed in the case of food and other materials of biological origin (McKenna, 1984). Values of the various coefficients and regression coefficient (R^2) for Langmuir equation, are presented in Table 2.7.

Table 2.7 Estimated parameters of the Langmuir equation for some foods.

Product	T(°C)	M ₀	C	R ²	Type	Reference
Pear osmotic dehydration	40	1015.778	0.000593	0.79	A	Park <i>et al.</i> , 2001 (26)
Pear	40	1596.919	0.00038	0.83	D	Park <i>et al.</i> , 2001 (26)
Garden mint leaves	30	5.748	0.055	0.93	D	Park <i>et al.</i> , 2002 (27)
Garden mint leaves	40	9.248	0.029	0.98	D	Park <i>et al.</i> , 2002 (27)

Source: Ricardo *et al.* (2011)

2.5.8 Iglesias-Chirife equation

Iglesias-Chirife (1976) proposed the following empirical model, presented in Equation 2.12 below.

$$\ln [M_w + (M_w^2 + M_{w,0.5})^2]^{\frac{1}{5}} = C_1 a_w + C_2 \quad \text{Equation 2.12}$$

Where $M_{w,0.5}$ is the moisture content at the water activity of 0.5; C_1 and C_2 are constants. This model was found to be suitable for food products with high sugar content, such as fruits among other product as it is shown in Table 2.8 below.

Table 2.8: Constants of the Iglesias-Chirife equation for some food products

Product	T (°C)	C ₁	C ₂	$M_{w,0.5}$	R ²	Type	Reference
<i>Chhana podo</i>	35	3.658	1.076	nr	0.943	D	Jayaraj <i>et al.</i> , 2006 (37)
Walnutkernels	25	1.807	1.415	nr	0.944	D	Togrul and Arslan, 2007
Walnutkernels	25	2.328	0.911	nr	0.995	A	Togrul and Arslan, 2007
Grapes	30	1.674	-0.843	0.290	nr	D	Kaymak-Ertekin and Gedik, 2004
Grapes	30	1.760	-1.923	0.240	nr	A	Kaymak-Ertekin and Gedik, 2004

Source: Ricardo *et al.* (2011)

2.5.9 Peleg Equation

This model is a purely empirical equation without a theoretical background. It presents the same or even a better suitability than the GAB model. It is a four-parameter model described in Equation 2.13 below.

$$M_w = C_1 a_w^{C_3} + C_2 a_w^{C_4} \quad \text{Equation 2.13}$$

where C_1 , C_2 , C_3 , and C_4 are constants; $C_3 < 1$ and $C_4 > 1$. The model does not have a monolayer incorporated in it.

The Peleg model adequately described the moisture sorption isotherms of pestil (Kaya and Kahyaoglu, 2005) and other food products as it is shown in Table 2.9 below.

Table 2.9: Constants of the Peleg model for various food products

Product	T (°C)	C ₁	C ₂	C ₃	C ₄	R ²	Type	Reference
Yam	45	2.609	0.507	7.372	0.635	0.9957	D	Montes <i>et al.</i> , 2009
Instant green tea	20	1.7266	3.8739	1.5540	16.545	0.9984	A	Sinija & Mishra, 2008
Green teagranules	20	3.8765	1.7269	16.555	1.5544	0.9984	D	Sinija & Mishra, 2008
Driedpotato	30	0.225	0.327	0.783	9.030	nr	A	Iguedjal <i>et al.</i> , 2008
Walnutkernels	25	7.820	5.809	1.013	6.191	0.9995	A	Togrul and Arslan, 2007
Walnutkernels	25	8.791	12.07	0.718	15.26	0.9943	D	Togrul and Arslan, 2007
Pistachionut	20	81.782	2.9602	8.3281	0.2008	0.9918	D	Hayoglu and Faruk, 2007
Pistachionut	4	56.468	1.8775	6.7588	-0.227	0.9835	D	Hayoglu and Faruk, 2007

Source: Ricardo *et al.* (2011)

3.1 Conclusion

Water sorption isotherms are important thermodynamic tools for predicting the interactions between water and food components. The kinetic models are designed to interpret sorption data from experiments. Parameters in adsorption kinetics provide information on adsorption capacity of adsorbent. All the models are good when applied but the most commonly used that are used for food and fruit products are BET and GAB models. The BET model

presents the obstacle that only provides good results in $a_w < 0.45$, and its application is reduced to the estimation of surface areas. Also, in the case of the GAB model, its use is generalized by its theoretical bases, mathematical simplicity, and ease to interpret since its parameters have a physical meaning; but it is not frequently used when $a_w > 0.93$, that is why some modifications have been performed to it.

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OPTIMIZING BUSINESS PERFORMANCE THROUGH ADVANCED BUSINESS INTELLIGENCE STRATEGIES

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ABSTRACT

The study assessed optimizing business performance through advanced business intelligence strategies. The population of this study consisted of all the staff of MTN Nigeria Ltd. The sample size of this was 291 respondents. The study adopted a correlational research design while stratified random sampling technique was used in selecting the respondents. The instrument for data collection which was tagged "Optimizing Business Performance through Advanced Business Intelligence Strategies Questionnaire (OBPABISQ)" was administered to the respondents and used for the study. Data collected were analyzed using descriptive analysis and Pearson Product Moment Correlation Analysis. From the results of the data analysis, it was observed that Optimizing business performance through advanced business intelligence (BI) strategies is essential in the current competitive environment. Organisations can achieve sustainable development, resilience, and market leadership in the digital era by making business intelligence (BI) a fundamental skill. This allows them to improve efficiency, foster innovation, and prioritise client needs. The study suggested encouraging firms to examine workflows, operational procedures, and performance indicators in order to spot inefficiencies, bottlenecks, and areas that might use improvement. Additionally, company owners have to spend their money on cutting-edge BI platforms, tools, and technologies that fit their demands in terms of scalability, data analytics capabilities, and business needs.

KEYWORDS: Optimizing, Business, Performance, Business Intelligence and Strategies

Introduction

In today's highly competitive corporate landscape, organisations are constantly searching for innovative strategies to gain a competitive advantage, improve decision-making processes, and boost overall performance. Contemporary Business Intelligence (BI) methods have advanced to the extent that they empower businesses to attain these goals through the use of data-derived insights for sustained expansion, operational effectiveness, and strategic decision-making. Firm intelligence encompasses a range of tools, techniques, and strategies that are utilised to gather, evaluate, and convey data pertaining to a company (Chen et al., 2012). Business intelligence (BI) has progressed from basic reporting tools to sophisticated analytical systems capable of processing large volumes of data in real-time. The integration of artificial intelligence (AI), advanced analytics, and machine learning algorithms has transformed business intelligence (BI), allowing organisations to extract actionable insights from large

datasets. The reference for the 2017 study carried out by Wang and Hajli is (Wang & Hajli, 2017).

Advanced business intelligence (BI) approaches enable businesses to make data-driven decisions, rather than depending on intuition or speculation. Organisations can utilise predictive analytics to forecast market trends, identify new opportunities, and manage any hazards (Davenport & Harris, 2007). Moreover, the application of real-time analytics enables timely decision-making, permitting companies to quickly adjust to changing consumer preferences and market dynamics (Liu et al., 2017). Therefore, the use of data to make decisions has become an essential component of modern company strategy, leading to a competitive edge and market dominance. Advanced business intelligence (BI) systems enhance operational efficiency and resource allocation by automating repetitive procedures. By integrating Business Intelligence (BI) platforms and Business Process Management (BPM) technology, organisations can improve productivity and operational efficiency across several divisions. The integration presented facilitates the recognition and alleviation of inefficiencies and restrictions (Sivarajah et al. 2017). Prescriptive analytics enables companies to achieve cost reduction and increased profitability by simplifying the optimisation of supply chain management, inventory control, and procurement activities. The citation is attributed to Chen et al. (2012).

Advanced business intelligence (BI) techniques help organisations obtain a deeper understanding of the behaviours, preferences, and emotions of their customers. By analysing client data, which includes transaction records, online interactions, and feedback; organisations can create tailored product offerings, marketing strategies, and customer experiences. Furthermore, the utilisation of sentiment analysis and social media monitoring enables organisations to detect emerging trends, proactively address consumer discontent, and capitalise on possibilities for customer interaction and loyalty (Liu et al., 2017). Organisations can improve their ability to manage risks and meet regulatory obligations by using advanced business intelligence (BI) technologies. Organisations that integrate business intelligence (BI) technologies into their governance, risk, and compliance (GRC) frameworks can efficiently monitor compliance with industry rules, detect compliance concerns, and reduce operational risks (Davenport & Harris, 2007). Furthermore, businesses may effectively protect their assets and reputation by employing predictive analytics to identify weaknesses, foresee possible risks, and establish precautionary actions (Sivarajah et al., 2017).

Statement of the Problem

In the current and dynamic business landscape, organisations face new challenges and opportunities as a result of technological advancements, greater data accessibility, and growing consumer preferences. Due to the complex nature of this issue, there has been a notable change in focus towards improving business performance. This necessitates the adoption and application of advanced business intelligence (BI) technologies. Many businesses face challenges when it comes to successfully deploying and integrating business intelligence (BI) tools and techniques, despite the increasing acknowledgment of their importance in improving decision-making, operational efficiency, and competitive advantage. The references cited are Wang and Hajli (2017) and Chen et al. (2014).

When analysing the potential influence of sophisticated business intelligence tactics on improving organisational performance, some notable barriers become apparent. Businesses often struggle to synchronise their business intelligence (BI) initiatives with their strategic goals, resulting in misalignment and subpar outcomes (Watson et al., 2015). Furthermore,

continuous investments in infrastructure, data management, and skill enhancement are necessary to adapt to the fast-paced advancements in business intelligence technologies. These advancements bring about financial and organisational difficulties (Kimball et al., 2016). Furthermore, the effective application of business intelligence is consistently impeded by problems pertaining to data quality, the complexity of integration, and the ability to get meaningful insights from large datasets (Liu and Yang, 2019). Furthermore, the incorporation of artificial intelligence, machine learning, and predictive analytics into corporate intelligence frameworks brings forth added intricacies that require careful oversight, encompassing ethical considerations, data privacy issues, and adherence to regulatory requirements. (Marr, 2020).

The main challenge lies in organisations' ability to strategically develop, implement, and manage advanced business intelligence methods to effectively improve operational efficiency. To overcome this challenge, it is imperative to implement a comprehensive approach that integrates technology advancements, cultural shifts within the organisation, strategic planning, and the promotion of ongoing learning and adaptability. Davenport and Harris (2007) as well as LaValle et al. (2011) provide backing for this claim. Given this, the study examines the optimizing business performance through advance business intelligence strategies.

Objective of the Study

The main goal of this research is to improve organisational performance by strategically implementing and deploying modern business intelligence (BI) approaches. To achieve this goal, the following particular objectives are outlined:

1. To examine the relationship between optimizing business performance and advance business intelligence implementation.
2. To evaluate the relationship between optimizing business performance and advance business intelligence competence.
3. To examine the relationship between optimizing business performance and advance business intelligence training and development.

Research Questions

1. Is there any significant relationship between optimizing business performance and advance business intelligence implementation?
2. Is there any significant relationship between optimizing business performance and advance business intelligence training and development?

Research Hypothesis

1. There is no significant relationship between optimizing business performance and advance business intelligence implementation
2. There is no significant relationship between optimizing business performance and advance business intelligence training and development.

Literature Review

Overview of Advance Business Intelligence

Increasingly, it is acknowledged that enhanced business intelligence (BI) is a crucial component for organisations seeking to make strategic decisions founded on data-driven insights. Organisations must utilise modern business intelligence (BI) methods to get a competitive advantage in the current dynamic and competitive business climate. Advanced

business intelligence (BI) strategies employ complex tools, technology, and procedures to analyse large amounts of data and produce meaningful insights. These approaches enable businesses to improve operational efficiency, optimise overall performance, manage risks, and promote innovation. Furthermore, enhanced business intelligence (BI) enables organisations to swiftly analyse data in real-time, predict future events, and provide prescriptive recommendations, hence facilitating the timely creation of well-informed decisions (Chen et al., 2012). According to Wang and Xu (2019), advanced business intelligence methods emphasise the seamless integration of data from various sources, including cloud platforms, internal databases, and external repositories. Efficient data administration establishes the basis for precise analytics and enlightening findings by ensuring the accessibility, excellence, and uniformity of data. Organisations can use advanced business intelligence to analyse data and identify intricate relationships, patterns, and trends. This is achieved by employing predictive modelling techniques, artificial intelligence, and machine learning algorithms. The use of analytics capabilities enables the prediction of future trends, the segmentation of consumers into discrete groups, and the execution of focused marketing campaigns. Ross and Kimball published a study in 2013.

According to Few (2012), advanced business intelligence (BI) systems offer user-friendly data visualisation tools and customised interfaces that transform complex data sets into visually appealing and interactive results. Data visualisation capabilities facilitate stakeholders in evaluating information, discerning patterns, and making data-driven decisions. In the face of increasing data breaches and growing concerns about privacy, advanced business intelligence (BI) strategies prioritise strong data security measures, encryption frameworks, and compliance systems. Adherence to legislation and safeguarding data privacy are crucial for maintaining the trust and credibility of a company (Khan et al., 2018). Application of Advanced Business Intelligence Methods:

1. **Strategic Decision-making:** Advanced business intelligence (BI) approaches equip executives and decision-makers with pragmatic and valuable insights, enabling them to formulate strategic plans, optimise resource allocation, and capitalise on expanding market opportunities.
2. **Customer Experience Enhancement:** Advanced business intelligence (BI) utilises the examination of client behaviours, preferences, and feedback to facilitate the development of customised products, services, and experiences tailored to fit the unique needs and preferences of individual customers.
3. **Operational Efficiency Optimization:** Advanced business intelligence (BI) enables businesses to streamline their business processes, enhance their supply chain management, and optimise resource allocation. As a consequence, there is a decrease in expenses, a reduction in waste, and a general enhancement in operational effectiveness (Davenport & Harris, 2007).
4. **Risk Management and Compliance:** Organisations can use advanced business intelligence (BI) approaches to actively identify, assess, and mitigate risks. This facilitates adherence to regulations and fosters a culture of accountable corporate governance and accountability.

Overview of Business Performance

Business performance is a crucial measure for evaluating the achievement, sustainability, and durability of businesses in all sectors. The evaluation entails an analysis of various aspects of an organisation, such as its operational efficiency, financial health, market competitiveness,

and alignment with overarching goals and objectives. The performance of a business is diverse, consisting of various aspects that together contribute to the overall success and competitiveness of an organisation. These dimensions can be broadly categorized as:

1. **Financial Performance:** This dimension evaluates an organization's financial performance, encompassing its profitability, liquidity, solvency, and return on investment (ROI). Crucial factors to take into account are net profit margins, revenue growth rates, asset turnover ratios, and cash flow metrics (Kaplan & Norton, 1996).
2. **Operational Performance:** Organisations that want to optimise resource utilisation, minimise costs, and enhance production must prioritise operational efficiency and effectiveness. Metrics such as process cycle duration, inventory turnover frequency, and capacity utilisation are essential for assessing operational success (Slack et al., 2016).
3. **Customer Performance:** Placing a strong emphasis on prioritising the client is crucial in today's fiercely competitive company landscape. To attain sustainable growth and profitability, businesses should give priority to customer happiness, loyalty, retention rates, and lifetime value (Reichheld, 2003).
4. **Strategic Performance:** Aligning with strategic objectives, vision, and mission is essential for attaining enduring success in the long term. Organisations must assess their success by considering strategic initiatives, market positioning, inventive capabilities, and adaptability to changing market conditions (Kaplan & Norton, 2008).

Multiple factors, including both internal and external elements, influence the performance of a company. Key determinants include:

1. **Leadership and Management Capabilities:** The success of an organisation depends on the fundamental concepts of efficient leadership and management approaches. Leaders must exhibit strategic acumen, excellent judgement, and the ability to inspire and rally teams to achieve common goals (Bass & Riggio, 2006).
2. **Organizational Culture and Structure:** An organisational culture that promotes cooperation, creativity, and adaptability creates an environment that improves performance. Furthermore, the organisational structure has a crucial impact on enabling effective communication, decision-making, and allocation of resources (Schein, 2010).
3. **Technological Capabilities:** In the present age of digitalization, possessing proficient technological abilities is a vital determinant of a firm's success. Organisations should employ emerging technologies such as artificial intelligence, data analytics, and cloud computing to foster innovation, improve efficiency, and achieve a competitive advantage (Brynjolfsson & McAfee, 2014).
4. **Market Dynamics and Competitive Landscape:** Business performance is highly influenced by external factors such as market demand, competitive rivalry, regulatory environment, and macroeconomic conditions. Organisations must skillfully negotiate these intricacies to take advantage of opportunities and reduce risks (Porter, 1985).

Assessing business performance necessitates a systematic approach that incorporates both quantitative and qualitative methodologies. Key measurement tools and methodologies include:

1. **Key Performance Indicators (KPIs):** Organisations employ Key Performance Indicators (KPIs) to impartially assess performance across various dimensions. Organisations can boost their performance by defining SMART (specific, measurable, achievable, relevant, and time-bound) KPIs, which enable them to evaluate progress, identify areas for improvement, and drive ongoing growth (Parmenter, 2015).
2. **Balanced Scorecard:** Developed by Kaplan and Norton (1996), the Balanced Scorecard framework offers an all-encompassing approach to assessing performance that takes into account financial, operational, customer, and strategic dimensions. The Balanced Scorecard facilitates strategic alignment and enhances decision-making by aligning performance metrics with organisational goals.
3. **Benchmarking:** businesses utilise benchmarking to evaluate their performance metrics in comparison to industry peers, competitors, or high-performing businesses. Benchmarking enables businesses to enhance operational efficiency, customer satisfaction, and market competitiveness by identifying areas of performance deficiency and exemplary practices (Camp, 1989).

Effective corporate performance management is essential for attaining organisational success, competitiveness, and sustainability. Organisations can improve their performance by improving their financial, operational, customer, and strategic elements. The success, competitiveness, and sustainability of an organisation in today's complex and dynamic commercial environment heavily rely on its business performance. Through thorough analysis and improvement of the financial, operational, customer, and strategic aspects, firms can increase profitability, achieve growth, enhance stakeholder value, and align their strategies, ensuring long-term success in a highly competitive global market.

Optimizing Business Performance and Advance Business Intelligence Implementation

Optimising performance is essential in today's competitive corporate environment to ensure continuous growth, promote innovation, and sustain a competitive advantage. Chen et al. (2012) found that the optimisation process is mostly influenced by the strategic use of Business Intelligence (BI) technology. These solutions empower companies to utilise data-driven insights for informed decision-making and enhanced operational efficiency. Corporate intelligence refers to the methods, technology, and tools used to gather, analyse, and disseminate information about a firm, with the aim of aiding in strategic decision-making (Chen et al., 2012). With the exponential growth of data generated by businesses on a daily basis, it is crucial to have the capability to convert this data into meaningful and valuable insights. Business Intelligence (BI) solutions empower firms to gain a comprehensive understanding of their operations, consumer behaviours, market trends, and competitive environments. As a result, this helps businesses to make proactive decisions and reduce risks. The robust benefits of optimizing business performance with business intelligence include:

1. **Informed Decision-Making:** Business intelligence (BI) systems provide prompt and precise information and analysis, enabling decision-makers to make well-informed decisions that align with the organization's objective. (Davenport & Harris, 2007).

2. **Operational Efficiency:** Business Intelligence (BI) helps businesses optimise resource allocation, save expenses, and enhance productivity by simplifying processes and discovering inefficiencies (Wang & Strong, 1996).
3. **Competitive Advantage:** Employing business intelligence enables organisations to acquire information regarding market trends, client preferences, and competitor strategies, thereby fostering innovation and maintaining a competitive edge. (Chen et al., 2012).
4. **Enhanced Customer Experience:** Business intelligence (BI) technology enable organisations to analyse consumer behaviours, preferences, and feedback, facilitating the creation of customised marketing campaigns and improving client satisfaction and loyalty (Liu et al., 2013).

To optimise business performance using advanced business intelligence (BI), businesses should consider the following recommended methods:

1. **Define Clear Objectives:** In order to achieve success in business intelligence, it is crucial to establish clear and specific goals and objectives that align with the organization's priorities and the requirements of stakeholders (Chen et al., 2012).
2. **Invest in Data Governance:** Creating robust data governance frameworks and ensuring data quality, consistency, and security are essential for effective business intelligence (Watson et al., 2007).
3. **Foster a Data-Driven Culture:** Encouraging data literacy, providing training, and raising awareness among employees and stakeholders enhances the ability to make well-informed decisions and optimises the use of business intelligence. (Davenport & Harris, 2007).
4. **Collaborate Across Departments:** Facilitating cross-functional collaboration and communication facilitates the integration of diverse data sources and viewpoints, resulting in comprehensive insights and strategic alignment (Liu et al., 2013).
5. **Monitor, Evaluate, and Iterate:** Regularly monitoring the success of business intelligence (BI), evaluating the outcomes against established key performance indicators (KPIs), and making necessary adjustments to plans based on insights and feedback are of utmost importance. It is imperative to guarantee that the company stays in line with its Embracing modern Business Intelligence is crucial for firms aiming to flourish in the current intricate and competitive business environment. Organisations may improve decision-making, operational efficiency, customer experience, and competitive advantage by utilising business intelligence (BI) tools to convert data into practical insights. Effectively tackling the difficulties linked to the adoption of business intelligence necessitates deliberate strategizing, financial dedication, cooperation, and a dedication to cultivating a culture that relies on data. Organisations may optimise the utilisation of their data, foster innovation, and achieve sustainable success by following to established principles and consistently assessing and adjusting their business intelligence strategy.

Optimizing Business Performance and Advance Business Intelligence Competence

Organizations are continually seeking ways to enhance their performance and gain a competitive edge. Central to this endeavor is the concept of optimizing business performance and advancing business intelligence (BI) competence. Business performance optimization entails a systematic approach to enhancing various facets of organizational operations to achieve desired outcomes efficiently. It encompasses a holistic evaluation of processes,

resources, and strategies aimed at maximizing productivity, profitability, and sustainability (Kaplan & Norton, 1996). Key components of business performance optimization include:

1. **Strategic Alignment:** Ensuring that organizational goals, objectives, and strategies are coherent and aligned with market dynamics and stakeholder expectations.
2. **Process Improvement:** Implementing methodologies such as Six Sigma or Total Quality Management (TQM) to streamline operations, eliminate inefficiencies, and enhance productivity.
3. **Resource Allocation:** Efficiently allocating resources, including human capital, financial assets, and technological infrastructure, to optimize performance and facilitate innovation.

Business Intelligence (BI) competence refers to the organization's ability to leverage data-driven insights to inform decision-making, enhance strategic planning, and drive innovation (Chen et al., 2012). Advancing BI competence involves:

1. **Data Collection and Integration:** Establishing robust data collection mechanisms and integrating disparate data sources to create a unified view of organizational performance and market trends.
2. **Data Analysis and Visualization:** Utilizing advanced analytics tools and strategies to analyze data, identify patterns, and visualize insights through intuitive dashboards and reports.
3. **Knowledge Dissemination:** Fostering a culture of data-driven decision-making by disseminating actionable insights across various organizational levels and departments.

The convergence of business performance optimization and BI competence creates a synergistic relationship that empowers organizations to make informed decisions, drive innovation, and achieve sustainable growth (Wang & Hajli, 2017). Strategies for synergizing these concepts include:

1. **Integrated Strategic Planning:** Aligning business performance optimization initiatives with BI capabilities to develop data-driven strategies that address market opportunities and challenges effectively.
2. **Continuous Improvement:** Establishing a feedback loop wherein BI insights inform ongoing performance optimization efforts, enabling organizations to adapt proactively to evolving market dynamics.
3. **Talent Development:** Investing in talent development initiatives focused on enhancing BI skills, analytical capabilities, and performance optimization competencies among employees at all organizational levels.

Technological advancements, including Artificial Intelligence (AI), Machine Learning (ML), and Big Data analytics, are instrumental in advancing BI competence and optimizing business performance (Davenport & Harris, 2007). Organizations can leverage these technologies by:

1. **Implementing Advanced Analytics Platforms:** Adopting AI-powered analytics platforms to automate data analysis, generate predictive insights, and facilitate real-time decision-making.

2. **Embracing Cloud Computing:** Utilizing cloud-based BI solutions to enhance scalability, agility, and accessibility, enabling organizations to leverage data-driven insights across geographically dispersed teams.
3. **Promoting Innovation:** Cultivating a culture of innovation by encouraging experimentation, collaboration, and knowledge sharing, thereby fostering continuous improvement and competitive advantage.

Maximising business efficiency and enhancing business intelligence expertise are crucial for organisations aiming to succeed in the current competitive business environment. By combining these concepts, organisations may utilise data-driven insights to guide strategic decision-making, improve operational efficiency, and achieve sustainable growth. To achieve these objectives, it is necessary to embrace technology innovations, promote a culture of continual improvement, and engage in talent development. As organisations negotiate the complexity of the digital age, it is crucial to prioritise business performance optimisation and business intelligence (BI) competency. These factors are essential for attaining long-term success and staying ahead of competitors.

Optimizing Business Performance and Advance Business Intelligence Training and Development

Optimizing performance and utilising business intelligence (BI) are crucial for achieving sustainable growth and success in the highly competitive and ever-changing company environment. According to Kaplan & Norton (2006), optimising business performance entails improving operational efficiency, maximising productivity, and accomplishing strategic objectives. It involves a comprehensive approach that combines many aspects of an organisation, such as personnel, technology, procedures, and tactics. By prioritising performance optimisation, firms can enhance operational efficiency, minimise expenses, enhance customer happiness, and attain a competitive advantage in the market. Business Intelligence (BI) is crucial for enhancing business performance by converting unprocessed data into practical insights. Business Intelligence (BI) refers to the utilisation of technologies, tools, and procedures to gather, combine, analyse, and present business-related data (Chen et al., 2012). Through the utilisation of business intelligence (BI) tools and analytics, organisations may acquire useful discernments on market trends, customer behaviour, competitive environment, and internal processes. This empowers them to make well-informed decisions and engage in strategic planning.

In order to fully exploit the capabilities of business intelligence (BI), organisations need to allocate resources towards advanced BI training and development programmes. Advanced business intelligence (BI) training surpasses fundamental data analysis abilities by emphasising intricate analytics approaches, data visualisation, machine learning, and predictive modelling (Davenport & Harris, 2007). Organisations may bolster data-driven decision-making, stimulate innovation, and promote sustainable growth by providing staff with strong business intelligence (BI) capabilities. Strategies for optimizing business performance through advanced bi training and development are:

1. **Skill Enhancement and Knowledge Transfer:** Organizations must prioritize skill enhancement and knowledge transfer through targeted BI training programs. These programs should focus on developing expertise in advanced analytics tools, data visualization strategies, and emerging BI technologies (Laursen & Thorlund, 2010).

2. **Integration of BI into Strategic Planning:** Effective utilization of BI requires integrating it into strategic planning and decision-making processes. Organizations should align BI initiatives with strategic objectives, ensuring that data-driven insights inform organizational strategies, priorities, and actions (Eckerson, 2010).
3. **Collaboration and Cross-Functional Integration:** Optimizing business performance through advanced BI training necessitates fostering collaboration and cross-functional integration. Organizations should encourage collaboration between business units, IT departments, and analytics teams to facilitate knowledge sharing, innovation, and synergy (Wang et al., 2016).
4. **Continuous Monitoring and Evaluation:** To ensure the effectiveness of BI initiatives, organizations must adopt a rigorous approach to continuous monitoring and evaluation. By establishing key performance indicators (KPIs), benchmarks, and metrics, organizations can assess the impact of BI on business performance and identify areas for improvement (Khan et al., 2018).

The combination of enhancing company performance and providing advanced BI training and development has profound consequences for modern organisations. Organisations can improve operational efficiency, foster innovation, and take advantage of emerging opportunities in the digital economy by adopting a strategic approach to business intelligence (Davenport, 2013). Moreover, the increasing need for proficient BI expertise highlights the significance of allocating resources towards employee training and development in order to cultivate a competitive workforce that can effectively navigate intricate business environments. The future of enhancing business performance through advanced BI training and development relies on ongoing innovation, adaptation, and agility. With the growing dependence of organisations on data-driven insights for decision-making and strategy execution, there is an increasing demand for advanced business intelligence capabilities, tools, and processes (Marr, 2015). Organisations may achieve sustainable success, growth, and competitive advantage in an interconnected and data-driven world by adopting a forward-thinking approach to BI training and development.

METHODOLOGY

Research Design

The survey design method was utilized for this study. This approach was considered most appropriate because it helped the researcher to describe, examine, record, analyze and interpret the variables that were found in the study. It is also useful because of the relatively large population from which the information was collected.

Method of Data Collection

Questionnaires were used to gather data because they were deemed acceptable for the study's design due to their larger coverage, more representative sample, adequate time for participants to provide thoughtful answers, and ease of delivery. Likert scale measurements of "strongly agree," "agree," "undecided," "disagree," and "strongly disagree" were used in the data collection tool.

Population of the Study

The population of the study consisted of all the staff of MTN Nigeria Ltd.

Sampling and Sample Size

The study employed convenience sampling, which was selected based on the respondents' availability and willingness to complete the research instrument. A total of 360 staff of MTN Nigeria Ltd made up the sample sizes.

Data Collection Instrument and Validation

The research instrument used for the study was self-structured questionnaire. The questionnaire was tagged “Optimizing Business Performance through Advanced Business Intelligence Strategies Questionnaire (OBPABISQ)” was used to obtain data on the independent and dependent variables presented in both sections A and B of the questionnaire. Congruent, content-based, and criterion-related validity tests were included in the study. The congruent validity was structured based on previous research, the content validity considered the details on the survey, and the criterion-relation validity examined the results from similar participants (Booth, Colomb, Williams, Bizup, & Fitzgerald, 2016).

Data Analysis

The data obtained were analyzed using descriptive and Pearson moment correlation analysis.

RESULTS AND DISCUSSION

Research Question One

Is there any significant relationship between optimizing business performance and advance business intelligence implementation in MNT Nigeria Plc?

Table 1: Descriptive analysis on the relationship between optimizing business performance and advance business intelligence implementation in MNT Nigeria Plc.

Variables	X	SD	Skewness	Kurtosis
Implementing advanced business intelligence tools is essential for optimizing business performance.	7.21	1.086	.258	-1.291
There is a direct correlation between the level of advanced business intelligence and the efficiency of business operations.	5.57	.825	.163	-.599
Companies that invest in advanced business intelligence have a competitive advantage over those that do not.	6.56	.905	.385	-.899
Advanced business intelligence tools facilitate better decision-making processes within an organization.	5.57	.821	.149	-.581
Companies that prioritize business intelligence implementation are more adaptable to changing market conditions.	6.58	.908	.353	-.927

Legend: X = Mean; SD = Standard Deviation; N =291

Source: Field Survey 2024

Table 1 presents the summary statistics of relationship between optimizing business performance and advance business intelligence implementation. Based on the result, it was

seen that the mean values were 7.21, 5.57, 6.56, 5.57 and 6.58, respectively, while the standard deviation of the variables were 1.086, .825, .905, .821 and .908. Given their means and standard deviation values, it is evident that the mean of all the variables in this study exceed their respective standard deviations values. This implies that the variables are relatively relevant. Thus, implementing advanced business intelligence tools is essential for optimizing business performance. Showing the relationship between optimizing business performance and advance business intelligence implementation is significant. Similarly, the skewness values imply that the variables are positively skewed towards normality. This is based on the fact that they all exhibit positive skewness values. Also, the kurtosis values from the analysis show that the variables are not leptokurtic.

Research Question Two

Is there any significant relationship between optimizing business performance and advance business intelligence training and development in MTN Nigeria Ltd?

Table 2: Descriptive analysis of the relationship between optimizing business performance and advance business intelligence training and development in MTN Nigeria Ltd

Variables	X	SD	Skewness	Kurtosis
Business Intelligence training enhances our organization's understanding of data-driven decision-making processes.	7.21	1.082	.256	-1.286
Employees with advanced business intelligence training contribute more effectively to strategic planning and execution.	5.56	.825	.147	-.587
Advanced training in business intelligence has improved our organization's operational efficiency.	6.57	.912	.362	-.921
Business intelligence training and development initiatives have positively impacted our organization's bottom line.	6.34	.988	.212	-.531
Investing in advanced business intelligence training programs is essential for future organizational growth.	6.57	.908	.373	-.920

Legend: X = Mean; SD = Standard Deviation; N=291

Source: Field Survey 2024

Table 2 presents the summary statistics of relationship between optimizing business performance and advance business intelligence training and development. Based on the result, it is seen that the mean values were 7.21, 5.56, 6.57, 6.34 and 6.57, respectively, while the standard deviation of the variables were 1.082, .825, .912, .988 and .908. Given their means and standard deviation values, it is evident that the mean of all the variables in this study exceed their respective standard deviations values. This implies that the variables are relatively relevant. Thus, Business Intelligence training enhances our organization's understanding of data-driven decision-making processes. Similarly, the skewness values imply that the variables are positively skewed towards normality. This is based on the fact that they all exhibit positive skewness values. Also, the kurtosis values from the analysis show that the variables are not leptokurtic.

Hypothesis One

There is no significant relationship between optimizing business performance and advance business intelligence implementation. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 3)

TABLE 3: Pearson Product Moment Correlation Analysis of the relationship between optimizing business performance and advance business intelligence implementation

Variable	$\sum x$	$\sum x^2$	$\sum y$	$\sum y^2$	$\sum xy$	r
Optimizing Business Performance (x)	9011	270655				
Advance Business Intelligence Implementation (y)			9113	58989	134663	0.94*

***Significant at 0.025 level; df =289; N =291; critical r-value = 0.086**

Table 3 presents the obtained r-value as (0.94). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 289 degree of freedom. The obtained r-value (0.94) was greater than the critical r-value (0.086). Hence, the result was significant. The result therefore means that there is significant relationship between optimizing business performance and advance business intelligence implementation.

Hypothesis Two

There is no significant relationship between optimizing business performance and advance business intelligence training and development. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 4)

TABLE 4: Pearson Product Moment Correlation Analysis of the relationship between optimizing business performance and advance business intelligence training and development

Variable	$\sum x$	$\sum x^2$	$\sum y$	$\sum y^2$	$\sum xy$	r
Optimizing Business Performance (x)	9011	270655				
Advance Business Intelligence Training and Development (y)			9113	58989	141752	0.91*

***Significant at 0.025 level; df =289; N =291; critical r-value = 0.086**

Table 4 presents the obtained r-value as (0.91). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 289 degree of freedom. The obtained r-value (0.82) was greater than the critical r-value (0.086). Hence, the result was significant. The result therefore means that there is significant relationship between optimizing business performance and advance business intelligence training and development.

Discussion of Findings

The result of the data analysis in tables 1 and 3 sought to find out the relationship between optimizing business performance and advance business intelligence implementation. It was significant due to the fact that the obtained r-value (0.94) was greater than the critical r-value (0.086) at 0.025 level with 289 degree of freedom. This rate of percentage was highly positive and therefore means that there is significant relationship between optimizing business performance and advance business intelligence implementation. The result is in line with Chen et al., (2012), who stated that the optimisation process is primarily motivated by the strategic implementation of Business Intelligence (BI) tools. Equally, these strategies empower organisations to utilise data-driven insights for making informed decisions and enhancing operational efficiency. Continuously monitoring BI performance, evaluating outcomes against predefined metrics, and iterating strategies based on insights and feedback are essential for maintaining alignment with organizational goals and evolving business needs (Wang & Strong, 2016). The findings of the study caused the null hypothesis to be rejected and the alternative to be upheld.

The result of the data analysis in tables 2 and 4 sought to find out the relationship between optimizing business performance and advance business intelligence training and development. It was significant due to the fact that the obtained r-value (0.91) was greater than the critical r-value (0.086) at 0.025 level with 289 degree of freedom. This rate of percentage was highly positive and therefore means that there is significant relationship between optimizing business performance and advance business intelligence training and development. The result is in line with Laursen & Thorlund, (2010), who stated that Organizations must prioritize skill enhancement and knowledge transfer through targeted BI training programs. These programs should focus on developing expertise in advanced analytics tools, data visualization techniques, and emerging BI technologies. The findings of the study caused the null hypothesis to be rejected and the alternative to be upheld.

Conclusion

In today's ever-changing business landscape, the incorporation and implementation of advanced business intelligence (BI) strategies play a crucial role in determining the success and competitiveness of organisations. The examination of enhancing business performance with BI strategies highlights their ability to bring about significant changes in several aspects of operations, decision-making, and customer involvement. Optimizing business performance through advanced business intelligence methods goes beyond simple data analysis. It represents a crucial strategic necessity for organisations aiming to succeed in today's intricate and competitive environment. Organisations can achieve sustainable development, resilience, and market leadership in the digital era by making business intelligence (BI) a fundamental skill. This allows them to improve efficiency, foster innovation, and prioritise client needs.

Recommendations

Optimizing business performance through advanced business intelligence (BI) strategies is essential in the current competitive environment. Utilising data-driven insights, analytics, and technologies can greatly improve decision-making processes, operational efficiency, customer satisfaction, and overall profitability. Based on the outcomes of this study and the subsequent debates, it is recommended that;

1. To define key performance indicators (KPIs) relevant to your industry, market, and organizational priorities to track progress and evaluate success.

2. To evaluate and invest in advanced BI tools, platforms, and technologies that align with your business needs, scalability requirements, and data analytics capabilities.
3. To leverage BI strategies to gain deeper customer insights, preferences, behaviors, and trends through advanced analytics, segmentation, and personalization techniques.
4. To analyze operational processes, workflows, and performance metrics to identify inefficiencies, bottlenecks, and opportunities for improvement.
5. To implement real-time BI analytics, reporting, and monitoring capabilities to enable proactive decision-making, responsiveness, and agility.

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TECHNOLOGY FOR SUSTAINABLE URBANIZATION: GREEN BUILDING TECHNOLOGIES AND URBAN PLANNING

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ABSTRACT

Rapid urbanization presents unprecedented challenges to global sustainability, requiring innovative technological solutions for creating eco-friendly and resilient urban spaces. This paper delves into the critical intersection of technology, sustainable urbanization, and the implementation of green building technologies within urban planning strategies. This paper emphasizes the urgency of adopting technology-driven approaches to achieve sustainable urbanization. It underscores the importance of interdisciplinary collaboration among urban planners, architects, technologists, policymakers, and communities to build cities that are environmentally sustainable, socially equitable, and economically vibrant. In summary, this paper contributes to the discourse on technology's pivotal role in shaping the cities of tomorrow, where green building technologies and sustainable urban planning coalesce to create resilient, livable, and sustainable urban environments. The paper concludes by exploring future directions in technology for sustainable urbanization. It discusses emerging technologies, potential policy frameworks, and collaborative efforts required to accelerate the transition toward green and resilient cities.

KEYWORDS: Technology, Sustainable Urbanization, Green Building Technologies, Urban planning, Smart infrastructure, Resilient cities.

Introduction

Urban areas are hubs of economic activity, but their growth often leads to environmental degradation and increased resource consumption. This paper focuses on leveraging technology to address these challenges, emphasizing the integration of green building technologies and sustainable urban planning. Urbanization, characterized by the rapid growth of cities, brings forth both unprecedented opportunities and challenges, particularly in the context of sustainability. As the world grapples with the impacts of climate change and the need for resource-efficient development, technology emerges as a pivotal force in shaping sustainable urbanization. While the promise of technology for sustainable urbanization is substantial, it comes with challenges.



Fig. 1: Necessary components of a zero-energy building[5].

Smith and Johnson (2020) discuss the challenges and opportunities associated with sustainable urbanization [1]. Issues related to affordability, equitable access, and the potential for unintended environmental consequences must be addressed. Striking a balance between technological innovation and inclusivity is key to realizing the full potential of sustainable urbanization. This paper delves into the intersection of green building technologies and urban planning, exploring how advancements in technology contribute to the creation of environmentally conscious and resilient urban spaces.

Urbanization challenges to global sustainability

Rapid urbanization poses several challenges to global sustainability:

- i. **Resource Depletion:** The demand for resources in rapidly urbanizing areas leads to depletion of natural resources, including water, energy, and raw materials, placing a strain on ecosystems.
- ii. **Infrastructure Strain:** The fast pace of urbanization often outstrips the capacity of existing infrastructure, leading to congestion, inadequate transportation systems, and challenges in waste management and sanitation.
- iii. **Environmental Degradation:** Urban expansion contributes to deforestation, loss of biodiversity, and increased pollution, harming ecosystems and exacerbating climate change.
- iv. **Housing Shortages:** The rapid influx of people to cities can result in housing shortages, informal settlements, and inadequate living conditions, leading to social and economic disparities.
- v. **Air and Water Pollution:** Increased industrialization and urban activities contribute to air and water pollution, negatively impacting the health of urban populations and ecosystems.

- vi. **Climate Change Impact:** Urban areas, especially those located near coastlines, are vulnerable to climate change effects such as sea-level rise, extreme weather events, and heat island effects, affecting the sustainability of cities.
- vii. **Social Inequality:** Rapid urbanization often leads to socio-economic disparities, with marginalized populations facing challenges in accessing basic services, education, and employment opportunities.
- viii. **Waste Generation:** Urbanization results in increased waste production, challenging waste management systems and posing risks to the environment and public health.
- ix. **Energy Consumption:** The energy demand in rapidly urbanizing areas rises significantly, often leading to a reliance on non-renewable sources, contributing to carbon emissions and climate change.
- x. **Public Health Concerns:** Urbanization can lead to increased health issues due to overcrowded living conditions, inadequate sanitation, and limited access to healthcare services.

Addressing these challenges requires comprehensive and sustainable urban planning, the adoption of green technologies, community engagement, and global cooperation to develop solutions that balance urban development with environmental and social sustainability.

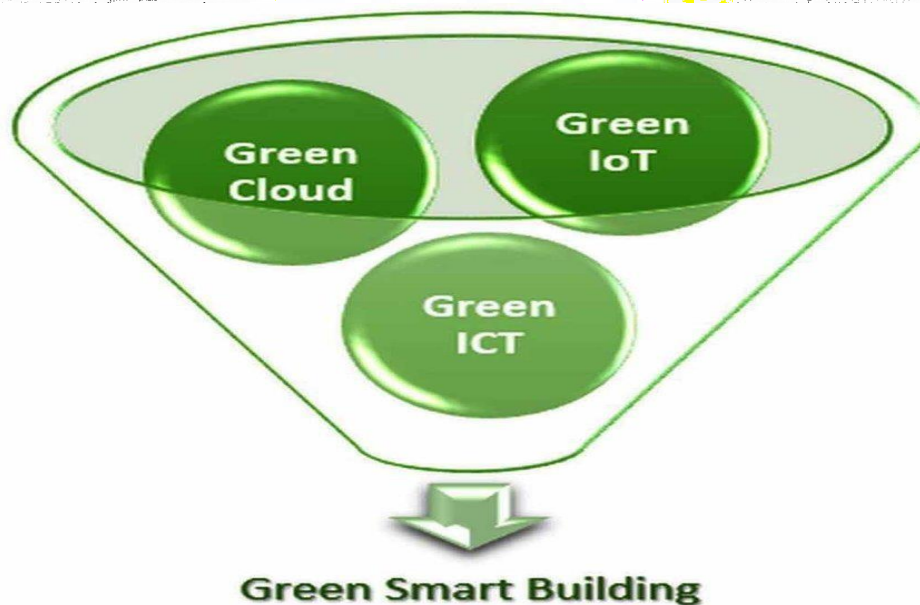


Fig. 2: Ingredients of green smart building[6].

Intersection of technology, sustainable urbanization, and the implementation of green building technologies within urban planning strategies.

The meeting point of technology, sustainable urbanization, and the integration of green building technologies in urban planning is a powerful combination that shapes the cities of the future. Imagine using advanced tools and innovations to construct buildings that not only provide spaces for people but also contribute positively to the environment. This intersection involves employing smart solutions to design cities where energy is used efficiently, green spaces thrive, and eco-friendly materials create a healthier urban lifestyle. It's about leveraging

technology to build sustainable, resilient cities that harmonize with nature and enhance the quality of urban living.

Urgency of Adopting Technology-Driven Approaches to Achieve Sustainable Urbanization

Embracing technology-driven approaches for sustainable urbanization is not just a choice but a pressing need. As our cities expand rapidly, the demand for resources intensifies, and environmental challenges escalate, technology becomes a crucial tool for effective urban planning. It enables us to optimize energy use, manage resources wisely, and create eco-friendly infrastructure. The urgency lies in addressing issues like population growth, climate change, and resource depletion by utilizing technology to build resilient, green cities that can withstand challenges and provide a better quality of life for generations to come.

Importance of interdisciplinary collaboration among urban planners, architects, technologists, policymakers, and communities.

Interdisciplinary collaboration is paramount in shaping cities that strike a balance between environmental sustainability, social equity, and economic vibrancy. Urban planners, architects, technologists, policymakers, and communities must work together to pool their diverse expertise and perspectives.

Urban planners contribute insights into effective city layouts, architects bring creative and functional designs, technologists offer innovative solutions[2], policymakers provide the regulatory framework, and communities offer valuable local knowledge. This collaboration ensures that the built environment not only minimizes its ecological footprint but also considers the needs and aspirations of diverse populations. The importance lies in creating cities that are not only environmentally responsible but also socially inclusive and economically robust. It's a holistic approach that recognizes the interconnectedness of these aspects, striving for urban spaces that enhance the well-being of residents while fostering sustainable growth.

Technology's pivotal role in shaping the cities of tomorrow.

Technology plays a pivotal role in shaping the cities of tomorrow by driving innovation and addressing various challenges:

- i. **Smart Infrastructure:** Technology enables the creation of smart infrastructure, including IoT sensors, real-time data analytics, and smart grids. This allows for efficient management of resources like energy, water, and waste.
- ii. **Urban Mobility:** Advances in transportation technology, such as electric vehicles, ride-sharing apps, and autonomous vehicles, contribute to more sustainable and efficient urban mobility, reducing congestion and emissions.
- iii. **Digital Connectivity:** High-speed internet and digital connectivity foster a connected urban environment. This includes smart homes, digital governance, and improved communication networks, enhancing overall efficiency and quality of life.
- iv. **Green Building Solutions:** Sustainable building materials, energy-efficient designs, and green construction technologies contribute to eco-friendly and energy-efficient structures, aligning with the principles of sustainable urbanization.

- v. **Data-Driven Decision-Making:** Big data analytics and artificial intelligence empower city planners to make informed decisions. This includes urban planning, resource allocation, and predictive modeling to address challenges like population growth and climate change.
- vi. **Resilience and Disaster Management:** Technology aids in developing resilient cities by implementing early warning systems, disaster response technologies, and adaptive infrastructure to mitigate the impact of natural disasters and climate-related events.
- vii. **Community Engagement:** Social media, digital platforms, and technology-driven communication tools facilitate increased citizen engagement. This involvement in decision-making processes contributes to more inclusive and participatory urban development.

In essence, technology serves as a catalyst for creating sustainable, efficient, and livable cities, addressing contemporary urban challenges and envisioning a future where cities are smart, resilient, and responsive to the needs of their inhabitants.

Emerging technologies, potential policy frameworks, and collaborative efforts required to accelerate the transition toward green and resilient cities:

Emerging Technologies:

- i. **Blockchain for Sustainable Development:** Blockchain can enhance transparency and traceability in supply chains, ensuring the use of sustainable materials in construction and fostering accountability.
- ii. **Artificial Intelligence (AI) in Urban Planning:** AI-driven tools can optimize urban planning by analyzing vast datasets, predicting trends, and proposing efficient land use, helping in the creation of sustainable and resilient city layouts.
- iii. **Biophilic Design and Green Infrastructure:** Incorporating technology into biophilic design, such as smart green roofs and living walls, can enhance biodiversity and improve air quality within urban areas.
- iv. **Internet of Things (IoT) for Smart Cities:** IoT devices and sensors can monitor and manage urban infrastructure, from energy usage in buildings to traffic patterns, contributing to more efficient resource utilization.
- v. **Renewable Energy Innovations:** Continued advancements in solar, wind, and other renewable energy technologies will play a crucial role in powering green and resilient cities with clean energy sources.

Potential Policy Frameworks:

- i. **Green Building Codes:** Implementing and enforcing strict green building codes can incentivize the construction of sustainable structures, promoting energy efficiency and environmentally friendly practices.
- ii. **Circular Economy Regulations:** Policies that encourage a circular economy, focusing on waste reduction, recycling, and reusing materials, can drive sustainable practices in construction and manufacturing.
- iii. **Incentives for Sustainable Transportation:** Governments can provide incentives for the adoption of electric vehicles, promote public transportation, and invest in

cycling and pedestrian infrastructure to reduce the environmental impact of urban mobility.

- iv. **Urban Resilience Planning:** Developing policies that require cities to create and implement comprehensive resilience plans can help mitigate the impact of climate-related events and other challenges.
- v. **Technology Adoption Grants:** Governments can offer grants and incentives to encourage the adoption of emerging technologies that contribute to sustainability and resilience in urban areas.

Collaborative Efforts:

- i. **Public-Private Partnerships:** Collaboration between public and private sectors is crucial for implementing sustainable technologies and infrastructure. Public-private partnerships can accelerate innovation and share the financial burden.
- ii. **Community Engagement and Empowerment:** Involving local communities in decision-making processes fosters a sense of ownership and ensures that urban development initiatives align with the needs and values of the residents.
- iii. **International Cooperation:** Sharing best practices and collaborating on global standards for sustainable urban development can accelerate the transition toward green and resilient cities on a larger scale.
- iv. **Cross-disciplinary Collaboration:** Encouraging collaboration among urban planners, architects, technologists, policymakers, and environmental experts ensures a comprehensive and well-informed approach to sustainable urbanization.

Knowledge Sharing Platforms: Establishing platforms for sharing knowledge, research, and successful case studies can facilitate the exchange of ideas and lessons learned, promoting more effective and widespread adoption of sustainable practices.

Accelerating the transition toward green and resilient cities requires a holistic approach that combines innovative technologies, supportive policy frameworks, and collaborative efforts among various stakeholders.

Future directions in technology for sustainable urbanization.

The future of technology for sustainable urbanization is likely to unfold in several directions[4]:

- i. **Smart Cities 2.0:** Advancements in IoT, 5G, and edge computing will lead to more interconnected and smarter cities. These cities will leverage real-time data to enhance infrastructure efficiency, optimize resource use, and improve overall urban living[3].
- ii. **Decentralized Energy Systems:** Future cities may adopt decentralized energy systems, incorporating renewable energy sources, energy storage, and smart grids. This move can enhance energy resilience, reduce dependence on traditional power grids, and promote sustainability.
- iii. **Circular Economy Integration:** Technology will play a crucial role in transitioning toward a circular economy, where resources are reused, recycled, and repurposed. This includes innovations in waste management, sustainable materials, and closed-loop systems.

- iv. **Urban Agriculture and Vertical Farming:** Technology will enable the integration of agriculture into urban landscapes, promoting local food production and reducing the environmental impact of transportation. Vertical farming, aided by automation and precision agriculture, may become more prevalent.
- v. **Augmented Reality (AR) in Urban Planning:** AR technologies could revolutionize urban planning by providing immersive experiences for stakeholders. This can aid in visualizing proposed developments, assessing environmental impacts, and fostering community engagement.
- vi. **Resilient Infrastructure:** Future technology will focus on creating resilient urban infrastructure capable of withstanding and recovering from natural disasters and climate-related events. This involves adaptive architecture, resilient construction materials, and advanced warning systems.
- vii. **AI for Predictive Analytics:** Artificial intelligence and machine learning will play a vital role in predictive analytics for urban planning. These technologies can forecast trends, model scenarios, and optimize resource allocation, contributing to more proactive and efficient city management.
- viii. **Green Construction Materials:** Advancements in sustainable and eco-friendly construction materials will continue, reducing the environmental impact of buildings. This includes developments in recycled materials, low-carbon concrete, and energy-efficient insulation.
- ix. **Inclusive Digital Platforms:** Future technology will focus on creating inclusive digital platforms that empower all segments of the population. This involves ensuring that technological solutions consider diverse needs, promote accessibility, and address digital divides within urban communities.
- x. **Mobility as a Service (MaaS):** Integrated and sustainable transportation solutions will be a key focus. Mobility as a Service platforms, incorporating various transportation modes, shared mobility, and seamless connectivity, could transform the way people move within cities.

These future directions in technology for sustainable urbanization reflect a holistic approach to building cities that are not only technologically advanced but also environmentally sustainable, socially inclusive, and resilient to change.

Conclusion

In conclusion, the intersection of technology, green building technologies, and urban planning holds immense promise for creating cities that are not only environmentally sustainable but also socially inclusive and economically vibrant. The integration of smart solutions, renewable energy sources, and innovative materials in construction, coupled with strategic urban planning, paves the way for a future where our cities are resilient, efficient, and in harmony with the natural environment.

Technology plays a pivotal role in optimizing resource use, improving infrastructure efficiency, and enhancing overall quality of life. Green building technologies contribute to eco-friendly and energy-efficient structures, while urban planning ensures thoughtful layouts that prioritize accessibility, green spaces, and community well-being.

To achieve sustainable urbanization, it is essential to continue fostering interdisciplinary collaboration among urban planners, architects, technologists, policymakers, and communities. Policy frameworks that incentivize green practices, support emerging technologies, and prioritize resilience further contribute to the transformation of our urban landscapes.

As we navigate the challenges of urbanization and environmental stewardship, the ongoing commitment to harnessing technology for sustainable urban development stands as a beacon for building cities that not only meet the needs of the present but also safeguard the well-being of future generations.

Definition of terms:

1. Technology: In the context of sustainable urbanization, "technology" refers to the application of scientific knowledge, tools, and innovations to address challenges related to urban growth.

2. Sustainable Urbanization: "Sustainable urbanization" involves the process of city development that seeks to balance economic growth, social inclusion, and environmental responsibility. It emphasizes creating cities that can meet the needs of the present without compromising the ability of future generations to meet their own needs.

3. Green Building Technologies: "Green building technologies" refer to construction and architectural practices that prioritize environmental sustainability. These technologies aim to minimize a building's environmental impact throughout its lifecycle. Examples include energy-efficient designs, renewable energy integration, use of sustainable materials, and smart building systems that enhance efficiency and reduce resource consumption.

4. Urban Planning: "Urban planning" involves the systematic organization and design of urban areas to achieve specific goals related to functionality, aesthetics, and sustainability. In the context of sustainable urbanization, planners work to create cities that are environmentally conscious, socially inclusive, and economically viable. This includes land-use planning, infrastructure development, and transportation systems.

5. Smart Infrastructure: "Smart infrastructure" refers to the integration of technology and digital solutions into the physical infrastructure of urban areas. This includes the use of sensors, data analytics, and automation to optimize the performance of essential services such as transportation, energy distribution, waste management, and water supply.

6. Resilient Cities: "Resilient cities" are urban areas designed to withstand and recover from shocks and stresses, including those related to climate change, natural disasters, and other challenges. Resilience involves adaptive urban planning, infrastructure that can withstand extreme conditions, and community engagement. Technology plays a crucial role in developing resilient cities through early warning systems, resilient infrastructure designs, and disaster response strategies.

7. Future Directions: "Future directions" refer to the anticipated paths and developments in the field of sustainable urbanization. This includes exploring emerging technologies, policy frameworks, and collaborative efforts that will shape the trajectory of urban development.

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LABOUR UNION AND INDUSTRIAL RELATIONS, A CATALYST FOR ECONOMIC SUSTAINABILITY

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ABSTRACT

This paper critically analyses the relationships between the labour union and their employers in the industries. It evaluates the strengths and limitations of various frameworks in explaining the dynamics of the employment relationships between employers and employees in industries. The paper focuses on three main frameworks, namely, The Unitary, pluralist and System perspectives. Conclusively, this paper highlights strength and limitations of the various frameworks used in industrial relations literatures. It suggests that a combination of these frameworks can provide a comprehensive understanding of the employment relationship that will bring economic development and sustainability. The paper also recommends the need for future research to develop a holistic framework that considers power imbalances and competing interest in the employment relationship.

KEYWORDS: Industrial Relations, Employees, Employers, Economic Sustainability. Labour union.

Introduction

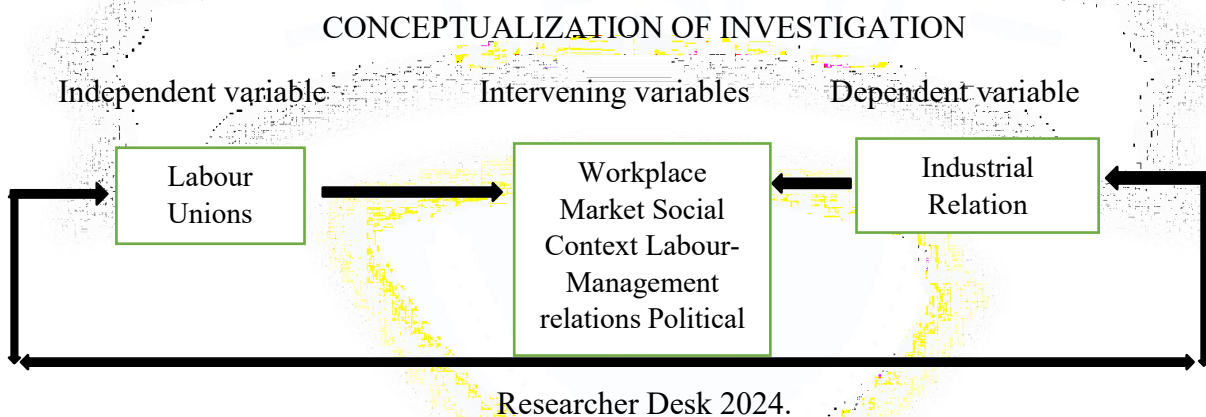
Meaning of Industrial Relations

Industrial Relations is a field of study and practice dealing with a set of interactions at the workplace predicated upon employment contract involving work parties and their representatives in job regulation. The meaning givers in this definition are: study field/practice, set of interactions, employment contract, work parties' representatives, and job regulation. (Zeb Obipi, 2018). It is common to find humans disagree from time to time, and this is especially noticeable between employees and employers of organisations. Popularly referred to as workplace disputes, disagreements between employees and employers result from several

workplace concerns such as working conditions, working salaries and benefits. Though workplace concerns are systems put in place to ensure that all stakeholders of an organisation are recognised and participate in the running of the organisation, the unequal power between employees and employers that such systems produced present employers as superior to employees. The power imbalance account for employees' grievances and constant demands for more power while employers make effort to remain in control. Grievances, which are not properly attended to have consequences for the survival and growth of any organisation. It therefore becomes vital that there is adequate awareness on the 'what' and 'why' of workplace disputes and particularly the ways by which such disputes should be effectively handled. Industrial relations is concerned with the complex nature of workplace dispute and measures for resolutions. This chapter introduces industrial relations by providing fundamental understanding of the history, definitions and theories of Industrial relations. It also discusses approaches to employment contract, the difference between Industrial relations and Human resources, and industrial relations in Nigeria.

Meaning of Labour Union

Collins (2013). Labour union is an association of workers, which consists of representatives that mediate between the workers and their employer in order to avoid any unfair treatment that could be meted on them by the employers and to conversely ensure commitment to work by its members in a way that, it will result in a high level of productivity and organization efficiency in general.



LITERATURE REVIEW

History and Definitions of Industrial Relations

Industrial relations have been studied in the Anglophone world as far back as the early twentieth century. Specifically, in the United States of American, Industrial relations is traced to the scientific works of John R. Commons, who was an institutional economist and the founder of Wisconsin school. In Germany and England, Industrial relations is traced to Lujo Brentano and Sidney and Beatrice Webb, respectively (Tapia, Ibsen & Kochan, 2015). The three authors had little confidence in laissez-faire capitalism to treat workers fairly and therefore were sympathetic to workers. Although the three authors produced scientific works on the role and usefulness of trade unions and features of labour as a commodity, Brentano and Commons focused on analysing and providing more understanding about the conflicts that exist in employment relationships while the Webbs uncovered what differentiates individual contracts from collective contracts (Webb & Webb, 1897; Müller Jentsch, 2004). The explorations on individual contracts from collective contracts resulted in the concepts of

collective bargaining and more findings about mutual insurance, and legal enactment. Earlier in the nineteenth and early twentieth century, Karl Marx's analysis supported the desires and efforts of workers to form trade unions under industrial relations but his theory about the unions was that they were more of historical organization of labour than as regulators of collective wage and labour (Abbott, 2006). Industrial relations occurred as a reaction to the inadequacies of Marxist analysis or classical economic models to address conflicts arising from employer / employee relationships. Industrial relations are the study of the complexities that exist in employment relationships. It provides a guide to how employees and employers should interact with one another and ways by which conflicts that arise from such interactions can be resolved. These interactions are workplace relationships and serve as contract between the two parties. Industrial relations are also described as the interdisciplinary study of employment relations (Kaufman, 1993), that provides a means by which collective bargaining or industrial actions through trade unions, government agencies and arbitrators give voice to employees to balance the power between them and their employers. Collective bargaining allows a group of employees to negotiate on concerned issues with employers with the aim of reaching an agreement that both parties are expected to keep to. Concerned issues include working conditions, working salaries and benefits, and other aspects that relate to workers' rights (Obiekwe, Felix, & Izim, 2018). Whereas employees are expected to be loyal to their employers, the absence of the means through which complaints and dissatisfaction can be presented and addressed results to exploitations by employers. Industrial relations therefore recognise the need to provide a platform to employees by which demands to their employers can be made. Industrial relations engage several academic disciplines or professional specialties to provide understanding of and resolutions to conflicts that arise in employment relationships. It describes the conflicts between employers and employees as multidimensional and long-standing and proposes that employers are advantageous in such relationships. Employers' advantages are attributed to the fact that they decide solely most of the terms that guide employment relations including recruitment employment. Industrial relations assume that since job description, job specifications and work conflict resolution process are decided by the employers, employee and employer relationship can only be likened to a servant-master or the governed and those who govern or the oppressed and the oppressor or the masses and the elites. In fact, under Marxism, the relationship is likened to the bourgeoisie (or capitalists) and the proletariat (or workers) (Marx, 1978). Ultimately, the employer assumes superiority over employees. This means that power balance between employers and employees will never be equal without deliberate and purposeful mechanisms put in place by unions or legislatures (Lewin, 2018). As result, Industrial relations proposes that employer/ employee conflicts can only be attended to and resolved through institutional interventions such as unions and governments. Such mechanisms provided are intended to ensure that there is power balance in the workplace, and while conflicts may not be regarded as beneficial, their occurrences between employers and employees become platforms for interventions (Tapia, Ibsen & Kochan, 2015).

The Approaches to in Industrial Relations

Industrial relations present no coherent theoretical rationale but is driven by realistic concerns about the diverse conflicts confronting employment contracts. The Dunlop's Industrial Relations Systems (1958), which is regarded as the best effort this far to produce a generally accepted theory, provides a significant framework for the identification and organisation of Industrial relations key features such as identification of key parties to the contract, what ideology that binds the parties, the regulations and the nature of environment. However, the theory is criticised for not being able to generate hypotheses that can be tested. In other words, the theory does not provide a platform upon which questions and future predictions about Industrial relations can be developed and answered. Consequently, in this chapter, to provide

basic understanding of how Industrial relations functions, we adopt the Fox's 'frames of reference' (1966, 1974). Although the Fox's 'frames of reference' can be described as old, it still presents relevant insight through its identified three frames of references in Industrial relations as unitary, pluralist and radical. The three frames of reference to Industrial relations provide varied explanations to the nature of employment contracts.

The Systems Model: This theoretical conception is accredited to John T Dunlop, an American Professor of Labour Economics. He drew great inspirations from the works of Professors Talcott Parsons and Neil J. Smelser and described Industrial relations as "an industrial relations system in its development is regarded as comprised of certain actors; certain contexts and ideology which binds the industrial relations system together and body of rules created to govern actors at the workplace and work community" (Otobo, 2000:18). Dunlop (1958) proposes that an industrial relation system must consist of three main bodies, which are: the workers and their organisation, employers and their association and the government. However, other components that keep the industrial relations functional include market, technology, ideologies that exist within the group, budgetary concerns and power struggles. Accordingly, "the task of any theory of industrial relations is to explain why particular rules are established and how and when they change in response to changes affecting the system" (Ubeku,1983:4).

Unitary Approach: The unitary approach to employment relationship is based on the assumptions and set of values that employment relationships come with conflicts that can be easily managed and eliminated. It is premised on the fact that employees and employers have common interest, which is to ensure the survival of the organisation. As a result, arising conflicts are usually temporal and do not lead to the insolvency of the organisation. In the unitary approach, conflicts that exist are not attributed to the ideology of the superiority of employers over employees but to personality disorders, poor communication, improper practices of recruitment, compensation and promotion and the wrong behaviours of rebels. To this end, the conflicts are handled by a good management team that would attend to eliminating the likely sources of conflicts. The management team can take measures that include establishing appropriate communication system to would assist in shaping and reshaping employees' interest to be in line with that of the organisation. In addition, appropriate communication system can help suppress or eliminate individuals with personalities prone to triggering conflicts. The goal of the management team should be to ensure the organisation is portrayed to the work group as the only authority that should demand their compliance. Consequently, other groups such as trade unions should be ignored and only management should be legitimate.

Pluralist Approach: Pluralism Pluralists believe that workplace conflicts are inevitable since the complexity of running an organisation triggers diverse interest between employees and employers. Consequently, conflicts become constant on issues that pertain to work allocation and associated rewards. The diverse interest leads to the existence of different authority within an organisation, whereby the management team is not seen as the only group with power to determine workplace activities. In this case, another source of authority is the unions. Conflicts are handled using the social mechanisms of collective bargaining, arbitration and conciliation. Workers join unions believing that the union is a medium to coerce employers to give attention to employees' interests. The power yielded by unions counterbalances that of employers. Pluralism believe that workplace conflict is healthy for any organisation because it provides a platform to acknowledge the grievance of employees and spur managers to delve into innovative conflicts resolution methods that would be effective. Employees and employers can compromise and agree because they want the organisation to survive.

The Research Implications of the Labour Unions and Industrial Relations Approaches to Economic Sustainability

The research Focus on firm performance, employee satisfaction, role of labour unions and of institutions such as collective bargaining to resolve conflict within the organization. Collins (2013) a labour union is an association of workers, which consists of representatives that mediate between the workers and their employer in order to avoid any unfair treatment that could be meted on them by the employers and to conversely ensure commitment to work by its members in a way that, it will result in a high level of productivity and organization efficiency in general. It also refers to organized groupings of workers that relate with employers on various issues related to the condition of employment of their members (Adefolaju, 2013). According to Hyman (2001), it is the continuous association of wage earners for the purpose of sustaining and enhancement of their workplace conditions. The Nigerian Trade Union Act of 1973 defines it as; “Any combination of workers or employees whether temporary or permanent, the purpose of which is to regulate the terms and conditions of employment of workers whether the combination by any reason of its purposes being in restraint of trade and whether it purpose do or do not include the provision of benefits to members”. Uvieghara (2001) observed that the two significant criteria of this definition for determining whether an association is a trade union are: the combination must be of workers or employers and, that it must have the proper purpose, which is that of regulating the terms and conditions of employment of workers.

The labour union is also seen as an organization whose membership consists of wage earners and union leaders, who are united to promote and pursue their common interest and welfare, and regulate terms and conditions of their employment through collective bargaining and consultations with employers. In the words of Webb and Webb (1894) it is a continuous association of wage earners for the purpose of maintaining or improving the conditions of their working lives. In this sense, employees in a union seek to use the union to protect and promote their own interest in the workplace, mainly by means of collective bargaining and consultations with employers. Labour union thus, is a platform utilized by workers in organizations to seek understanding as well as to influence management decisions that could be detrimental or contrary to the terms and the contract of agreement which the management entered into with the workers. In this sense, a labour union can be seen an organization of wage earners or salary workers established for the purpose of protecting members collective interests in their dealing with employers and in the wider society using the process of rule-making and collective bargaining in an industrial settings or workplace. Labour union is therefore vital for the improvement of the workers quality of life.

The Important of Industrial Relations Amongst Actors’ Unions in Industries to Economic Sustainability

The Labour Union approach to Industrial Relations conceives Industrial Relations as the relationships amongst unions, and the institutions and processes that have developed to structure them. Unions as used here refer to industrial unions, which include trade unions and employers' association. Within the trade unions could be found associations of senior employees (staff associations) on one hand and junior employees (labour unions) on the other. The interactions amongst the members of these unions either as individuals with collectively examined in this approach as constituting Industrial Relations. (Izaak-Zeb Obipi, 2018). The beginning and growth of Industrial relations in Nigeria is traced back to the pre-colonial era and in particular, the colonial history of the country. The colonialist operated a system that relied on the interaction of employees, employers and government and, in the system,

interventions depended on coercion that ensured compliance and the prevention of industrial actions. When Nigeria gained independence in 1960, Alhaji Abubakar Tafawa Balewa became the Prime minister; unfortunately, he but did not effectively handle political crises in the country. Whereas the prime minister had the executive power to handle crises, he utilised military means. For example, crises such as the Tiv riots and the AG crises of western Nigeria were handled by the military means. The constant use of military led to the military attempting to seize power in 1966. Within January to July 1966, two coups were executed in Nigeria, after which, the military ruled the country from 1966 to 1979, making it a total of thirteen years. In this period, amidst the civil war and other economic challenges the country faced, the military suspended the constitution and ruled by decrees. In addition, several radical reforms were introduced, and this greatly changed the social, economic and political terrain of the country. The new decrees, labour laws and regulations resulted to structuring and restructuring of labour unions that saw the arrest and detention of labour union members and increased minimum wage is an impact to economic sustainability.

The Nigerian Industrial Relations System and the Recognised Mechanisms of Statutory Regulation to Resolve Industrial Disputes and to Aid Economic Sustainability

The recognised mechanisms of statutory regulation that guides collective bargaining in Nigeria is referred to as the Nigerian industrial relations system. To resolve industrial disputes the Nigerian industrial relations system works at two levels, which are levels are voluntary mechanisms and statutory mechanisms. Voluntarism This level of industrial relations is also referred to as the internal mechanisms. This voluntaristic approach is the process where the parties to the employment contract willingly come together for collective bargaining to settle existing grievances. This mechanism of industrial dispute resolution prevents the occurrence of further recourse within an organisation, which can lead to industrial actions such as strikes and lockouts. Investigations show that many organisations in Nigeria lack appropriate grievance resolution mechanisms and this account for the incessant industrial actions that characterised the country's work system (Diejomoah, 1979). Statutory mechanism This mechanism is contained in the Trade Disputes Act of 1976 and can also be referred to as external machineries for dispute settlement. It involves four stages which are

- i. **Conciliation:** This allows the parties to the dispute to negotiate informally and reach an agreement where possible;
- ii. **Arbitration:** In this case, instead of going to court, the parties bring the issues before an arbitrator(s), whose decisions are binding on all parties.
- iii. **Inquiry:** this can also be called enquiry or fact-finding: It is the process of finding more detailed information about a dispute in the hope that such accurate information would make things more translucent in ways that grievances can then be eliminated. Inquiry can also be a preliminary of the other dispute resolution mechanisms; and
- iv. **The National Industrial Court:** This court handles issues related to employment, labour, trade unions and in general industrial relations in Nigeria. The above four stages are expected to help resolve issues when voluntary mechanism for dispute settlement fails. Although these four stages are in place, reports indicate that there is constant failure of dispute settlement in the country (Adebisi, 2013). Particularly, the Federal and State government are guilty of not adhering to statutory mechanisms and even when the mechanisms are partially adhered to, the Governments violates the terms agreed on. For example, the Governments often does not keep to terms of collective bargaining between them and Academic Staff Union of Universities (ASUU) or the Nigerian Labour Congress (NLC).

Labour Unions Right to Strike and Government Participation

The fundamental understanding of industrial relations provided to equips an individual with the boost to engage in further studies of industrial relations. The understanding provided extends from what industrial relations infer to how it functions in Nigeria by presenting laws that guide how disputes are handled. Also of relevance is the awareness that the workplaces in Nigeria mostly fall short in ways disputes are attended to. Several académie disciplines including sociology, psychology economies, history, political science and industrial relations can pool their resources to analyse and operationalize sources, motive and nature of power in the society. If their analysis is to terminate with conflict, conflict resolution or bargaining theory, conflict can become a dependent variable, instead of being an intervening variable. If they are interested in extending their analysis to theories of motivation, industrial relations, wage determination or society, they should utilize conflict and other contexts as intervening variables and treat satisfaction of human needs as their dependent variable.

Conclusion

This paper highlights strength in industrial relations literatures to industries sustainability. It suggests that a combination of these frameworks can provide a comprehensive understanding of the employment relationship that will bring economic development and sustainability. The paper further concludes that, there is a need for future research to develop a holistic framework that considers power imbalances and competing interest in the employment relationship.

Recommendations

In an attempt to minimize industrial relations disputes in Nigeria, the following recommendations are made: One, government should be faithful to its statutory role of an impartial arbiter who should not meddle unnecessarily in the dispute's resolution procedures. Two, parties to industrial relations disputes should embrace the principles of voluntarism rather than the usual recourse to statutory procedures which usually, makes government to intervene by imposing settlement on the parties. Usually, labour falls victims of such imposition by governments. Three, government should immediately repeal some anti-labour laws that usually generate conflicts, e.g. Labour Amendments Act of 2004 which seeks to literally castrate labour in financial terms, by its attempt to make check-off dues paid by workers voluntary. Four and finally parties to industrial relations disputes should endeavour to demonstrate more sincerity in their collective bargaining procedures. The usual attempt by the government to repudiate agreements it reached through collective bargaining with labor at will should be discouraged for harmonious industrial relations to exist. If the government would lead by example by demonstrating sincerity in its dealings with parties in industrial relations, it would have established exemplary precedence and leadership for durable and sustainable industrial relations to thrive in Nigeria. Unfortunately, the reverse is the case today where the economic-political system is bedevilled by monumental corrupt practices.

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**BEYOND THE HEADLINES: INVESTIGATING THE IMPACT OF MEDIA BIAS
ON PUBLIC PERCEPTION**

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ABSTRACT

This study explores the multifaceted impact of media bias on public perceptions, focusing on political, ideological, cultural, and economic biases. It emphasizes the influence of political ideology on media bias, exacerbated by economic and political factors. To address this issue, the study advocates for promoting editorial transparency and diverse media ownership. The growing influence of media outlets, especially on social media, raises concerns about echo chambers. Various factors, including deliberate and inadvertent influences from newsmakers and journalists, contribute to biased news creation. The study identifies types of bias such as political bias, sensationalism, confirmation bias, selection bias, and framing bias, urging media consumers to recognize and understand these biases for a balanced understanding. It delves into political bias's manifestations, including partisan rhetoric and cherry-picked reportage. Sensationalism and corporate bias are also explored, with large conglomerates shaping narratives in line with corporate interests. The historical context of bias as a political pawn is discussed, highlighting its presence for over half a century. The study addresses the impact of fake news, emphasizing the need for critical analysis. It underscores media bias's significant influence on public understanding, political choices, and the formation of echo chambers. Case studies and research findings, such as disparities in Iraq War coverage and framing's impact on perceptions, illustrate the consequences of biased reporting. The study incorporates psychological theories like Gerbner's cultivation theory and Ajzen's theory of planned behavior to analyze the influence of media on individuals' perceptions and behaviors. It concludes by emphasizing the crucial role of mass media in shaping public opinion and attitudes toward emerging issues.

KEYWORDS: Headlines, Media, Bias, Public and Perception

Introduction

Disregarding the media's impact on public opinion in the current era of excessive information would be an error. In contemporary culture, individuals mostly get their news and current affairs from several media platforms, exerting a significant impact on their perspective of the world. Media bias, however, has existed for a considerable period and now poses a significant challenge to the credibility of news coverage. This study examines the impact of media bias on public perceptions.

Media bias refers to the structuring of news and information sources in a way that favours certain ideologies or points of view. Political, ideological, cultural, and economic biases are many manifestations of prejudice that may result in a distorted understanding of events. Multiple scholarly research have shown that news coverage often exhibits bias, which has the potential to significantly influence public opinion (Entman, 2012; Jamieson & Cappella, 2018). Media bias has been shown to potentially influence cognitive processes, hence affecting individuals' information intake and comprehension. The cognitive effect of bias may be explained by the selective exposure hypothesis (Zillmann & Bryant, 2015), which posits that individuals are inclined to selectively consume information that aligns with their preexisting beliefs. Hence, media bias might potentially foster the creation of echo chambers and exacerbate societal differences.

An individual's political ideology may influence their predisposition towards bias towards the media. Media biases occur when the media promotes certain political viewpoints via their content development. As to Groeling's (2013) findings, news organisations have a tendency to support political parties that align with their own ideological beliefs. This tendency exacerbates the polarisation of political discourse, since it reinforces party narratives. Both economic and political factors contribute to the formation of media bias. According to Bağdikian (2014), media companies may prioritise financial profit above journalistic principles when they prioritise advertising revenue and corporate influence targeting certain demographic segments. A thorough examination of media ownership structures is necessary to address the economic bias that hampers the media's ability to provide impartial information.

The ramifications of media bias are extensive and pose a significant danger to the very foundations of democracy. Biassed reporting has the potential to undermine public faith in democratic institutions and media. This is concerning since a well-informed populace is crucial for the proper functioning of a democratic society, as stated by Sunstein in 2017. The effect of media bias, which moulds popular opinion, may impact elections, public policy, and the viability of democracies. Hence, it is imperative to develop a comprehensive approach to address the ramifications of media bias. Media literacy initiatives, such as the one endorsed by the News Literacy Project, aim to educate individuals in identifying biassed journalism and assessing news outlets with a critical mindset. To enhance news companies' credibility and minimise bias, it is crucial to promote editorial transparency and encourage a wide range of media ownership.

Prior research has shown the connections between perspectives, opinions, and behaviours. Wiese and Akareem (2020) discovered correlations between user attitudes, behaviours, and perceptions of social media advertising in three countries: South Africa, Germany, and Australia. The objective of the study's trials was to ascertain if there exists a link between individuals' perspectives, behaviours, and dispositions towards advertisements on social media. Research has also focused on examining how digital elements influence consumers' perceptions and attitudes towards social media advertisements. The findings indicate a robust and

favourable correlation between individuals' attitudes towards social media advertisements and their perception of the degree of interaction between these advertisements and their audience. A positive association exists between individuals' perception of the commercials and their perceived credibility (Lee et al., 2022). Thus, the present study contributed to the previous literatures that incorporates the public perception of mass media news is brought about. The current study employs the cultivation theory and the theory of planned behavior (TPB).

Several scholars have conducted research on the impact of media bias on the formation of public opinion. Hamborg, Donnay, and Gipp (2019) contend that influential media outlets have had a substantial influence on public sentiment throughout time, as seen by their impact on electoral procedures and societal perceptions of tobacco use. The influence wielded by media companies has seen a substantial surge in the last several decades. As to Lutz's (2017) findings, by 2017, a few six corporations have a 90% stake in the media industry inside the United States. This inherently allows for the potential of deliberate bias in media coverage (Hamborg et al., 2019). Individuals may remain susceptible to media bias on social media platforms, where a more extensive array of viewpoints is often shown (Bakshy, Messing, & Adamic, 2015). However, social media is still distinguished by increased user participation and, presumably, a broader spectrum of perspectives being shown. Social media users often limit their exposure to news and ideas that align with their own beliefs, whether intentionally or unintentionally, resulting in the formation of a "filter bubble" or "echo chamber" (Sunstein, 2002; Hamborg et al., 2019). However, the level of isolation is not necessarily as severe as it is often assumed. Barberá et al. (2015) discovered a notable disparity in the coverage of political affairs compared to reporting on accidents and catastrophes, whereas no such difference was seen in other domains. Advancements in technology may result in a reduced scope of news that is typically consumed, thereby contributing to the isolation of social media users in terms of the subjects they interact with. Facebook, the largest social network globally, with more than one billion active members (Hamborg et al., 2019), recently introduced Trending Topics, a feature that consolidates news articles. Presently, consumers are restricted to just obtaining current events via Facebook. Conversely, the aforementioned amount of impact is heightened when individuals only receive news from a single distributor. In this instance, a solitary company has authority over the content that is shown to news recipients (Hamborg et al., 2019).

Statement of the Problem

The media sector in Nigeria is marred by a pervasive issue – media bias. As a nation with diverse cultures, ethnicities, and political ideologies, the impact of biased reporting on public perception cannot be overstated. The problem lies in the fact that media outlets, often influenced by political affiliations or economic interests, may present news in a way that skews public opinion and fosters division. The consequences of media bias extend beyond mere misinformation; it erodes the foundation of a well-informed citizenry crucial for a thriving democracy. Inaccurate and slanted reporting can contribute to the exacerbation of existing social tensions, deepen political polarization, and impede national unity. Furthermore, the public's trust in media as a reliable source of information is jeopardized, leading to a potential erosion of the democratic values that underpin Nigerian society. This research aims to examine the multifaceted dimensions of media bias, exploring its roots, manifestations, and the far-reaching implications on public perception. By shedding light on the problem, this study aspires to contribute to the development of strategies for fostering unbiased journalism, promoting media literacy, and ultimately fortifying the democratic fabric of Nigeria.

Understanding Media Bias

Hamborg et al. (2019) argue that investigations of biased news reporting have been conducted in the field of social sciences since the 1950s. Williams (2023) defines media bias as the intentional and consistent exhibition of partiality or favouritism. The prejudice being alluded to is apart from other manifestations of subconscious predisposition seen in news coverage, and it is specifically delineated by the previously described concept. Unintentional bias may arise from two primary sources: firstly, the impact of news values on the process of creating news (Park, 2009); and secondly, the manner in which diverse audiences consume news (Oelke et al., 2012). The news values are shown by the proximity of a significant event to the news organisation and its audience, as well as the tangible effects of a particular subject's extensive knowledge or societal importance (Hamborg et al., 2019).

In order to reduce the influence of media bias on consumers, it is advantageous to have a thorough understanding of the many types of bias and how it is evident throughout the process of producing news (Park, 2009). Figure 1 depicts the process by which news organisations convert events into narratives and how viewers absorb and understand those tales. Each step of the process corresponds to the bias categories defined by Baker, Graham, and Kaminsky in 1994.

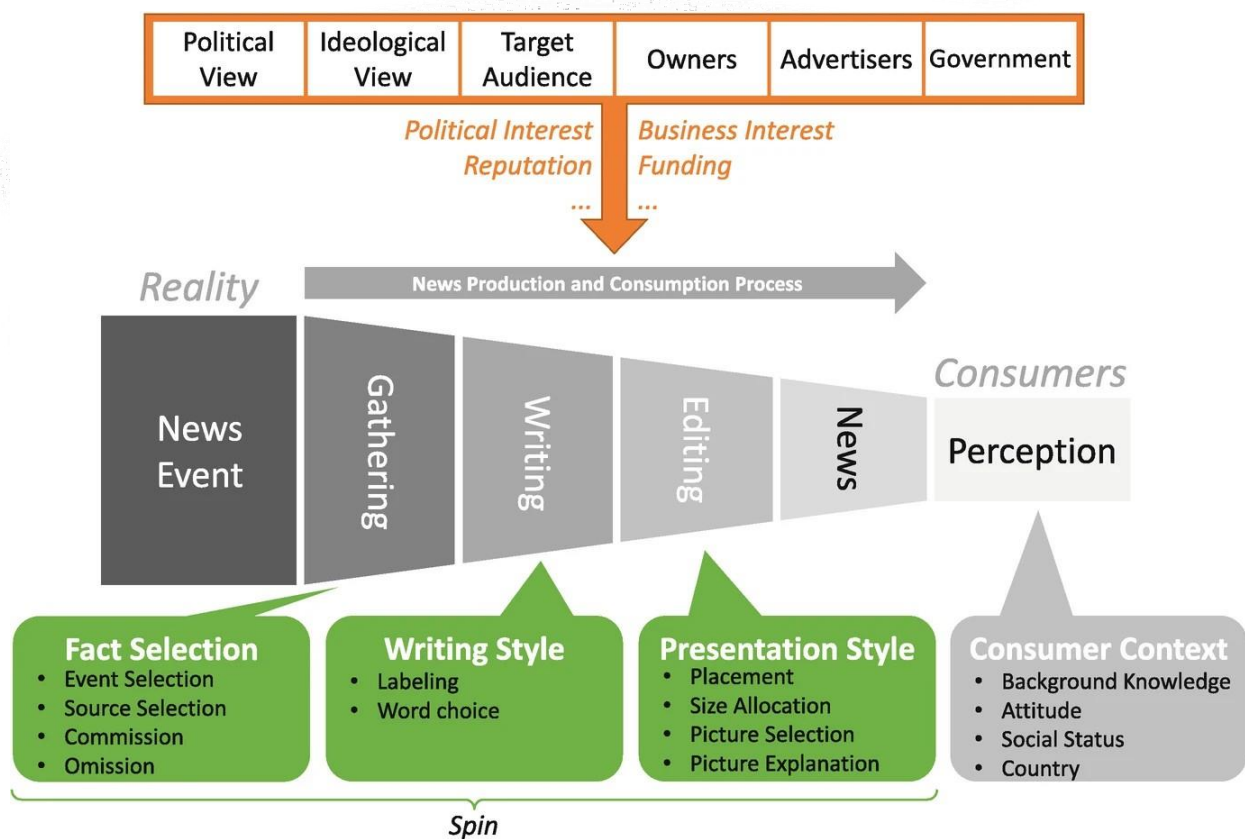


Figure 1: The News Production Process Model.

Source: Hamborg (2023)

The above model illustrates the many manifestations of media bias that arise when an actual event is converted into a news article and then influenced by the perspectives of news consumers, as emphasised by Hamborg (2023). The viewpoint and growth of a news article are shaped by several internal and external forces, as shown in the prominent orange area. Throughout the three stages of news creation, many forms of bias might emerge, as shown by

the green segments positioned at the bottom. In the realm of news consumption, consumer context refers to any external element that impacts the way in which the audience perceives and understands a news piece, alongside the presence of media bias. Based on the first investigation done by Park (2009). Subsequently, we will analyse the ways in which the media might introduce bias into the procedures of acquiring and consuming news.

Various individuals and groups may have an impact on the news generating process, whether their influence is deliberate or not (refer to the orange rectangle in Figure 1 for the elements that contribute to media bias). According to Cohen (2019), newsmakers exhibit a wide range of political and ideological viewpoints. The influence of these ideologies permeates all aspects of a news organisation, shown in the prevalent political bias found inside news businesses and among its reporters. Journalists are allowed to display partiality in their work if they perceive it to be beneficial for their career progression. Both external and internal variables may influence the process of news creation. News items are often altered to suit the particular demographic of the news company (Gentzkow & Shapiro, 2010). This phenomenon arises when readers see that their news source constantly contradicts their own ideas, prompting them to choose for an other source. For example, Mullainathan and Shapiro (2010) and Mullainathan and Shleifer (2005). Journalists has the capacity to shape news narratives in alignment with the preferences of their owners and sponsors. If any negative incident happens to one of its main sponsors or related firms, they have the option to not acknowledge it. D'Angelo and Kuypers (2010) found that producers may have a predilection towards governments as a result of the information they get from them. Furthermore, the final news report might be impacted by commercial factors, such as the cost comparison between editing pre-written press releases and doing investigative journalism. Ultimately, the fundamental impetus for the bulk of news sources is economic profit, even if they do not overtly recognise it. They may even refute the assertion that their main priority is to maintain objectivity (Paul & Elder, 2004). News programme viewers want commentators to take stances on important issues and differentiate relevant information from trivial material (Boczkowski, 2004).

Hamborg (2023) argues that these traits have subtle but noticeable effects on several areas of the news creation process. Journalists start the information-gathering process for a story by painstakingly assembling relevant material from previous news items. The process of event selection, which is often referred to as narrative selection, begins at this juncture. Evidently, not every incident has significance for the target audience of a new media platform, and narratives with a considerable number of dramatic aspects may provide more financial prosperity. Journalists are responsible for curating materials, such as research, press releases, or other news pieces, to include into their work. The last duty of a journalist is to choose the sources that will be included into their upcoming report and those that will be omitted. Hamborg (2023) characterises this phenomena as "commission or omission," which has a substantial influence on the interpretation of the event.

Journalists should use a diverse range of writing styles in order to proficiently mould the news. The production stages of communication impact the use of designations, whereby a person may be favourably labelled as a "independent politician," while the opposing party may be negatively labelled or not labelled at all. In addition, the selection of words is impacted by factors such as referring to a group as "coalition forces" rather than "invading forces" in an article (Hamborg, 2023). The last phase of the process, editing, is focused on enhancing the presentation of the narrative. The determinants influencing the attention and perception of an event include the selection of visuals, including their dimensions and the incorporation of emotive content. Furthermore, the organisation and ratio of the articles, where a big feature story garners more attention compared to a long analysis on page 3, also contribute to this

phenomenon. In addition, the elucidation of the images, including the provision of context via captions, is a crucial element of this procedure (Hamborg, 2023). Finally, spin bias serves as a prime example of media bias by showcasing the complete partiality of an article. Furthermore, apart from the aforementioned biases, the paper also displays other biases of lesser significance (Christian, 2019).

Types of Media Bias

Media bias comes in various forms, influencing how information is presented and interpreted. Types of bias include political bias, where reporting favors a particular ideology; sensationalism, which prioritizes dramatic or attention-grabbing content; and confirmation bias, reinforcing pre-existing beliefs. Additionally, selection bias occurs when certain stories are emphasized or omitted, while framing bias involves shaping narratives to influence perception. Recognizing and understanding these biases is crucial for media consumers seeking a balanced and nuanced understanding of the news.

A. Political Bias

The prevalence of media bias, particularly in relation to political bias, is a pervasive phenomenon that may significantly influence public sentiment. In order to actively engage in critical analysis of information, media consumers must acquire a comprehensive comprehension of bias. The media may demonstrate political bias via several means, therefore influencing the communication, presentation, and interpretation of news (Jamieson & Cappella, 2018). The presence of political bias in the media is apparent via the use of partisan rhetoric, cherry-picked reportage, and a concentration on some issues while disregarding others. Political bias is often shown via the deliberate and strategic presentation of material that supports a certain political ideology or candidate. Media firms have the ability to emphasize content that aligns with their own perspectives, while disregarding or concealing elements that might potentially undermine their own storyline (Sunstein, 2017). Moreover, the use of political vocabulary, which includes emotionally charged expressions and strategic communication methods, has the ability to slowly shape public sentiment. For instance, the selection of vocabulary used to depict an occurrence or an individual may evoke intense emotions and perspectives. Political prejudices have a significant influence on public mood. Biased reporting may exacerbate societal polarisation by reinforcing preexisting viewpoints and fostering echo chambers, when individuals are only exposed to information that coincides with their own ideas. This has the capacity to hinder constructive discourse and create a distorted picture of reality (Entman, 2012). Moreover, political bias has the potential to erode public trust in the media by instilling scepticism about the veracity of the information disseminated. The credibility of the media is crucial for the proper functioning of a robust democracy. Therefore, biased reporting has the capacity to undermine the media's reputation as an unbiased distributor of information.

B. Sensationalism

Sensationalism in media refers to the practice of presenting information in a way that is designed to provoke excitement, shock, or emotional reactions from the audience rather than providing objective and balanced reporting. This type of bias often involves exaggeration, dramatization, or focusing on the most attention-grabbing aspects of a story, sometimes at the expense of accuracy (McManus, 2014). Examples of sensationalism can be found across various media platforms. Headlines that use hyperbolic language to create a sense of urgency or fear, such as "Breaking News: Crisis Unfolding!" or "Shocking Revelations Exposed!" are common in sensationalized reporting. Additionally, news stories that prioritize the emotional

impact of an event over its broader context can contribute to sensationalism. For instance, coverage that emphasizes the personal tragedies of individuals involved in an incident while neglecting the underlying causes or systemic issues (Kovach & Rosenstiel, 2014). Sensationalism can significantly impact public perception by shaping how individuals perceive events and issues. When media outlets prioritize sensational stories, they may contribute to the distortion of reality, leading to a skewed understanding of the world. The emphasis on emotional and dramatic content can generate fear, anxiety, or outrage among the audience, influencing public opinion and potentially swaying attitudes on certain issues (Fallows, 2017). Moreover, the constant exposure to sensationalized news can desensitize individuals, making them more prone to seeking out extreme and sensational content. This can contribute to a cycle where media outlets feel compelled to produce increasingly sensational stories to capture and maintain audience attention, further perpetuating biased reporting.

C. Corporate bias

Media bias is a pervasive issue that can significantly influence public perception and understanding of various events. One prominent form of bias is corporate bias, which can manifest in different ways, including through corporate ownership and the shaping of narratives. According to Bagdikian (2014), corporate ownership of media outlets plays a crucial role in determining the perspectives presented to the public. Large media conglomerates, with interests in diverse industries, often control multiple media platforms. This concentration of ownership can lead to a narrowing of viewpoints and an emphasis on narratives that align with the corporate interests. For instance, a media outlet owned by a major corporation in the pharmaceutical industry might downplay negative stories about the industry, potentially affecting the public's awareness of certain issues. Corporate bias goes beyond ownership and permeates the narratives constructed by media outlets. Editors and journalists may be influenced by the overarching corporate agenda, consciously or subconsciously shaping their reporting to favor corporate interests. This can result in the omission of critical information, framing stories in a way that benefits the corporation, or even promoting specific ideologies that align with the corporate ethos. Such shaping of narratives can contribute to a skewed public understanding of events and issues (McChesney, 2019).

Bias as a Political Pawn

The media has consistently shown political bias for over half a century (Schiffer, 2017). As Schiffer (2017) explains, the assertion of liberal bias may be comprehended by considering the historical backdrop of 1964, when Goldwater won the Republican nomination against Rockefeller. The Republican Party was concluding its 36-year tenure without simultaneously possessing the presidency and a majority in Congress. During this period, publications like the National Review started publishing pieces that voiced disapproval towards the New Deal and the subsequent liberal policies. The Republican Party revitalised the conservative movement in response to these allegations. Goldwater published *The Conscience of a Conservative* in 1960. This book might facilitate the attainment of the conservative movement's goals. This booklet enhanced his campaign by offering Republicans an alternative to the New Deal's progressive ideals. Nevertheless, the Republican Party had an unfavourable view of him, the media overlooked his presence, and his credibility was undermined by his unorthodox stance on conservatism. As the mainstream media ignored this growing conservative movement, accusations of liberal bias in the media began to arise (Schiffer, 2017).

When evaluating an accusation of prejudice, it is essential to take into account the many forms of bias. Schiffer (2017) classifies bias into four separate categories: gatekeeping, coverage,

tone, and quality. When two problems of comparable significance are merged into a single accusation, the media tends to exhibit partiality towards one side at the expense of the other. In the middle of fervent political discourse, this prejudice is quite widespread. Biased coverage is the term used to describe when a news institution is seen to have taken a stance in support of one side of a conflict. The term used to describe the presence of flaws in news reports that seem to favour one side over the other is quality bias (Schiffer, 2017). The phrase "tone bias" is used to characterise coverage that shows a preference for one side over the other.

According to the 2011 data from the Pew Research Centre, 52% of Americans maintain the notion that news coverage demonstrates bias. Upon analysing party identity, it was shown that prejudice was prevalent among Republicans (62%), conservatives (61%), and independents (52%). In contrast, the Democrats secured 47% of the vote, and the Liberals garnered 46%. Research conducted by Hassell, Holbein, and Miles (2020) has shown that academic evaluations of prejudice in news have found no substantial political bias in the coverage of contemporary events. The majority of Americans maintain the conviction of media bias, notwithstanding the absence of corroborating proof.

In 2019, Weeks et al. established a correlation between the perception of media bias and the probability of individuals following politicians on social media. Engaging with political figures on social media may incite hostility towards other parties and cultivate enthusiasm for one's preferred candidate or leader. Furthermore, those who choose to endorse lawmakers are prone to developing emotional engagement in politics, making them more vulnerable to unfavourable media bias. The increasing use of social media by politicians to interact with constituents may be creating the sense of a growing unfavourable media bias (Kreiss, Lawrence, & McGregor, 2020).

Fake News

There is a growing apprehension over the fairness of news reporting as a result of the widespread circulation of erroneous material by ostensibly reliable news outlets. According to Desai, Mooney, and Oehrli (2020), "fake news" refers to news stories that are entirely untrue, biased, or intentionally created to generate a false or biased result. A study conducted in 2016 found that misleading news articles might potentially influence individuals with strong political beliefs in a manner comparable to legitimate campaign commercials (Hunt & Gentzkow, 2017). While it is concerning that some examples of fake news appear online, it is important to remember that these stories do not represent the whole of the issue. Furthermore, voters should carefully consider the importance of the phrase "fake news" and its consequences. A study done by Linden et al. (2010) revealed that a significant majority of American voters linked the phrase "fake news" with two well-known mainstream news networks, namely CNN and Fox News. Why? The "Fake news effect" has the potential to influence people's perspectives and their trust in the media. The concept of "fake news impact" refers to the tendency of political supporters to undermine the credibility of unbiased news outlets by labelling them as "fake news" (Linden et al., 2010). President Trump's Twitter feed often exhibits several occurrences of this phenomenon. In a recent tweet, he claims that, except for one poll conducted by @ABC NEWS, which he believes is false and lacks crucial information such as the sample size, party affiliation, and other pertinent factors, he has received mostly favourable poll results, with some exceeding 50%. Despite facing a 12-point deficit before to the previous election, they managed to secure a triumph with just one week left. "Their content is abhorrently misleading!" Trump's viewpoint on the year 2020 (Trump, 2020).

Effects of Biased News Consumption

According to Gerber et al. (2019), media bias significantly influences how the public and individuals understand news events, which in turn affects their political choices. Despite the progress made in social media, reputable news agencies continue to be the major source of information about current events (Crossman, 2018). Therefore, when news organisations participate in biased reporting, the probability of readers forming biased notions is increased. Present-day users of social media have a greater tendency to "follow" news items that conform to their previous beliefs, which may lead to the spread of biased reporting (Mullainathan & Shleifer, 2015). Therefore, people who get news via social media are prone to becoming ensnared in a "echo chamber" that strengthens their previous beliefs. A considerable fraction of individuals who consume news have a tendency to quickly glance through a restricted set of news outlets as a result of variables such as being overwhelmed with information, facing language hurdles, or having personal preferences and habits (Newman et al., 2015).

Media bias may potentially affect election results for all voters (Kull et al., 2017; Larcinese et al., 2021). According to Sunstein (2019), media bias exacerbates the division of public opinion, hence hindering the process of achieving agreement on intricate matters. Many researchers contend that media bias undermines the core tenets of our democratic system as a result of its substantial detrimental impacts. Does the public's view, influenced by media outlets, really reflect "authentic" popular opinion? An extensive assessment conducted in 2003 uncovered notable disparities in the manner in which information was presented across American television channels. Concerning the Iraq War, those who consumed Fox News exhibited the most pronounced degree of ignorance. According to Kull et al. (2017), the US administration's efforts to justify the war resulted in over 40% of viewers believing that weapons of mass destruction (WMD) had been found in Iraq.

Media bias impacts people's interpretation of news via three main mechanisms: priming, agenda setting, and framing (Daumman and Parkin, 2015). Priming theory posits that people's prior perspectives on specific concerns addressed in news articles about a certain subject impact their subsequent evaluations of that subject. News providers influence the direction of public discussion by strategically emphasising subjects that attract their audience's interest. According to Entman (2013), the viewpoints presented in news items, known as frames, influence how news consumers evaluate situations. According to Entman (2017), journalists use framing tactics to promote a certain perspective while reporting on a topic.

Hamborg et al. (2019) demonstrated the impact of framing by presenting a case study by Kahneman and Tversky in 1984. Consider a hypothetical situation in which 600 persons are in danger as a result of a viral pandemic. For the first poll, Kahneman and Tversky asked participants to assess their preferences for the following choices:

- A. Total of 200 individuals will be rescued.
- B. The likelihood of 600 persons being saved is 66%. There is a one-third (33%) likelihood that no one will be exempted.

Option A was chosen by 72% of the respondents in the first poll, while Option B was selected by 26%. Following that, an additional poll was carried out to ensure an unbiased depiction of the same options. However, in this case, the voting alternatives were provided according to the anticipated fatality count rather than the number of lives that would be saved.

- C. The predicted fatality count is expected to reach about 400.
- D. 66% chance that no one will die. In two-thirds (66%) of instances, there will be no deaths. The likelihood of 600 persons dying is 33%.

The situation was characterised by the reversal of individuals' choices. Only 22% of poll respondents picked option C, however option D was selected by a majority of 72%. The survey findings indicate that framing, defined as the method of presenting information, may successfully emphasise both the favourable and unfavourable elements of the issue (Hamborg, 2023). Nevertheless, the consequences of media bias are many, and when people are unaware of the full amount of prejudice, these effects are intensified. The concentration of power within a small number of firms has magnified the potential influence of any one news organisation due to media bias.

Bias and Public Trust

Although it is a fact that several news networks are under the direction of a single individual, not everyone is apprehensive about the dissemination of false information via media platforms. In 2018, to the surprise of the American public, several local news stations broadcasted an almost identical script to their viewers. The intended declaration offered by the local news analysts failed to instill confidence in viewers about the impartiality and equity that need to be maintained in the news transmission, contrary to expectations. The Sinclair Broadcast Group, with its extensive network of over two hundred television stations, has provided them with virtually same script, making it impossible to tell them apart. The widespread distribution of a standardised script among network anchors throughout the country provoked substantial public anger and discussion, prompting inquiries into the trustworthiness of local television stations and the rationale for the exclusive control of a single firm in station ownership (Fortin & Bromwich, 2018). The credibility of media is diminished when corporations exert control over news outlets and use them to further their own agendas. Based on the results of a 2017 poll carried out by the Pew Research Centre (b), which revealed that local news stations were seen as the most reliable source of information, this scenario might have significant repercussions. Based on Pew Research Centre's findings in 2017, Republicans, Democrats, and Independents all see local news as equally reliable. The trust differentials between national and local news vary from 2 to 13 percent. The Sinclair Broadcast Group controversy, although not overtly exhibiting ideological bias, generated a sense of disquiet among the public over the potential compromise of their reliable news outlets. This might potentially result in more allegations of disseminating inaccurate information.

According to a 2018 study conducted by the Pew Research Centre, those who had associations with both major political parties were more likely to attribute honesty to both views and factual information. Partisans often support a statement if they perceive it to be based on facts, whereas they categorise a disagreement as a subjective issue. This study confirmed the findings of Fragale and Heath (2004) that individuals have a tendency to trust the validity of their own thoughts, assuming that they must have originated from trustworthy sources due to their veracity. Individuals are more likely to see a news source as reliable if their viewpoints align with its own, since they feel it to be more precise.

In 2018, Gallup and the Knight Foundation established an internet-based research tool to examine the level of public confidence in the media. The internet platform generated news articles and organised them in several formats that obscured the source, the image, both, or neither in the case of each individual story. The research gathered and used the political affiliations of the participants to examine and contrast the perceived credibility of news sites

according to their political orientation, as well as the accessibility of sources and visuals. The research found that using political heuristics had a detrimental effect on trustworthiness, while source attribution resulted in a general decline in trustworthiness. The participants were more inclined to evaluate the authenticity or lack thereof of a source based on its perceived link, rather than the content of the article.

Theoretical Framework

The current study employs the cultivation theory and the theory of planned behavior (TPB).

Cultivation Theory by George Gerbner (1976)

The sociocultural paradigm known as "cultivation" analyses the impact of television on the perceptions, beliefs, attitudes, and values of its audience (Gerbner & Gross, 1976). Initially, it was conceptualised as a part of a broader cultural indicators study that investigated the broader impact of media on culture, namely via its representation of storytelling. While subsequent research have explored the effects of cultivation in non-American contexts, the original concept largely centred on the significant influence of American media on the development of American culture (Shanahan & Morgan, 1999). The cultural indicators project comprised three distinct elements: an examination of the institutional process, which analysed the creation and dissemination of media messages; a scrutiny of the message system, which assessed the content of the media messages; and an exploration of the cultivation of recipients, which investigated how exposure to media messages influenced their perceptions of reality. Moreover, given the significant influence of television in shaping this theory, the majority of research and analysis has concentrated on examining the effects and consequences of television on viewers' understanding of social reality.

The connection between cultivation, as a sociocultural framework, and its three main constituents—media institutions, message origination, and message consequences on viewers—is readily evident. However, media research has mostly concentrated on cultivation analysis, which is the third component. The main indicator of a cultivation effect is the correlation between the amount of time people dedicate to watching television and their perspectives on the world. The central claim posits that an increase in television use is linked to a heightened convergence between an individual's worldview and the prevailing narratives shown on television. To be more explicit, cultivation theory asserts that television plays a very powerful role in shaping narratives. Thorough examinations of television messaging demonstrate a significant consistency in the underlying belief systems, even if there may seem to be variation in the subjects, kinds of programmes, and persons delivering them. Gerbner asserts that television has the greatest impact in developing both individual and social ideals within American culture. This is due to the impact that the regularity and frequency of television broadcasts may have on these beliefs.

The research used the cultivation theory to underscore the interconnections among the various components. The idea suggests that extended exposure to media content causes individuals to develop a tendency to see social reality in accordance with their portrayal in the media. Therefore, this level of exposure directly impacts the attitudes and behaviours of the audience (Cheng et al., 2016). The concept explicitly examines the influence of regular television viewing on individuals' perception of reality, so showing that mass media has a significant impact on people's worldview. Excessive media material that unduly emphasises positive or negative themes or news might harm the audience, as shown by the cultivation theory in mass communication (Callanan, 2012). Essentially, individuals' perspectives and attitudes might be adversely affected by their exposure to inaccurate information.

Theory of Planned Behavior (TPB) by Icek Ajzen (1991)

The theory of planned behaviour (TPB) was developed by Icek Ajzen in 1991 with the objective of accurately forecasting and elucidating a wide range of human actions. The Theory of Reasoned Action (TPB) was formulated in 1980 with the purpose of predicting an individual's inclination to engage in a certain activity under given circumstances (Ajzen, 1985). The fundamental concept behind the proposal was to include all conceivable actions that may be autonomously regulated by individuals. The notion of behavioural purpose is quite significant in this approach. Behavioural intentions emerge when individuals evaluate the possible benefits and drawbacks of the expected outcome, together with their assessment of the likelihood of achieving the desired result. The theory of planned behaviour (TPB) posits that the efficacy of engaging in an activity is contingent upon the significant interplay between motivation (or behavioural control) and capacity (or purpose). The three primary types include behavioural beliefs, normative views, and control beliefs. The Theory of Planned Behaviour (TPB) has six components that evaluate the degree of an individual's genuine behavioural control.

The research established a correlation between certain independent factors and the dependent variable of altruistic behaviour by using the theory of planned behaviour (TPB). The practical conceptual framework proposed by Yadav and Pathak (2017) aids in understanding the complexities of human social behaviour. In line with the Theory of Planned Behaviour (TPB), it is important to possess the intention to do a certain action prior to its implementation. Their purpose is influenced by their level of motivation, the expectations of the group, and the perceived level of ease or difficulty in doing the task (Lee, 2011). Furthermore, the Theory of Planned behaviour posits that individuals are more likely to translate their intentions into actions when they explicitly articulate their purpose to engage in a certain activity, particularly when they possess sufficient autonomy over that behaviour (Slater, 2004).

According to Lee (2022), mass media play a crucial role in distributing information and acquainting the public with emerging subjects and difficulties. The media's depiction of less known topics may influence the public's perception of these issues, leading to increased public attention (Hong & Kim, 2020). Moreover, the media have the capacity to influence public sentiment about significant matters. The medium via which news is delivered has the potential to shape the perspectives and acceptance of certain ideas and attitudes among readers and viewers. According to the TPB (Pfattheicher & Nielsen, 2022), an individual's behaviour is influenced by intentional actions, which are determined by their attitudes (personal desires), subjective norms (the opinions of others), and perceived behavioural control (one's belief in their ability to carry out the desired behaviour). Interacting with news may be likened to acquiring knowledge, both of which ultimately shape individuals' perspectives (Ho et al., 2018). As per the Theory of Planned Behaviour (TPB), an individual's attitude has the ability to predict their future behaviours. The probability of a person engaging in a certain activity is closely correlated with their attitude towards that conduct. Individuals' negative perception of an activity diminishes their inclination to engage in it. The public's level of generosity is influenced by their perception of news disseminated by the media.

Conclusion

In conclusion, the pervasive issue of media bias, encompassing political, sensational, and corporate biases, significantly influences public perceptions and political choices. The study underscores the importance of recognizing and understanding these biases for media consumers seeking a balanced and nuanced understanding of news events. It emphasizes the role of

political ideologies, economic factors, and ownership structures in shaping media narratives. The impact of media bias extends to the rise of echo chambers and the cultivation of individual worldviews. The study also draws attention to the role of social media in perpetuating biased reporting and the potential consequences of fake news. To address these challenges, promoting editorial transparency, encouraging diverse media ownership, and fostering critical media literacy are crucial steps. Overall, understanding the complexities of media bias is essential for maintaining a robust democracy and fostering an informed and engaged public.

Recommendations

Based on the findings of the study, here are some key recommendations that were deemed necessary:

1. To address media bias, governments should consider implementing policies that promote editorial transparency and diversity of ownership in the media industry. Establishing independent regulatory bodies to monitor and assess media outlets for bias can help maintain journalistic integrity. Governments can also encourage media literacy programs to educate the public on recognizing different forms of bias. Additionally, funding or supporting initiatives that foster investigative journalism and fact-checking can contribute to a more informed citizenry.
2. Technology companies should invest in algorithms and features that expose users to a diverse range of viewpoints, reducing the risk of echo chambers. Social media platforms can collaborate with fact-checking organizations to identify and label misleading content. Transparent algorithms and content moderation policies can help build user trust. Governments can work with tech companies to develop and enforce regulations that curb the spread of fake news and encourage responsible platform behavior. Additionally, individuals should be encouraged to use digital tools that help identify and filter out biased or inaccurate information.
3. Government should advocate for a diverse range of media ownership to prevent concentration of media power in a few hands. Policies can be implemented to encourage independent and diverse media outlets, fostering a plurality of perspectives.
4. News platforms as well as social media platforms should implement rigorous fact-checking processes to ensure the accuracy of news content. These websites should invest in fact-checking teams or collaborate with independent fact-checking organizations to maintain credibility.
5. News platforms should encourage journalists to present multiple viewpoints on a given issue, avoiding sensationalism and ensuring a balanced representation of diverse opinions. Foster a culture that values journalistic integrity over the pursuit of sensational headlines.

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SOCIOECONOMIC DETERMINANTS OF POLITICAL PARTICIPATION AMONG RURAL FARMING HOUSEHOLDS IN IKWO LGA, EBONYI STATE, NIGERIA

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ABSTRACT

Citizen participation is a fundamental aspect of any democratic society, involving engagement in political activities like joining political parties, voting in elections, and pursuing political roles. This study delves into the socioeconomic determinants influencing the political participation of rural farmers in Ikwo LGA, Ebonyi State, Nigeria. Employing a sampling probability method, 150 farmers in Ikwo LGA were randomly selected, and data was collected through structured questionnaires. The data was analyzed using SPSS and Stata 14, employing descriptive statistics, Pearson correlation, and Logit regression. The study revealed that a majority (54.7%) of the farmers were female, with most falling within the age bracket of 18-29 years (46.7%) and being married (56.0%). Alarming, the majority (90.7%) of these farmers live on less than \$2.15 per day, indicating a state of poverty. Logit regression analysis demonstrated that socioeconomic factors significantly impact rural farmers' willingness to participate in politics, with government incentives (p -value = 0.010) being a key influencer. Furthermore, the study discovered that gender does not significantly affect the willingness to participate in politics, as evidenced by a 2-tailed significance value of 0.903. As recommendations, the study emphasizes the importance of timely provision of social amenities and incentives to facilitate farmer engagement in politics. Additionally, it underscores the need for extensive political education programs for rural residents to promote political awareness and participation, particularly among the youth. These measures can contribute to a more engaged and empowered rural populace in the realm of politics.

KEYWORDS: political participation, election, socioeconomic, poverty, farmers, rural

Introduction

Political participation is a fundamental cornerstone of modern democracy, an intrinsic practice that confers upon citizens a sense of belonging and dignity while simultaneously holding both

rulers and the ruled accountable for their duties and responsibilities (Vráblíková, 2010). Its paramount significance is underscored by its status as one of the fundamental conditions for a properly functioning democracy (Dahl 1998; Verba et al. 1995; Norris 2002). Political participation encompasses a spectrum of activities through which individuals exert influence over governmental decisions, policy priorities, resource allocation, and access to public goods and services (World Bank, 2014). However, the extent of political participation among rural farming households in Ikwo, Ebonyi State, Nigeria, is a complex issue with multifaceted socioeconomic determinants that necessitate a closer investigation.

Over time, the problem of low political participation has persisted, particularly among Nigerians in rural areas. This issue manifests in various forms, including apathy towards voter registration, dismal turnout during national elections, prevailing negative attitudes towards government policies, widespread tax evasion, and a reluctance to fulfill civic responsibilities. These low participation rates often culminate in the election of unpopular candidates. Notably, empirical evidence suggests a significant association between political participation and education. Data from Statistica (2021) reveals a substantial disparity in literacy rates between urban and rural areas in Nigeria. This difference in educational attainment underscores the prevalence of political apathy in rural regions, where limited exposure and education often lead to disengagement from political affairs.

Furthermore, the issue of gender imbalance in political participation has been a long-standing concern. Women, especially in African nations, have been underrepresented in political leadership positions. The persisting disparity between men and women in political participation raises questions about whether this imbalance is due to women's reluctance to engage in politics or the failure of states to implement policies promoting gender equality in politics. Hence this research seeks to address the questions: what socioeconomic factors influence the willingness of rural farmers in Ikwo to participate in politics?

Understanding the factors that influence political participation among rural farming households in Ikwo, Ebonyi State, holds significant implications for enhancing the political consciousness of these communities and improving governance. The insights gained from this research will be invaluable to leaders, farmers, students, policymakers, and researchers, shaping strategies to promote greater political engagement among rural populations. To achieve these objectives, the study focuses on rural farming households in Ikwo Local Government Area, Ebonyi state, Nigeria. A structured questionnaire will be administered to a minimum of 150 farming households/respondents between March and April 2023. This research aspires to contribute to a deeper understanding of political participation dynamics and offer a foundation for informed decision-making aimed at fostering inclusive and effective governance.

Literature review

Political participation is the active engagement of citizens in the political process. It encompasses various activities through which individuals influence government decisions and contribute to the political life of their communities (Adelekan, 2010). These activities include voting, attending public meetings, contacting government officials, participating in campaigns, and more. Political participation is indispensable for democracy, as it bolsters government legitimacy, encourages community involvement, and fosters societal, political, and economic progress (Nie and Verba, 1978). It manifests in both conventional and unconventional forms, reflecting individual preferences (Ratner, 1970). Conventional political participation involves routine activities like voting, interacting with representatives, attending political rallies, and joining political parties. Unconventional political participation encompasses less common and

often surprising methods such as demonstrations, protests, marches, and boycotts. Both forms aim to influence government actions, with individuals choosing based on their goals and preferences.

Political participation is influenced by multiple factors, including the social environment, political context, cooperative activities, and mass media exposure. Social elements like education, occupation, income, age, and place of residence significantly impact an individual's political engagement. The political context, characterized by political parties and government systems, also plays a pivotal role. Cooperative activities, such as organized group work and community efforts, encourage collective participation. Mass media exposure shapes an individual's engagement with politics (Madianou and Miller, 2013).

Elections are a fundamental pillar of representative democracy, allowing citizens to select their representatives and influence government decisions. They serve as a crucial mechanism for appointing political leaders and ensuring effective governance. Elections entail voters making choices by casting their votes for candidates vying for elected offices, thereby determining who governs and makes decisions on behalf of the public (Obakhedo, 2011).

Rural farming households are those residing in rural areas where agriculture is the primary occupation. They play a vital role in preserving and safeguarding natural resources, often contending with factors such as ethnicity, religion, regional politics, and neocolonialism. The political culture in rural areas can be influenced by challenges like money politics, poverty, corruption, elite influence, political instability, and unfulfilled promises from the political class, posing unique challenges to political participation (Ojo, 2014).

The participatory democratic theory emphasizes direct involvement of people in their communities and incorporates political parties into pyramidal structures to establish democratic control over specific aspects of governance. This theory promotes greater political participation from the general populace, in contrast to representative democracy. Historical examples include the "Iroquois confederacy" (Haudenosaunee Confederacy), which has operated under the world's oldest still-in-force constitution since the seventh to eighth centuries. This theory aims to reduce the influence of oligarchs and reinstate a limited form of participatory democracy. Although it mentions direct involvement as a form of expanded participation, it doesn't delve deeply into the topic. The concept also raises questions about rural people's views on democracy and public participation in a nation's democratic processes.

The civic voluntarism model, originally known as the resources model, is a widely applied model of political participation. It argues that people become politically inactive due to three main factors: a lack of resources (time, money, civic skills), a lack of psychological engagement with politics (measured by political efficacy), and being outside of recruitment networks that draw people into politics. This model places significant emphasis on resources, particularly an individual's social status (job, education, income), as a determinant of political participation. Group resources and ideology also affect participation, with the theory highlighting that "groups—and ideology—are the weapons of the weak" in promoting participation (Verba, Nie, and Kim, 1978).

The general incentives model explains high-intensity forms of political engagement, emphasizing a wide range of incentives that encourage political activity. It includes process incentives (enjoyment derived from participation), outcome incentives (personal goals like political careers), and ideology (aligning with specific beliefs). The theory suggests that people require various incentives to engage in political activities, and these incentives can vary from

person to person. Political parties, as platforms for obtaining elected office, serve as essential elements in the general incentives model.

A study by Onakoya (2021) explored the political culture and participation of rural residents during the 2015 general elections, emphasizing the role of occupation and education. Dim and Asomah (2019) investigated socio-demographic predictors of political participation among Nigerian women, highlighting variables such as education, party affiliation, and employment. Udemezue and Oforle (2019) examined determinants of political participation among farmers in the South East of Nigeria, emphasizing education, income, age, and political interest. Ngwu et al. (2022) explored gendered political participation and implications for social work practice in Enugu State, shedding light on the gender-specific nature of political participation. These studies collectively contribute to our understanding of political participation and its influencing factors, emphasizing the importance of education, gender, social status, and ideological factors in shaping individuals' political engagement.

Methodology

Sample Size Determination

Ikwo LGA is one of Ebonyi state's thirteen local government areas. In Nigeria, approximately 87 percent of 223,840,639 million households are engaged in agriculture, totaling around 194,741,349 farming households. To determine the average number of farming households in Ikwo LGA, this study divides the national estimate by the population of Ikwo LGA, yielding a sample size of 608, chosen for 90% accuracy. The sample size was calculated using Yamane (1967) and Cochran's (1977) formula cited in Ojide (2016):

$$s = \frac{N}{1+N(e^2)} \quad 1$$

Where:

s = sample size

n = farming household population in the study area

e= margin of error

Therefore

$$s = \frac{608}{1+608(0.07^2)} \quad 2$$

Thus, s = 203

Validation and Reliability of the Instrument

To validate the instrument, the questionnaire is scrutinized by the supervisor before administering it to respondents. A reliability test is also conducted during a pilot study with 30 randomly selected farming households in the first three zones of Ikwo LGA. The responses are assessed using Guttman split-half reliability index, resulting in a coefficient alpha of 0.644, indicating a 64.4% reliability rate. Some questionnaires are presented in the local Igbo dialect to gather more accurate responses. Precautions are taken during administration to minimize bias, enhance validity, and improve reliability by reducing subjectivity and external interference. This study employs a well-structured questionnaire for data collection. It utilizes descriptive statistical tools, particularly SPSS (Statistical Package for Social Sciences) and

STATA 14, to analyze the socio-economic characteristics of rural farming households and their political participation. The econometric method of the multivariate logit model is chosen to examine the participation rate of rural farming households in politics due to its ease of interpretation and its compatibility with the binary form of the dependent variable.

Both descriptive and inferential statistics are applied in the analysis. Descriptive statistics involve graphical representations, charts, and tables, which aid in organizing and summarizing data obtained through administered questionnaires. Inferential statistics, as outlined by Stephens (1998), are used to draw conclusions about a population based on information derived from a sample.

Model Specification

A Logit model is employed as the primary quantitative response model. This choice is motivated by the binary nature of the dependent variable, where a value of 1 denotes respondents willing to participate in politics, and a value of 0 indicates those not willing to participate. As per Pikkarainen et al. (2004), a dummy regression model is selected to identify significant variables determining the willingness of rural farming households to participate in politics in Ikwo. To summarize the data collected, simple means and percentages, as demonstrated by Ogbodo and Mieseigha (2013), are used.

The logit model is as adopted from Gujarati (2013) and is specified as thus:

$$P_i = \frac{1}{1+e^{-z_i}} = \frac{e^z}{1+e^z} \quad \text{-----} \quad 2$$

Where $z_i = \beta_1 + \beta_2 X_i + \beta_3 X_j$

The equation 2 represents the cumulative logistic distribution function. We can verify that as p_i ranges between 0 and 1, z_i ranges from $-\infty$ to $+\infty$, and p_i is linear in parameters but nonlinear when it relates to z_i in the model.

If p_i , the probability of that respondents are willing to participate in politics is 1 and for respondents who are not willing to participate in politics is $(1 - p_i)$, therefore, the probability of the willingness is given as

$$1 - P_i = \frac{1}{e^z + 1} \quad \text{-----} \quad 3$$

we can therefore expand the equation as:

$$\frac{P_i}{1-P_i} = \frac{e^z}{e^z + 1} * \frac{e^z + 1}{1} = e^{z_i} \quad \text{-----} \quad 4$$

$\frac{P_i}{1-P_i}$ is the odd in favor of political participation (patl). Taking the natural log of equation 4, hence we attain equation as follows:

$$l_i = \text{Ln} \left(\frac{P_i}{1-P_i} \right) = z \quad \text{-----} \quad 5$$

z_i remains as stated above. The function of n- explanatory variables for purpose of the study, the logit model will be analyzed using two regressions namely; for participate and apathy

$$l_i \text{ (willingness to participate in politics)} = \text{Ln} \left(\frac{P_i}{1-P_i} \right) = \beta_1 + \beta_2 X_i + \beta_3 X_j + \mu_i \quad \text{-----} \quad 6$$

$$l_i \text{ (socioeconomic factors of farmers on politics)} = \text{Ln} \left(\frac{P_i}{1-P_i} \right) = \beta_1 + \beta_2 X_i + \beta_3 X_j + \mu_i \text{-----} 7$$

The model will be explicitly stated as:

Willingness to participate in politics

$$= \beta_1 + \beta_2(\text{gender}) + \beta_3(\text{ageInYr}) + \beta_4(\text{povertyLine}) + \beta_5(\text{Farmsize}) + \beta_6(\text{FamilySize}) + \beta_7(\text{GovIncentives}) + \beta_8(\text{actualYrOfEdu}) + \mu_i \text{.....} 8$$

From the above equation, β_1 is the intercept

$\beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7,$ and β_8 are parameters to be estimated.

Where

β_2 = gender of respondent (farmer)

β_3 = age in years

β_4 = poverty line representing if household is poor or not.

B_5 = size of farmland cultivated by the respondent

B_6 = household size of respondent

B_7 = incentives from government to respondent

B_8 = educational qualification of respondent

μ_i = error term (disturbance term)

Equation (8) is the logistic function. Equation (8) shows the log of odd that a rural farmer is willing to participate in politics given the socio-economic factors.

Result and Finding

A pilot study was carried out on 30 randomly selected rural farmers in Ikwo LGA. The responses from the pilot study on the socio-economic were examined using Guttman Split-half reliability index. The coefficient alpha for socio-economic determinants is 0.644, depicting 64.4% reliability.

Distribution of the rural farmers by gender

Table 1 shows the distribution of the rural farming households on their gender. Elucidating that exactly 45.3% of the questionnaire were administered to the male gender, whereas about 54.7% were administered to the female gender.

Table 1. Gender of Farming Households

Gender	Frequency	Percent
Female	82	54.7
Male	68	45.3
Total	150	100.0

Findings on Education, Age brackets, and Marital Status

The results show that most categories are SSCE holders with 26.0%, FSLC 22.0%, BSC/BA/B.ED/B.ENG 21.3%, No Formal Education 14.7%, JSCE 6.7%, OND/NCE 4.7%, HND 3.3%, and M.SC 1.3%. In terms of age distribution of rural farmers, the highest is from 18-29 with a percentage of around 46.7%, 40-49 have exactly 18.7% are ,followed by 11.3% for those within the range of 30-39, then 10.7% are for 50-59, 6.7% for 60-64 and finally the aged from 65 and above has 6.0%. Further finding shows that most of them are married with a percentage of around 56.0%, around 43.3% are single, around 7% were divorced/separated and the percentage of others (widow and widower) amounted to about 0%.

Findings on the poverty level among the rural farmers

Table 2 provides insights into the poverty levels among rural farming households in Ikwo LGA. The poverty assessment was based on annual household income derived from both food and non-food expenditures, converted to daily income per capita. By applying the United Nations' poverty threshold of living on less than \$2.15 per day, the findings indicate that approximately 90.7% of rural farmers are living in poverty, with only 9.3% enjoying financial stability.

Table 2. Poverty Level among the Farming Households

Poverty Line	Frequency	Percent
below Poverty Line	136	90.7
above Poverty Line	14	9.3
Total	150	100.0

Result of inferential statistics is presented below

Table 3 shows the result of estimated logistic regression on household who are willing to participate in politics in Ikwo LGA Ebonyi State.

Table 3. Logistic regression estimation of the socioeconomic determinants of political participation

Number of obs=150 LR chi2(8)=16.75 Log likelihood = -74.48744 Prob> chi2 = 0.0191 Pseudo R2 = 0.0884							
willingnessToVote	Coef.	Odds Ratio	Std.Err.	Z	P> z	[95% Conf.Interval]	
gender	-0.5481538	0.578016	0.3876784	-1.41	0.157	-1.30799	0.2116819
ageInYrs	-0.0199413	0.9802562	0.018151	-1.10	0.272	-0.0555166	0.0156341
actualYrsofEdu	0.0357399	1.036386	0.0510798	0.70	0.484	-0.0643748	0.1358545
farmSize	0.2034522	1.225627	0.10806	1.88	0.060	-0.0083415	0.4152459
povertyLine	-1.144622	0.3183441	0.6580732	-1.74	0.082	-2.434422	0.1451774
GovIncentives	0.570367	1.768916	0.2202951	2.59	0.010	0.1385965	1.002137
familySize	-0.0040719	0.9959364	0.0711944	-0.06	0.954	-0.1436103	0.1354665
_cons	-0.8593805	0.4234243	1.314803	-0.65	0.513	-3.436347	1.717585

In the table above, the log likelihood's proximity to zero (-74.48744) signifies the model's significance. The decision rule dictates that a p-value below 0.05 rejects the null hypothesis, indicating statistical significance of parameter estimates. The $\text{prob} > \chi^2$, at 0.0000, confirms the model's statistical significance. It suggests that regression coefficients aren't zero. The logit regression demonstrates that political participation depends on gender, age, poverty, education, farm size, family size, and government incentives. Table 3 reveals that the respondents' gender, age, farm and family size, and education lack statistical significance at the 5% level. In contrast, only government incentive was found to be statistically significant at the 5% level. Thus, gender, age (actual age in years), poverty line which indicates households living on less than 2.15 dollars, and family size all have an insignificant inverse relationship with political participation in the study area as indicated by their respective p-values and coefficients. Additionally, education (ActualYrOfEdu), farm size, and government incentives all have a positive impact on farmers willingness to participate in politics, but only government incentives with a probability value of 0.010 has a statistically significant influence on farmers willingness to participate in politics in the study area.

Conclusion

The goal of this work is to determine the effect of the main objective of this study which is to examine the willingness of rural farming households in Ikwo LGA to participate in politics. But the specific objective is to determine the socio economic factors influencing the willingness to participate in politics in Ikwo LGA. After the analysis, it was discovered that socio economic factors (Poverty Line and incentives) influences rural farmers' participation in politics.

Recommendation

There exists high level of poverty among the rural farming households in this study area as a large number of them are living on less than 2.15 dollars per day which is United Nations' poverty threshold. The government should enact policies that would help raise the standard of living of the people as this would boost the confidence of the people in the government and thus increase the people's level of participation in politics. Also to increase political participation among rural farmers, there should be timely provision of incentives for rural farmers by the government as incentives is a crucial factor according to the results of the analysis that influences willingness to participate in politics.

During the administration of questionnaire, it was observed that a large number of the young rural dwellers do not engage in politics due to their seeming misconceptions about politics irrespective of the benefits entailed in participating. It is paramount to explicate the need for one to be politically active and the benefits accruing from active participation to these young rural dwellers so as to improve politics at the grass root level.

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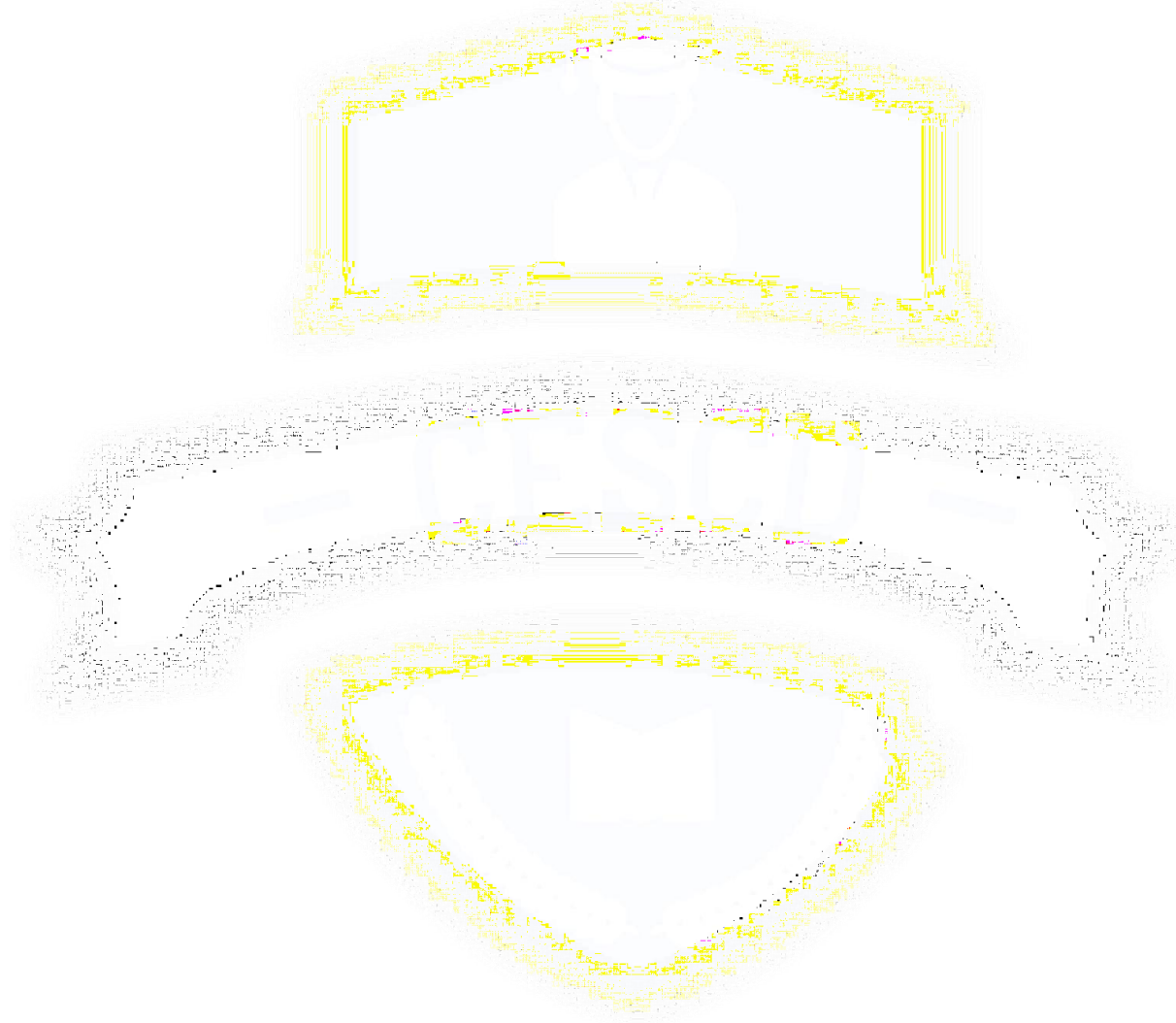
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EFFICACY OF TELEHEALTH COMMUNICATION IN IMPROVING ACCESS TO HEALTH SERVICES IN URBAN SETTING

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ABSTRACT

The study assessed optimizing business performance through advanced business intelligence strategies. The population of this study consisted of all the staff of MTN Nigeria Ltd. The sample size of this was 291 respondents. The study adopted a correlational research design while stratified random sampling technique was used in selecting the respondents. The instrument for data collection which was tagged "Optimizing Business Performance through Advanced Business Intelligence Strategies Questionnaire (OBPABISQ)" was administered to the respondents and used for the study. Data collected were analyzed using descriptive analysis and Pearson Product Moment Correlation Analysis. From the results of the data analysis, it was observed that Optimizing business performance through advanced business intelligence (BI) strategies is essential in the current competitive environment. Organisations can achieve sustainable development, resilience, and market leadership in the digital era by making business intelligence (BI) a fundamental skill. This allows them to improve efficiency, foster innovation, and prioritise client needs. The study suggested encouraging firms to examine workflows, operational procedures, and performance indicators in order to spot inefficiencies, bottlenecks, and areas that might use improvement. Additionally, company owners have to spend their money on cutting-edge BI platforms, tools, and technologies that fit their demands in terms of scalability, data analytics capabilities, and business needs.

KEYWORDS: Optimizing, Business, Performance, Business Intelligence and Strategies

Introduction

The evolution of healthcare delivery has been significantly impacted by technological advancements, particularly in the realm of telehealth communication. Telehealth, encompassing a range of digital technologies and communication platforms, has emerged as a

potential solution to address challenges in accessing health services, especially in urban settings. Urban areas often grapple with issues such as traffic congestion, limited healthcare facilities, and disparities in healthcare access, necessitating innovative approaches to enhance service delivery.

Urban populations face barriers to accessing healthcare services, including long commute times, crowded waiting rooms, and limited availability of healthcare professionals. These challenges contribute to delays in seeking medical attention, reduced adherence to treatment plans, and an overall strain on the healthcare system. The effectiveness of telehealth communication in mitigating these challenges and improving access to health services in urban settings remains an area that requires in-depth exploration. Telemedicine refers to the transmission of electronic medical data, such as pictures, audio, live video, and patient information, from one place to another. Telemedicine encompasses the use of electronic information and communications technology to facilitate remote clinical healthcare, education for both patients and healthcare professionals, public health initiatives, and health management (Larson, 2004).

The title consists of the Greek word "tele," which means "far," with the word "medicine." Telemedicine may range from a basic telephone conversation between two healthcare experts discussing a case, to a more intricate process including the use of satellite technology and video-conferencing equipment to provide a real-time consultation between medical specialists located in different countries. Additionally, it may include the use of an autonomous robot (Field, 2002).

Telemedicine provides the greatest advantages to people living in secluded villages and distant areas, and is now being used in almost all medical fields. Specialties that use telemedicine sometimes include a prefix of "tele-". For instance, when radiologists employ telemedicine, it is referred to as Teleradiology. Telecardiology refers to the use of telemedicine by cardiologists (Harrop and Curry, 1998).

The capacity of telemedicine to provide medical treatment regardless of geographical distance and the presence of professionals on location makes it appealing to both the public and private healthcare sectors. Telemedicine enables more efficient use of limited medical staff and resources. It promotes equitable access to diverse medical services and healthcare, regardless of geographical or economic constraints, at a reduced cost. Telemedicine is particularly regarded as a helpful instrument for delivering essential medical care to isolated rural regions. The program aims to improve the ongoing medical education of young physicians, nurses, and other healthcare practitioners in rural regions, both during their training and during their professional careers (Adewale, 2004).

The healthcare system varies from highly specialized metropolitan districts to tiny rural clinics in most undeveloped and emerging nations. The consequences of the last several decades include an inequitable allocation of healthcare professionals and specialized knowledge, which is mostly concentrated in large metropolitan areas. Consequently, individuals residing in rural regions have restricted availability of essential healthcare services due to geographical isolation and inadequate public transit. Telemedicine, an advanced technological solution, has the potential to address many healthcare and education challenges in undeveloped and emerging nations.

Telemedicine is the use of electronic information and communications technology to provide and facilitate healthcare services when there is a physical distance between the individuals involved (Field, 2002). While the concept of telemedicine may include traditional telephone use, it mostly pertains to modern telecommunication methods, such as interactive video

conferencing, store-and-forward imaging techniques, remote medical record access, and remote patient monitoring.

Prior to 1995, the use of store-and-forward technology, which involves the storage and subsequent sending of pictures or data to a provider for evaluation, was very limited. The number of private sector teleconsultations saw an annual growth rate of over 100% from 1995 to 1998, with a total of 90,000 consultations recorded in the United States in 1998 (Allen and Grigsby, 1998; Strode et al., 1999).

Conversely, the healthcare industry presents a significant market for information technology (Roger and Santucci, 1991). The interdependence of economic prosperity and physical well-being necessitates the universal accessibility of healthcare, including in rural areas. Failure to do so might jeopardize the whole socio-economic structure of the nation. Currently, individuals have the ability to access healthcare information via the Internet, leading to more knowledgeable patients who have elevated expectations and a need for top-notch quality treatment. An evaluation of the health-care system in Nigeria, considering its decline, the services offered, and the overall health condition of Nigerians, based on the existing data, indicates that the Nigerian health-care system is marked by inadequate infrastructure, elevated rates of infant mortality, and substandard nutritional status among children. This issue is further exacerbated by the combination of elevated fertility rates and elevated maternal death rates (Awosika, 2005).

Given the significant transformations and ongoing financial challenges in Nigeria's healthcare system, it is imperative to contemplate the use of telemedicine in both urban and rural areas. Telehealth has resurfaced as a viable method of assisting patients and providers in the evolving healthcare system, with Nigeria being one of the nations where this is happening. This approach is considered clinically suitable and cost-effective (Miller et al., 2003). Telemedicine has been seen as a possible solution to the challenges of providing healthcare to rural and underserved locations (Gagnon et al., 2004).

Telemedicine stands out from other healthcare services due to the absence of evidence regarding its effectiveness. However, the growing need for such evidence from health plans, patients, clinicians, and policy makers presents a challenge to proponents of clinical telemedicine. They are urged to conduct more comprehensive and improved evaluations to assess its feasibility, worth, and affordability. Nevertheless, the widespread adoption and implementation of Tele-health will ultimately rely on the acceptability of healthcare professionals and the general public (Gagnon et al., 2004).

Purpose of the Study

1. To examine the effect of telehealth communication impact the accessibility of health services for urban populations
2. To examine the perceptions of healthcare providers and patients regarding the efficacy of telehealth in an urban setting
3. To examine the challenges and barriers exist in implementing telehealth communication to improve healthcare access in urban areas

Research Questions

To guide the investigation, the following research questions will be addressed:

1. How does telehealth communication impact the accessibility of health services for urban populations?

2. What are the perceptions of healthcare providers and patients regarding the efficacy of telehealth in an urban setting?
3. What challenges and barriers exist in implementing telehealth communication to improve healthcare access in urban areas?

Hypotheses

HO₁: Telehealth communication does not significantly impact the accessibility of health services for urban populations

HO₂: Perceptions of healthcare providers and patients does not significantly impact the efficacy of telehealth in an urban setting

HO₃: Challenges and barriers does not significantly impact implementing telehealth communication to improve healthcare access in urban areas

LITERATURE REVIEW

Telemedicine is defined as the use of telecommunication technologies to provide medical information and services. It may be as simple as two health professionals discussing a patient's case over a telephone line, or as sophisticated as using satellite technology to broadcast a country using video conferencing equipment. The America telemedicine Association defines telemedicine as the use of medical information exchanged from one site to another via electronic communication for health and education of the patient or healthcare providers and for the purpose of improving patient care. Craig (1999) considered telemedicine as a process, rather than a technology: Telemedicine connects patients and healthcare professional in a chain of care. Telemedicine is useful as a communication tool between a general practitioner and a specialist available at a remote location. Care at a distance (also called in absentia care), is an old practice which was often conducted via post; there has been a long and successful history of in absentia health care, which thanks to modern communication technology has metamorphosed into what we know as modern telemedicine (Adewale, 2002)

Telemedicine helps to eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. In developed countries, access to healthcare services and practitioners with patient-doctors interaction are increasingly being boosted by the advent of Information and Communication Technology (ICT). Without distance being a barrier, healthcare professionals can now employ the services of telemedicine towards efficient consultation with medical practitioners within and outside their geographic location, delivery of healthcare services and establishing continuous communication with their patients (Matawalli and Ibrahim, 2014). Tools such as telemedicine, teleducation and health informatics have of late been incorporated in the health sector to enable easy access to essential services, for example, in medical areas from referral centers by the patients on one hand and enabling the doctor to doctor consultations for the benefit of patients (Wamala and Kaddu, 2013). The World Health Organization (2009) defines e-Health as the cost-effective and secure use of information and communications technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research. Telemedicine which is a subset of e-health is an integrated system of health-care delivery that employs telecommunications and computer technology as a substitute for face-to-face contact between health service provider and client (James et al., 2015). Telemedicine can improve the quality and accessibility of medical care by allowing distant providers to evaluate, diagnose, treat, and provide follow-up care to patients in less economically developed countries. The Internet which serves as the

backbone on which telemedicine thrives provides opportunities to retrieve up-to-date information on different aspects of diseases interact and enhance communication among medical professionals and patients especially through videoconferencing facilities and medical data processing application in the health centers (James et al., 2015).

The previous section demonstrated that telemedicine, whether through medical practitioners or direct online channels, has been widely used and accepted as a viable option in a diversity of areas, specialties, diagnostic conditions, and applications (Hailey et al., 2004; Turner et al., 2004). More important, the use of telemedicine demonstrates that health communication between the patient and the health care provider has been made more rapid and efficient. Nevertheless, we would hope and expect that telemedicine be more readily embraced as a tool by all medical specialists who desire to discover and ascertain its maximum potential and utility. In fact, telemedicine offers a manifold of health communication benefits to both practitioners who engage its services and the health care system in general. Every individual can benefit from telemedicine, from the patient, to the community, to physicians and other practitioners.

EMPIRICAL STUDIES

The study Obotu (2019) investigated the perceived effect of telemedicine on medical service delivery by the Federal Medical Centers in North Central Nigeria. Six objectives guided the study. The study answered six research questions and tested two null hypotheses at 0.05 level of significance. The study adopted survey research design. The research was conducted in the North Central Zone of Nigeria. The population of the study was one thousand four hundred and seven (1407) medical staff (Doctors, Nurses, Laboratory Technologists and Pharmacists). The sample size was three hundred and eleven (311) respondents comprising 97 doctors, 178 nurses, 19 laboratory technologists and 17 pharmacists; this was determined using Taro Yamane formula. The instrument used for data collection was a structured questionnaire titled: Perceived Effect of Telemedicine Questionnaire (PETQ) developed by the researcher from literature reviewed. Three experts validated the instrument while split-half method was used to determine the internal consistency of the items and a reliability co-efficient of 0.76 was obtained, indicating that the instrument is reliable for the study. The instrument was administered by the researcher and four research assistants. Descriptive statistics of mean and standard deviation were used to answer the research questions while inferential statistics of Chi-square was used to test the null hypotheses at 0.05 level of significance. The findings revealed that nine (9) Telemedicine services are available to a high extent in the Federal Medical Centers in North Central Nigeria. The findings also revealed that Telemedicine exerts twelve (12) effects on medical service delivery, fourteen (14) challenges were discovered to be associated with the use of telemedicine, while eight (8) strategies were identified to mitigate the challenges of the use of telemedicine. It was also found that availability of telemedicine significantly affects medical service delivery in Federal Medical Centers in North Central Nigeria. Further analysis of data revealed that the degree of application of telemedicine exert significant effect on medical service delivery in Federal Medical Centers in North Central Nigeria. It was recommended that Federal Medical Centers should embark on drastic development of telemedicine in line with global trend in order to promote effective utilization of telemedicine services, stake holders should establish a basic understanding of what this medical technology can lead to as it will help policy makers enlighten the telemedicine debate by turning unique insights into more adequate approaches that will enrich and humanize mediated channels of health communication, thereby offering remedies and clarifications for effective health care exchange and delivery.

Shittu and Olamide (2007) conducted a study to determine the perception of health workers in the health-care towards telemedicine application in a new tertiary teaching hospital, a modified structured questionnaire using a prospective postal survey was administered to a cross-section of health workers in Lagos State University Teaching Hospital (LASUTH) and Lagos State University College of Medicine (LASUCOM). Only 60.9 % of respondents were familiar with this new emerging concept of telemedicine in the health care system. Although, 50 % of health workers had expressed concern about the ethical and medico-legal consideration of telemedicine practice, this was irrespective of their socio-religious background. The principal factors weighing in favour of willingness to use telehealth services were knowledge of telehealth applications (28.1 %); perception of telehealth benefits (14.1 %), reduced barriers to telehealth care among others. Most of the respondents believed that telehealth would enhance direct access to health care services (23.4 %), improve quality of care (14.1 %) among others. It is desirable to offer telemedicine to patients especially for emergency and chronic medical conditions

Justice (2012) carried out a study on the assessment of telemedicine readiness in some selected states in Western Nigeria. Considering some critical factors of e-Health readiness such as needchange readiness, engagement readiness and structural readiness. The responses were analyzed statistically using descriptive analysis. The analysis was applied to determine the e-Health readiness status of health practitioners, public, patients and the managers from the western part of Nigeria. The result of the overall evaluation of all samples shows that (i) health managers are not structurally ready, (ii) the public and patient fairly agreed but structural factor will be a constraint and (iii) the healthcare practitioners fairly agreed but structural, social influence, engagement will affect the successful adoption of the invention.

THEORETICAL FRAMEWORK

Hooshmand (2010) Theory of Cost Minimization

The theoretical framework for this study is based on the theoretical model of Hooshmand (2010), which has been further modified by other works, especially in the study that addressed the issue of cost from the perspective of the parents/guardians of children with special health care needs (CSHCN) when care is provided via telemedicine. Families of CSHCN face financial burdens beyond that of families of healthy children. The cost framework for this study is a cost minimization analysis framework. Cost minimization is a form of a cost-effectiveness analysis which presumes the effectiveness or outcomes of a program are similar but that the costs are different (Gold et al., 1996; Muennig, 2008). This framework focused on the difference in costs between the comparable interventions of traditional face-to-face care and telemedicine. This study focused on the cost difference from the perspectives of the family of the CSHCN, recognizing the importance of reducing financial burden and hardship for this vulnerable population. Using the cost-minimization framework, the study examined cost from the family perspective comparing the costs of traditional face-to-face care to care provided utilizing telemedicine. This included both direct and indirect costs as well as hidden costs recognized by the family but not evident to those outside the family or community health providers. Costs examined included travel, lodging, loss of wages, child care, and ancillary family costs such as food. The Cost framework was developed for this research project to measure both direct and indirect costs for the purpose of this research.

RESEARCH METHODOLOGY

Research Design

The research design used for this study was a correlational survey design. This design is deemed necessary because it is a type of non-experimental research method in which a researcher measures two variables, understands them, and assesses the statistical relationship between them with no influence from any extraneous variable Bhat, (2019).

Research Setting

The Anaang (also spelled Annang) are a Southern Nigerian ethnic group whose land is primarily within 8 of the present 31 local government areas in Akwa Ibom State: Abak, Essien Udim, Etim Ekpo, Ika, Ikot Ekpene, Obot Akara, Oruk Anam, and Ukanafu in Akwa Ibom State. Nutrition in pregnancy is very important in that the proper development of the baby is dependent on what the mother eats, but some cultural practices and beliefs also hinder or prevent pregnant women from accessing these foods.

Population of the study

The population of this study was made up of populace of Uyo residence.

Sampling and sample size

A sample size for the study was determined using Kreacy and Morgan's 1970 formula to select a sample size of 196 respondents for the study. A proportional sampling technique was also employed in selecting the respondents from each department in the study area.

Source of data

The research data are of two kinds: primary and secondary data. Graham (2009: 141) agrees that the primary data contains a direct or original account of an event or phenomenon given by someone who actually observed the event or phenomenon.

Validation of the Research Instrument

The two research instruments were given to us for validation in the physical and health fields. The purpose was to ensure that items on the questionnaire were properly worded to meet the respondents' level of understanding and comprehensively covered the research objectives.

Instrument for Data Collection

The research instrument used for the study was a questionnaire. The questionnaire was used to obtain data on the independent and dependent variables presented in both sections A and B of the questionnaire. Section A measured the demographic data of the respondents, such as name, gender, age, educational qualification, and marital status of health workers, while Section B measured the independent variables. A Likert (1932) scale was used in the study.

Validation of the Research Instrument

The research instruments were given to research experts to validate. The purpose was to ensure that items on the questionnaire were properly worded to meet the respondents' level of understanding and comprehensively covered the research objectives.

Reliability of the Instrument

The researcher adopted alpha-cronbach analysis to determine the reliability of the instruments. In the trial testing, a total of 20 persons who were not part of the main study were randomly selected from the study area, and the instruments administered. The collected data were analysed, and the result showed a 0.72 reliability coefficient. This indicated that the instrument was reliable for use.

Administration of the Instrument

The questionnaire was administered to the sampled respondent after obtaining consent from the respondent. This method was adopted by the researcher to ensure that time was judiciously utilised and to avoid missing copies of the questionnaire. At the end, all the copies distributed were collected for subsequent analysis.

Method of Data Analysis

The collected data were analysed using appropriate statistical techniques, such as descriptive statistics, for research questions.

DATA ANALYSIS AND RESULT

Table 1: Analysis of Age Distribution of the respondents

Age	No. of respondents	% of Percentage
18 years	9	4.59
19-24 years	30	15.31
25-29 years	73	37.24
30-34 years	76	38.78
40-45 years	8	4.08
Total	196	100

Table 1 above shows that nine (9) respondents representing 4.59% of the sample were the age of 18 years, thirty (30) respondents representing 15.31% were between the age bracket of 19 – 24 years, seventy three (73) of the respondents representing 37.24% were 25 – 29 years respectively, also seventh six (76) respondents representing 38.78% of the sample were between the age limit of 30 – 34 years and eight (8) respondents representing 4.08% were within the age limit of 40 - 45 years.

Table 2: Analysis of Marital status of the respondents

Status	No. of Respondents	% of Respondents
Married	154	78.57
Single	42	21.43
Total	196	100

Table 2 shows that hundred and fifty four (154) respondents representing 78.57% of the sample were married women and forty two (42) respondents representing 21.43% were single respectively.

Table 3: Highest Level of Education of the respondents

Qualification	No. of respondents	% of Percentage
Primary education	22	11.22
Secondary education	47	23.98
Tertiary education	56	28.57
Total	196	100

Table 3 above shows Twenty two (22) respondents representing 11.22% had primary education, also forty seven (47) respondents representing 23.98% of the sample had secondary education. that fifty six (56) of the respondents representing 28.57% had tertiary education education.

Testing of Hypotheses

Hypothesis One

Telehealth-communication does not significantly impact the accessibility of health services for urban populations. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 4)

TABLE 4: Pearson Product Moment Correlation Analysis of telehealth communication does significantly impact the accessibility of health services for urban populations

Variable	$\sum x$	$\sum x^2$	$\sum xy$	r
Accessibility of Health Services(x)	9011	270655	134663	0.94*
Telehealth Communication (y)	9113	58989		

***Significant at 0.025 level; df =101; N =103; critical r-value = 0.086**

Table 4 presents the obtained r-value as (0.94). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 103 degrees of freedom. The obtained r-value (0.94) was greater than the critical r-value (0.086). Hence, the result was significant. As a result, Telehealth communication does significantly impact the accessibility of health services for urban populations

Hypothesis Two

Perceptions of healthcare providers and patients does not significantly impact the efficacy of telehealth in an urban setting. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 5)

TABLE 5: Pearson Product Moment Correlation Analysis of Perceptions of healthcare providers and patients does significantly impact the efficacy of telehealth in an urban setting

Variable	Σx	Σx^2	Σxy	r
	Σy	Σy^2		
Perceptions of Healthcare (x)	9011	270655	140162	0.83*
Efficacy of Telehealth (y)	9113	58989		

***Significant at 0.025 level; df =101; N =103; critical r-value = 0.086**

Table 5 presents the obtained r-value as (0.83). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 101 degrees of freedom. The obtained r-value (0.82) was greater than the critical r-value (0.086). Hence, the result was significant. The result, therefore, means that perceptions of healthcare providers and patients does significantly impact the efficacy of telehealth in an urban setting

Hypothesis Three

Challenges and barriers does not significantly impact implementing telehealth communication to improve healthcare access in urban areas. In order to test the hypothesis, Pearson Product Moment Correlation analysis was then used to analyze the data in order to determine the relationship between the two variables (see table 6)

TABLE 6: Pearson Product Moment Correlation Analysis of the challenges and barriers does significantly impact implementing telehealth communication to improve healthcare access in urban areas

Variable	Σx	Σx^2	Σxy	r
	Σy	Σy^2		
Challenges and Barriers (x)	9011	270655	141752	0.91*
Improve Healthcare Access (y)	9113	58989		

***Significant at 0.025 level; df =101; N =103; critical r-value = 0.086**

Table 6 presents the obtained r-value as (0.91). This value was tested for significance by comparing it with the critical r-value (0.086) at 0.025 levels with 101 degrees of freedom. The obtained r-value (0.82) was greater than the critical r-value (0.086). Hence, the result was significant. The result, therefore, means that challenges and barriers does not significantly impact implementing telehealth communication to improve healthcare access in urban areas

Conclusion

The exploration of the efficacy of telehealth communication in improving access to health services in urban settings has revealed valuable insights into the potential of technology-driven interventions. Telehealth has demonstrated the capacity to address urban healthcare challenges by enhancing accessibility, reducing barriers to care, and improving overall healthcare system efficiency. The findings of this study contribute to the growing body of literature on telehealth and its role in urban healthcare.

Telehealth interventions, including virtual consultations, remote monitoring, and digital health platforms, have shown promise in bridging the gap between healthcare providers and urban

populations. The positive impact is evident in improved patient outcomes, increased healthcare provider efficiency, and a more responsive and accessible healthcare system. Urban residents, particularly those facing geographical and socioeconomic barriers, have benefited from the convenience and flexibility afforded by telehealth communication.

Recommendations

Based on the findings of this study, the following recommendations are put forth:

Investment in Technological Infrastructure: Policymakers and healthcare institutions should prioritize investments in robust technological infrastructure to support widespread adoption of telehealth. This includes ensuring reliable internet connectivity, promoting the use of secure digital platforms, and providing necessary hardware for both healthcare providers and patients.

Digital Literacy Initiatives: To overcome barriers related to digital literacy, there is a need for targeted education and training programs. Initiatives should be designed to enhance the digital skills of both healthcare providers and patients, ensuring they can effectively navigate and utilize telehealth technologies.

Regulatory Frameworks: Policymakers should actively review and adapt existing regulatory frameworks to accommodate the dynamic nature of telehealth. Clear guidelines on telehealth practice, reimbursement policies, and data privacy regulations are essential to foster a supportive environment for telehealth implementation.

Interdisciplinary Collaboration: Encouraging collaboration among healthcare professionals, technology developers, and policymakers is crucial for the successful integration of telehealth into urban healthcare systems. Multidisciplinary teams can work together to address challenges, design user-friendly solutions, and ensure the seamless integration of telehealth into existing healthcare workflows.

Continuous Evaluation and Improvement: Healthcare institutions should establish mechanisms for continuous evaluation of telehealth programs. Regular assessment of outcomes, user experiences, and system efficiency will enable ongoing improvement and optimization of telehealth services.

Equity Considerations: In the implementation of telehealth, special attention should be given to addressing health disparities and ensuring that vulnerable populations have equitable access. Strategies such as targeted outreach, mobile telehealth units, and community partnerships can help reach underserved urban communities.

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ADMINISTRATIVE LAW: DISTINCTION BETWEEN PUBLIC ADMINISTRATION AND PRIVATE ACTION IN THE CONTEXT OF A LOCAL GOVERNMENT COUNCIL AND A GOVERNMENT AGENCY

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ABSTRACT

This study delves into the nuanced distinctions between public administration and private action within the realm of administrative law, focusing on the context of Local Government Councils and Government Agencies. The delineation between public and private spheres becomes particularly pertinent in the functioning of these entities, as they navigate the complex landscape of governance, service delivery, and regulatory authority. The research employs a comparative analysis to elucidate the fundamental differences in the administrative processes and legal frameworks that govern the actions of Local Government Councils and Government Agencies. It explores the dichotomy between public administration, rooted in the principles of transparency, accountability, and the public interest, and private action, which may involve contractual relationships, proprietary decision-making, and individual interests. Furthermore, the study investigates the legal implications of these distinctions, examining how judicial decisions and statutory provisions contribute to shaping the boundaries between public and private realms within the administrative domain. It critically evaluates the challenges and ambiguities that may arise when Local Government Councils and Government Agencies engage in activities that blur the lines between public and private spheres. The research also addresses the potential impact of these distinctions on issues such as citizen rights, access to information, and the overall effectiveness of administrative processes. By analyzing case studies and precedents, the study seeks to provide practical insights into how legal frameworks can be refined to ensure clarity and adherence to the principles of administrative law. Ultimately, this research contributes to the broader discourse on administrative law by offering a comprehensive understanding of the distinctive features that characterize public administration and private action within the specific context of Local Government Councils and Government Agencies. The findings aim to inform policymakers, legal practitioners, and scholars, fostering a more robust and coherent framework for administrative governance in the public sector.

KEYWORDS: Administrative Law, Distinction, Public Administration, Private Action, Local Government Council, and Government Agency

Introduction

Administrative law serves as the legal framework within which public administration is carried out. It is distinguished from private action by the nature of its functions and its objectives.

Activities that fall under the purview of administrative law typically include those that are sovereign and governmental in nature, such as traffic control, fire-protection services, policing, smoke abatement, construction or repair of highways, provision of currency, town and country planning, and the collection of customs and excise duties (Robson & Page, 2023). These are primarily carried out by governmental bodies and their executive organs. Originating from the English legal system, administrative law in Nigeria was established through local legislation in 1863. The Nigerian Constitution acts as the main source of authority for administrative law in the country (Nabiebu & Takim, 2019).

The distinction between public administration and private action is fundamental and does not belong to the law itself. It reflects the necessity for every human community to delineate the sphere of the state, administration, and the collective public domain from private interests. This distinction is crucial as it defines the scope of administrative law, which governs the actions of state administration and is a branch of public law. However, public administration encompasses the scope, nature, and approaches to administration within the public sector, focusing particularly on the Nigerian civil service (National Open University of Nigeria, 2022). It deals with the growth and characteristics of administrative law, ensuring legal safeguards over administration, judicial review, administrative procedures, and the accountability of officers. The differentiation is essential because administrative law and the actions of public administration have significant implications for the public interest (Quinot, 2023). Public administration must navigate within the constraints of administrative law to ensure that the government's actions are legal and that there is a mechanism to protect the public from any abuse of power. On the other hand, private law regulates the actions, interests, and obligations of private persons, which is quite different from the public law regulating state administration. For instance, civil servants, who are part of the public administration, do not serve under a contract of employment but have a special status under administrative law (Robson & Page, 2023).

The importance of distinguishing between public administration and private action lies in ensuring that governmental agencies and councils operate within their legal bounds and fulfill their roles in serving the public interest without encroaching on private rights. It also ensures that there is clarity in the roles and responsibilities, which is fundamental for accountability and the rule of law. The distinction is critical in a legal and societal context as it affects how laws are applied and how the public perceives the legitimacy of government action. In terms of local government councils in Nigeria, as grassroots governance entities, are responsible for implementing government policies at the community level. Distinguishing between public administration and private action in local councils is essential to prevent the misuse of resources and ensure that public services are delivered efficiently (Obi, 2019). Government agencies, on the other hand, operate at the state and federal levels, overseeing specific functions such as regulatory compliance, public services, and economic development. Clear distinctions between public administration and private action within these agencies are imperative to prevent conflicts of interest and maintain the public's trust according to Okonkwo (2020).

Overview of Administrative Law

Administrative law is a branch of public law that governs the activities of administrative agencies of government. It is concerned with the organization, powers, and duties of such agencies, and ensures the enforcement of the legal principles that are meant to guide their behavior. It involves overseeing the creation and operation of government agencies, managing the procedures, rules, and regulations that they follow, and making sure that they act within their legal bounds. It also governs the relationship between the government and the public,

protecting individuals from arbitrary decisions of administrative bodies by ensuring actions are based on fairness, reasonableness, and justice. The scope of administrative law is broad, covering the creation of rules, adjudicatory actions, and the application of these rules, while also providing mechanisms to keep administrative bodies in check. This dynamic legal discipline navigates complex interactions between citizens, government entities, and the judiciary, seeking a balance between effective governance and protection of individual rights (Koch, Jordan & Murphy, 2010).

Administrative Law in Nigeria governs government actions, ensuring fairness, accountability, and adherence to the rule of law. The Constitution grants powers to administrative bodies, defining their scope and limitations, while key statutes like the Administrative Procedures Act regulate decision-making procedures to promote transparency. Judicial review plays a crucial role, allowing courts to scrutinize administrative actions for legality and procedural regularity, as exemplified in the landmark case of Attorney General of Ogun State v. Aberuagba in 2002. Shaped by a mix of common law, Islamic law, and customary law rooted in the English legal system, Nigeria's administrative law is outlined in the 1999 Constitution, establishing the federal system and separation of powers. Legal processes, including court proceedings, alternative dispute resolution (ADR), and legal aid services, aim for fair and equitable justice, but challenges such as corruption and slow justice require ongoing reforms to enhance efficiency, transparency, and access to justice for all according to Max & Well Solicitors (2023). However, the administrative law in Nigeria is governed by Acts of Parliament or practice rules, requiring public authorities to act according to the law that establishes them. This includes adherence to principles such as Natural Justice, which includes the rule against bias (*Nemo Judex in Causa Sua*) and the right to a fair hearing (*Audi Alteram Partem*). Additionally, Section 36(1) of the 1999 Constitution of the Federal Republic of Nigeria mandates a fair hearing within a reasonable time by an impartial court or tribunal (Kyaure, 2017).

Public Administration as an academic discipline

The study of Public Administration has experienced various stages or identity crises since efforts were made to study the requirements for co-operative action to achieve common goals. It is trite to state that the study of Public Administration is a product of the national state (Thornhill & van Dijk, 2010). It is important to state that the discipline as a member of the Social Science fraternity is inseparably linked to human action and human behaviour. These two further argue that, these phenomena are studied within the framework of organisational structures operating in a particular social context i.e. a political system. Thus efforts to consider the possibility of theorising have to consider the values, the culture, and the social as well as the political environment within which the operational activities of public administration are carried out. "Woodrow Wilson provided the rationale for public administration to be an academic discipline and profession management specialty" (Shafritz, Russell & Borick, 2009: 24). These authors further state that the study of Public Administration is cross-disciplinary because it encompasses so much of political science, sociology, business administration, psychology, law, anthropology, medicine, forestry, and many. Therefore, the importance of a study leads to 'theories' that affect how society functions better.

Practice of Public Administration

As Weber discovered that the implementation of government policies by the public servants to be referred as 'bureaucracy', he created this theory so that there could be improvement on how the practices on government activities are done (Weber, 2012). They further argue that

bureaucracy is the principle of fixed and official jurisdictional areas, which are generally ordered by rules, that is by laws or administrative regulations. Like Thornhill and van Dijk, their argument on the idea that theory studies are done to develop strategies for change on implementations in society, this then leads and agrees to why Weber formulated the theory of bureaucracy. Furthermore, the practice of Public Administration works with the principles of office hierarchy and levels of graded authority meaning a firmly ordered system of super and subordination in which there is a supervision of lower offices by higher ones (Weber, 2012). For instances, since the duty of the government officials is to implement service delivery to the citizens, this is done through the bureaucratic system which was developed to ensure efficiency and productivity in government practices. In such that these activities are being carried out successfully, and this is all formulated from the 'theory' which guides those who are in the process of implementation on how should they carry out public activities. However, different theories have been formulated, which then create contradictions between the 'theories' and 'practice' of Public Administration; that is different views have been voiced out.

Public Administration in a Local Government Council

Public administration in a local government council is multifaceted, encompassing the management and delivery of key public services. These services are broad and crucial, ranging from sanitation and waste management to the provision of schooling and health care services for the elderly and vulnerable populations (Walker & Andrews, 2013). The role of public administration at this level includes not only administrative tasks but also a more dynamic involvement in policy advice, community leadership, and the development of innovative solutions to social issues (Nelson & Svava, 2015). Public administrators serve as crucial connectors within the community, facilitating collaboration and participation, which are vital for successful public infrastructure implementation (Alozie, 2020). They are described as the government of difference, meaning they are responsive and adaptive to the unique needs and challenges of their local areas. This function is essential for enhancing the learning capacity within the system of government and for fostering local initiatives that may not be fully supported or understood by central governments (Jones & Stewart, 2012).

Public administration in a Local Government Council plays a crucial role in implementing government policies, delivering public services, and ensuring effective governance at the grassroots level. The roles of public administration in a Local Government Council include:

Policy Implementation: Public administrators in local government are responsible for translating national and state policies into actionable plans at the local level. They work to implement policies that address the specific needs of the community.

Service Delivery: Local government administrators are tasked with delivering essential public services to the community. This includes services related to education, health, sanitation, infrastructure, and more. They ensure that these services meet the needs of the local population.

Planning and Development: Public administrators engage in strategic planning for the development of the local government area. They identify priorities, set goals, and create plans to address issues such as infrastructure development, urban planning, and community growth.

Budgeting and Financial Management: Public administrators are responsible for preparing budgets that allocate resources to various programs and services. They also manage financial resources efficiently, ensuring that funds are used effectively and transparently.

Human Resource Management: Local government administrators oversee the recruitment, training, and management of personnel. They ensure that the local government workforce is skilled, motivated, and capable of delivering quality public services.

Regulatory Functions: Administrators enforce local regulations and ordinances. This includes zoning regulations, building codes, and other rules that contribute to orderly development and the well-being of the community.

Public Engagement and Participation: Public administrators facilitate communication between the local government and the community. They organize public hearings, town hall meetings, and other forums to gather input from residents and promote citizen participation in decision-making.

Conflict Resolution: Administrators play a role in resolving disputes and conflicts within the community. This can involve mediating disagreements, addressing grievances, and promoting harmony among residents.

Emergency Management: Public administrators are responsible for coordinating responses to emergencies and disasters. They work to ensure the safety and well-being of the community during crises and disasters.

Data Collection and Analysis: Administrators collect and analyze data relevant to the local government's functioning. This information is used to make informed decisions, assess the impact of policies, and identify areas for improvement.

Collaboration with Stakeholders: Public administrators collaborate with various stakeholders, including community leaders, non-governmental organizations (NGOs), and businesses, to address local challenges and promote development.

Capacity Building: Administrators focus on building the capacity of local government staff through training and development programs. This enhances the skills and efficiency of the workforce.

Local Governance Council: Structure and Responsibilities

The structure of local governance within councils varies significantly across different regions and is influenced by various factors including sustainability policies, representation systems, and administrative practices. The administrative organization within local governments is significantly shaped by how local representation is structured, whether council representatives are elected by district, at-large, or through a mixed system. This structure impacts the administrative placement and has implications for local sustainability efforts (Chaudhry et al., 2020). In some systems, like the mayor-council form of government, the mayor plays a significant role, and the number of representatives on each city's council can vary. This form of government is characterized by a dichotomous structure, where the city has a mayor-council system, and the council could be elected at-large (Feiock et al., 2017). The council-manager form of government, which separates politics from administration, has been popular in the United States since the 20th century. This model promotes a professional administration and is seen as a product of the Progressive movement, emphasizing efficiency and a separation between elected officials and administrative functions (Connolly, 2016).

Local government management also involves jurisdictions such as cities, counties, school, and special districts. The public administration perspective traditionally focuses on these jurisdictions and their governance structures. The council-manager plan, which spans over fifty

years, is one such structure where the manager is appointed by the council to provide professional administration (Frederickson & O’Leary, 2014). Shared services and collaborations between different local governments have also been introduced to improve administrative intensity. Council administrations that benefit from upscaling and collaborations can achieve sensible savings, indicating a trend towards efficiency and shared service centers (Elston & Dixon, 2019). An example of local government structure adaptation can be seen in Nigeria, where Local Council Development Areas (LCDAs) emerged as a fourth-tier government unit. These areas have managed to exist without the traditional federal allocation and reflect a response to political and legal contestations (Abati, 2019). In the context of Nigeria, there's a discussion about the suitability of the uniform local government system, with arguments that it does not fit the culture of the people, suggesting the need for a system that is more adaptive and functionally effective (Egwim, 2020).

In Nigeria, the responsibilities of local government councils are outlined in various legal documents, including the 1999 Constitution. The functions and responsibilities of local governments are to be detailed by the State Houses of Assembly as per Section 7 (1) of the 1999 Constitution. Local governments serve as the third tier of government focused on grassroots development by addressing the unique needs of their communities. However, their autonomy is compromised by several factors, including constitutional and legislative impediments, corruption, lack of democratic principles, and inadequate finances (Chioma, 2020). The Constitutional impediment to the autonomy of Local Government can be found in Section 197(1) of the Constitution which has made provision for the establishment of state bodies. One of such state bodies is the State Independent Electoral Commission – Paragraphs 3 & 4 of Part II of the Third Schedule to the 1999 Constitution. This is the Commission charged with the responsibility of conducting elections into the various Local Government Councils in Nigeria. Each state of the Federation must have one established for this purpose Chioma, 2020).

Local government councils play a pivotal role in the effective administration and governance of a community. Their responsibilities encompass a wide range of functions that directly impact the lives of residents. One fundamental duty is the provision of essential services such as water supply, sanitation, and waste management (Musgrave, 2020). Additionally, local government councils are tasked with maintaining and developing local infrastructure, including roads, bridges, and public spaces (Smith, 2018). These responsibilities contribute to the overall well-being and quality of life for community members.

Furthermore, local government councils are crucial in the implementation of social welfare programs, aimed at addressing the needs of vulnerable populations within their jurisdiction (Jones & Brown, 2019). This includes the management of public health initiatives, education services, and housing projects. Through these efforts, local government councils strive to create a conducive environment for sustainable development and community growth (Clark & Roberts, 2021). However, there is discourse regarding the effectiveness of the current uniform local government system in Nigeria, with some arguments suggesting that it does not suit the diverse cultures of the Nigerian people and has been functionally unsatisfactory (Egwim, 2020). Moreover, good governance within local governments also entails examining the roles and responsibilities of local government legislators, who are integral to ensuring that governance is conducted in an equitable and efficient manner (Mohammed, 2023).

Primary Education: Local governments are often responsible for the administration and supervision of primary education within their jurisdiction. This includes the establishment and maintenance of primary schools.

Health Services: Local governments play a role in the provision and management of basic health services. This may involve running health clinics, immunization programs, and other public health initiatives.

Agricultural Development: Local governments may be involved in promoting agricultural development within their areas. This could include providing support to farmers, implementing agricultural extension services, and facilitating the development of local markets.

Infrastructure Development: Local governments are tasked with the planning and implementation of basic infrastructure projects. This includes the construction and maintenance of roads, bridges, markets, and other essential facilities.

Waste Management: Local governments are responsible for waste collection and management. This involves ensuring the proper disposal of solid waste and maintaining a clean environment.

Town Planning and Development: Local governments have a role in urban and rural planning. They are responsible for regulating land use, approving building plans, and promoting orderly development within their areas.

Revenue Generation: Local governments have the authority to collect certain taxes and levies within their jurisdiction. This revenue is used to fund local development projects and services.

Community Development: Local governments are expected to engage in activities that foster community development. This could include supporting local initiatives, promoting community cohesion, and addressing the specific needs of various communities within the local government area.

Social Welfare: Local governments may be involved in social welfare programs, including poverty alleviation initiatives, support for vulnerable populations, and the implementation of social intervention programs.

Market Regulation: Local governments often regulate markets within their jurisdiction. This involves ensuring fair trade practices, cleanliness, and orderliness in market areas.

Youth and Sports Development: Promotion and support for youth and sports activities are often part of the responsibilities of local governments. This includes organizing sports events, providing facilities, and supporting youth empowerment programs.

Government Agency in Local Government Area

Agencies are established by the government to implement policies, enforce laws, and oversee specific functional areas to ensure efficient public service delivery. These agencies are diverse, catering to various sectors such as health, education, infrastructure, finance, agriculture, and more. Nigeria, with its federal structure, has agencies at the national level and state levels, each with its distinct mandates and responsibilities. At the federal level, there are ministries, departments, and agencies (MDAs) that are responsible for formulating and implementing the government's agenda. For example, the Central Bank of Nigeria (CBN) regulates the financial sector, while the National Agency for Food and Drug Administration and Control (NAFDAC) oversees the safety of food and drugs. State agencies mirror federal agencies, focusing on regional governance. They are vital for decentralizing power and bringing governance closer to the people, allowing for tailored solutions to local issues. Moreover, some agencies are

regulatory bodies designed to oversee professional practices and maintain standards, such as the Nigerian Medical Association (NMA) for healthcare professionals.

Distinction Between Public Administration and Private Action in the Context of a Local Government Council and a Government Agency

The distinction between public administration and private action lies in the nature of their goals, responsibilities, funding sources, and the principles guiding their operations. Here's a breakdown of the differences in the context of a Local Government Council and a Government Agency:

Public Administration in a Local Government Council:

Goal and Purpose:

Public Administration: Focuses on serving the public interest and meeting the needs of the community. The primary goal is to provide essential public services and ensure the welfare and development of the local population.

Responsibilities:

Public Administration: Involves implementing government policies, delivering public services (education, healthcare, infrastructure, etc.), and addressing the specific needs of the local community.

Funding:

Public Administration: Relies on public funds, including taxes and grants, to finance its operations. The budget is subject to public scrutiny and approval.

Accountability:

Public Administration: Accountable to the public and subject to democratic processes. Decision-making is often transparent, and administrators are accountable to elected officials and the community.

Decision-Making Process:

Public Administration: Involves a public decision-making process where community input is often sought through public hearings, consultations, and other forums.

Principles:

Public Administration: Guided by principles of transparency, accountability, equity, and responsiveness to the public. Decisions are expected to align with public values and serve the common good.

Private Action in a Government Agency:

Goal and Purpose:

Private Action: Primarily aims at achieving specific organizational objectives, which may include profitability, efficiency, and competitiveness.

Responsibilities:

Private Action: Focuses on the specific mission or goals of the organization, which may not necessarily align with broader public welfare concerns. The emphasis is on achieving organizational success.

Funding:

Private Action: Depends on private funding sources, such as revenue from sales, investments, or private donations. The organization's financial decisions are often driven by the pursuit of profit or sustainability.

Accountability:

Private Action: Accountable to private stakeholders, such as shareholders or private owners. The decision-making process may not be as transparent as in the public sector, and accountability is primarily to those with a financial interest in the organization.

Decision-Making Process:

Private Action: Involves internal decision-making processes driven by organizational goals. While some private organizations may seek input from customers or clients, the process is not necessarily subject to public scrutiny.

Principles:

Private Action: Guided by principles of efficiency, profit maximization, and competitiveness. Decision-making is often oriented towards achieving financial success and market objectives.

Key Points of Distinction:

SN	PUBLIC ADMINISTRATION	PRIVATE ACTION
1	Public administration is oriented towards public service and community welfare	private action is often oriented towards organizational success and profit
2	Public administration relies on public funds	private action is funded through private sources such as sales, investments, or donations
3	Public administration involves a more transparent and public decision-making process	private action decisions are driven by internal organizational goals.
4	Public administration is accountable to the public through democratic processes,	private action is accountable to private stakeholders
5	Public administration is guided by principles of transparency, accountability, and the common good	private action is guided by principles of efficiency, profit maximization, and competitiveness

In the context of a Local Government Council and a Government Agency, public administration is responsible for serving the public interest and delivering essential services to the community, while a government agency may be involved in specific functions driven by government policies and objectives.

Theoretical Framework

Scientific Management Theory by F. W. Taylor (1901)

In 1901, Taylor published *The Principles of Scientific Management*. In his theory, he stated that “productivity would increase if jobs were optimized and simplified. He also proposed matching a worker to a particular job that suited the person’s skill level and then training that worker to do the job in a specific way”. The theory focuses primarily on the operative level (individuals at the workshop level) from the bottom of the organizational hierarchy upwards and ignored the larger top level issues. His scientific concepts of work simply imply a well thought out plan that presents a sequential or orderly manner by which workers can attain efficiency in job performance.

The concept is therefore concerned with the principle of work and motion study, work measurement and time study. Taylor believes that every piece of work should be thoroughly measured so as to be able to know or determine the quantity of materials required for its execution, the kind of manipulative skill (motion study) required for it, which will also determine the level of skill and experience possessed by the worker slated to perform that task.

In the course of task performance, Taylor demands that the worker shall be well supervised to ensure that the correct tools, methods and procedures are adopted for the effective performance of a given task. Taylor advocates for the training of a worker so that he can acquire the needed skill for improved performance. This is why staff needs refresher courses through in-service programmes, workshops and seminars where they can interact with other professionals on modern methods and techniques.

The other aspect of Taylor’s approach to efficiency at work is his believe that time should be allotted for the completion of any piece of work. This would ensure that each worker per day, per week, per month, justifies his wages or salaries for the work done and carries out an estimated volume of work. This gave rise to his principle of a good day’s work for a good day’s pay. Taylor introduced the use of ‘stop watch’ with which he was able to set the time a worker starts performing a given job and would ensure that he stops at the end of the allotted time. This enabled him to assess whether the worker needed to maintain or improve on his performance at that level of task difficulty. Also timing for each task affords the superior the opportunity to assess the task performance ability of each worker so as to enable him assign them to subsequent tasks depending on the reliability of finished products.

Taylor initiated good reward system to motivate workers to greater productivity through annual bonuses, prizes, over-time pay etc. For example, a school administrator can reward teachers through praises, gift from school farm proceeds, fruits from the school economic trees. This will take care of the distressed teachers in times of non-payment of salaries. Awarding prize to the best performing teacher of the year etc., Taylor’s methods and analyses stimulated others to continue the formulation of management thought. He helped the unskilled worker by improving productivity enough to raise the pay of the unskilled labour close to that of the skilled.

Leadership is the art of influencing people, that is, subordinate so that they strive willingly enthusiastically towards the achievement of the management objectives. This is in consonance with Taylor’s theory, which involves the motivation and controlling of individual to deliver effective service, which at the end would have brought about the achievement of set goals or targets. He added that the function of leadership is to reduce or encourage subordinates

to willingly make their maximum contributions. Frederick Taylor, the father of scientific management sought ways to use people effectively in industrial organizations.

Management can be described as the art of working particularly through people, for the achievement of the broad goals of an organization. In trying to achieve these goals, the administrative office manager has to map his strategy, he must find the people and materials to do their jobs, assignment of different people to do different jobs, get them to do these jobs, ensure that the jobs are being done as planned, and report back the result of his work to his boss. Leadership in two dimensions, as property an individual possess or as that of a group, the former perspective conceptualizes leadership as the psychological traits of individual wielding the influence, while the later perspective considers leadership as interpersonal exchange and as psychological properties of a group.

Conclusion

In the realm of administrative law, the distinction between public administration and private action within the context of a local government council and a government agency is crucial for maintaining the principles of good governance, accountability, and fairness. Throughout this analysis, it has become evident that while both entities operate within the administrative framework, they serve distinct purposes and must adhere to different sets of rules and regulations.

Local government councils play a vital role in serving the immediate needs and interests of their communities. Their actions are inherently public in nature, as they involve the provision of essential services, the implementation of local policies, and the management of public resources. The decisions made by local government councils impact the lives of citizens directly, making transparency, accountability, and procedural fairness essential elements in their administrative processes.

On the other hand, government agencies operate at a broader level, often focusing on specific policy areas or regulatory functions. While they, too, are bound by principles of transparency and fairness, the nature of their work may involve a more complex interplay of legal, economic, and social factors. Striking the right balance between efficiency and adherence to legal principles becomes crucial for government agencies.

Recommendations:

Clarity in Legal Frameworks: It is imperative to establish and maintain clear legal frameworks that distinguish between the administrative actions of local government councils and government agencies. This clarity will guide these entities in understanding their respective roles and responsibilities.

Training and Capacity Building: Ensure that personnel working within local government councils and government agencies receive adequate training on administrative law principles. This includes understanding the nuances of public administration, procedural fairness, and the legal obligations that come with their roles.

Enhanced Accountability Mechanisms: Strengthen accountability mechanisms for both local government councils and government agencies. This could involve regular audits, public disclosures, and mechanisms for citizens to voice their concerns or grievances.

Collaboration and Coordination: Encourage collaboration and coordination between local government councils and government agencies, especially in areas where their functions

overlap. This can help streamline processes, reduce duplication, and enhance overall effectiveness.

Continuous Review of Policies: Regularly review and update policies related to the actions of local government councils and government agencies. This ensures that these entities are equipped to address emerging challenges while upholding the principles of administrative law.

Public Participation: Foster mechanisms for public participation in decision-making processes, especially at the local government level. This not only promotes transparency but also ensures that the voices and concerns of the community are taken into account.

By implementing these recommendations and maintaining a clear understanding of the distinction between public administration and private action, local government councils and government agencies can contribute to a more transparent, accountable, and fair administrative system that serves the best interests of the public.

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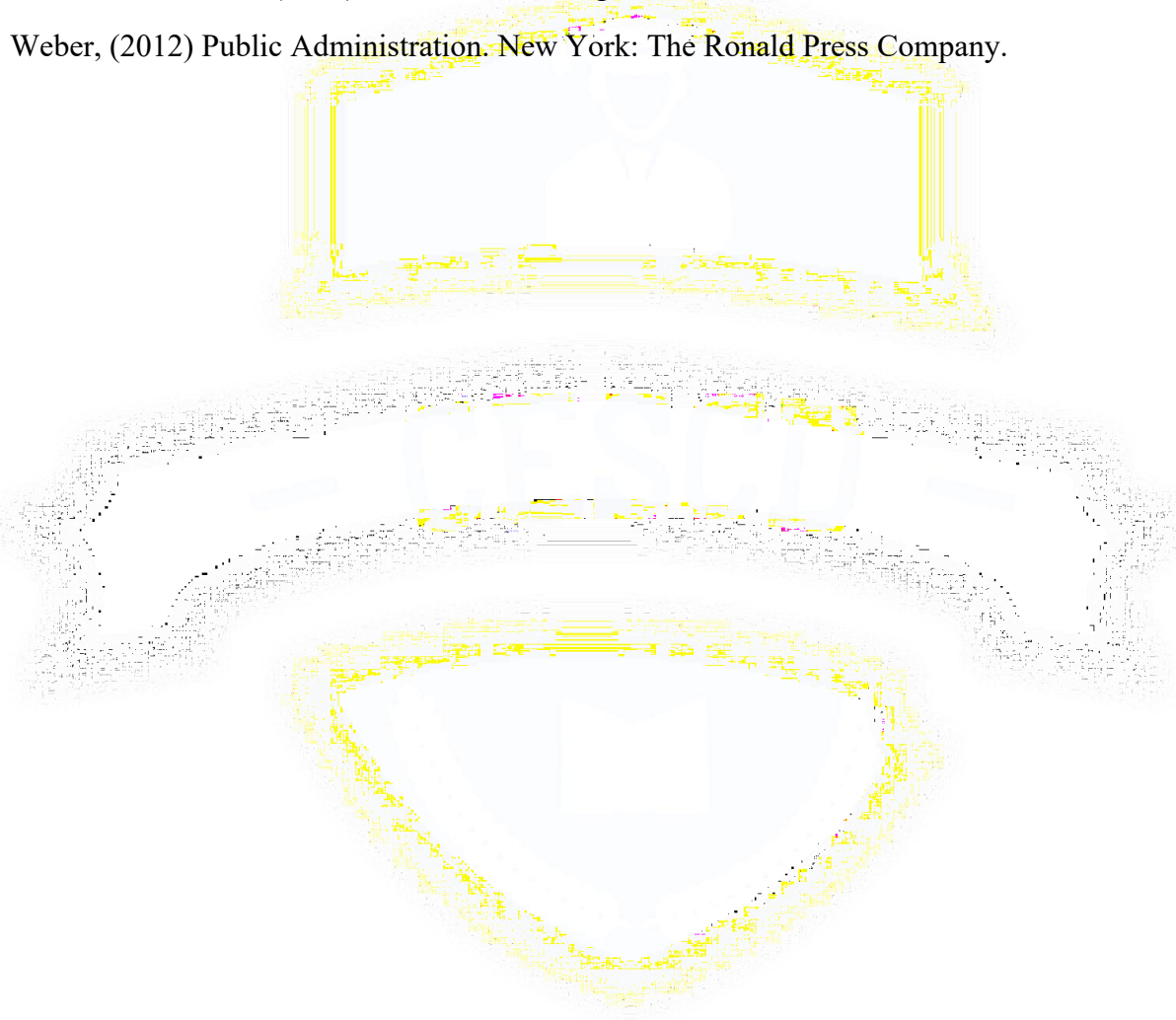
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ACHIEVING ADMINISTRATIVE COST REDUCTION THROUGH IMPLEMENTATION OF ELECTRONIC INVOICING IN MULTINATIONAL COMPANIES

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ABSTRACT

This research explores the transformative impact of electronic invoicing (e-invoicing) on administrative cost reduction within the context of multinational companies (MNCs). As businesses continue to globalize, the complexities of managing invoicing processes across diverse regions and currencies create significant administrative challenges. Traditional paper-based invoicing systems not only contribute to operational inefficiencies but also incur substantial costs associated with manual handling, errors, and delays. The study employs a comprehensive review of existing literature, case studies, and empirical data to analyze the adoption and integration of e-invoicing systems in multinational corporate environments. By examining the key drivers and barriers, the research aims to provide insights into the strategic and operational considerations that influence the successful implementation of e-invoicing. The findings highlight the various ways in which electronic invoicing contributes to administrative cost reduction. Automation of invoicing processes, improved accuracy, and faster transaction cycles are identified as primary mechanisms through which MNCs can achieve operational efficiency. Furthermore, the study investigates the potential impact on compliance and regulatory adherence in different geographical regions, shedding light on the adaptability of e-invoicing solutions to diverse legal frameworks.

KEYWORDS: Administrative, Cost Reduction, Electronic Invoicing, and Multinational Companies

Introduction

In an era characterised by the pervasive influence of digital transformation and the relentless progression of technology, multinational corporations (MNCs) are perpetually in pursuit of novel methodologies to augment operational efficiency, rationalise financial procedures, and curtail expenditures. The concept of e-invoicing pertains to the digital transmission of invoices between purchasers and vendors. In contrast to conventional paper-based invoicing systems, e-invoicing harnesses digital technologies to generate, transmit, receive, and process invoices with enhanced efficiency and automation. The constant digitization of business operations, along with the need for organizations to improve their financial acumen and reduce operational costs, have driven the aforementioned metamorphosis. Within this particular framework, the

implementation of e-invoicing signifies a strategic manoeuvre aimed at enhancing the efficiency of financial procedures and attaining noteworthy reductions in costs (Hugos, 2018).

Multinational corporations (MNCs) engage in operations of considerable magnitude, encompassing intricate financial transactions and administrative procedures. One of the pivotal facets of their operational framework pertains to the process of invoicing, which encompasses the intricate exchange of bills, receipts, and various financial documents. The conventional practice of utilising paper-based invoicing systems has prevailed over an extended period. However, the rapid progression of technology has given rise to electronic invoicing (E-invoicing), which has emerged as a revolutionary instrument that bestows a multitude of benefits upon multinational corporations (Nasiri et al., 2020).

E-invoicing represents a modernised methodology for the administration of financial transactions through the digitization of the invoicing process. E-invoicing, in contrast to traditional reliance on physical documentation, utilises digital technology as a means to generate, transmit, receive, and handle invoices in an electronic format (Alnsour et al., 2023). The utilisation of this novel approach represents a notable deviation from traditional methodologies, namely the utilisation of paper invoices and manual data entry. According to Zion market research from 2019, this innovative method has the potential to fundamentally transform the financial operations of multinational corporations.

The pursuit of cost reduction is an inherent and essential objective for all entities, including multinational corporations (MNCs). The organisation's operational scope encompasses various nations, currencies, and regulatory landscapes, necessitating the imperative to streamline procedures and enhance cost efficiency. E-invoicing presents a potential avenue for realising substantial cost reductions through the elimination of various inefficiencies inherent in traditional paper-based invoicing processes. These inefficiencies encompass expenses related to printing, postage, data entry, and storage. Additionally, according to research by Martínez-Román et al. (2020), the implementation of this technology has the potential to increase precision, velocity, and visibility in the world of financial transactions.

The advantages of electronic invoicing are manifold and extend well beyond the mere mitigation of dependence on traditional paper-based documentation. While it is commendable to prioritise environmental sustainability and paper reduction, the true significance lies in the profound influence that e-invoicing exerts on an organisation's cost structure. Multinational corporations, owing to their expansive global operations, intricate supply chains, and substantial transaction volumes, are inherently poised to realise substantial cost-saving advantages through the implementation of electronic invoicing (Hugos, 2018).

Within the vast array of digital solutions that have materialised, electronic invoicing has emerged as a prominent catalyst for change within the domain of corporate finance. The implementation of electronic invoicing systems by multinational corporations signifies a significant paradigm shift in the manner in which enterprises oversee their monetary transactions and engage with both suppliers and clients. Nasiri et al. (2020).

E-invoicing, being an integral part of e-procurement and digital financial management, has been the subject of growing interest due to its potential to drive cost reduction within multinational corporations (MNCs). The potential of this innovation lies in its ability to fundamentally transform conventional invoicing procedures, resulting in enhanced efficiency, precision, and cost-efficiency. In an era characterised by the utmost importance placed on agility and cost-consciousness, the strategic incorporation of electronic invoicing possesses the capacity to generate profound and far-reaching effects. Nevertheless, it is imperative to conduct

a thorough analysis of the effects of e-invoicing on cost reduction, specifically within the distinctive framework of multinational corporations (MNCs).

Overview of Electronic Invoicing

Electronic invoicing, commonly referred to as e-invoicing, entails the conversion of the conventional paper-based invoicing procedure into a digital format, thereby facilitating a technological advancement in this domain. The process encompasses the generation, propagation, reception, and manipulation of invoices through electronic modalities, commonly facilitated by dedicated software or platforms. The European Commission in 2019 provided a definition for e-invoicing, which entails the digital transmission of invoicing data encompassing billing and payment information between collaborating entities. Henceforth, it is imperative to acknowledge that invoices that are conveyed as attachments, such as Portable Document Format (PDF) files, within electronic mail correspondences do not meet the criteria to be classified as authentic electronic invoices. According to Koch (2019) and Innopay (2019), the reason for this restriction is that e-mail attachments are inherently incapable of facilitating the seamless automation of invoice data processing within the payment system. For tax rules to be followed, depending on where the buyer or supplier is located, they may need to provide a government-issued ID number, use qualified electronic signatures, stick to certain content fields, and put in place long-term storage options for the invoice (Keifer, 2021). The legislative framework in the Czech Republic lacks a precise definition of an invoice, regardless of its format, be it electronic or paper-based. The tax document has the potential to exist in either a physical or digital manifestation. A tax document is deemed to be in electronic format when it is both issued and received through electronic means. In order to proceed with the reception of an electronic tax document, it is imperative for the recipient to provide explicit consent to the utilisation of said document in its electronic format. Schmandt and Engel-Flechsich's 2018 research emphasized the need for the invoice to have a few characteristics in order to maintain its credibility, content integrity, and readability. In 2012, the Chamber of Commerce said that using a properly recognised electronic signature or making electronic information exchange easier is a good way to make sure that the source of an electronic tax document is real and that the document's content stays the same. The inclusion of an advanced digital signature within an e-invoicing system serves to enhance the validation of the invoice (Foryszewski, 2016; Rombel, 2017). According to Kaliontzoglou (2016), for e-invoicing to be integrated into a firm's financial practices, it is imperative that it adhere to stringent security standards. Notwithstanding the prevalent utilisation of electronic means for invoice preparation, it is noteworthy that a significant proportion of invoices undergo manual data entry, wherein information from a physical invoice is transcribed into a financial management system for subsequent processing and disbursement. This phenomenon exemplifies a substantial expenditure of time and exertion, particularly in light of the fact that the act of replication may give rise to the incorporation of errors. The implementation of automation in this particular function not only serves to mitigate the aforementioned risks but also facilitates the utilisation of digitised content in a manner that is characterised by enhanced efficiency (Hayward, 2018). The effective administration of inbound monetary inflows resulting from finalised transactions is of utmost importance for the sustainability of an enterprise (Hanif, 2018).



The vendor locates the purchase order (PO) within their software system and proceeds to generate an invoice. The information is conveyed from the primary source. The vendor transmits the invoice electronically via their proprietary software platform. The invoice is transmitted via the Peppol network, exhibiting a near-miraculous quality as it seamlessly interfaces with the recipient's software system.

In order to verify the invoice's accuracy and subsequently authorize payment, the purchaser's software compares the received invoice with the corresponding purchase order (PO). The operational efficiency of both the seller and buyer is enhanced through the implementation of automated processes. The elimination of issues associated with traditional invoicing is achieved through a substantial reduction in redundant manual processing. Using electronic invoicing (e-invoicing) has been shown to be significantly more efficient than the old way of processing invoices on paper, by a factor of 60% to 80%. This substantial enhancement in efficiency consequently leads to a significant reduction in payment durations. According to a particular source, the mean duration for the processing of e-invoices is estimated to be merely five days. Through the implementation of e-invoicing, sellers are able to expedite the processing times associated with invoice management, resulting in accelerated payment cycles. This not only enables sellers to receive their payments in a timely manner but also facilitates the optimisation of buyers' operational workflows and business processes.

Types of Electronic Invoicing

Electronic invoicing, or e-invoicing, refers to the digital exchange of invoices between businesses or individuals, typically in a standardised electronic format. E-invoicing offers several advantages over traditional paper-based invoices, including cost savings, efficiency, and reduced errors.

Structured E-Invoicing: Structured e-invoicing is a method of electronic invoicing that involves the exchange of invoices in a highly organised and standardised format, making it easily processable by both computers and humans. This type of e-invoicing is characterised by the use of structured data, typically adhering to specific data standards or schemas. It includes EDI (Electronic Data Interchange), one of the earliest forms of e-invoicing, and involves the structured exchange of data between computer systems using standardised formats. It's commonly used for B2B transactions, and XML (Extensible Markup Language) is used to create structured invoices that can be easily processed by computers. It allows for flexible customisation while maintaining a standard format (Hsu et al., 2016; Kovačič et al., 2019).

Web-based E-Invoicing: Many businesses provide web-based portals where suppliers can log in and submit electronic invoices. This method is commonly used for large enterprises with multiple suppliers, and it includes cloud-based platforms that offer e-invoicing solutions that enable businesses to create, send, and receive invoices online. These platforms often include features for automation, integration, and compliance (González-Fernández et al., 2020).

Email E-Invoicing: Invoices are created in digital formats and sent directly to recipients via email as attachments. While this is a simple method, it may lack automation and tracking features (Yongchareon et al. 2016).

Blockchain E-Invoicing: Blockchain technology has been investigated for secure and tamper-proof e-invoicing. Researchers have explored how blockchain can enhance the trustworthiness and transparency of invoices and transactions recorded on a distributed ledger, providing transparency and security (Pournajaf et al., 2019; Petychakis et al., 2020).

Mobile E-Invoicing: Researchers have examined the role of mobile apps in enhancing invoicing convenience and accessibility. Some e-invoicing solutions offer mobile apps that allow businesses to create and send invoices from their smartphones or tablets. This is useful for on-the-go invoicing (Laine et al., 2017; Adeleye et al., 2020).

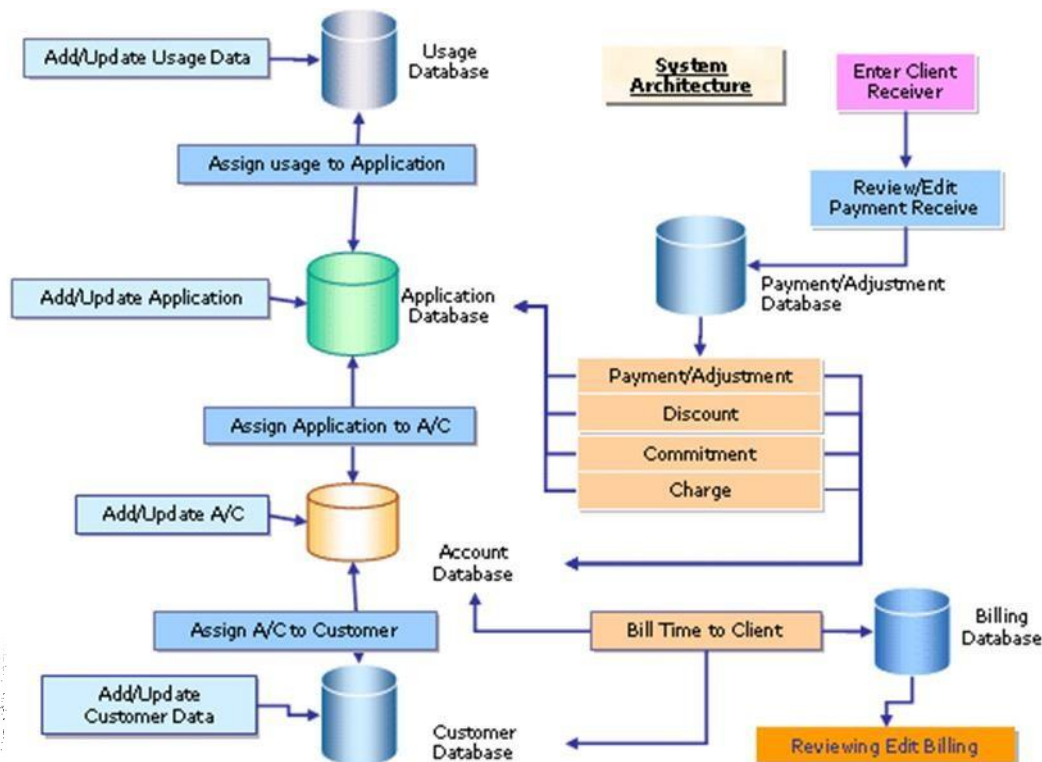
Machine-to-Machine (M2M) E-Invoicing: M2M e-invoicing involves automated invoice generation and exchange between machines or systems without human intervention. It is commonly used in industries like telecommunications and utilities. Mörtberg et al. (2015).

Government-Mandated E-Invoicing: Some countries mandate the use of specific e-invoicing systems or formats for businesses, especially in B2G (business-to-government) transactions. These systems are designed to ensure tax compliance and reduce fraud. Researchers have analysed the effectiveness of government initiatives in promoting e-invoicing compliance among businesses (Chen et al., 2018; Javed et al., 2020).

Supplier Network E-Invoicing: Supplier networks or e-invoicing platforms bring together buyers and suppliers within a digital ecosystem. Suppliers can submit electronic invoices to multiple buyers using a single platform. Research has highlighted the importance of network effects in driving e-invoicing adoption within business ecosystems (Mörtberg et al., 2015; Huang et al., 2021).

Integrated E-Invoicing: Integrated e-invoicing solutions seamlessly integrate with a company's existing accounting, ERP (Enterprise Resource Planning), or financial systems. This streamlines the entire invoicing and payment process (Mejía et al., 2015; Tomic and Benzeš, 2016; Dong and Xu, 2016; Leppänen and Pajunen, 2017).

Architectural Framework of E-Invoicing



Source: Swastik Infotech Services (2018).

The primary function of this module entails the meticulous conversion of the biller data file, preserving the integrity of each individual byte, into the requisite data fields that align with the database specifications. The information parser component creates an interface with the biller's pre-existing billing system. The parser effectively retrieves the pertinent billing information from the data formats of the legacy billing systems, encompassing fixed length, data-tagged, Xerox Line Mode, or alternative file formats. The salient aspect pertains to the extraction of billing information for electronic bill presentation, wherein said information is derived directly from the biller's existing format, thereby obviating the necessity for any upgrades or modifications on the part of the biller. The fundamental technological framework employed in this context is a bespoke middleware meticulously crafted utilising the Visual Studio development environment (Swastik Infotech Services, 2018).

E-Invoicing as a Strategic Lever for Cost Reduction

E-invoicing has emerged as a pivotal strategy for attaining cost reduction amidst the concerted efforts of companies to optimise their financial supply chain. According to Hugos (2018), this statement is especially important for businesses that send a lot of documents because they need to look at their internal processes in order to free up money that has been stuck in the company because credit is hard to come by and costs a lot. One of the fundamental components for enhancing the efficiency of the financial supply chain entails the provision of electronic data, which necessitates the adoption of electronic invoicing, commonly referred to as e-invoicing. According to Alhawamdeh et al. (2023), firms perceive the advantages associated with cost reduction to surpass any potential costs or inconveniences incurred in the process of altering their operational procedures. E-invoicing serves as an automated solution that encompasses the complete cycle of invoice processing, commencing from the inception of the invoice to its

ultimate settlement. Putting this automated system into place effectively reduces the need for human involvement in tasks like data entry and harmonisation, which saves a lot of time and money by getting rid of tasks that require a lot of work. The implementation of e-invoicing obviates the necessity for traditional paper invoices, thereby mitigating the accompanying expenditures encompassing printing, postage, envelopes, and physical storage. Transitioning to a paperless system effectively curtails both direct and indirect costs. Consequently, this adoption not only aligns with ecological principles but also presents a financially prudent alternative (Bruno, 2019). The manual input and processing of data exhibit a susceptibility to errors, thereby engendering the potential for consequential discrepancies and disputes and the necessity for subsequent remedial actions. E-invoicing systems have been purposefully developed to mitigate errors by means of automated validation checks, thereby guaranteeing the precision of financial data (Marak & Pillai, 2021).

The utilisation of e-invoicing frequently encompasses the implementation of automated approval workflows, thereby expediting the process of approval and subsequent payment. Better efficiency like the one described here makes it easier to approve invoices without having to spend as much time and money on administration. This speeds up payment cycles and improves cash flow. E-invoicing systems facilitate instantaneous access to pertinent information regarding the current state of invoices and financial transactions. The enhanced visibility afforded by this system facilitates more effective decision-making, diminishes the duration dedicated to status inquiries, and augments reporting capabilities, thereby optimizing administrative operations (Marak & Pillai, 2021; Moretto & Caniato, 2021). The implementation of e-invoicing enables the expeditious and precise processing of payments, thereby augmenting the rapport between suppliers and their counterparts. The mitigation of payment delays and disputes results in enhanced supplier interactions, thereby diminishing the administrative burden associated with issue resolution. E-invoicing systems frequently incorporate inherent compliance verification mechanisms and maintain meticulous records of audit trails. The aforementioned process enhances adherence to tax regulations and streamlines the readiness for audits, thereby potentially mitigating expenses associated with audits. Fairchild (2016) is a scholarly source that can be referenced for further exploration and analysis. The implementation of e-invoicing systems facilitates the automation of mundane administrative tasks, thereby enabling organisations to redirect their administrative resources towards endeavours that are more strategic and yield added value. These endeavours may include but are not limited to financial analysis, supplier negotiations, and process enhancements (Olaleye et al., 2023).

E-invoicing solutions commonly present pricing structures that exhibit predictability, thereby facilitating the process of budgeting and forecasting invoicing-related expenditures for organizations. The heightened predictability engenders a more robust financial planning framework, thereby mitigating the necessity for unforeseen cost allocation. The implementation of electronic invoicing (e-invoicing) offers the potential for organisations to effectively accommodate their growth and transaction volume while minimising the corresponding rise in administrative costs. The inherent scalability of the system guarantees the preservation of cost efficiencies in tandem with the expansion of the enterprise. Furthermore, the implementation of e-invoicing enables organisations to achieve enhanced efficiency and precision in payment processing, thereby mitigating the risk of incurring penalties and associated expenses due to delayed payments. Additionally, the adoption of this digital invoicing system facilitates a reduction in the utilisation of paper and eliminates the need for physical transportation of invoices, thereby making a significant contribution towards environmental sustainability. This aligns perfectly with the objectives of corporate social responsibility, as highlighted by Fairchild (2016).

E-invoicing adoption and reduction of administrative costs within MNCs

The adoption of electronic invoicing, commonly referred to as e-invoicing, within multinational corporations (MNCs) has been observed to exert a discernible influence on the realm of administrative expenditures. Adopting electronic invoicing (e-invoicing) streamlines and automates different parts of the billing process, which significantly lowers the costs and difficulties of managing paperwork. One of the foremost advantages inherent in the adoption of e-invoicing lies in its capacity to obviate the need for labour-intensive manual data entry and the reliance on paper-based processing methods. The conventional method of utilising paper invoices necessitates substantial exertion in terms of data entry, thereby resulting in a significant expenditure of time and an increased susceptibility to errors (Marak & Pillai, 2021). The adoption of electronic invoicing systems facilitates the automated extraction of data, thereby mitigating the necessity for manual data entry and the concomitant expenses incurred in administrative labor. The utilisation of conventional paper invoices entails the requisite engagement in physical manipulation, printing, dispatching via mail, and subsequent storage. The adoption of e-invoicing effectively mitigates the financial burdens associated with the procurement of paper, printing materials, envelopes, postage fees, and the allocation of physical storage space. According to the 2016 study by Edelman and Sintomen, the observed decrease in administrative tasks associated with paper usage results in significant financial benefits. E-invoicing systems serve as electronic platforms that facilitate the storage and organisation of invoices and associated documentation. The adoption of a centralised document management system effectively mitigates the administrative burden typically associated with the processes of filing, organising, and retrieving physical paper invoices. The scholarly works of Marak and Pillai (2021), as well as Moretto and Caniato (2021), demonstrate that the adoption of this technology also serves to increase the levels of document security and accessibility.

The integration of electronic invoicing frequently encompasses the adoption of automated approval workflows, which facilitate the electronic routing of invoices to the relevant personnel for their approval. The adoption of this automated system expedites the process of invoice approval, thereby mitigating administrative bottlenecks and minimising the concomitant financial burdens. E-invoicing systems provide instantaneous visibility into the current state of invoices, enabling administrators to monitor the advancement of payments, identify areas of congestion, and generate reports with enhanced efficiency. The study conducted by Caniato et al. (2016) The enhancement of visibility in this context serves to optimise administrative decision-making processes while concurrently mitigating the need for labour-intensive manual status checks, thereby streamlining overall efficiency. The adoption of electronic invoicing has the potential to cultivate more robust and mutually beneficial associations with suppliers and vendors. The adoption of a prompt and precise invoice processing system yields a reduction in disputes, inquiries, and subsequent follow-ups, thereby mitigating the amount of administrative effort expended on dispute resolution (Moretto & Caniato, 2021).

A group of researchers led by Ni, L. et al. (2023), Olaleye et al. (2023), and Skare et al. (2023) all found that using electronic invoices makes it easier to balance payments because they automatically match up invoices with purchase orders and delivery receipts. The adoption of this approach effectively optimises the allocation of administrative resources in the process of reconciling financial records, thereby mitigating the occurrence of discrepancies. The study conducted by Wang et al. (2016) found that e-invoicing systems frequently incorporate compliance verification mechanisms and uphold meticulous records of audit trails. The aforementioned action serves to mitigate the administrative encumbrance associated with guaranteeing adherence to regulatory standards while concurrently expediting the preparatory

measures for audits, thereby potentially diminishing the financial burden associated with audit-related expenses. The adoption of e-invoicing facilitates the automation of mundane administrative tasks, thereby enabling organisations to reallocate their administrative resources towards more impactful endeavors. These may include strategic financial planning, supplier relationship management, and initiatives aimed at enhancing process efficiency and effectiveness. The study conducted by Waarts et al. (2022) is of particular significance in the field. However, e-invoicing systems can effectively adapt to the constantly changing needs of multinational corporations (MNCs). This makes it easier to manage higher transaction volumes and different business units without having to hire more administrative staff and pay more for them.

According to Cheng et al. (2019), the adoption of e-invoicing systems may incur initial expenses related to employee training. However, it is observed that the subsequent need for administrative training and support is relatively lower in comparison to the continuous training demands associated with manual invoice processing. According to Edelman and Sintomen (2016) and Penttinen and Tuunainen (2019), the adoption of e-invoicing has the potential to significantly reduce costs, such as those associated with clerical work and printing expenses. The aforementioned study conducted by Lumiaho and Rämänen (2011) as well as the research conducted by Poel et al. (2016) demonstrate that the adoption of this solution yields improvements in delivery time, reductions in payment delays, and enhanced reliability through the mitigation of error rates. Furthermore, Sandberg et al. (2019) noted that the adoption of this strategy has the potential to result in increased process efficiency within the organization. An additional noteworthy advantage lies in its provision of convenience to the various stakeholders within the supply chain and its enhancement of service delivery to clientele (Sandberg et al., 2019; Poel et al., 2016). The adoption of electronic invoicing, commonly referred to as e-invoicing, has the potential to significantly enhance firm tax compliance and augment government tax collection efforts. According to the studies done by Krysovatty et al. (2021), Olaleye et al. (2023), and Skare et al. (2023), this is particularly pertinent in the context of high-risk non-compliance groups. Moreover, the adoption of e-invoicing yields numerous environmental advantages, including a notable reduction in paper consumption and a significant enhancement in energy utilisation efficiency (Poel et al., 2016). As referenced in the scholarly work of Ashish et al. (2023), the relative advantage associated with the adoption of e-invoicing encompasses various dimensions, namely compatibility, complexity, observability, and trialability.

The concept of compatibility pertains to the extent to which an innovation is perceived as aligning with the prevailing values, needs, and prior experiences of prospective adopters (Rogers, 2020; Moore and Benbasat, 2021). In order to enhance the probability of e-invoicing adoption, it is imperative that the system aligns with prevailing values, fulfils established requirements, and takes into account the organisation's historical encounters. Previous research conducted on various technologies has demonstrated the favourable impact of compatibility on the acceptance and utilisation of said technologies (Ghobakhloo et al., 2021; Wang et al., 2016; Waarts et al., 2022). The establishment of congruity in both the cognitive orientation and competencies within the organisation, as well as among the various entities comprising the supply chain network, is imperative. This is due to the potential emergence of resistance to change and obstacles hindering the assimilation of novel innovations, as expounded upon by Töytäri et al. (2018).

Complexity

According to Rogers (2020), complexity refers to how difficult it is to understand and use an innovation. For optimal adoption rates, it is imperative that the innovation exhibit a high degree of compatibility with the operational framework of the business organization. If the organisations possess the perception that the technology in question is characterised by complexity in terms of comprehension and utilisation, it shall serve as a deterrent to the adoption of said technology. The concept of complexity pertains to a model characterised by a highly intricate subsystem that operates according to a multitude of interactions governed by a local rule (Mehra et al., 2020; Moore and Benbasat, 2021). According to Mehra et al. (2020), the likelihood of embracing technological innovation can be enhanced through reducing its inherent complexity. It has been observed that the complexity of technology exerts a detrimental impact on the adoption of these innovations.

Observability

Observability refers to the degree to which the results of an innovation are observable to others (Rogers, 2020). The discernible effects of technological advancements within the industry render them more amenable to favourable reception and subsequently increase their likelihood of being embraced (Marak et al., 2019). Previous research conducted on innovative technologies has demonstrated that observability plays a crucial role in facilitating the acceptance and utilisation of these novel advancements (Al-Jabri and Sohail, 2012; Teo et al., 2015).

Trialability

According to Rogers (2020), trialability refers to the degree to which an innovation is amenable to experimentation before adoption. According to Marak et al. (2019), there is a general preference among firms and users to engage in a trial period for new technologies prior to making a definitive decision and allocating resources towards their implementation. The concept of trialability has the potential to facilitate a more comprehensive comprehension of novel technological advancements, encompassing their inherent capabilities, associated benefits, and potential challenges. According to Agarwal and Prasad (2018), Rogers (2020), and Al-Jabri and Sohail (2022), the use of said technology might make the firm's familiarity with it better.

Factors Militating Against Effective E-Invoicing System Implementation

Despite the numerous advantages offered by electronic invoicing, the rate of adoption has been characterised by a sluggish pace, primarily attributable to the various obstacles encountered by those who choose to adopt this technology. While larger corporations may encounter minimal challenges in the implementation of an electronic invoicing system, smaller businesses often encounter obstacles in adopting such a system due to the substantial investment and integration costs associated with it (Sandberg et al., 2019). Fairchild (2016) identified two primary obstacles impeding the adoption of e-invoicing: restricted capital allocation and insufficient internal sponsorship. Edelman and Sintonen (2016) elucidated a multitude of rationales pertaining to the lack of embracement of electronic invoicing within the small and medium-sized enterprise (SME) sector. The aforementioned rationales encompassed a dearth of demand within the surrounding milieu, a perception of uncertainty, and a limited degree of cognizance. The presence of buyer fragmentation may potentially contribute to the challenges encountered in the adoption of said technology. The challenges may also arise from the perspective of the service provider; for instance, the fragmentation of service providers can pose a substantial

obstacle to the successful implementation among the various partners within the supply chain (Ahmad, 2019).

The task of achieving a smooth and cohesive integration between the recently implemented electronic invoicing system and pre-existing enterprise resource planning (ERP) or financial systems presents a notable challenge. The integration process may be complicated due to challenges related to data compatibility, system customisation, and the requirement for APIs (application programming interfaces). As per the findings elucidated by Kimberly (2020), multinational corporations (MNCs) frequently engage in operations across various nations, necessitating their adherence to disparate invoicing standards, tax regulations, and languages. The task of reconciling these heterogeneous demands in order to establish a uniform electronic invoicing procedure presents a significant obstacle. It is imperative to ascertain that the electronic invoicing system adheres to the tax legislation, legal prerequisites, and reporting norms specific to each jurisdiction in which the multinational corporation conducts its operations. This undertaking can prove intricate and laborious (Kyove et al., 2021). The process of e-invoicing encompasses the transmission of confidential financial information, with a primary focus on safeguarding data security and privacy. This entails adhering to data protection regulations, notably the General Data Protection Regulation (GDPR), and addressing the substantial apprehensions surrounding cybersecurity threats and potential breaches (Basil et al., 2022). Hernandez-Ortega (2012) asserted that the ability and willingness of both suppliers and customers to implement compatible systems are essential for the successful adoption of e-invoicing. Consequently, the task of fostering and facilitating the transition to e-invoicing for external partners can prove to be a formidable undertaking.

The successful implementation of e-invoicing necessitates the alteration of processes and workflows within the organisational framework. Consequently, the potential resistance to change exhibited by employees who are habituated to conventional invoicing methods poses a significant obstacle that must be effectively managed through the deployment of change management strategies. Hence, it is imperative to provide comprehensive training to both employees and stakeholders in order to ensure proficient utilisation of the newly implemented electronic invoicing system, as emphasised in the Capstone Report of 2015. Koch (2019), Gamaralalage (2020), and Matthieu et al. (2022) have all discussed the difficulty of achieving widespread user adoption and proficiency, particularly in large and geographically dispersed organizations. While the implementation of e-invoicing holds the potential for long-term cost reductions, it is important to acknowledge that the initial costs associated with its adoption can be significant. Consequently, effectively managing the project to ensure adherence to budgetary constraints while simultaneously achieving the anticipated return on investment poses a formidable challenge. Multinational corporations (MNCs) frequently engage in collaborations with a heterogeneous array of suppliers, a portion of whom may possess limited resources or technological proficiencies that hinder their seamless adoption of electronic invoicing mechanisms. The management of diversity and the facilitation of inclusive participation by all suppliers in the e-invoicing process can pose considerable challenges.

According to a study by Huang (2020), the e-invoicing process is susceptible to technical difficulties like system outages, software bugs, and compatibility problems with other software or hardware. These challenges have the potential to disrupt the e-invoicing process and subsequently hinder overall operational efficiency. The challenge of seamlessly implementing the e-invoicing system across all geographical regions and business divisions of a multinational corporation (MNC) without encountering substantial complexities or delays is a formidable task, particularly for enterprises with an extensive global presence. The temporal aspect of integrating suppliers onto the e-invoicing platform can be characterised as a laborious

undertaking. The seamless facilitation of supplier transition and the effective resolution of any onboarding challenges are imperative for the successful execution of the implementation process.

The Prospect of E-Invoicing

E-invoicing, at its core, refers to the transformation of the invoicing procedure into a digital format, which involves the generation, transmission, receipt, and handling of invoices via electronic methods. Instead of relying on conventional paper-based invoicing methods, multinational corporations (MNCs) that adopt e-invoicing leverage technological advancements to enable smooth and automated invoicing workflows. The aforementioned workflows encompass the process of creating invoices in digital formats, transmitting them electronically to recipients, and integrating them with financial systems to facilitate efficient processing and payment (Matthieu et al., 2019). The appeal of electronic invoicing resides in its capacity to enhance multiple aspects of financial operations within multinational corporations (MNCs). One of the primary advantages is the potential for significant cost reduction by bypassing the inherent inefficiencies of manual, paper-based invoicing. E-invoicing has the ability to drastically reduce processing times, minimise human errors, and eliminate the expenses associated with physical mail and storage (Peng, Yixuan, 2023). Moreover, the implementation of e-invoicing serves to augment transparency in financial transactions, fortify adherence to tax regulations, and cultivate enhanced cooperation between multinational corporations (MNCs) and their respective business associates. According to Oliveira et al. (2014) and Wang et al. (2016), the implementation of e-invoicing holds the potential to optimise invoicing procedures, resulting in enhanced efficiency and reduced time consumption. The utilisation of this technology obviates the necessity for manual data input and the handling of paper-based documents, thereby enabling organisations to expedite and enhance the accuracy of their invoice processing procedures.

According to the findings of Di Vaio et al. (2017) and Bortenschlager and Schmiedinger (2019), the implementation of e-invoicing has been shown to yield cost-reduction benefits. By automating invoicing workflows, organisations can effectively mitigate operational expenses typically incurred through the use of paper, printing, postage, and manual processing. This phenomenon results in tangible reductions in expenses and enhanced fiscal outcomes. In accordance with the research conducted by Ahmad, A. (2024), and Pérez and López (2017), it has been determined that the implementation of e-invoicing has proven to be advantageous in expediting the approval and payment procedures. By electronically directing invoices to the relevant personnel for approval, the delays associated with physical routing or manual approvals are significantly reduced. Consequently, the acceleration of payment cycles contributes to enhanced management of cash flow and working capital. The utilisation of manual invoicing procedures is susceptible to the occurrence of errors, thereby resulting in potential delays in payment, disputes, and supplementary administrative expenditures.

E-invoicing systems frequently incorporate automated validation checks, thereby mitigating the likelihood of errors and discrepancies. Using a strong invoicing data verification system improves the accuracy of invoicing data, which lowers the chance of invoice disputes and the need for time- and resource-consuming reconciliation tasks that follow. This heightened level of accuracy engenders a climate of trust and transparency in the realm of financial transactions. The implementation of timely and precise invoicing and payment processing procedures serves to fortify and cultivate mutually beneficial relationships with both suppliers and customers. The implementation of this approach has the potential to yield favourable outcomes such as improved contractual conditions, reduced pricing, and enhanced interpersonal exchanges,

thereby alleviating the administrative complexities associated with the process of resolving conflicts (Yahiya, 2023). The adoption of e-invoicing is in congruence with sustainability endeavours as it effectively mitigates paper consumption, diminishes the carbon footprint attributed to the physical conveyance of paper invoices, and advocates for a more environmentally conscious modus operandi within business operations (Tung and Trimi, 2019).

According to the findings of Dias and Rodrigues (2018) and Baskerville & Hansen (2010), it has been demonstrated that e-invoicing systems possess the capability to provide instantaneous access to the current state of invoices and financial transactions. By enabling organizations to make well-informed decisions, this feature reduces the need for labor-intensive status inquiries and increases the effectiveness of reporting capabilities. Consequently, these advantages collectively foster the optimisation of administrative processes, resulting in a more streamlined operational framework. Numerous regions and nations have implemented e-invoicing regulations with the primary objective of fostering enhanced operational efficiency and heightened transparency. According to the research of Di Vaio et al. (2017) and Vishal and Gupta (2017), e-invoicing systems often have compliance features that help businesses follow the rules and avoid possible fines. Moreover, these platforms place significant emphasis on ensuring data security and confidentiality. Encryption and authentication mechanisms are implemented in order to safeguard sensitive financial data, thereby mitigating the potential for data breaches and the subsequent financial implications. Additionally, e-invoicing solutions possess the capability to expand alongside an organisation's growth and transaction volume without incurring proportionate increments in administrative expenses. The inherent scalability of the system guarantees the preservation of cost efficiencies in tandem with the expansion of the business. E-invoicing solutions frequently present predictable pricing frameworks, thereby facilitating the process of budgeting and forecasting for expenses associated with invoicing.

Conclusion

Based on the study, the researcher concluded that:

E-invoicing significantly streamlines the invoicing process by automating data entry, validation, and approval workflows; it reduces the likelihood of errors and accelerates the payment cycle. This streamlined process can lead to substantial cost savings in terms of time and resources.

E-invoicing eliminates the need for paper invoices, envelopes, and postage, resulting in direct cost reductions. Multinational corporations dealing with a high volume of invoices can realise substantial savings by reducing their paper-based processes.

Manual invoice processing involves labour-intensive tasks such as data entry, document handling, and reconciliation. E-invoicing systems can significantly lower these processing costs by automating these tasks, allowing staff to focus on more value-added activities.

Recommendation

Based on the study, the researcher wishes to recommend that:

1. Before implementing e-invoicing, conduct a thorough assessment of your existing invoicing processes. Identify pain points, bottlenecks, and areas where automation can bring the most significant cost savings.

2. Choose an e-invoicing solution that aligns with your organisation's needs and goals. Consider factors such as scalability, integration capabilities, compliance with local regulations, and the ability to handle your transaction volume.
3. Invest in training and change management programmes to ensure that your staff is comfortable with the new e-invoicing system. Resistance to change can hinder the realisation of cost-saving benefits.
4. Make use of the data generated by e-invoicing systems to gain insights into your spending patterns, supplier performance, and potential areas for cost reduction. Regularly analyse this data to inform your cost-saving strategies.

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ROLE OF FINANCIAL TECHNOLOGY PLATFORMS IN IMPROVING ACCESS TO FINANCE FOR SMEs IN NIGERIA

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ABSTRACT

Financial technology (FinTech) platforms have transformed access to financing for Nigerian SMEs, according to this study. SMEs are vital to the economy, yet many struggle to obtain conventional banking services. FinTech platforms have arisen as creative financing options to help SMEs, according to this report. The research examines how FinTech platforms streamline financial procedures, lower transaction costs, and provide SMEs with efficient and accessible finance. The study also examines how regulatory frameworks affect FinTech platform growth, sustainability, financial inclusion, and economic development. This research seeks to inform policymakers, financial institutions, and FinTech entrepreneurs on how to help Nigerian SMEs using technology. The study adds to the discussion on technology, finance, and economic growth in developing nations. Understanding how FinTech platforms improve SME financing access is essential for sustainable and inclusive economic development in Nigeria.

KEYWORDS: Role, Finance, Technology, Platforms, SMES and Nigeria

INTRODUCTION

The Nigerian economy relies on SMEs for employment, innovation, and development. SMEs boost entrepreneurship, lower unemployment, and diversify the economy. These enterprises have struggled to get financing, restricting their growth, investment, and competitiveness (Al-Haddad et al. 2019). Traditional funding channels, like banks and financial institutions, have struggled to help SMEs. SME owners with poor credit histories or inadequate collateral face hurdles due to strict collateral requirements, long approval procedures, and conservative risk assessment frameworks (Bani Ahmad et al., 2023). Thus, many SMEs have struggled to get funds to survive and develop. Recently, fintech platforms have offered a viable answer to Nigeria's SME finance deficit. Fintech has revolutionized the banking sector by using technology and innovation to provide financial services. Fintech platforms use data analytics, machine learning, and digital platforms to provide SMEs with alternative funding and expedite the loan process (Mohsin et al., 2023; Bani Atta & Marzuki, 2020).

SME-specific fintech platforms provide alternative loans, invoice financing, supply chain finance, and crowdfunding. These platforms use novel algorithms and data-driven creditworthiness assessments to make educated lending choices beyond standard risk assessment methodologies. Fintech platforms may finance SMEs that conventional lenders may not approve by using non-traditional data sources and real-time company performance analysis. SME use of fintech platforms may boost financial inclusion, entrepreneurship, and economic development. These platforms simplify financing access and reduce bureaucracy. Fintech platforms also provide digital tools, financial education, and advisory services to help SMEs improve financial management and make educated choices (Sharma et al., 2023; Al-Amarneh et al., 2023).

The Nigerian government and regulators acknowledge fintech platforms' revolutionary potential in boosting SME credit access. Regulatory sandboxes, digital payment infrastructure, and fintech startup-traditional financial institution cooperation have been promoted to enable fintech innovation. These projects promote fintech options for SME funding. Fintech platforms might assist Nigerian SMEs, but there are dangers and limitations. Regulatory regimes must balance innovation, consumer protection, and financial stability. Fintech platforms must solve cybersecurity and data privacy issues to preserve confidence. For SMEs to effectively benefit from fintech solutions, digital literacy and awareness must be promoted (Almahadin et al., 2023; Bani Atta et al., 2023).

Nigerian SMEs have struggled to get capital, hampering their development, innovation, and economic impact (Lerong 2018). Traditional finance channels, with strict collateral requirements and long approval procedures, frequently fail SMEs, especially those with poor credit or inadequate collateral. Recently, fintech platforms have emerged as a viable solution to Nigeria's SME finance deficit. Fintech platforms use technology, data analytics, and digital platforms to provide SMEs with alternative finance and expedite loans. These platforms can boost financial inclusion, access to financing, and SME success in a digital economy.

Fintech platforms and their advantages may be unfamiliar to many Nigerian SMEs. The lack of awareness about these platforms and their funding possibilities might prevent SMEs from using them. SMEs may struggle to build financial platform trust. Fintech platforms are young and have little track record, which may make SMEs wary of using them for their financial requirements. SMEs in Nigeria, especially traditional ones, may confront digital literacy and technology challenges. SMEs may struggle to use fintech platforms due to a lack of technology, expertise, and infrastructure (Mustafa et al., 2023; Lerong, 2018). The regulatory environment for fintech platforms in Nigeria may be changing and not entirely matching their specific qualities.

Regulatory limitations, ambiguities, or delays in implementing supporting policies and procedures may hinder SMEs' fintech adoption. Fintech platforms may worry SMEs about financial data security and privacy. SMEs may see cybersecurity and data breaches as hurdles to utilizing these platforms (Al-Gasaymeh et al. 2023). Understanding and tackling these problems is essential to achieving fintech platforms' promise to boost SMEs' access to credit in Nigeria. Thus, this study examines how fintech platforms might help Nigerian SMEs access capital and improve financial inclusion, boosting SME development.

Impact of SMEs in the Nigerian Economy

Over 90% of Nigeria's fully functioning firms are small and medium-sized, employing 60% of the workforce and producing over half of GDP. This suggests that these institutions need serious consideration and help to overcome the barriers that are preventing them from

contributing to the national economy in many areas. These foundations give nearly to a billion Nigerian dinars in reserves and money for 134 000 projects. These projects have produced 80,000 permanent employment. Since the end of the century (CDPR 2011), Nigeria's financial revolution and market expansion have begun. This methodology achieved its main goals by establishing an organized commerce agreement with the European Association in 1997 and expanding to the World Exchange Organization in April 2000 to improve Nigerians' standard of living through goal-oriented monetary growth at 6.7% annually and providing more job opportunities. In 1959, the Agricultural Credit Corporation began granting advances to farmers to support SMEs in Nigeria to increase competition in the Nigerian market, reduce costs, and allow it to improve its products in neighboring countries at prices Nigerians can afford. Industrial Improvement Bank was founded in 1965 to service this area (JSF 2018).

Nigeria started its empowerment of SMEs in the mid-1970s with the Five-Year Economic Development Plan (1976–1980), which fostered social and financial advancement and small businesses that produced alternatives to imported commodities. In 1984, the Nigeria Loan Guarantee Corporation was founded with 10 million dinars (Al-Monitor 2015). The Union of Charities was founded in 1986 to promote labor-intensive and agro-ventures. The government introduced a social security program in 1998 to reduce poverty and unemployment. Financial stability was the goal of a 1989 financial progress program. This initiative has financial and social components to help Nigerian small business owners.

However, the Africa upheavals, global financial crisis, and global financial congestion have hurt the Nigerian economy and raised calls for a fair playing field in business and equitable access to social and economic possibilities. Nigeria's unemployment rate has risen owing to its inability to hire more than 60,000 teenagers annually. Unemployment was highest among young men and women at 22.8% and 22.3% (JSF 2018). Additionally, geographical differences provide new complications. Private part-time employment is limited in rural governorates, where industry depends on public sector jobs and the common administration. Meanwhile, corporate issues and a lack of assistance impede the private sector. Job creation and financial security are Nigeria's main concerns. By increasing finance, intensity, and smart, privately driven growth, these aims may be achieved (JSF 2018). Smaller firms in Nigeria develop faster and generate more jobs, but they confront several hurdles. Financial incapacity is sometimes a need. Nigeria has very minimal budgetary intermediation compared to other emerging nations. More people have access to finances. In contrast to other middle-income countries, the budgetary system's controlling accounts component is overworked and restricted in budgetary intermediation. Small enterprises often ask friends and family for help. Abu Jaber Chuma-Makandwire (2004) examined the significance of small and medium-sized enterprises in reducing poverty and promoting social and economic development in 2014. Building successful industrial firms will boost economic development by creating employment for the local populace. Job availability will raise disposable income, which will enhance demand for goods and services and lead to the purchase of in-demand things. Makatiani (2006) states that small and medium-sized firms drive economic growth and employment creation. Small and medium enterprises need skilled management to develop globally. An entrepreneurial firm's achievements will show how to reduce poverty and enhance lives in developing countries. If they cannot develop swiftly and compete globally, SMEs will not contribute to the global economy. Small and Medium Enterprises (SME) need managers who can compete globally and expand them.

Schollhammer and Kuriloff (1979) argued that Small and Medium Enterprises lack the management skills needed for stability, even if many individuals may be entrepreneurs. Every business's success depends on its management team's inventiveness and talents. Despite the

fact that small and medium-sized firms employ many people in developing countries, (Liedholm, 2002 and Marei et al. 2022) argued they should be held accountable. Small and medium-sized enterprises have been criticized for their poor performance due to low production input, sluggish development, and inability to adapt to stronger industries.

Components of Fintech

The term "fintech," which stands for "financial technology," describes the creative application of technology in the financial industry to enhance financial services, procedures, and goods. It includes many different components from several fields, including information technology (IT). Here are a few crucial components of fintech:

- **Mobile Banking:** By enabling users to access financial services through mobile applications, fintech has transformed traditional banking. Users of mobile banking may simply check account balances, transfer money, pay bills, and do other financial tasks from their cellphones.
- **Payment Systems:** Fintech has introduced numerous digital payment systems that provide alternatives to traditional cash-based transactions. Examples include mobile wallets (e.g., Apple Pay, Google Pay), peer-to-peer payment apps (e.g., Venmo, PayPal), and digital currencies (e.g., Bitcoin, Ethereum).
- **Blockchain Technology:** Blockchain is a distributed ledger technology that enables secure and transparent transactions. It has gained significant attention in fintech for applications like cryptocurrencies, smart contracts, and decentralized finance (DeFi) platforms. Blockchain enhances security, reduces transaction costs, and increases efficiency.
- **Artificial Intelligence (AI):** AI plays a crucial role in fintech, powering various applications such as chatbots, fraud detection systems, and credit scoring algorithms. AI algorithms can analyze vast amounts of financial data to provide personalized recommendations, automate customer service, and detect fraudulent activities.
- **Data Analytics:** Fintech relies heavily on data analytics to extract insights from large datasets. By leveraging techniques like machine learning and predictive analytics, financial institutions can make data-driven decisions, assess risk, improve customer experience, and develop personalized financial products.
- **RegTech:** Regulatory technology, or RegTech, refers to the use of technology to facilitate compliance with regulatory requirements in the financial industry. RegTech solutions automate processes such as Know Your Customer (KYC) verification, anti-money laundering (AML) checks, and regulatory reporting, reducing costs and enhancing efficiency.

These elements collectively drive the transformation and disruption in the financial industry, offering new opportunities for customers, businesses, and the overall economy.

Fintech Innovation and the Rise of Fintech Platforms

Fintech is growing as clients handle their money digitally (Khalatur et al., 2022). Modern technology, or fintech, improves financial processes. Automating and streamlining these procedures improves productivity and quality and reduces human contact. Fintech aids company growth. Fintech payment is used for electronic financial transactions across channels and items. Fintech advances payments by integrating technology into credit and debit cards, improving mobile and internet banking, introducing new ATM capabilities, and allowing users to build digital wallets. The COVID-19 pandemic also enhanced Fintech payment technology

adoption (Alchuban et al., 2022; Pallathadka & Pallathadka, 2022). Digital finance is heavily influenced by fintech businesses. The banking industry leads technological innovation. Digital finance delivers affordable, practical, and secure financial services to individuals. The advances in digital banking have enabled digital finance to improve user services. The current economic system has evolved due to digitization and technology. Fintech businesses are combining bank functions to provide new financial services and solutions for customers. If successful, this will revolutionize the financial services sector (Goel et al., 2022; Kumari & Devi, 2022). The UAE fintech industry is young yet growing. UAE is the hub for Middle Eastern and North African financial startups. Strong fintech ecosystems assist economic diversification. Several worldwide fintech investment funds have emerged throughout time. Since late 2017, six Bahraini and UAE funds have focused on joint ventures or direct investments in startups. About \$1.5 billion was raised by these funds. Many fintech funds have recently begun to focus on regional prospects that are emerging (Al Suwaidi et al., 2022). With over 1.3 billion people, India is a growing fintech market. The world's largest bankless population makes India an interesting financial technology market. Fintech might upend financial markets. Fintech has grown rapidly in India during the last five years and is expected to grow further (Sharma et al., 2022). Fintech enterprises in Thailand have a better chance of growing when they partner with related and unconnected companies. Going it alone limits startups from improving risk and return. Fintech startups and customers benefit from government and public agency assistance. Centralization of connected organizations may affect fintech enterprises' prospects and challenges. National financial and technical policies that support FinTech enterprises and user trust must be considered (Kijkasiwat, 2021). Fintech has revolutionary possibilities for China's banking industry and others. Several cryptocurrencies have been created worldwide to speed up payments and financial inclusion. The People's Bank of China (PBOC) believes introducing a central bank digital currency (CBDC) will strengthen its international position and help reshape the global economy (Allen et al., 2022).

The Role of Fintech Platforms in SMEs Financing in Nigeria

- Money was limited during the financial crisis, making financing impossible for many enterprises. Fintech detected market discrepancies and produced a new financing and crediting method (Golubi'c 2019). Fintech also provided innovative finance alternatives, easing the global credit constraint. Klein et al. (2020) say human capital and fintech strategic absorption may boost investment and venture quality. Many finance channels employ non-traditional funding sources, according to Leong and Sung (2018). Globally, crowdfunding and peer-to-peer lending are the most successful fintech financing methods. Startups build online platforms for financing services.
- **Crowdfunding:** Ibrahim (2018) says a group makes choices to generate money for commercial endeavors utilizing internet platforms. In a crowd test, a commercial crowdfunding concept, entrepreneurs pitch their concepts to largely investors. Crowdfunding helps small business entrepreneurs without bank loans generate money, minimizing banking hassles and enabling them to start their own firm. Regulation is needed to help enterprises join the crowdfunding sector and improve economic development due to the large number of players (Abdullah and Oseni 2017; Lee and Kim 2015). Before writing a crowdfunding regulation to improve opportunities and reduce risks, the government must assess public trust and credibility (Ibrahim 2018; Wonglimpiyarat 2017a). Costa-Climent and Martnez-Climent (2018) identified P2P lending and equity crowdfunding as promising financial trends. Comparable scholarly publications produced between 2014 and 2020 include Abdullah and Oseni (2017) and Venturelli et al. (2000). The sorts of participants and services crowdfunding platforms

provide major stakeholders determine their growth. Rossi and Vismara (2018) suggested that investment-based crowdfunding platforms provide post-campaign services to improve demand-side participation and campaign frequency. Venturelli et al. (2020) have observed that investors' and entrepreneurs' racial and gender similarities affect investment amounts.

- **Peer-to-Peer (P2P) Lending P2P:** (Peer-to-Peer) Adriana and Dhewantoa (2018) define lending as on-line matching of lenders and borrowers. P2P financing lowers transaction costs by using cutting-edge communication technology, allowing numerous investors to participate (Rosavina et al. 2019). Loan default rates vary on borrower characteristics and loan terms and conditions, making P2P lending risky (Funke et al. 2019). Therefore, regulations are needed to balance risks and rewards. As mobile phone use grows, P2P lending is growing rapidly due to its impact on business development (Stern et al. 2017). This platform's investors face high risks but high rewards that boost portfolio efficiency (Marot et al. 2017). P2P lending platforms reach more people and access unbanked regions than banks, which affects their performance (Funke et al. 2019). Due to the COVID-19 pandemic, new market ideas have emerged, including P2P lending platforms for rural borrowers who would otherwise have minimal access to finance (Najaf et al., 2022). The world's most practical banking and finance alternative is fintech P2P lending.
- **Personal finance and wealth management:** Fintech has also transformed the way individuals manage their finances and invest their money. Personal finance apps provide consumers with tools to budget, save, and invest their money, whereas platforms for wealth management employ AI and algorithms to offer services like portfolio management and investment advice.
- **Insurtech:** This category of fintech includes digital insurance services that use technology to enhance the customer experience and improve the efficiency of the insurance industry. Insurtech companies offer products such as usage-based insurance, digital claims processing, and insurance comparison platforms.

Factors Influencing SMEs' Adoption of Fintech Platforms in Nigeria

Several factors influence the adoption of fintech platforms by small and medium-sized enterprises (SMEs). Understanding these factors can help shed light on why some SMEs embrace fintech solutions more readily than others.

- **Awareness and Knowledge:** SME awareness and expertise of fintech platforms are important to uptake. SMEs may be less inclined to utilize fintech platforms if they are ignorant of their advantages and features. Informing, educating, and raising awareness may assist SMEs embrace fintech solutions (Olaniyi 2023).
- **Perceived Benefits:** Fintech platforms' advantages are considered by SMEs before using them. These advantages include greater financing access, operational efficiency, cost reductions, financial management, customer experience, and competitiveness. If they observe a good effect on their firm and demonstrable benefits over conventional techniques, SMEs are more inclined to utilize fintech systems (Elgoghel 2023).
- **Cost and Affordability:** SMEs must evaluate financial platform adoption and implementation costs. Fintech solutions may save SME money over time, but the initial investment, continuing fees, and interoperability with current systems may influence

their choice. SMEs choose fintech providers with flexible pricing and affordable solutions (Najib 2021).

- **Trust and Security:** SMEs exploring fintech adoption must consider trust and security. SMEs require financial, transaction, and customer data security. Fintech platforms with strong security, data protection compliance, and trustworthiness are more likely to win SMEs' trust and acceptance (Singh et al 2021).
- **Technological Infrastructure and Readiness:** Fintech adoption by SMEs depends on their technology infrastructure and willingness to accept new technologies. SMEs without modern technology may struggle to integrate and use financial solutions. Internet connection, device compatibility, and staff digital competence might affect adoption (Nugraha 2022).

Conclusion

In conclusion, fintech platforms can improve SMEs' access to financing in Nigeria. These platforms may help SMEs get capital for development and expansion by using technology, innovation, and alternative lending methods.

Fintech systems simplify lending, automate credit evaluations, and speed loan approvals for SMEs. Alternative credit scoring models using non-traditional data sources analyze SMEs' creditworthiness more thoroughly, improving their funding prospects. Peer-to-peer lending systems link SMEs with lenders or investors, boosting finance options (Steyn & Leonard 2012). Digital payment solutions from financial platforms enable cashless transactions and help SMEs reach more customers.

SMEs may better manage cash flow gaps using supply chain finance. Fintech platforms' financial education and consulting services increase SMEs' financial literacy and management, making them more lender-friendly. SME funding may benefit from regulatory and conventional banking institution collaboration. Fintech platforms and regulators may create supporting rules, frameworks, and initiatives to promote responsible lending and safeguard SMEs by working together.

Using technology and data, fintech platforms provide new financial services to Nigerian SMEs. These platforms may boost economic growth, entrepreneurship, and the SME sector. Collaboration and innovation are essential for SMEs in Nigeria to expand sustainably and inclusively as the fintech ecosystem evolves.

Recommendations

Nigerian SMEs may benefit from fintech platforms' improved funding availability. Here are some ways fintech platforms might help SMEs get financing:

Nigerian SMEs get digital loan options from fintech platforms. Technology allows these platforms to simplify lending, automate credit evaluations, and speed loan approvals. This helps SMEs get cash faster and meet their urgent finance requirements.

Traditional credit scoring methodologies may not fully assess SMEs' creditworthiness owing to inadequate financial history or collateral. Fintech platforms may create new credit scoring models using transactional data, social media activity, and digital footprints. SMEs' creditworthiness may be better assessed, improving their funding prospects.

Fintech platforms may link SMEs with individual lenders or investors for peer-to-peer financing. Disintermediation allows SMEs to borrow from more lenders and lowers their dependence on conventional financial institutions. Peer-to-peer lending platforms may help SMEs get loans transparently and efficiently.

Nigerian SMEs may get financial education and guidance from fintech platforms. These platforms may increase SMEs' financial literacy and management by offering educational materials, tools, and individualized coaching. This helps SMEs make educated choices and impress lenders.

Regulators and policymakers may work with fintech platforms to enable SME finance. Collaboration may create legislation, guidelines, and programs that promote innovation, safeguard SMEs, and promote responsible financing. Together, fintech platforms and authorities can help Nigerian SMEs develop and survive.

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MACHINE LEARNING APPROACHES FOR FAULT DETECTION AND DIAGNOSIS IN POWER SYSTEMS

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ABSTRACT

Power systems' dependability and effectiveness are crucial for an uninterrupted and safe supply of energy. Conventional techniques for power system problem diagnosis and detection often depend on expert knowledge and rule-based systems, which may not be sufficient to handle complex and dynamic circumstances. The use of machine learning (ML) techniques to improve problem identification and diagnosis in power systems is examined in this research. The article analyses numerous ML approaches, including supervised learning, unsupervised learning, and ensemble methods, applied to distinct datasets from power systems. These databases include data from sensors positioned strategically across the electrical grid, including voltage levels, current readings, and frequency fluctuations. A potential approach to improving the dependability and efficiency of vital infrastructure is the use of machine learning in power systems for issue identification and diagnosis. As the sector develops, it will be more important to take into account issues of interpretability, explainability, and ethical implications to guarantee the appropriate use of these technologies in the field of power system operations and maintenance.

KEYWORDS: Machine Learning, Approaches, Fault Detection, Diagnosis, and Power Systems

Introduction

In the world of modern power systems, ensuring the reliable and efficient operation of electrical networks is paramount. As the demand for electricity continues to rise and the complexity of power systems increases, the need for advanced fault detection and diagnosis mechanisms becomes imperative. This paper explores the intersection of power systems, fault detection and diagnosis, and the transformative role played by machine learning (ML) techniques in enhancing the robustness and reliability of power infrastructure.

In the web of modern civilization, power systems serve as the lifeline, ensuring a seamless flow of electricity to meet the ever-growing demands of industries, households, and critical infrastructures. According to Kundur (2019), power systems encompass an extensive network of generators, transformers, transmission lines, and distribution systems that work cohesively to deliver reliable electricity. The efficiency and reliability of power systems are paramount for sustaining economic activities and maintaining the quality of life. A comprehensive

understanding of the various components within power systems is fundamental to addressing the challenges and complexities inherent in their operation (Glover & Sarma, 2020). Key elements include generators that convert mechanical energy to electrical energy, transformers facilitating voltage transformation, transmission lines for efficient power transfer, and distribution systems ensuring electricity reaches end-users (Wood & Wollenberg, 2016). These components collectively form a dynamic and interdependent network, susceptible to faults that can disrupt the continuous and stable supply of electricity.

The uninterrupted functioning of power systems is of paramount importance for the vitality of society. Faults within the power grid, such as short circuits, equipment failures, and transmission line faults, can lead to disruptions, causing economic losses, and compromising the stability and reliability of the entire network (Haque & Islam, 2018). Rapid and accurate fault detection and diagnosis are crucial to minimize downtime, prevent cascading failures, and maintain the resilience of power systems. As noted by Tleis in 2016 that faults not only pose operational challenges but also have far-reaching implications on the safety of equipment, personnel, and the environment. Understanding the root causes of faults and swiftly identifying their presence is essential for timely intervention and effective maintenance, ensuring the longevity and efficiency of power system components. Moreover, fault information serves as an important input for decision-making processes, allowing operators to implement appropriate corrective measures promptly (Liu et al., 2019). According to Gao et al. (2021), there are three primary processes in the intelligent fault diagnostic process: (1) employing field sensors to acquire data; (2) preprocessing signals to extract features; and (3) applying machine-learning algorithms to categorise defects. This procedure is often known as a pattern recognition issue. Several signals, including vibration, sound emission, current, and infrared heat from the field, may be measured as part of the signal collection approach (Márquez et al., 2012). In particular, condition monitoring and diagnosis by vibration signal analysis has been deemed beneficial for rotating machinery since vibration signals include the most inherent properties associated with health issues (Zarei et al., 2014). During the feature extraction process, it is necessary to comprehend the properties of signals received from different field sensors and develop the appropriate sensitive features to solve particular diagnostic difficulties (Gao et al., 2021).

However, the introduction of machine learning (ML) has transformed problem identification and diagnosis in power systems, providing new analytical tools for processing massive volumes of data created by linked components. ML algorithms may reveal complicated patterns, identify abnormalities, and anticipate probable errors with more accuracy than conventional approaches (Chowdhury & Rahman, 2018). This revolutionary capacity places machine learning (ML) as a critical tool for improving power system reliability and resilience. Kim and Lee (2020) emphasised that the use of machine learning in power systems is multidimensional, including predictive maintenance, real-time monitoring, and decision support systems. ML models may train and adapt to the dynamic behaviour of power systems using historical data and real-time observations, allowing for the early detection of defects and probable breakdowns. This proactive strategy not only reduces downtime but also optimises maintenance schedules, lowering operating costs while improving overall system performance.

There have been numerous studies looking into the potential of ML techniques in fault detection and diagnosis in power systems, such as Vaish et al. (2021), who found that adaptive and intelligent protection methodology, based on advanced measurement techniques and intelligent fault diagnosis such as machine learning (ML), is useful in meeting the challenges of newer generation sources and loads on traditional power system protection schemes. ML-based power system problem diagnosis has been the subject of several research studies. However, ML approaches are rapidly changing, necessitating a comprehensive and up-to-date

evaluation of ML-based power system failure diagnostics. Additionally, Peykarporsan et al.'s (2023) investigation into the machine learning technique for four-legged inverter fault identification and diagnosis shown that, in the absence of transformers, four-legged inverters are a good option for imbalanced loads. Inverters with open and short circuit switches are susceptible to malfunctions. Therefore, in order to guarantee the system's prompt restoration in the event of a malfunction, machine learning-based fault detection and diagnostic techniques are crucial. However, for a system to operate safely and dependably, precise and effective problem detection and diagnostics are essential. Deep learning-based methods have advanced quickly in recent years, enabling the automated and effective learning of high-level feature representations from the raw input data (LeCun et al., 2015). A variety of deep learning techniques have also demonstrated exceptional feature learning capacity and noteworthy diagnosis outcomes in mechanical fault diagnosis. These techniques include deep belief networks (DBN), sparse autoencoders (SAE) (Sun et al., 2016), denoising autoencoders (DAE), sparse filtering, convolutional neural networks (CNN), and recurrent neural networks (RNN) (de Bruin et al., 2017).

Overview of ML

A subset of artificial intelligence (AI), machine learning (ML) focuses on creating models and algorithms that let computers learn from data and provide precise judgements or predictions. Machine learning's main objective is to free computers from the need for explicit programming for each job by allowing them to learn from experience and become more intelligent machines. Without explicit programming, computers can function autonomously thanks to machine learning methods. Machine learning systems has the ability to learn on their own, advance, improve, and adjust to new data. Massive datasets are used in machine learning, an algorithmic technique, to find patterns and gain insightful knowledge. Machine learning methods do not depend on a predetermined equation or existing model; instead, they employ computer techniques to extract knowledge directly from data. Throughout the learning process, machine learning algorithms get more and more adaptable as the number of samples provided increases. A subset of machine learning called deep learning enables computers to simulate real-world human behaviours like learning from examples. Performance-wise, it outperforms traditional machine learning techniques.

Key Concepts of Machine Learning in Detection Diagnoses

Features and Labels: In supervised learning, the input variables are referred to as features, and the output variable to be predicted is called the label. The goal is to learn the mapping from features to labels.

Training and Testing Data: A typical machine learning workflow involves splitting the dataset into training and testing sets. The model is trained on the training set and evaluated on the testing set to assess its generalization performance.

Model Evaluation: Various metrics, such as accuracy, precision, recall, and F1 score, are used to evaluate the performance of machine learning models. The choice of evaluation metric depends on the specific task and goals.

Overfitting and Underfitting: When a model learns the training set too well, it overfits and starts to identify noise and unimportant patterns. Conversely, underfitting occurs when the model is too simplistic to identify the underlying patterns in the data.

Hyperparameters and Model Tuning: Machine learning models often have hyperparameters that need to be set before training. Model tuning involves finding the optimal values for these hyperparameters to improve performance.

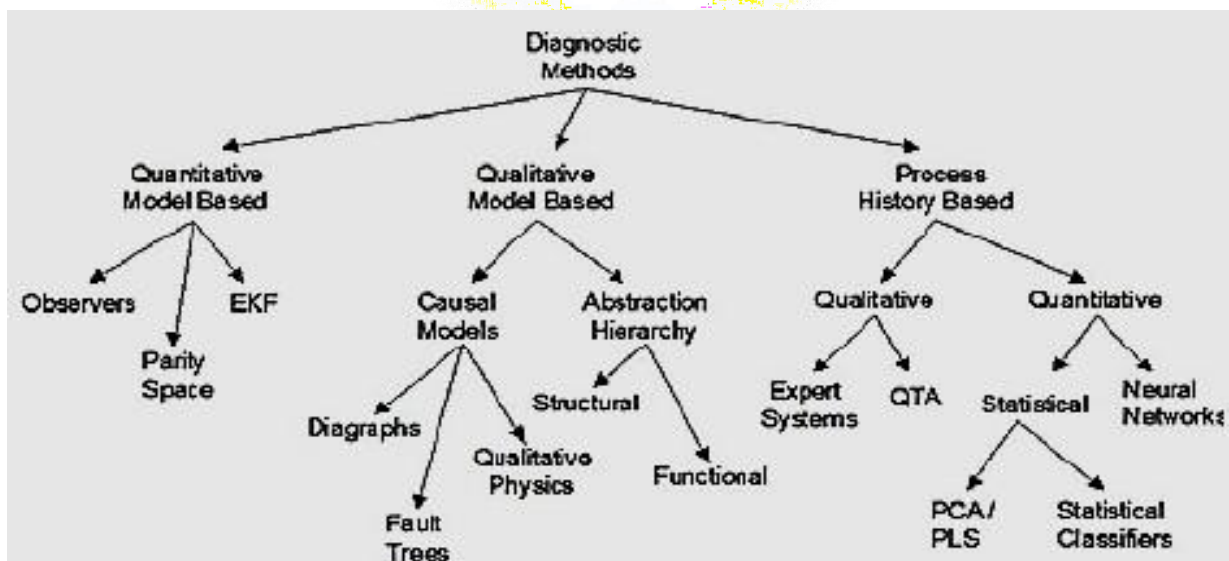
Machine Learning Algorithms

- **Linear Regression:** Employed to forecast a continuous output by leveraging linear associations among input characteristics.
- **Decision Trees:** Hierarchical structures that create choices by evaluating input attributes, often used for tasks involving classification and regression.
- **Support Vector Machines (SVM):** SVM are a powerful tool for both classification and regression tasks. The main objective of SVM is to identify a hyperplane that optimally divides various classes.
- **Neural Networks:** Modelled after the human brain, neural networks are composed of linked nodes arranged in layers. Deep learning is a specific branch of machine learning that emphasises the use of deep neural networks, which consist of numerous layers.
- **K-Nearest Neighbors (KNN):** The KNN technique is a straightforward method that assigns a data point to a class based on the majority class of its k-nearest neighbours.
- **K-Means Clustering:** An unsupervised learning approach used to divide data into separate groups.

Fault Detection and Diagnosis in Power System

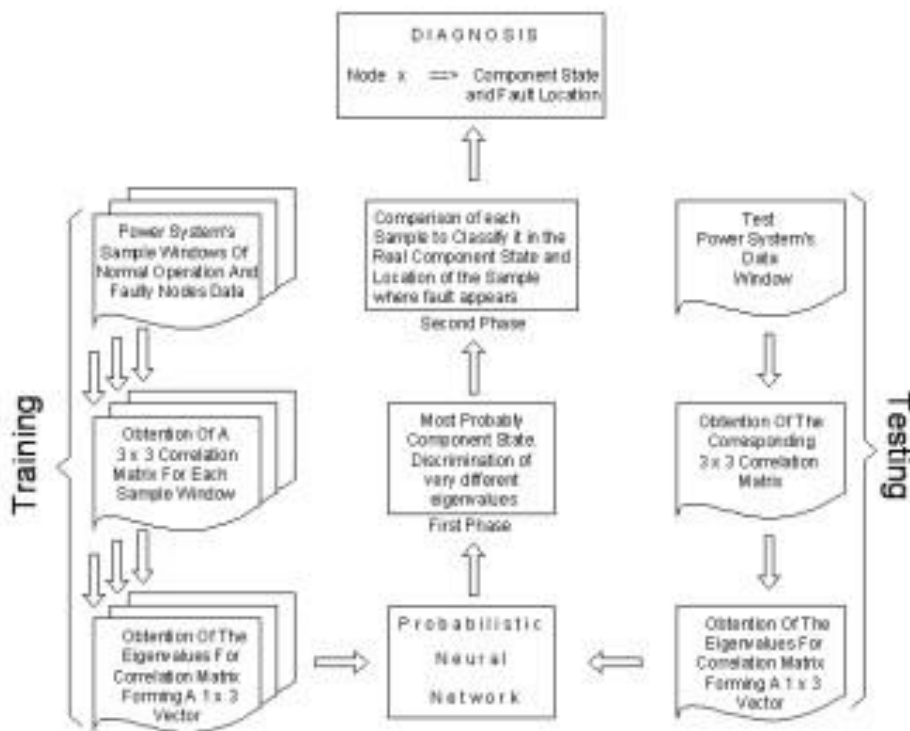
Power systems are critical infrastructures that play a pivotal role in the modern world, providing the necessary energy for various applications ranging from residential use to industrial operations. Ensuring the reliability and stability of power systems is paramount for the seamless functioning of societies and economies. However, power systems are susceptible to faults and disturbances that can lead to disruptions, outages, and even catastrophic failures.

Classification of Diagnostics Method



Power system fault detection and diagnosis (FDD) is an essential element of real-time monitoring and preventative maintenance programmes. Conventional methods rely on rule-based systems and expert knowledge, whereas contemporary power systems are complex and always changing, necessitating more sophisticated and flexible approaches. Machine learning (ML) methods have become effective instruments for identifying and diagnosing issues, enhancing the precision and effectiveness of operations.

The effectiveness of modern societies and economies depends on the essential nature of dependable and consistent power networks. Power systems, being the fundamental infrastructure for delivering energy, are intricate networks that are susceptible to many faults and interruptions. Early and accurate detection and diagnosis of issues in power systems are essential to avoid disruptions, save downtime, and provide a consistent and reliable energy supply. Conventional methods for identifying and analysing issues often prove inadequate in efficiently handling the increasing intricacy and ever-changing characteristics of modern power systems. As a result of these issues, there is a growing inclination to use machine learning (ML) methods in order to enhance the precision and effectiveness of diagnostic and fault detection systems.



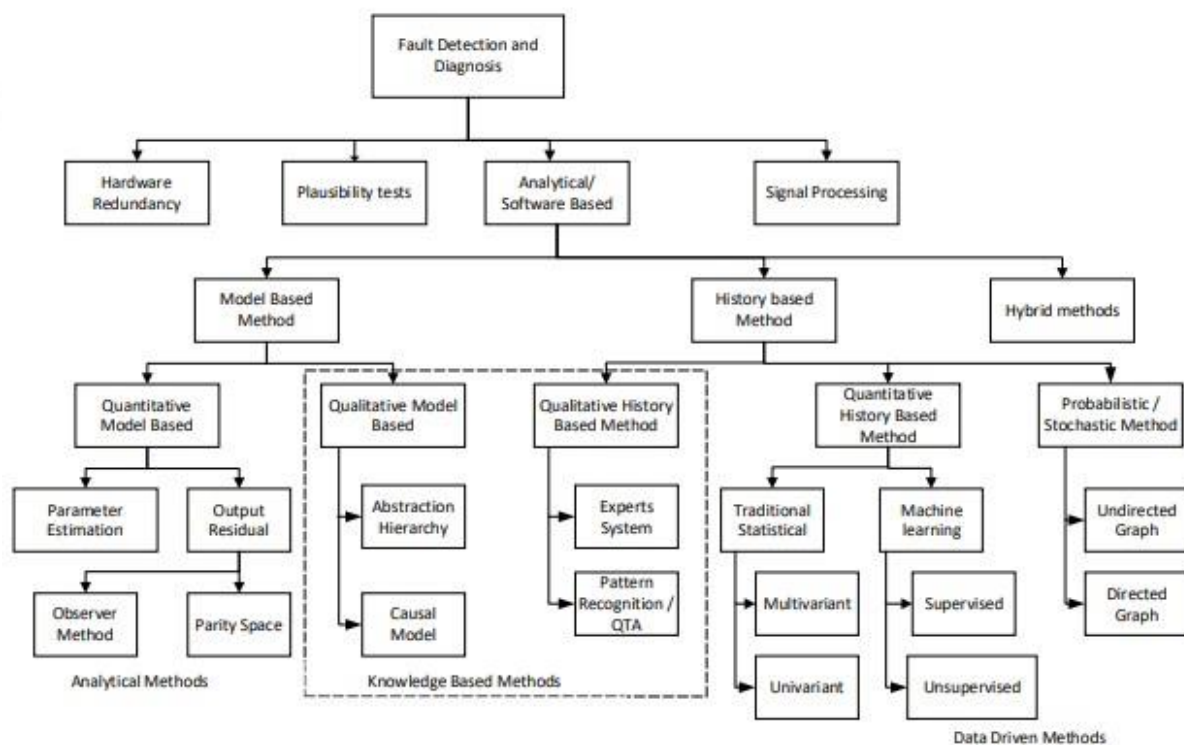
General fault detection framework

A power system has several components such as generators, transformers, transmission lines, and distribution networks. The interplay of these components creates a dynamic and intricate environment, which may lead to mistakes caused by equipment breakdowns, environmental circumstances, or unforeseen occurrences, among other potential factors. Conventional approaches to identifying defects often depend on rule-based systems and expert judgement, which may be insufficient in reflecting the complexities and unpredictability inherent in interconnected, extensive power networks.

Traditional Fault Detection and Diagnosis Methods

Traditional fault detection and diagnosis methods play a pivotal role in ensuring the reliability and performance of complex systems across various industries. These approaches, rooted in classical engineering principles, leverage signal processing, statistical analysis, and expert knowledge to identify abnormal conditions and diagnose faults. Techniques such as model-based methods, rule-based systems, and statistical process control have been extensively applied in diverse domains, including manufacturing, energy, and transportation. Model-based methods employ mathematical models to characterize system behavior and detect deviations from expected performance. Rule-based systems rely on predefined rules and expert knowledge to identify abnormal patterns in data. Statistical process control techniques monitor process variables to detect deviations indicative of faults. Researchers have extensively explored these methods, and their applications have been documented in seminal works by authors like R. Isermann, P. Frank, and others. While newer technologies are emerging, understanding the foundations of traditional fault detection and diagnosis remains crucial for addressing challenges in system reliability and maintaining operational excellence.

The advancement of many methodologies, such as mathematical, analytical, data-driven, statistical, computational, and hybrid methods, has greatly aided in the identification and diagnosis of fault situations in recent years. The following enhanced classification of contemporary Fault Detection and Diagnosis (FDD) procedures is derived from the categorization of FDD methodologies presented in the studies conducted by Chiang et al. (2001), Venkatasubramanian (2003), Zhang and Jiang (2008), Mouzakis (2013), and Alzghoul et al. (2014).



Methodological classification of fault detection and diagnosis (Adapted from Alzghoul et al., 2014)

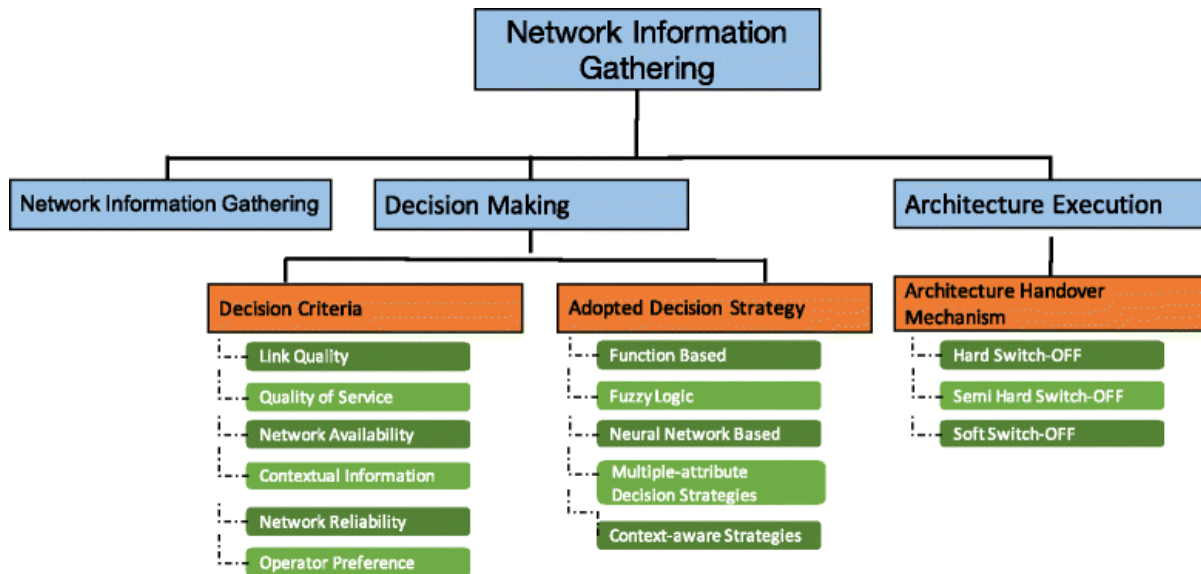
The categorization of fault detection and diagnosis in the process sector has been divided into four separate areas since the early 1970s: signal processing techniques, hardware redundancy, plausibility tests, and analytical models (Chiang et al., 2001). The FDD method was first devised utilising the hardware redundancy concept, obviating the need for identical hardware components in the operating system. An inherent limitation of this technique is its potential inability to precisely detect a malfunction scenario when a similar component system fails to provide the anticipated result. The plausibility test in the system process component relies heavily on the examination of physical laws. As process systems increase in complexity, plausibility tests become insufficient in identifying failure situations owing to the assumptions made by physics laws and the need for real-time system accuracy. Following the deployment of Industry 3.0, computer-based analytical or data-driven models replaced hardware redundancy and plausibility tests in response to the cited problems. Furthermore, signal processing approaches include the assessment of steady-state conditions in process signals to determine fault situations. However, this strategy is inadequate for complex process systems that include a large number of process parameters (Arunthavanathan, 2022).

Rule-Based Systems: Rule-based systems have been widely used for fault detection and diagnosis. These systems rely on predefined rules that capture the knowledge and expertise of domain experts. When certain conditions are met, these rules trigger an alarm or suggest a diagnosis. Early fault detection systems often employed simple if-then rules to identify deviations from normal operating conditions.

Signal Processing Techniques: Signal processing methods, such as Fourier analysis, wavelet analysis, and time-domain analysis, have been applied for fault detection. These techniques focus on analyzing signals from sensors to identify patterns indicative of faults. Frequency analysis, for instance, can be used to identify abnormal vibrations or oscillations in a mechanical system.

Statistical Methods: Statistical methods play a crucial role in fault detection and diagnosis. Techniques like statistical process control (SPC), principal component analysis (PCA), and multivariate statistical analysis have been applied to detect anomalies and deviations from normal behavior. Anomalies in sensor readings or process parameters are identified by comparing them to statistical models of normal behavior.

Fuzzy Logic Systems: Fuzzy logic has been used to model uncertainty and imprecision in fault detection and diagnosis. Fuzzy logic systems can handle vague and ambiguous information, making them suitable for complex systems where precise modeling is challenging. Fuzzy expert systems have been employed to represent the expertise of human operators in diagnosing faults.



Dynamic Network Management Concept

Neural Networks: Artificial neural networks, including feed forward and recurrent architectures, have been applied to fault detection and diagnosis. These systems learn from historical data and can adapt to changing conditions. Backpropagation algorithms and self-organizing maps are examples of neural network approaches used for fault diagnosis.

Model-Based Approaches: Model-based methods involve creating mathematical models of the system and comparing actual behavior with the expected behavior predicted by the model. Discrepancies indicate the presence of faults. Bond graph modeling, state-space modeling, and system identification are examples of model-based approaches.

Expert Systems: Expert systems integrate domain knowledge into a knowledge base and use an inference engine to reason about the system's state. These systems emulate human expertise in fault diagnosis. MYCIN and Dendral are early examples of expert systems applied to medical diagnosis and chemical analysis, respectively.

Hybrid Approaches: Hybrid approaches combine multiple techniques to enhance the accuracy and reliability of fault detection and diagnosis. For example, combining neural networks with rule-based systems or integrating statistical methods with model-based approaches.

System Failure, Risk Assessment, and Risk Mitigation in Power Station

The identification of risks and the conduction of risk assessments mostly depend on the design of process systems or the deployment of plants (Arunthavanathan, 2022). Implementing efficient abnormal situation management, alarm management, and safety instrumented systems (SIS) might possibly reduce the probability of a hazardous incident taking place in a system or facility. However, if a malfunction occurs and leads to failure and an accident, the first action for the RA would be to examine the accident situation and ascertain the cause of the mishap. When evaluating the safety implications of system failure analysis, it is essential to scrutinise the system's flaw, the circumstances surrounding the failure, and the subsequent accident that occurred. Therefore, the first objectives of the risk analysis perspective on system failure include assessing and simulating the probability of faults resulting in failures by failure modelling. Furthermore, it involves doing research on the accident scenario by examining the initial events and their consequences using an accident model (Arunthavanathan, 2022).

Machine Learning Approaches and Fault Detection and Diagnoses in Power Station

Machine Learning (ML) has become a powerful instrument for fault diagnosis and detection, revolutionising conventional methods and enhancing the efficiency and accuracy of systems in several fields. The historical background, methods, and real-world uses of machine learning (ML) for fault detection and identification are examined in this overview of the literature. This study makes a distinction between machine learning, knowledge-based, and statistical approaches. Instead of adhering to clear rules, machine learning models extract knowledge from data by identifying patterns or making assumptions. While statistical models create correlations to produce information from incoming data, knowledge-based models employ rules applied to data to get knowledge. Research has been done by Liu et al. (2018) and Lei et al. (2020) on the use of machine learning techniques for defect diagnosis and detection. The learning process, which may be supervised or unsupervised, determines how machine learning techniques are classified. Supervised learning comprises the user supplying input to teach a computer model, whereas unsupervised learning allows the model to independently gain information.

Supervised Machine Learning

According to Lo, Flaus, and Adrot (2019), a comprehensive historical dataset that includes both accurate and inaccurate information is essential for supervised learning. In order to build the model, it is necessary to collect the defective condition data in a holistic manner. Since there is no erroneous data, this strategy is difficult for a freshly built system to employ. According to the research, supervised machine learning methods like Neural Networks (NN) and Support Vector Machines (SVM) are often used for problem scenario categorization. The first use of neural networks for the purpose of detecting process system failures occurred in the second part of the 1980s. Hoskins and Himmelblau (1988), Venkatasubramanian and Chan (1989), and Lit et al. (1990) were among the research that used neural network-based methodologies to detect and diagnose process system faults. Data from nonlinear dynamic systems may be analysed using FDD approaches that are based on neural networks. The early 1990s saw a dramatic increase in funding for scientific studies. Now more than ever, building models using neural networks is a complex process that calls for powerful computers and copious amounts of data collected under usual and non-typical settings (Arunthavanathan, 2022). Vapnik (1995) laid forth the foundational theories that formed the basis of the SVM-based approach to FDD in nonlinear systems, which he attributed to statistical learning and pattern recognition. He wraps up the lesson by explaining how to construct nonlinear binary classifiers using the kernel approach. Support vector machines aim to classify data by addressing fundamental ML issues such as overfitting, nonlinearity, dimensionality, model selection, and local minimums (Corties & Vapnik 1995). Due to the success of the kernel method, SVM is now a leading topic in FDD studies. Recent work by Li et al. (2005) successfully adapted support vector machines (SVMs) from their original binary classification purpose to multiclass classification. Methods like support vector machines (SVMs) and neural networks (NNs) can tell the difference between normal and unusual situations. To pinpoint and assess the malfunction scenario, more algorithm improvements, physical system model inclusion, or probabilistic techniques are needed.

UNSUPERVISED MACHINE LEARNING

In order to train the model, supervised learning requires labelled data, which is one of its primary drawbacks. However, it would be challenging to generate statistics from such data in the context of a process business. In recent years, the unsupervised learning approach has become increasingly prevalent in machine learning FDD. Unsupervised machine learning models are trained using historical data that lacks labelling. However, these models select categorization categories by utilising the algorithm to detect a concealed pattern in the data. Unsupervised model behaviours in FDD frequently involve the implementation of clustering and anomaly detection techniques (Dike et al., 2019; Arunthavanathan, 2022).

Probabilistic Methods

Fault detection and diagnosis (FDD) systems frequently employ Bayesian Networks (BN) and Hidden Markov Models (HMM), both of which are founded on stochastic probabilistic theories. Preserving the Markov property, a Hidden Markov Model (HMM) is a probabilistic model that describes a set of random variables and their relationships using an undirected network (Arunthavanathan, 2022). The Bayesian framework is a directed probabilistic graphical model that is acyclic in nature. It is frequently employed in numerous contexts, fault detection and diagnosis being one of them.

Deep Learning in Fault Detection

The utilisation of Deep Learning, specifically Neural Networks, in defect detection and diagnosis has increased in significance as a result of their inherent capability to generate hierarchical representations from data. Recurrent Neural Networks (RNNs) are superior at processing sequential data, whereas Convolutional Neural Networks (CNNs) are superior at evaluating and manipulating spatial data. It has been demonstrated that LSTM networks, which are a type of recurrent neural network (RNN), can capture temporal correlations in defect detection tasks.

Feature Selection and Dimensionality Reduction: ML methods often deal with high-dimensional datasets. Feature selection and dimensionality reduction techniques, such as Principal Component Analysis (PCA) and autoencoders, contribute to improving model efficiency and reducing the risk of overfitting. These techniques are critical for extracting relevant information from complex datasets, enhancing the performance of fault detection models.

Transfer Learning: Transfer learning involves leveraging knowledge gained from one domain to improve performance in another. In fault detection, pre-trained models on related tasks can be fine-tuned for specific applications, particularly in cases where labeled data is limited. Transfer learning enhances the generalization capabilities of ML models, making them more adaptable to different environments.

Ensemble Learning: Ensemble learning combines multiple models to improve overall performance. Techniques like bagging and boosting have been applied in fault detection and diagnosis to enhance robustness and accuracy. Random Forests, an ensemble of decision trees, are particularly effective in handling noisy datasets and increasing the reliability of fault detection systems.

Conclusion

Machine Learning has brought about a paradigm shift in fault detection and diagnosis, providing innovative solutions that complement and, in some cases, surpass traditional methodologies. As the field continues to evolve, researchers and practitioners are poised to leverage the capabilities of ML to create more adaptive, efficient, and reliable fault detection systems across a wide array of industries. Understanding the current state of ML in fault detection and diagnosing its future prospects is essential for optimizing system performance and ensuring the resilience of complex engineering and industrial processes.

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GREEN MARKETING IN THE DIGITAL AGE: LEVERAGING TECHNOLOGY FOR ENVIRONMENTAL MESSAGING

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ABSTRACT

This study investigated into the multifaceted realm of Green Marketing in the Digital Age, focusing on the strategic fusion of technology and environmental messaging. Leveraging diverse methodologies and challenges within this domain. The investigation begins by scrutinizing the landscape of digital platforms as channels for disseminating eco-friendly messages. A critical examination of social media, websites, apps, and their efficacy in engaging environmentally conscious consumers sets the stage for understanding the diverse avenues available to marketers. Moreover, this study probes the transformative potential of data analytics and machine learning in green marketing endeavors. In the context of influencer-driven marketing, the research evaluates the role of social in advocating environmental causes, elucidating their capacity to mobilize and influence audience perceptions and behaviors. Ethical and regulatory considerations governing digital green marketing practices are critically analyzed, acknowledging the need for transparent and responsible strategies in this domain. The researcher recommended that further study should be carried on impact of AI-driven personalization on green marketing. Investigating how tailored messaging influences consumer behavior and fosters sustainable choices.

KEYWORDS: Green Marketing, Digital Age, Technology and Environmental Messaging

Introduction

Due to growing environmental concerns and a rising worldwide awareness of sustainability, the field of marketing has seen a significant change in focus towards promoting environmentally friendly goods and activities. Green marketing is a strategic strategy that focuses on promoting and selling products and services that are ecologically friendly. This notion originated as a result of the increasing recognition of ecological concerns and the need for companies to embrace sustainable practices. Nevertheless, due to the fast progress of technology and the widespread use of digital platforms, the marketing industry has seen a

significant and fundamental change. This progression offers a unique opportunity to seamlessly incorporate technology into green marketing initiatives, so increasing environmental message and influencing customer behaviour.

Peattie (2001) identifies the origins of green marketing in the 1960s and 1970s, a time when public awareness of environmental concerns started to emerge. At first, the main emphasis was on promoting environmental responsibility and drawing attention to the negative impacts of traditional behaviours on the ecosystem. Industries such as cosmetics and consumer goods were quick to embrace the practice of labelling their products as "environmentally friendly" or "natural" in order to attract environmentally concerned customers. According to Peattie (2001), companies in the late 20th century began to acknowledge the significance of sustainability and environmental responsibility in their operations and communications. The initial emphasis was on highlighting the environmentally friendly characteristics of goods, but it has since extended to include a wider range of corporate sustainability actions.

Green marketing refers to the practice of reducing a product's negative effect on the environment by using product redesign, sustainable manufacturing processes, and integrated marketing strategies. The objective is to encourage the use of environmentally friendly goods and fulfil the need for sustainable consumption (Dahhan & Arenkov, 2021).

Over time, this movement progressed beyond simple categorization to include a wider range of sustainable endeavours. Companies began prioritising product innovation, energy efficiency, waste reduction, and ethical sourcing to conform with environmentally conscious values. As a result, green marketing has evolved to include a comprehensive approach that seeks to not only advertise goods, but also cultivate a feeling of environmental accountability among customers (Laroche et al., 2021). Concurrently, the digital revolution transformed the marketing terrain, fundamentally altering how businesses interact with their target audience. The emergence of social media, mobile technology, and data analytics brought about a substantial change in marketing methods. Digital platforms provide exceptional prospects for instantaneous communication, precise advertising, and worldwide consumer involvement (Kaplan & Haenlein, 2010). The fusion of green marketing concepts with digital technologies offers a unique chance to enhance environmental message and encourage sustainable behaviours. Utilising digital platforms allows marketers to efficiently distribute information, interact with customers, and have a significant impact on purchase choices (Laroche et al., 2021).

Digital marketing refers to the use of electronic devices and digital communication channels, such as the internet or text messaging, to effectively engage with prospective customers, establish connections, and persuade them to make a purchase. Digital marketing has emerged as a potent instrument for consumer outreach, market research, and comprehension of client preferences, demographic characteristics, and the correlation between these factors and attractive items. Utilising contemporary digital media, market research is now conducted automatically, resulting in enhanced efficiency and substantial cost reduction. This advancement benefits both producers and consumers (Ayush & Gowda, 2020).

Accenture (2020) states that social media platforms have become influential instruments for promoting environmental campaigning and raising awareness. By using captivating narratives, visually stimulating material, and interactive initiatives, companies can cultivate a community of environmentally aware customers, stimulating conversations and initiatives centred on sustainability. Hartmann & Ibanez (2016) said that the use of big data and analytics empowers marketers to acquire profound understandings into customer behaviour, choices, and attitudes

about sustainability. Utilising data analysis, this strategy enables firms to implement focused marketing tactics, enabling them to customise their environmental message based on distinct customer categories. Peattie (2021) asserts that AR and VR technology provide captivating and immersive opportunities that may be used for environmental education and involvement. Brands may use these technologies to demonstrate the effects of their sustainable practices, enabling customers to envision the favourable environmental results of their purchase choices.

The combination of digital technologies with green marketing tactics has significant potential due to the fast evolution of technology and the ongoing worldwide debate on environmental issues. The objective of this research is to investigate the interactions and positive effects that arise from the combination of technology and environmental message in the field of green marketing during the era of digital advancements. This study aims to provide insights into successfully using technology to encourage sustainable behaviours and consumer choices by analysing the evolution, problems, possibilities, and best practices in this field.

Concept of Green Marketing Strategies

Green marketing tactics include several methods that focus on promoting goods or services by highlighting their positive impact on the environment. Corporations have been compelled by legislations to establish environmental management systems for their activities (Haegeman et al., 2012; Jenkins & Yakovleva, 2006; Mohr et al., 2001). Jenkins & Yakovleva (2006) proposed that green marketing tactics have arisen as a component of corporate social responsibility (CSR) activities, specifically in relation to environmental disclosure. Environmental programmes demonstrate organisations' dedication to addressing the social and environmental issues associated with their activities, procurement, and retail operations. Presently, firms openly disclose comprehensive corporate social responsibility (CSR) initiatives on their websites, which include the release of reports and the implementation of social campaigns that demonstrate the companies' active involvement with the community.

Companies often adopt a set of worldwide norms when they want to integrate environmental reporting systems into their operations. Companies seeking certificates for their social and environmental practices must participate in recognised certification programmes that can verify the data they have gathered on their operations. The often adopted criteria by corporations include ISO 14 000, ISO 26 000, GRI criteria on Sustainability Reporting, and the carbon disclosure project (CDP). These rules provide corporations with credibility and responsibility for their conduct. Although these principles are not legally binding, they have effectively facilitated the monitoring of firms' social and environmental implications. In addition, they have played a role in promoting the use of environmental management systems (EMS) that include more comprehensive and proactive approaches. Moreover, a significant addition of the ISO 14000 environmental management standard is its endorsement of the use of life cycle assessment (LCA) for goods. This standard has facilitated the depiction of a more comprehensive and inclusive representation of the tangible effects of goods' lifecycle and has played a role in the proliferation of ecolabels (Baldo, Marino, Montani, & Ryding, 2009; Ball, 2002; D'Souza, Taghian, Lamb, & Peretiakko, 2006). Companies strive to develop goods that adhere to higher standards in order to maintain a competitive edge. Their aim is to develop items that demonstrate their commitment to social and environmental problems, such as energy-efficient, easily disassembled, organic, locally sourced, and fair trade products. These efforts have compelled the industry to embrace measures such as extended producer responsibility (EPR), which prioritises waste management systems, or deposit-refund programmes. The inclusion of certification organisations and reporting criteria in firms' operations has resulted in these implications.

Nevertheless, the current advancement in the adoption of these standards has been sluggish. Historically, these efforts have been executed under hierarchical management systems, where ideas are first developed at the headquarters and subsequently spread to the subsidiaries. In addition, a significant number of the subsidiary companies are situated in countries with less rigorous rules (Gamper-Rabindran, 2006; Reed, 2002). Consequently, some firms have been implicated in media controversies due to their unscrupulous conduct involving certain subsidiaries or suppliers abroad. Scandals have tarnished the image of brands and corporations, resulting in negative effects. Corporations have pledged to expand their social and environmental responsibilities to its stakeholders abroad and have been striving to enforce consistent environmental standards among businesses, despite the hurdles associated with this commitment. Conversely, civil society has heightened consciousness of the conduct of companies. This group has used media platforms to disseminate information on firms' conduct. They have exerted more pressure on corporations and governmental entities to improve their industrial cleanliness and compel them to adopt more effective methods (Stolle et al., 2005). Greenpeace has undertaken many initiatives to combat greenwashing in business (Greenpeace, 2001). Furthermore, grassroots efforts have played a role in compelling firms to increase the level of information transparency. Companies are now required to publish information about their performance and product details, such as the source of materials, nutritional data, and place of origin, to the public (Jenkins & Yakovleva, 2006).

Green Marketing Terminologies

In order to have a comprehensive understanding of the extent of the green marketing phenomena, this text will provide concise explanations of some of the key terminology associated with the notion of green marketing.

- **Environmental Sustainability**

Environmental sustainability refers to the practice of maintaining, promoting, and guaranteeing the continuous existence of anything. Sustainability may be described as the act of addressing the resource and service demands of both present and future generations without causing harm or degrading the environment (Morelli, 2011).

- **Eco-Label**

An eco-label is a designation that conveys information to customers on the specific environmental attributes of a product. It indicates the level of environmental performance that a particular products or service has (Global Ecolabelling Network, 2004). Ecolabels originated in the late 1980s as a means of scrutinising assertions for customers in many nations (Wasik, 1996). The eco label is a prominent and crucial instrument in green advertising. It primarily aims to enhance consumers' comprehension of the manufacturing process of goods, enabling them to make well-informed judgements when buying environmentally friendly items (Yeng & Yazdanifard, 2015).

- **Eco-Brand**

Brand is a name, symbol or image of products, the difference between a ‘brand’ and ‘Eco-brand’ is that Eco – brand is a name, symbol or image of products which are safe to the environment (Delafrooz et al., 2014). Eco-brand is often used as an instrument used to promote a company’s green products and services (Rahman & Haq, 2016).

- **Environmental Advertisement**

Environmental advertising is a method used to promote and popularise green movements worldwide. It may be disseminated via newspapers and other media platforms (Yeng & Yazdanifard, 2015). Its purpose is to enhance worldwide green movements and raise public awareness about environmental challenges (Wahid & Rahbar, 2011). To achieve success in environmental advertising, the marketing message must accurately convey the company's environmental purpose. In order to do this, the messaging should highlight the company's all-encompassing strategy towards several phases, such as production, distribution, packaging, recycling, and disposal. Precise product claims that cater to a global customer base are necessary. Several typical customer queries in advertising need solutions, including the degree of energy conservation. What is the degree of reduction in water consumption? Is the use of recycled packaging widespread? The citation is from Dawson's work published in 1996. The method by which items are advertised is a crucial element of the total marketing communication. Packaging serves as a means of conveying a distinctive and individualised message. Advertising in the marketing industry undergoes thorough scrutiny from both regulatory organisations and customers. Perplexing or deceitful advertising might hinder an organization's admirable efforts in green marketing (Dawson, 1996). Environmental advertising is a method of promoting and supporting global green initiatives. It may be done via several forms of media, such as newspapers (Yeng & Yazdanifard, 2015). The purpose of this is to bolster global green initiatives and promote consciousness about environmental issues (Rahbar & Wahid, 2011). In order for an environmental commercial to be successful, its marketing message must effectively promote the company's environmental agenda. The marketing message should emphasise the company's comprehensive approach to production, distribution, packaging, recycling, and disposal. Product claims must be precise and cater to a worldwide audience. Common inquiries from consumers in advertising are to the amount of energy conserved. What is the reduction in water usage? Is recyclable packaging utilised? (Wasik, 1996). The manner in which items are promoted is an integral component of the overall marketing communication. The box alone communicates a unique message. In the realm of marketing, advertising undergoes rigorous examination, not just by regulatory bodies, but also by consumers. Inaccurate or deceptive advertising may hinder a company's most effective attempts at promoting environmentally friendly products or practices. The citation is from Wasik's work published in 1996.

Green Marketing Mix

The green marketing mix is a crucial marketing concept comprising of controllable instruments used by firms to elicit desired responses from customers (Khan, 2014). In order to keep up with the ongoing expansion of environmental sustainability, marketers must adapt their competitive environment and examine different approaches to include environmentally-friendly practices into their marketing mix (Leonidou et al., 2013). Hence, it is essential for organisations to demonstrate receptiveness to consumers' environmental apprehensions (Arseculeratne & Yazdanifard, 2014). This may be accomplished by approaching the marketing mix from an environmentally conscious standpoint. Green marketers have the difficulty of promoting the innovative use of green 7 p's (Chinnadorai & Sudhalakshmi, 2014). This section elucidates the 7p's of green marketing as expounded by the author.

- **Green Promotion**

The objective of green promotion is to educate people about the environmentally-friendly goods. The promotion of environmentally sustainable products is crucial for increasing

awareness of environmental sustainability. Therefore, it is important for marketers introducing green products to have a concise and effective communication strategy to make their products more appealing (Hasan & Ali, 2014). However, in contrast to traditional marketing, green marketing proponents have a significant challenge in effectively communicating their message using environmental terminology such as biodegradable, recyclable, and ecologically friendly (Solaima et al., 2015). Consequently, the marketers of environmentally friendly goods and services have faced criticism for their use of complex terminology (Hasan & Ali, 2014). Oftentimes, this results in firms refraining from advertising green goods due to the challenges associated with identifying and documenting them. Consequently, rather of allocating more resources towards promotion, they choose to cease pushing green products (Solaima et al., 2015).

- **Green Place**

Place refers to the management of tactics involved in the distribution of green products from their origin to the point of consumption. It is crucial for companies to strategically plan how and where to make green products available, as only a small number of consumers are willing to actively search for them. Consumers are more likely to purchase green products when they are readily available (Davari & Strutton, 2014). Selling a product in a green market presents challenges in terms of effectively communicating the product's features and allowing consumers to experience it. This may impact the choice of distribution partners and ultimately benefit the end user by making the product more accessible at a lower cost. However, Bhalerao (2015) highlights that challenges may arise for highly technical products that require testing and visiting the manufacturer's location by the end user.

- **Green Price**

The process of adopting environmentally sustainable practices include the implementation of new technology and equipment, the education and training of individuals, the incorporation of external expenses, and the transformation of trash into reusable materials. These expenses are unavoidably incorporated into the ultimate cost of a product (Eneizan & Wahab, 2016). Green pricing refers to the additional costs that customers often have to bear in order to purchase environmentally friendly items (Peattie & Crane, 2005). Moreover, the impact of images in conveying the ecological advantages of items is limited when individuals do not see their purchases or fail to share this knowledge with others to get social validation (Solvalier, 2010). Nevertheless, for customers who do not prioritise ecological concerns, the price remains the most significant factor in their decision to purchase a product. Companies have a duty to promote environmental consciousness until it becomes the most important factor in the purchase decision process. The aforementioned remark implies that customers want further knowledge on the advantages of green goods in order to assess their worth in a more objective manner (Kinoti, 2011).

- **Green Product**

The word "green products" originated the term "green advertising". It is well acknowledged that product advertising has a substantial impact on consumption habits. Multiple studies have shown that effective advertising strategies have the ability to influence and alter individuals' everyday routines and behaviours, increasing their likelihood of consuming certain items. The advertising strategies and methods that aim to promote the adoption of environmentally-friendly goods are known as green advertising (Ottman, 2017). A green product is a product that has been manufactured using ecologically sustainable processes (Eneizan & Wahab,

2016). Businesses have a responsibility to minimise environmental dangers by using industrial procedures that are less harmful to the environment.

The Role of Digitalization in Green Marketing

The convergence of digitization and marketing in the modern world has brought forth a new age of environmental awareness, sometimes referred to as "green marketing." The adoption of eco-friendly practices by companies, driven by technology improvements, has led to a paradigm change. This shift is aimed at resonating with environmentally concerned customers by harnessing new technologies.

1. Digitalization as a Catalyst

Digitalization acts as a catalyst in reshaping green marketing strategies. Advancements in renewable energy, sustainable manufacturing processes, and eco-friendly product development have paved the way for businesses to align their marketing efforts with environmental sustainability. This convergence has led to the emergence of sustainable practices integrated into various facets of marketing, from product design to distribution and communication strategies (Dangelico & Pujari, 2010).

2. Digital Transformation for Sustainable Practices

The digital revolution has revolutionized marketing strategies, offering platforms for eco-conscious messaging. Digitalization minimizes the need for physical materials, reducing waste in advertising and marketing collateral. Social media platforms and digital marketing enable companies to engage with consumers in real-time, advocating environmental causes and promoting sustainable products (Elkington & Hailes, 2018). Social media platforms have played a significant role in amplifying green marketing initiatives. Research by Smith et al. (2019) highlights how social media channels serve as influential tools for disseminating environmental messages and fostering consumer engagement. Brands can utilize these platforms to showcase their sustainable practices, share eco-friendly initiatives, and interact directly with environmentally conscious consumers, thereby building a loyal and committed customer base.

3. Big Data and Analytics for Sustainability

Big data analytics empowers businesses to make informed decisions towards sustainability. Analyzing consumer behavior and preferences aids in developing products aligned with eco-conscious values. Additionally, supply chain analytics help identify areas for improvement, minimizing environmental impacts throughout the product lifecycle (Geissdoerfer et al., 2017).

4. IoT and Smart Digitalization for Sustainability

The Internet of Things (IoT) and smart technology play a pivotal role in promoting sustainability. Smart devices enable energy-efficient operations, optimizing resource utilization. For instance, smart meters regulate energy consumption, reducing waste and carbon footprints (Sundarakani & Laari, 2019). IoT-based solutions contribute significantly to environmental monitoring and conservation efforts. These technologies facilitate real-time data collection from remote locations, aiding in wildlife tracking, air quality monitoring, and ecological research. This data assists in making informed decisions for conservation and mitigating environmental risks (Atzori et al., 2010)

5. Blockchain for Transparency and Traceability

Blockchain digital technology ensures transparency and traceability in supply chains, crucial for validating eco-friendly claims. It allows consumers to trace the origins of products, ensuring adherence to sustainable practices. This transparency fosters trust and enhances brand credibility among environmentally conscious consumers (Tian, 2016). Digitalization has facilitated transparency in supply chains, a critical aspect of green marketing. Blockchain technology, as highlighted by Ivanova et al. (2021), offers a decentralized and transparent ledger system that enables traceability and verification of sustainable practices throughout the supply chain. This transparency instills trust in consumers, allowing them to make informed choices by supporting brands with verifiable eco-friendly processes.

6. AR and VR for Environmental Education

AR and VR technologies offer immersive educational experiences, allowing users to interact with virtual environments that simulate real-world scenarios. Studies indicate their effectiveness in enhancing environmental education by creating engaging, experiential learning opportunities (Cheng & Tsai, 2013). These technologies offer novel ways for organizations and activists to launch impactful environmental campaigns. By creating interactive, emotionally resonant experiences, AR and VR can drive engagement and encourage participation in sustainability initiatives (Choi & Tussyadiah, 2016). Digital platforms provide avenues for educating and mobilizing consumers towards sustainable behaviors. Gamification, as explored by Chen and Chai (2019), leverages digital games and interactive applications to educate users about environmental issues while incentivizing eco-friendly actions. These gamified approaches not only raise awareness but also encourage individuals to adopt sustainable habits in their daily lives.

Digital Platforms for Environmental Messaging

Digital platforms play a significant role in disseminating environmental messages and raising awareness about various environmental issues. Here are some digital platforms commonly used for environmental messaging:

Social Media Platforms (Twitter, Facebook, Instagram ect.): social media plays a crucial role in spreading environmental messages due to its widespread usage. Research by Kaplan & Haenlein (2010) in the Journal of Management Information Systems highlights the impact of social media on environmental awareness campaigns.

- **Facebook**, being one of the largest social media platforms, offers a vast reach for environmental messaging. Studies have highlighted its potential for spreading environmental awareness and engaging diverse audiences (Bonsón, 2012). Groups and pages dedicated to environmental causes facilitate community building and discussions on sustainability topics (Zhang et al., 2017).
- **Twitter's** quick dissemination of information makes it suitable for spreading urgent environmental messages and updates on current events (Huang & Xu, 2019). Hashtags and retweets help in advocacy campaigns, and Twitter serves as a networking platform for environmental activists (Tranter & Woods, 2015).
- **Instagram's** visual nature makes it effective for storytelling through images and videos, encouraging engagement and emotional connections to environmental issues (Chang et al., 2016). Environmental influencers on Instagram play a significant role in raising awareness and promoting sustainable lifestyles (Deng & Lin, 2020).

- **YouTube** is a hub for educational content, making it valuable for disseminating information about environmental issues and sustainable practices (Loureiro et al., 2016). Its video-centric approach enables detailed discussions, demonstrations, and engaging content that captures audience attention (Zhang & Yuan, 2018).
- **LinkedIn** serves as a platform for professionals to discuss sustainability, share insights, and collaborate on environmentally friendly practices in various industries (Sinha & Kapur, 2019). It also aids in promoting corporate sustainability initiatives and sharing success stories (Vătămănescu et al., 2018).
- **TikTok's** popularity among younger demographics makes it an influential platform for raising awareness about environmental issues among the youth (Chu & Yang, 2021). Its short-form, creative content format helps in making environmental messages entertaining and shareable (Sundar, 2021).

Blogs and Online Articles: Platforms like Medium, WordPress, and various environmental blogs serve as channels for in-depth discussions on environmental topics. Research by Gadenne et al. (2009) in the *Journal of Business Ethics* discusses the role of online articles in environmental education and awareness.

- **WordPress** allows diverse content formats, fostering comprehensive discussions on environmental topics (Eklund & Mäntymäki, 2017). Its features support search engine optimization, aiding in the discoverability of environmental content (Yadav & Rahman, 2016).
- **Medium's** curated articles often gain traction, making it an influential platform for thought-provoking environmental content (Kim & Kim, 2019). Reader responses and engagement through comments enable dialogue and discussions around environmental issues (Ling, 2019).
- **HuffPost** offer a broad readership, amplifying the reach of environmental articles (Fesenmaier et al., 2015). Environmental news articles on respected platforms lend credibility and authority to sustainability discussions (Ibrahim et al., 2020).
- **Academic platforms and scientific journals** provide authoritative, evidence-based environmental information (Vanclay, 2017). Rigorous peer-review processes ensure accuracy and reliability of environmental research communicated through these platforms (Trench et al., 2013).
- **Green-focused** platforms attract audiences specifically interested in environmental topics, providing a targeted reach (Lindgreen et al., 2012). *GreenBiz* emphasize sustainable business practices, appealing to corporate audiences (Shrivastava & Kennelly, 2013).
- **Personal blogs and influencer** platforms provide relatable, authentic voices that resonate with audiences, fostering engagement (Hajli et al., 2017). Environmental influencers contribute to shaping perceptions and promoting sustainable behaviors among followers (Jin & Phua, 2014).

Measurement Metrics for Assessing the Impact of Digital Green Marketing

Measurement metrics are vital for assessing the effectiveness and impact of digital green marketing strategies. Here's an exploration of key metrics used to evaluate the impact of these strategies.

Website Traffic and Engagement Metrics: Website visits, page views, time spent on site, bounce rate, and click-through rates (CTRs) on green-related content (Islam et al., 2021).

Higher traffic and engagement indicate interest and resonance with environmental messaging, reflecting the effectiveness of content and user interest (Islam et al., 2021).

Social Media Engagement Metrics: Likes, shares, comments, retweets, and follower growth on sustainability-focused posts (Jin & Phua, 2014). Increased engagement signifies audience interest and the effectiveness of digital green marketing strategies in capturing attention and fostering conversations (Jin & Phua, 2014).

Conversion Rates and Sales Metrics: Conversion rates from digital campaigns promoting green products, eco-friendly initiatives, or sustainable behaviors (Hassini et al., 2017). Higher conversion rates and increased sales of green products indicate successful audience adoption of sustainable choices due to marketing efforts (Hassini et al., 2017).

Brand Sentiment Analysis: Sentiment analysis of online mentions, reviews, and discussions related to a brand's green initiatives (Delmas & Burbano, 2011). Positive sentiment reflects improved brand perception due to successful communication and implementation of green marketing strategies (Delmas & Burbano, 2011).

Customer Lifetime Value (CLV): Calculating the CLV of customers who engage with green marketing initiatives over time (Turel et al., 2020). Higher CLV indicates sustainable customer loyalty and long-term profitability resulting from effective digital green marketing efforts (Turel et al., 2020).

Environmental Impact Metrics: Metrics quantifying the actual environmental impact resulting from behavioral changes influenced by digital green marketing (Abou-Zeid et al., 2017). Tracking real-world environmental changes, such as reduced carbon footprints or increased recycling, reflects the tangible effect of marketing efforts on eco-friendly behavior (Abou-Zeid et al., 2017).

Return on Investment (ROI): Comparing the costs and revenue generated from digital green marketing initiatives (Hassini et al., 2017). A positive ROI demonstrates the financial success of sustainability-focused campaigns, indicating the effectiveness of investments in digital green marketing (Hassini et al., 2017).

Challenges of Green Marketing in Digital Age

- **Greenwashing:** Greenwashing involves misleading consumers by overstating or falsely advertising a product's environmental benefits (Delmas & Burbano, 2011). This erodes trust and credibility, hindering genuine sustainability efforts (Parguel et al., 2011).
- **Information Overload:** The abundance of information available online can overwhelm consumers, making it challenging to discern accurate environmental claims (Rana & Paul, 2017). Consumers might disengage due to skepticism or confusion about green claims (Singh et al., 2018).
- **Consumer Skepticism:** Consumer skepticism towards green claims can arise from doubts about the authenticity of companies' environmental commitments (Mittal, 2019). Skepticism can lead to reduced trust in brands and reluctance to support green products or initiatives (Chang & Lee, 2013).
- **Regulatory Compliance:** Adhering to varying environmental regulations globally poses challenges for companies in maintaining consistency in their green marketing strategies (Awan & Saleem, 2020). Non-compliance can lead to legal issues and damage to brand reputation (González-Benito & González-Benito, 2006).

Conclusion

In the digital age, green marketing has become an integral component of sustainable business practices, harnessing technology to disseminate powerful environmental messages. Leveraging various digital tools and platforms, businesses have initiated impactful strategies to promote eco-friendly products, advocate for sustainable behaviors, and foster environmental consciousness among consumers.

Technology offers an array of opportunities, from data analytics providing insights into consumer behavior to immersive experiences through virtual reality, all contributing to the effectiveness of environmental messaging. However, amidst these advancements, challenges persist, such as combating greenwashing, navigating information overload, and fostering consumer trust in green claims.

The convergence of technology and green marketing presents an opportunity for businesses to not only drive sales but also inspire meaningful change. Metrics measuring website traffic, social media engagement, sales, and environmental impact enable the assessment of campaigns, guiding strategies towards greater effectiveness and authenticity. Moreover, the transparency facilitated by technology, including blockchain for supply chain transparency and AI-driven personalization, nurtures trust and accountability.

Ultimately, the success of digital green marketing lies in its ability to engage, educate, and inspire action. As businesses continue to innovate and refine their approaches, the collective impact of these efforts holds the promise of a more sustainable future driven by informed consumer choices and a genuine commitment to environmental stewardship.

Areas for Further Studies

Investigate how various digital platforms (social media, websites, apps) are utilized for eco-friendly messaging by companies. Analyze the effectiveness of different platforms in reaching and engaging with environmentally conscious consumers.

Explore how data analytics and machine learning are used in green marketing. Look into case studies where companies leverage consumer data to tailor eco-messages and target the right audience effectively.

Investigate the role of VR and AR in creating immersive experiences for consumers to learn about environmental issues. How effective are these technologies in conveying sustainability messages?

Analyze how e-commerce platforms integrate green marketing tactics. Study the impact of labeling products as eco-friendly or sustainable on consumer behavior and purchasing decisions.

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THE PLACE OF TECHNOLOGY IN IMPROVING EFFECTIVENESS IN DEBT COLLECTION

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ABSTRACT

The integration of financial technology (Fintech) in debt collection has transformed traditional business models, offering innovative solutions to enhance efficiency and effectiveness. This study explored the effect of technology in improving debt collection. Originating in Silicon Valley and expanding globally, Fintech, particularly in countries like Nigeria, has introduced peer-to-peer lending, revolutionizing the direct link between borrowers and loan recipients. However, challenges such as cyber-ethics and legal complexities arise. Debt collection, a critical process for businesses, involves recovering funds through various methods like debt rescheduling and repossession of security. Outsourcing debt collection services to entities like agencies and banks is common, relieving companies to focus on core responsibilities. Challenges faced by banks in debt collection include customer bankruptcy and unexpected business failures. Technology plays a pivotal role in debt collection, with the adoption of digital payment methods, automation, AI, and multi-channel communication. Customer Relationship Management (CRM) software optimizes operations, while the financial services industry undergoes digital innovation, impacting market dynamics. Policymakers grapple with regulating technology-driven financial structures. The effectiveness of technology in debt collection can be seen in numerous sectors including communication channels, data analytics and predictive modeling, automation and artificial intelligence, etc. In conclusion, technology has revolutionized debt collection, improving effectiveness and efficiency, enhancing debtor engagement, and accelerating debt recovery. The researcher recommended that a thorough assessment be conducted on the organization's current technological infrastructure and identify areas where technology can be integrated and comprehensive training programs be provided to employees on the effective use of technology tools and platforms in debt collection.

KEYWORDS: Technology, Effectiveness, and Debt Collection

Introduction

The term "financial technology" (Fintech) refers to the result of mixing technology with financial services, which ultimately results in the transformation of the business model from one that is more conventional to one that provides clients with more easily available commodities. In the past, transactions were carried out in person and involved the carrying of physical cash as well as paper work. However, because to advancements in technology, transactions can now be performed remotely in a matter of seconds by conducting payments.

According to the definition provided by the Financial Stability Board, fintech is a type of technology-based financial innovation that has the potential to result in new business models, applications, processes, or products that have significant implications for financial markets, institutions, and service providers (Suharini & Hastasari, 2020). In order to improve unique ways of providing financial services, fintech is focused on the creative use of smart mobile devices to develop and supply financial services and goods (Al-Mudimigh & Anshari, 2020). Fintech allows for the creation and supply of financial services and products. Historically, the term "fintech" has been described as a financial product and service that is provided via the use of a combination of technical platforms and innovative business models. The origins of fintech can be traced back to Silicon Valley, which is located in the southern part of the San Francisco Bay Area state of California. Following its initial success, this internet-based banking service has now expanded to a great number of additional countries.

In a country like Nigeria, which is located in Africa, the basis for a wide variety of new financial services is created by the combination of technology and trust. The concept of peer-to-peer lending was first introduced in Nigeria, and it is lauded for its ability to directly link borrowers and loan recipients. Because Nigeria's economy is heavily dependent on cash transactions and has a high degree of lending, the country is well-suited for the establishment of an alternative credit system. Financial technology (Fintech) simplifies the process of obtaining credit for people. However, it also raises other difficulties, such as the incorporation of cyber-ethics in safeguarding personal information and the legal complexities of debt collection. Engaging in cyber ethical violations might result in repercussions akin to breaking the law. Sexual harassment, defamation, threats, and stalking are among the several forms of billing breaches that may occur within the financial technology business. Borrowing customers are unable to challenge the conduct of debt collectors because debt collectors use the personal information of the borrowers to exert psychological coercion on the debtors to comply with the unilaterally determined bills. This difficulty is typically experienced by unregistered financial technology businesses that operate illegally without the authorization of the Financial Services Authority.

Financial management services, particularly electronic collection services, are undergoing a fast digital transformation. Simultaneously, the company is facing a growing number of payment delays, necessitating the incorporation of receivables management and debt collection as essential components of daily operations. In addition, the company has the option to independently collect outstanding payments; however, it is more common for collection services to be outsourced to other entities such as debt collection agencies, legal companies, banks, or accounting firms. Although outsourcing the debt collection service does not entirely eliminate the firm's involvement in the collection process, it significantly liberates the company's resources for allocation towards other development projects and allows the company to focus on managing its core business responsibilities. When companies want to outsource their debt collection services, they must acquaint themselves with both the debt collection process and the regulations pertaining to debt collection. Our objective is to efficiently and effectively help customers address outstanding invoices, regardless of whether the debt collection service is provided by our business or an external entity.

The firm's cash flow may depend on the industry or be influenced by seasonal factors. Therefore, the company's liquidity should not be endangered by outstanding receivables or unexpected expenses. While many organisations may handle late payments without significant challenges, others may have severe consequences that impact their whole operation under certain situations. Consequently, if a corporation lacks the financial resources to settle its obligations, the negative effects on business development may accumulate and ultimately affect profitability. This might potentially trigger a sequence of events that would finally

culminate in a rise in the number of individuals seeking bankruptcy protection. Smaller enterprises often provide a higher degree of individualised customer service, which might pose challenges when it comes to effectively communicating with clients about any payment delays, they may encounter. Hence, the firm may choose to forgo a collection in order to retain client loyalty. The company deems it necessary to do this task in order to focus on its core operations. It is possible that collection may not be accomplished due to insufficient resources, and it is also feasible that previous receivables will not be recovered.

Due to these concerns, a business may choose to acquire the services of a third-party debt collection agency external to the organisation. The corporate customer may delay payment of the invoice due to several conditions. Prior to commencing the collection process, it is essential for a company or an outsourced collection agency to authenticate the legitimacy of an invoice and ensure the accuracy of the information included within. Several causes might contribute to payment delays from business customers. These variables include the absence of an initial invoice, the decline in the company's financial condition, the denial of payment, insolvency, a slow invoicing method, or an undeveloped process. Similarly, the sender of the invoice might sometimes make human mistakes. In this scenario, the cause might be attributed to factors such as mishandling of the invoice or a discrepancy between the invoice and the contract. Furthermore, certain system errors or omissions might prevent the automated transmission of invoice payments to the recipient's system. Because of this, the corporate customer should also avoid paying an erroneous or unjustified invoice out of fear of incurring collection charges or getting a payment default notice. While faced with such scenarios, maintaining a professional and compassionate approach guarantees the preservation of the client relationship, even while offering explanations about unfortunate events.

Background and context of Debt Collection

Debt collection pertains to the procedure of recovering funds that have been loaned to individuals and have now reached the end of their repayment period, necessitating reimbursement by the lender. Debt recovery is the act of retrieving any assets or money that is due by a party that is bound by a contract. A debtor may refer to either individual or a corporate entity. Recovery may be sought via several legal channels; however, preliminary negotiations are often required before initiating any legal proceedings. The efficacy of credit risk management measures used prior to loan disbursement plays a crucial role in determining the potential for loan recovery. As to Jones (2015), the conventional debt collection method requires extensive follow-up, including the frequent initiation or receipt of several phone calls each day to discuss payment arrangements with the debtor. As per the studies conducted by Rose and Wright (2005), Taylor and Bain (1999), and Wang (2009), debt collectors mostly operate from call centres.

These call centres provide distinct problems and stresses due to the high demands placed on the personnel. Call centres mostly use technology, such as automated dialers, to streamline the process of debt collectors contacting debtors. Collectors are not only responsible for meeting productivity performance measures, which are meant to quantify productivity levels. The software and hardware used by collectors also possess their own automatic key performance indicators. These indications should ideally complement the performance of the collector, but they may sometimes hinder it (Fluss, 2005). Workers may face significant obstacles in their ability to perform well if they lack access to up-to-date and readily available tools. All the equipment used in a contact centre, encompassing telephones, computers, office supplies, databases, written rules and processes, as well as unique applications or software, have to be technologically advanced, current, and automated if possible. Providing workers with the

necessary tools to do their tasks is crucial for ensuring the organization's well-being and achieving stated productivity goals.

Debt collectors must possess the skills of inquiry and research to identify the obstacles preventing consumers from repaying their debt. Prior experience in law enforcement or legal expertise can be advantageous for individuals seeking to transition into the field of debt collection, as it requires the ability to ask sensitive questions in order to elicit truthful responses from debtors regarding their capacity and willingness to repay. The role of debt collection, however, requires a certain degree of proficiency in conducting interrogations. Law enforcement professionals have the duty of interrogating offenders, and it is expected of them to hide any emotions that would make them seem vulnerable (Tracy, 2005). Due to the absence of government enforcement authorities, debt collectors often face an unequal power dynamic with customers. Hochschild (1983), the originator of the term "emotional labour" (EL), provided a concise summary of this concept. Hochschild observed that there is frequently an expectation for workers to tolerate mistreatment from customers, a phenomenon that is evident in contemporary times. Emotional labour encompasses the ability to discern and articulate the emotions of others, while adhering to laws, corporate norms, and exercising self-restraint in the job. Grandey et al. (2011), Hochschild (1983), and Rafaeli and Sutton (1991) argue that emotional intelligence is an essential ability for those engaged in emotional work.

Based on these studies, emotional labourers are required to possess the ability to accurately perceive the emotions of others and exhibit both empathy and assertiveness. This is necessary in order to meet the demands set by regulatory agencies. Due to the arrangement where businesses compensate workers for their behaviours, it is unavoidable for the worker to exert significant control in the relationship between the provider and the consumer. Consequently, this creates an imbalance of power (Fournies, 1987). Debt collectors must participate in a cognitive process to successfully regulate and adapt their emotions while working, which requires them to deliberate before taking action. In order to publicly express emotions to consumers, it is necessary to possess a high degree of intelligence and the ability to hide negative emotions in a manner that aligns with the firm's goals and mission statement. Grandey (2000) suggests that suppressing emotions may lead to an artificial display of emotions, perhaps causing harmful consequences for the individual involved. Gross (1998a) conducted a thorough examination of the two separate types of emotional regulation. There are two forms of regulation: antecedent-focused emotion regulation, which includes changing how one perceives an emotion, and response-focused emotion regulation, which requires changing one's own reaction or response to an emotion. In addition, Gross contended that corporate standards govern the reactions to eight emotions, leading to either suppression, amplification, or fabrication of these responses.

Overview of debt collection methods and challenges

The phrase "debt collection process" denotes a set of techniques used to retrieve outstanding claims from a debtor who has failed to make timely payments. Debt collection is a universal challenge for businesses, with a profound influence on a company's financial condition. According to Geşicki (1997), "debt collection" can be understood as a legal investigation of a creditor's ownership. For Podel (2014), debt collection is a process in which the debtor fulfills the contract's requirements with respect to the person entitled (a creditor). Debt collection also means enforcing a claim under common law. The legal factor embraces the procedures and consequences for the company when filing an enforcement case with the court (Świeca 2010).

According to the European Payment Report [Intrum Justitia 2016], around 36% of enterprises operating in Poland and involved in business-to-business transactions (B2B) have admitted to experiencing delayed payments. The date and time provided is September 25, 2018, at 12:04:20, with a value of 148. Conversely, Małgorzata Wejer-Kudęłko and Monika Łada have significant impact on the ongoing survival of the company. Delinquent payments in business-to-business transactions are a common and persistent problem. In this situation, it is crucial to outline the key success criteria and identify the obstacles that hinder effective debt collection. Uncollected claims have a substantial influence on the overall functioning of any company. Debt collection is a complex phenomenon that involves several aspects.

Accordingly, Meyer-Spasche (2002) stated that the beginnings of debt collection may be traced back to the era of the Roman Empire, when the notion of *rei vindication* was first implemented. Originally, the phrase "*rei vindication*" denoted a legal claim in property law that empowered the owner of a certain item to request the return of that object from any possessor who lacked the right to retain it. In the recent past, when lending became more popular and easily accessible as a result of the expansion of Fintechs, a debt collection technique in its broad conception did not generate a great lot of interest as a subject of research. Since then, there has been a surge in the focus on debt collection due to the difficulties faced by several firms in retrieving funds. Currently, debt collection is initiated inside a company when the payments owed are overdue (Patterson, Wejer-Kudęłko 2018). Providing the current definitions of debt collection from the perspectives of law, economics, and psychosociology is essential since debt collection is a complex phenomenon that involves several components to be taken into account. A study conducted in Kenya by Migwi (2013) on credit monitoring and recovery strategies adopted by commercial banks, the aim of the study was to determine the monitoring and debt collection strategies adopted by commercial banks. The following are the debt collection methods highlighted in the study.

Debt rescheduling: If it is determined that rescheduling a debt is in the organization's best interests and there is a reasonable assurance of recovering all or part of the obligation, a financial institution must examine the option of rescheduling the debt (Maphartia, 2004). Prior to rescheduling a debt that is being paid in installments, the agency should conduct a reassessment of the debtor's financial circumstances and ascertain their capacity to fulfil the obligation if it is rescheduled. The agency is also responsible for assessing whether it should compel the debtor to use pre-authorized debit for payments wherever feasible. For any kind of repayment arrangement, it is necessary for the terms and conditions of the rescheduling, which includes the acceleration clause, to be documented and endorsed by the borrower. The bank should not provide any endorsement for informal workout arrangements with debtors. Each bank should establish rescheduling policies, techniques, and criteria that are uniform and in agreement with each other. To adhere to credit management standards, it is necessary for the rules and procedures to maintain the present status of earnings and losses on rescheduling accounts, without considering their popularity.

Repossession of security: The purpose of this is not to strip the borrower of the property in any way, but rather to recover the outstanding debts. The process of recovering assets via repossession involves three key components: the seizure of the collateral, the assessment of its worth, and the lawful purchase of the collateral. These will be administered in a manner that is both very equitable and transparent. Repossession may only occur following the issuance of the aforementioned notice. Throughout the property acquisition process, all necessary legal processes will be strictly followed in compliance with the law. As a routine practice, the bank will take all required measures to ensure the security and maintenance of the property after it assumes ownership of it (Umoh, 2007). Early (2006) states that banks may use the assistance

of a personal collection agency to retrieve long overdue debts. Private collection companies have expenses, and these costs are covered by the revenue they collect. The creditor agency has the obligation of retaining the final authority to resolve conflicts, negotiate debts, cease or conclude collection activities, and report accounts to credit reference agencies.

Credit scoring systems: Utilising this approach as a means of credit restoration is a viable option. A credit score is a numeric indicator that shows an individual's creditworthiness. To assess the creditworthiness of a person, a credit score is used, which is supported by a statistical analysis of the borrower's credit history. The information included in a credit report is used to compute a credit score. Lenders, such as banks, use credit ratings to assess the potential risk involved in granting loans to consumers and mitigate losses resulting from debt. Financial institutions determine the most suitable candidate for a loan, together with the appropriate interest rate and credit limit, by using credit ratings (Capon, 2002). Credit scores are used to evaluate the most eligible individual. The bank will employ various loan follow-up measures such as written communication, telephone reminders, or personal visits by bank representatives. However, before taking any legal or repossession actions, the bank will ensure that borrowers are given sufficient written notice.

Chakraborty (2015) conducted an essay to identify the obstacles faced by banks in the debt collection process. The issues connected with debt recovery are as follows:

Customer Bankruptcy: If a customer, whether a person or a company, declares insolvency, the bank must promptly halt all collection efforts. Given the complexity and protracted nature of the bankruptcy filing process, it may take a considerable number of years, if not more, for a bank to recover any funds, if it manages to do so at all. Consequently, banks are confronted with a multitude of non-performing loans (Chakraborty, 2015)

Delinquent debtors: Financial institutions are facing increasing challenges in recovering funds from borrowers who have failed to make their obligations. The reason for this is that the presence of non-performing loans continues to exert strain on their capital reserves and weaken their ability to grow in a fiercely competitive setting. The proportion of consumers who fail to pay for valid reasons is quite small, however the number of persons who use tactics to delay or disregard payment is rather significant. Financial institutions are making significant efforts to get access to these customers and persuade them to furnish the bank with a justification for their conduct.

Customers unexpectedly falling out of business: Annually, a number of debtors get significant loans for corporate ventures, although they default on their obligations, resulting in the eventual and utter downfall of the organisation. This leaves the debtor vulnerable and unable of repaying whatever debts they have borrowed. The year 2015 (Chakraborty, 2015). This is often a cardinal obstacle that banks face.

Undertaking several efforts for commercial collections: When a customer fails to repay their obligations by the due date, the bank is obligated to send a substantial volume of communication to the client. This communication includes the transmission of alerts for outstanding payments, letters for debt collection, letters of request, and statements for follow-up purposes subsequent to the expiration of the due date. Regularly, emails and phone calls are sent. If this contact gets too bothersome, there is a likelihood that the bank may lose a portion of its most loyal clientele. As a result, it becomes a substantial obstacle.

Hiring a collection agency at last minute: Banks have a tendency to hire commercial collection agencies shortly after sinking in a sea of debtors, which escalates collection efforts

(Chakraborty, 2015). The most relatively easy part of the process is the granting of loans, but the recovery process is much more difficult. The only key is to take action before the loan completely goes bad, and this is only possible if loans are regularly monitored through multiple channels.

Factors driving Debt collection Outsourcing

The main reason why businesses outsource less advanced tasks is because they are cheaper and require less skilled labour. However, outsourcing advanced tasks is also a strategy that many businesses use to become internationally competitive by gaining access to knowledge and resources from other countries (Jensen and Pedersen, 2012). This assertion is supported by several research studies. Furthermore, the expansion of trade, economic changes in significant developing economies, enhanced control over intellectual property rights, the progressive development of the service sector in these economies, and the emergence of advanced information and communication technologies are among the various factors propelling this trend (Jensen & Pedersen, 2012). Debt collection outsourcing has gained significant traction in the business landscape, driven by various factors that prompt organizations to seek external assistance in recovering outstanding debts. This strategic move allows companies to focus on their core competencies while leveraging specialized expertise for efficient debt recovery processes. Several factors contribute to the growing popularity of debt collection outsourcing, each playing a pivotal role in shaping this industry such as:

Regulatory Compliance: Stringent regulatory requirements and evolving compliance standards in the debt collection industry necessitate specialized knowledge. Outsourcing provides access to professionals well-versed in local and international regulations, ensuring adherence to legal frameworks (Smith, 2020).

Cost Efficiency: Controlling operational costs is a paramount concern for businesses. Outsourcing debt collection services offers a cost-effective solution, eliminating the need for in-house infrastructure, staff training, and technology investments (Johnson, 2019).

Expertise and Technology: Specialized agencies employ cutting-edge technologies and employ experienced professionals with expertise in debt recovery. This enhances the efficiency of the collection process, leading to higher recovery rates (Jones, 2021).

Focus on Core Activities: Outsourcing debt collection allows businesses to concentrate on their core competencies, fostering growth and innovation. It enables internal resources to be redirected toward strategic objectives rather than being consumed by debt recovery efforts (Brown, 2018).

Flexibility and Scalability: Outsourcing provides the flexibility to scale operations up or down based on business requirements, adapting to fluctuating workloads without the burden of maintaining a dedicated in-house team (Clark, 2022).

However, the increasing demand for outsourcing in the debt collection sector is a response to economic and technological factors that negatively impact operational margins and the speed at which organisations need to grow. These factors are the cause of the need for enterprises to innovate promptly. Kumar et al. (2009) acknowledged the long-standing recognition of outsourcing important roles as a potential solution to these challenges. Jensen and Pedersen (2012) offer additional insight into the factors that contribute to outsourcing. They assert that the level of knowledge intensity within the outsourcing firm, as well as the firm's experiential learning in the outsourcing field, impact the likelihood of firms offshoring advanced tasks.

Outsourcing to low-cost nations may be seen as a learning-by-doing process, where the firm progresses through a series of steps in order to source for innovation. According to Maskell et al. (2007), experience plays a crucial role in shaping organisations' choices and actions when it comes to outsourcing. Additionally, they discover that experience plays a crucial role in the decision-making and behaviour of organisations when it comes to outsourcing. Organisations often see outsourcing as a way to reduce costs and focus on their core strengths by avoiding the outsourcing of strategic or core competency items (Arnold, 2000). They also manage outsourced relationships carefully to achieve this goal (Williamson, 1985, as cited by Ellram et al., 2008). This allows them to cut costs and invest resources more efficiently (Doig et al., 2001). Currently, there is a shift in attention towards the prevailing practice of outsourcing services, particularly the outsourcing of professional services to foreign locations. Ellram et al. (2008) state that the development of affordable and reliable information and communications technology has enabled the outsourcing of services to individuals in other nations.

Adoption and Integration of Technology in Debt Collection

A positive association exists between the many technological developments and the overall debt repayment in a certain year. According to Kiplagat (2012), the use of mobile phone payments, electronic money transfers, and standing orders had a positive effect on loan recovery. However, the use of debit and credit cards was shown to be negatively correlated with the quantity of loans recovered. During the last several decades, there has been a substantial growth in the technological industry, resulting in the development of novel financial instruments and processes in the financial sector. Bankley (2006) asserts that technology enables organisations to improve their operations. Technologically advanced organisations consistently seek out superior processes and systems management techniques to maintain their position as market leaders. Notably, the rapid progress in Information and Communication Technology (ICT) has played a crucial role in shaping banks' business strategies, customer services, and organisational structures, among other functions. Technology innovation is the production and dissemination of new technologies or improved iterations of current technologies for widespread usage. According to Sagar (2013), innovation consists of four components: research, development, demonstration, and deployment.

This remark represents the fundamental essence of innovation. In the 1950s, banks began installing the first automated accounting equipment, which signalled the beginning of technical progress in the financial sector. Due to the quick recognition by bankers that a large part of the labor-intensive information processing tasks could be automated using computers, automation became widespread in the banking sector during the following decades. The first automated teller machine (ATM) was reportedly developed in the United States of America in 1968. At that time, it was only a cash dispenser machine. According to Jayamaha (2008), technological progress has led to the swift processing and transmission of information, the streamlined marketing of banking products, enhanced consumer access and awareness, the growth of financial networking, and the establishment of regional and global connections on an unprecedented scale. This technological improvement has had a tremendous impact on the banking sector. The prevalence of online banking has seen substantial growth in recent years. Internet banking provides consumers with an extensive and user-friendly financial network that is cost-effective and convenient. This network enables clients to conveniently access financial services at their preferred time and location. The internet's widespread use facilitated the development of sophisticated communication networks, enabling the execution of online financial transactions. The internet has led to the development of integrating e-trading with online banking and bank websites. This is a crucial advancement in the promotion of banking products. Porteous and Hazelhurst (2004) argue that the internet has enabled the creation of

affordable professional networking opportunities in the finance industry. Hence, technical progress has resulted in the emergence of many payment channels, the innovation of new items, and the improvement of existing technology. These advancements have been the central focus of the financial industry.

Importance of Technology in Debt Collection

Repaying loans is a significant challenge for financial institutions. However, despite this difficulty, credit institutions persist in expanding their presence in the market, even in the face of a staggering number of borrowers who fail to make timely payments. To attain such remarkable results, it is necessary to make a focused effort towards implementing effective debt repayment strategies and developing suitable technological infrastructure. Otherwise, attaining such outcomes inherently becomes unattainable. Investing in technology is costly due to substantial capital investments, which may not immediately result in higher output and profitability. However, the significance of investing in technology cannot be ignored, making it an imperative rather than an optional decision, especially in the financial sector. The rationale for investing in developing forms of information technology Brian Dos Santos's study revealed the benefits of investing in information technology, despite the potential delay in reaping the returns. He contended that once the whole ramifications of the technology had been actualized, forthcoming endeavours will be more profitable than their current state. Internet banking, electronic payment technologies, and information exchanges are technological components that may be seen, and some of their effects can be directly evaluated (White, 2002). Additional examples include technical progress. Technology innovation may lead to a diverse array of potential, tangible, and quantifiable outcomes. While these financial technologies may not be the most prominent, they do underscore the many potential impacts. By using technology successfully, clients may be catered to in a manner that enhances their satisfaction and increases the likelihood of loan repayment, all without the need for expensive human follow-up strategies.

A greater percentage of debt recovery may be achieved by the use of information technology in the debt collecting process. This is achieved by enhancing portfolio management by automating payment tracking, generating alerts, and prioritising segmentation. Utilising information technology for collecting is crucial to guarantee adherence to the existing regulations governing the actions of the engaged company. Technology contributes to a reduction in delinquencies resulting from economic crises, which typically lead to an increase in the number of overdue accounts in a portfolio. One major advantage of technology is its ability to facilitate the improvement of collection follow-ups and payment operations via automation. Due to technological improvements, the specifics of each customer's responsibilities are now recorded inside the digital domain. Hence, collection managers may conveniently get this information using their mobile or desktop devices, and they can provide customised approaches that cater to the unique conditions of each client. The use of technology allows for the automation of collections and payments, resulting in improved debt management and the ability to track the productivity of individual managers and the effectiveness of the implemented collection plan. By consolidating all data into a single platform, it becomes possible to construct many indications. These indicators enable the examination of developed strategies and tactics to assess their effectiveness and propose potential enhancements for improved efficacy. Consequently, debt collectors transition into the role of financial consultants. Consequently, they may provide a customised solution to each individual client based on their specific payment habits. By using this approach, you may offer customers the chance to diminish the whole debt they are accountable for by making a single payment. Alternatively, if the debtor is facing challenges due to situations like unemployment or illness,

it may be possible to develop additional options, such as debt restructuring, to assist them. Integration of collection management systems has the benefit of expanding service channels. As a result, consumers have access to universally applicable methodologies for the portfolio recovery process.

One may improve the connection with the customer via several ways, such as text messaging, social networks, websites, and more. These channels may also be used for proactive debt collection activities, targeting consumers whose debt is nearing its expiration. This enables customers to circumvent the collection procedure for overdue payment, which would otherwise be obligatory. There are two alternatives for using technology in collection management: it may either be done internally inside the company or outsourced to an external party. Outsourcing the processes is a very effective method to have more control over the assigned portfolio. Similarly, it provides access to state-of-the-art technology used by highly skilled experts, whose oversight will contribute to the growth of the company's economy. Consequently, we can affirm that technology progress has fundamentally transformed the institutions accountable for global financial and debt management.

Current state of technology adoption in debt collection

The concept of a technology-driven banking system originated in 1950 with the introduction of computer-based financial services in the United States (Bátiz-Lazo et al., 2014; Gießmann, 2018). This marked the inception of the electronic banking idea. The digitization process initially started at a moderate pace, but it has progressively gained momentum over the last several decades (Oertzen and Odekerken-Schroder, 2019). The advent of Internet banking in the 1990s was followed by the emergence of mobile banking in the 2000s (Jiménez and Díaz, 2019). Commonly recognised digital payment methods (DPMs) currently include mobile banking, Internet banking, and bank cards provided by financial institutions. The financial industry and authorities have continually backed various digital payment methods (Cohen et al., 2020). The Covid-19 outbreak has led to an escalation of this process (Chen et al., 2020; Leong et al., 2022). Foster and Greene (2021) found that companies choose to replace cash acceptance with digital payment methods (DPMs) in response to concerns that Covid-19 may be transmitted via the use of physical money. However, it is important to note that the danger of contracting Covid-19 via the exchange of money has been thoroughly assessed and shown to be small. According to Foster and Greene (2021), 62.5% of the participants in a research conducted in the United States in 2020 said that they started making online payments after 2019. The banking industry has played a significant role in driving the bulk of innovative advancements in the field of finance. Starting from the initial implementation of technology that stored information or had value in the early 15th century, the banking industry surpassed the previous constraints on the use of physical mediums and allowed the market to operate within a regional context. This progress continued until the 19th century, when simulation technology was introduced. This was achieved by using simulation technologies. From the mid-20th century until the 2007 financial crisis, the use of digital information and communication technologies introduced the age of digital financial technology. This period was marked by the establishment of international electronic networks, the introduction of interface standards, and the advancement of standardised software. In the digital era, the expansion of information and communication technology has resulted in an increase in the outsourcing of many operations and procedures by banks. However, there is still a significant level of vertical integration.

Nevertheless, in comparison to other enterprises within the financial industry, banks allocate the highest amount of funds towards investments in digital information and communication

technology. Investing a large amount of resources in information and communication technology is not in line with the digital transformation of the banking industry's processes and business model. Moreover, the inefficiency caused by this situation has led to the emergence of the Fintech banking sector, now being shown. The banking sector is using fintech to improve both the user experience and the operational efficiency of banking. The present corpus of research mostly focuses on investigating the fintech strategy and risk for banking from the supply side. Zavolokina and her colleagues conducted an analysis on the cooperation paradigm known as "peer to peer" between Indonesian banks and Fintech firms. Chang et al. conducted a research to examine how Indonesian banks modified their business operations in reaction to the emergence of fintech and competed with other fintech businesses. Examining the impact of Fintech adoption by bank users from a fixed viewpoint may help enhance the quality of services provided to bank customers and strengthen the connection between banks and their clients. Furthermore, it has the capacity to provide new insights and a more thorough understanding of the emphasis on using Fintech services. Due to the comparatively lower financial literacy of millennials in relation to older generations, they are currently not a significant demographic for banks. This is due to the fact that millennials tend to be of a younger age compared to their older counterparts. Over time, the financial prowess of millennials will gradually enhance, positioning them as the ultimate dominant users of the internet platform. Hence, investigating the determinants that influence the acceptance of fintech services among bank clients would greatly aid banks in meeting the demands of the millennial cohort in the future.

Types of technology utilized in Debt collection

In today's technological landscape, debt collection agencies can leverage technological strategies to improve efficiency and effectiveness in their operations. Here are some efficient and advanced strategies for debt collection in the current technological landscape:

Automation and AI: Automation and artificial intelligence have the potential to change and improve the debt collection process in the sector of finance. Debt collection firms may streamline their processes, reduce their reliance on human labour, and enhance their efficiency by using automated technology and leveraging the capabilities of artificial intelligence. Automated systems have the capability to do routine tasks such as sending reminders, arranging follow-up appointments, and generating customised communications. This enables debt collectors to allocate a substantial amount of time to more intricate cases, therefore enhancing their focus. Artificial intelligence technology has the capacity to evaluate vast amounts of data, identify patterns, and provide valuable insights that enable efficient data collection. Through the use of automation and artificial intelligence, debt collection agencies may enhance their operational efficiency, amplify debtor engagement, and attain higher rates of debt recovery.

The importance of using technology, such as automated systems and artificial intelligence, in the debt collection process cannot be overstated. By using these technologies, several benefits may be achieved, including enhanced productivity, heightened precision, and an elevated level of customer satisfaction. Automation reduces the probability of human error and ensures that follow-ups are consistently and promptly conducted, resulting in enhanced debtor satisfaction. Moreover, artificial intelligence technologies have the capability to assess data on debtors, payment histories, and other relevant information to create prediction models that may identify accounts with a high probability of default and focus collection efforts accordingly. By using this data-driven approach, debt collectors may effectively allocate resources and focus their efforts on accounts with higher prospects of successful recovery. Automation and artificial intelligence technologies in debt collection have the potential to completely transform the

industry, leading to more streamlined processes, higher rates of debt recovery, and improved customer relationships.

Multi-Channel Communication: Efficient and simple communication may be accomplished by actively involving debtors via several channels, including as telephone, email, text messaging, and Interactive Voice Response (IVR) technology. The use of technology in debt collection has led to the establishment of effective and user-friendly communication channels with debtors. These channels include connections with many channels. Debt collection agencies today possess the capability to engage with debtors in a customised and convenient way via the use of several communication channels. The communication channels included are the telephone, email, text messaging, and Interactive Voice Response (IVR) systems. Employing this multi-channel approach enables debt collectors to contact with debtors via their preferred communication methods, hence enhancing the likelihood of successful engagement and debt retrieval. By using technology to facilitate contact across many channels, debt collection businesses may enhance response rates, foster more trust and cooperation among borrowers, and elevate debtors' satisfaction with the collection process.

The fundamental reason for the significance of multi-channel communication in debt collection is its ability to cater to the diverse communication preferences of borrowers. Regarding communication mediums, borrowers may have varying preferences. Debt collection agencies provide a range of communication methods to accommodate debtors' preferences and ensure effective contact. By using this approach, barriers to communication are minimised, the probability of a debtor's reaction is heightened, and a positive debtor experience is cultivated throughout the whole of the debt collecting procedure. Moreover, the use of technology allows for the automation and customisation of communications across several channels, ensuring that communication remains uniform and focused. Debt collection agencies may use technology to integrate communication channels, monitor interactions, and maintain a comprehensive record of contacts. Ultimately, the use of technology that facilitates multi-channel communication empowers debt collection companies to establish contact with debtors that is both efficient and easy. As a consequence, this leads to improved interaction with debtors and increased rates of debt collection.

Online Payment Portals: The integration of technology in debt collection has led to the implementation of online payment portals, offering debtors a secure and user-friendly option for making payments and setting up repayment arrangements. Debt collection businesses use internet platforms to provide debtors a convenient and secure user interface for making debt payments. To cater to the diverse interests of debtors, these online payment portals provide a range of payment options, such as electronic fund transfers, digital wallets, and credit card payments. Debt collection agencies use these platforms to reduce barriers to repayment, speed up the payment process, and enhance debtor satisfaction by offering flexibility and convenience in managing their financial obligations.

The fundamental reason for the significance of online payment portals in the context of debt collection is their ability to provide prompt and efficient debt repayments. These platforms are available 24/7 to debtors, allowing them to make payments at their convenience, without the necessity for direct communication with debt collection professionals. Furthermore, online payment portals may be integrated with automated notifications and warnings, so guaranteeing that debtors are informed about upcoming payment deadlines and facilitating their ability to respond accordingly. These platforms also provide debtors the option to create structured repayment plans, allowing them the autonomy to manage their obligations in an orderly manner. Debt collection companies may accomplish many positive results by using technology

to provide secure online payment gateways. These benefits include raising the likelihood of successful debt recovery, enhancing cash flow, and providing a better experience for debtors.

Customer Relationship Management (CRM) Software: CRM software in debt collection functions as a centralised repository for overseeing debtor data, including contact information, payment history, and communication records. Debt collection firms may get a comprehensive understanding of each debtor's record, which empowers them to customise their collection techniques according to specific circumstances. Debt collectors have convenient access to debtor profiles, allowing them to check unpaid amounts and monitor payment statuses, which enables them to communicate more effectively and precisely. CRM software is a pivotal technology used to optimise operations, facilitate communication, and promote overall efficiency. CRM software facilitates streamlined task management and automation of workflows. Debt collection firms have the ability to establish reminders, alerts, and automated follow-up procedures in order to guarantee prompt and constant connection with individuals who owe debts. This automation not only enhances efficiency but also mitigates the possibility of overlooked or postponed encounters. Debt collectors have the ability to schedule calls, send emails, or text messages straight from the CRM platform, which guarantees a smooth and well-structured method for debt collection.

CRM software also enables collaboration within debt collection teams. Multiple team members can access and update debtor information in real-time, enabling seamless coordination and collaboration. This allows for efficient handovers, shared knowledge, and better overall team productivity. Additionally, CRM software often provides reporting and analytics capabilities, allowing debt collection agencies to track key performance indicators, monitor success rates, and identify trends or patterns. This data-driven approach empowers debt collectors to make informed decisions, optimize collection strategies, and improve overall debt recovery rates. The benefits of utilizing CRM software in debt collection are numerous. It enhances debtor engagement by enabling personalized and targeted communication, resulting in increased debtor satisfaction and higher chances of successful debt recovery. The automation and centralization of debtor information harmonize processes, reduce manual effort, and improve the reporting and analytics functions of the team. By using this state-of-the-art technology, debt collection agencies may enhance their operational efficiency, strengthen their debtor engagement, and get superior outcomes in the contemporary digital landscape.

Impact of Technology on Debt Collection Effectiveness

Debt collection agencies may enhance their effectiveness, enhance debtor engagement, and produce superior results in the current digital era by using advanced technologies available to them. The financial services industry is seeing a profound change due to digital innovation. Financial technology has seen global advancements, including mobile money, peer-to-peer (P2P) or marketplace lending, and crypto-assets like cryptocurrency. In the last decade, fintech has significantly enhanced the availability and convenience of financial services for retail users. Simultaneously, artificial intelligence (AI), cloud services, and distributed ledger technology (DLT) are revolutionising wholesale marketplaces. These technologies are transforming wholesale markets across several disciplines, such as financial market trading and regulatory and supervisory technology (regtech, etc.). Many new firms have formed to incorporate innovative technology and meet client needs, while most established organisations have said that digital transformation is a key strategy objective (Feyen et al., 2021).

Major banks are rapidly addressing the lack of digitalization in their internal operations and client services to stay competitive against fintech startups and huge technology corporations,

who have also entered the market (BIS 2019; Frost et al 2019). This is done to ensure their competitiveness in the market. These advancements possess the capacity to enhance market diversity, competitiveness, efficiency, and inclusivity. However, they also carry the potential to amplify concentration. Innovation, particularly in developing nations and growing markets, has led to the introduction of competition and increased inclusion (Pazarbasioglu et al., 2020; Frost et al., 2021). There is compelling evidence to suggest that financial technology has seen significant growth, particularly in regions where the financial system was less developed compared to its current state (FSB 2020; Didier et al 2021). Conversely, the underlying principles of intermediation, together with the emergence of innovative technology, might lead to a consolidation of both traditional and modern providers of financial services. An ongoing inquiry is now examining whether major technology platforms are involved in anticompetitive or monopolistic activities.

Regulators are facing challenges in determining the most efficient methods to control and oversee the financial services industry as it adopts technology-driven structures. This industry is now distinguished by the emergence of new players and business models. In addition, authorities are striving to tackle possible obstacles to financial stability, financial integrity, equitable competition, and consumer safeguarding (including data privacy). The underlying forces that are propelling these advancements, together with the potential outcomes in terms of the configuration of the industry, provide policymakers with valuable insights on how to use the benefits of fintech while mitigating some risks, particularly concerning competition and market organisation. This discussion primarily focuses on the economic and technological aspects that are relevant to a broad spectrum of financial services. It recognises the industry's encompassment of a wide range of products and services, as well as its composition of several sub-markets that may use different technologies or possess distinct economic structures. This evolution is marked by improved communication, data analytics, and streamlined processes. In this context, several key aspects highlight the transformative influence of technology on debt collection including:

Communication Channels: Technology has diversified communication channels, allowing debt collectors to reach debtors through emails, text messages, and online platforms. This multichannel approach facilitates quicker responses and engagement, thereby enhancing overall collection rates (Brown, 2018).

Data Analytics and Predictive Modeling: Advanced analytics and predictive modeling tools enable debt collectors to assess debtor behavior and payment patterns. By leveraging big data, collectors can make informed decisions, prioritize accounts, and tailor strategies for optimal results (Smith, 2020).

Automation and Artificial Intelligence: Automation and AI-powered systems streamline routine tasks such as reminders, follow-ups, and documentation. This not only reduces operational costs but also ensures consistency and compliance with regulations (Jones, 2019).

Online Payment Platforms: The advent of secure online payment platforms has simplified the debt repayment process. Debtors can easily make payments, set up automated schedules, and monitor their accounts online, enhancing convenience and boosting repayment rates (Lee, 2021).

Compliance Management: Technology aids in ensuring compliance with ever-evolving regulations by automating monitoring processes. This reduces the risk of legal issues and enhances the overall ethical standing of debt collection practices (Williams, 2022).

However, the integration of technology into debt collection practices has led to a paradigm shift, offering a range of benefits that enhance overall effectiveness and efficiency. These advancements are crucial for navigating the complexities of the modern debt collection landscape.

Factors Influencing the Effectiveness of Technology in Debt Collection

The effectiveness of technology in debt collection is influenced by several factors, each of which has the capacity to change the outcomes and the consequences of its application. Debt collection businesses must possess a comprehensive comprehension of these aspects in order to effectively use technology in their operations. An essential factor to take into account is the magnitude and configuration of the organisation. When it comes to investing in novel technology solutions, bigger businesses may possess more resources and capabilities to do so, whereas smaller organisations may be limited in their technical expertise and financial means. Moreover, the organisational structure may impact both the decision-making process and the capacity to effectively use technology. Several variables might either facilitate or hinder the incorporation and use of technology in debt collection processes. Several elements that contribute to this include organisational hierarchy, communication channels, and interdepartmental collaboration.

The effectiveness of technology in debt collection is also greatly impacted by other factors, including those associated with the market and the business. Every industry has unique characteristics, regulatory requirements, and consumer behaviour patterns that might potentially influence the implementation and impact of technology. Certain industries may need the use of specific technical solutions to ensure compliance with increasingly strict regulations. Furthermore, the suitability and effectiveness of technical solutions may be affected by market dynamics, including elements like as the magnitude and intricacy of loans, the frequency of delinquencies, and the level of competition. To effectively create technology implementation techniques and choose appropriate solutions for the debt collection environment, it is crucial to possess a comprehensive awareness of the unique components specific to the business and market. The efficacy of technology in debt collection is mostly determined by elements such as the organization's scale and framework, as well as the industry and market circumstances. This emphasises the importance of considering these elements while deploying and improving technological solutions in the debt collecting process.

Organizational size and structure: The efficacy of technology in debt collection may be significantly influenced by the magnitude and configuration of an organisation, which can have a substantial effect. When considering investments in advanced technical solutions, bigger businesses often possess more resources and financial capabilities. The implementation and upkeep of technology might be managed by professional teams or departments exclusively dedicated to information technology. In contrast, smaller businesses may have budgetary constraints and lack technical expertise, which might hinder their ability to effectively adopt and use technology. Another crucial component is the organisational structure. Hierarchical companies may encounter challenges in decision-making and implementation due to the intricate nature of their approval processes or their initial resistance to change. On the other hand, businesses with fewer hierarchical structures and efficient communication channels may find it easier to integrate technology smoothly and make agile decisions.

Industry and market factors: The magnitude and configuration of an organisation may have a substantial influence on the efficacy of technology in the process of debt collection. This is due to the fact that these elements might have a substantial influence. Large corporations often

possess more resources and financial capabilities compared to smaller firms when it comes to investing in innovative technological solutions. Specialised teams or departments solely focused on information technology are responsible for the implementation and upkeep of technology. These teams or departments may have the responsibility for it. However, smaller organisations may have constraints in terms of their budget and limited technical skills, which might impede their ability to fully adopt and use technology. This might potentially hinder their capacity to effectively adopt and exploit technology. The structure of the organisation is an extra component that is quite important. Hierarchical firms may have difficulties in decision-making and execution due to the complexity of their approval processes or their initial reluctance to embrace change. Hierarchical organisations may also encounter challenges. On the other hand, companies with fewer hierarchical structures and efficient communication channels may find it simpler to adopt technology seamlessly and make rapid choices.

Employee training and skill development: The level of success technology achieves in debt collection is heavily influenced by the extent to which personnel in an organisation get training and continually improve their abilities. Personnel often need to acquire new tools, software, or processes to effectively deploy technology solutions. To ensure that workers can effectively use the technology and maximise its potential, it is essential to provide comprehensive and ongoing training sessions. The training should include not just the technical aspects, but also provide people with knowledge on the optimal methods for using technology in debt collecting, along with the ethical considerations that must be adhered to. An additional advantage of skill development courses is their potential to aid workers in enhancing their "soft skills," including as communication and bargaining, which are crucial in the debt collection process. Proficiently trained employees with requisite abilities are more inclined to effectively use technology, demonstrate adaptability to new techniques, and attain superior outcomes in debt collection endeavours.

Organizational culture and change management: The effectiveness of technology in debt collecting is significantly impacted by the corporate culture and change management approaches. To cultivate a positive disposition towards embracing new technology and change, it is necessary to nurture the organisational culture. The successful integration of technology into debt collection methods is more probable in a culture that highly values innovation, consistently pursues improvement, and eagerly embraces technological advancements. Change management approaches are crucial when guiding people in the process of switching to new technologies. Efficient change management requires many essential elements, such as transparent communication, stakeholder involvement, and the analysis of change resistance. An organization's chances of improving technological efficiency in debt collecting are greater when it prioritises change management activities and fosters a conducive atmosphere for technology implementation. The efficiency of technology in debt collection will be greatly influenced by the careful consideration and effective management of various factors. These factors include the size and structure of the organisation, industry and market conditions, employee training and skill development, as well as the management of organisational culture and changes. Companies that use a strategic approach to handling these difficulties are more likely to maximise their utilisation of technology and get superior outcomes in debt collection.

Conclusion

The integration of technology in debt collection has revolutionized the industry, bringing about significant improvements in effectiveness and efficiency. This paper has explored the various technological advancements that have transformed debt collection processes, including the use of artificial intelligence (AI), automation of collections and payment follow-ups, and the

increase in communication channels with customers. These advancements have led to better portfolio management, personalized debt collection strategies, improved decision-making through advanced analytics, and enhanced customer relationships. By leveraging technology, debt collection agencies can optimize their operations, increase recovery rates, and ensure compliance with legal regulations. This research article investigates the impact of technology on improving the efficiency of debt collection. The findings highlight the significant impact of technology on debt collection procedures, as well as its ability to enhance debtor engagement, streamline operations, and increase the rate of debt recovery.

Recommendations

Based on the research findings, the following recommendations are proposed to enhance the effectiveness of technology in debt collection:

- The researcher recommended that a thorough assessment be conducted on the organization's current technological infrastructure and identify areas where technology can be integrated.
- Comprehensive training programs should be provided to employees on the effective use of technology tools and platforms.
- The benefits and goals of technology should be clearly communicated to member staff and stake-holders to ensure a smooth transition and successful integration of technology.
- Security measures, including encryption, access controls, and regular data backups, to protect debtor information should be implemented.
- Data should be continuously analyzed to identify trends, patterns, and areas for improvement. Use the insights gained to refine collection strategies, enhance debtor engagement, and optimize operational efficiency.
- Encourage the use of technology platforms for real-time collaboration, information sharing, and task coordination, through regular meetings or workshops to share best practices, success stories, and lessons learned from utilizing technology in debt collection.

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ETHICAL DILEMMAS IN AI-DRIVEN HEALTHCARE: NAVIGATING PRIVACY, CONSENT AND BIAS IN PATIENT DATA

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ABSTRACT

As artificial intelligence (AI) technologies continue developing rapidly, their application within healthcare promises significant potential to advance medical understanding, improve clinical decision-making, and enhance health outcomes. However, utilizing AI systems also inevitably raises complex ethical issues that must be carefully navigated to ensure technologies augment healthcare responsibly. This paper examines several key ethical dilemmas arising from the use of AI when analyzing sensitive patient data, with a focus on concerns around privacy, informed consent, algorithmic bias, and the need for robust frameworks of governance, oversight and accountability. Potential harms related to lack of transparency, unfair biases within algorithms, and insufficient consent practices are discussed. Technical and procedural approaches for mitigating these risks, such as dynamic consent models, algorithm auditing and impact assessments, are reviewed alongside their limitations. Finally, the importance of multi-stakeholder collaboration is emphasized to establish standardized principles that protect privacy, equity and trust as AI increasingly transforms clinical practice going forward.

KEYWORDS: Ethical Dilemmas, AI, Healthcare, Privacy, Consent, Bias and Patient Data

Introduction

Artificial intelligence is poised to transform modern medicine through advanced tools and technologies that analyze the growing volume of patient data. Healthcare has long struggled with inefficiencies as clinicians strive to keep up with information overload (Sbaffi et al., 2020). AI offers solutions to process this deluge of data to discover meaningful patterns and insights that can improve patient outcomes. The digitization of medical records through electronic health record (EHR) systems in recent decades generated huge datasets. Simultaneously, the reduced costs of collecting genetic, imaging, and other biomarker data through various omics technologies have further expanded available data. This clinical big data holds tremendous value when mined using machine learning algorithms. Similarly, wearable

devices and Internet of Things technologies now routinely collect troves of daily health statistics on individuals.

Propelled by these data sources, AI is proliferating across many key areas within healthcare. Medical diagnosis has seen groundbreaking progress from deep learning on medical images. Systems trained on millions of retinal scans can detect diabetic retinopathy more accurately than humans alone (Erfurth et al., 2018). Natural language processing tools extract useful information from unstructured physician notes in EHRs. Drug discovery leverages AI to analyze molecular structures at rapid, massive scales beyond human cognitive capacities. Healthcare providers and insurers have also begun piloting AI for applications like readmission risk prediction, personalized disease screening recommendations, and remote patient monitoring for chronic conditions. Academic medical centers and startups alike recognize new opportunities to enhance patient care, cut costs, and optimize resource allocation with AI. This uptake reflects growing enthusiasm for AI to innovate clinical practice and outcomes through big data analytics. However, healthcare AI development remains in an early stage overall and key issues require addressing to ensure its proper and responsible evolution. This paper examines some of the most pressing ethical concerns that have emerged alongside the ascent of AI in medicine.

First, it aims to examine the important ethical issue of patient privacy and data sharing in regards to how personal health information is collected, stored, and utilized without clear consent or oversight in many AI applications today. As data serves as the fuel powering healthcare AI, ongoing collection and dissemination practices could seriously undermine patient trust without sufficient privacy protections. Second, this paper will analyze the dilemma of obtaining informed consent from patients when AI systems are constantly evolving through self-learning techniques. The complexity of machine learning may obscure how data is actually used, requiring novel models of Dynamic or Continuous Consent to uphold autonomy principles.

Third, the issue of algorithmic bias will be explored, as biases present in the datasets used to train AI could negatively impact particularly vulnerable patient groups through distorted interpretations or adversely skewed predictions. It is crucial that techniques to detect unfair biases are developed and that mitigation strategies are mandated to ensure equitable, just outcomes across all populations.

By systematically investigating these intersecting ethical tensions of privacy, consent and bias, this research aims to substantiate the pressing need for frameworks to guide responsible development and oversight of AI in clinical decision-making. Only by adequately addressing dilemmas that endanger patient rights and well-being can the full societal benefits offered by healthcare AI be appropriately realized and its adoption supported. This analysis contributes to scholarly understanding of challenges that must be resolved to ensure AI augments rather than jeopardizes quality care.

To properly resolve the complex ethical issues raised by the use of artificial intelligence technologies in healthcare, new models of governance, oversight and technical solutions must be established. Unless the dilemmas of privacy, informed consent and algorithmic bias are systematically addressed through participatory frameworks involving patients, clinicians, technologists and policymakers, the growth of AI applications risks undermining trust in the

medical system and exacerbating inequities in patient treatment. This research argues that respecting principles of transparency, accountability, fairness and autonomy is essential for ethically guiding the continued development and integration of AI to augment, rather than compromise, quality care and access.

Effect of Artificial Intelligence on Privacy and Data Sharing in Health Care System

One of the core issues surrounding the use of patient data in AI systems is how personal health information (PHI) is currently collected and managed by healthcare providers and institutions. As noted by Ohm and Territo (2019), the transition to electronic health records (EHRs) over the past two decades has "transformed clinical data into a highly liquid asset, easily assembled into vast datasets and transferred among different institutions." However, the sharing and integration of data across disconnected information systems has often occurred without sufficient attention to privacy safeguards or patient consent (Katz et al., 2018). Most EHR software adopted by hospitals and physician practices allows for the wide collection of structured and unstructured data, from demographics and medical history to test results, billing codes, and physician notes (Oh et al., 2018). In addition to primary clinical settings, the rise of third-party applications integrating patient health information has created a complex network of data flows with unclear oversight (Ohm & Territo, 2019). Once collected, PHI is routinely pooled into large databases and used to train AI algorithms without transparency about data uses or opportunities for individuals to access, correct or request deletion of their records (Katz et al., 2018). The lack of meaningful restrictions on the collection and sharing practices has understandably raised privacy concerns.

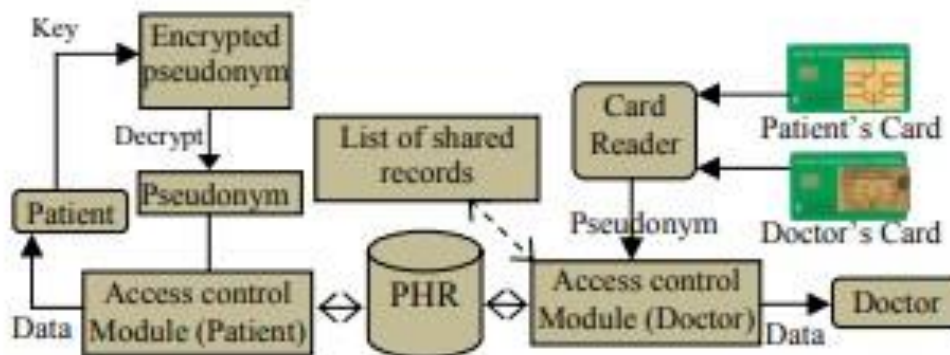


Fig. 1. Strong authentication mechanism protects PHR from unauthorized access

Accessing PHR by a doctor requires correct identification of the doctor as well as the patient. This is done at the doctor's workplace by using both the patient's smart IC card and the doctor's smart IC card through a card reader. Fig. 1 sketches strong authentication mechanisms of PHR system. The patient's smart card supplies patient's pseudonym to identify and supply only the respective patient's health records. However, this pseudonym is not disclosed to healthcare professionals. Each patient is allowed to create/update the policies for accessing his health records by third parties (e.g., the healthcare professionals who are not the creators of the records). In his profile, a patient sets general access rules for healthcare professional for accessing his health records. For example, a profile may specify that a doctor can view only the records of the respective patient that are created by the doctor himself. Another profile may set that a doctor can view only the records of the respective patient that are created by any doctor in the same department (or hospital) where the accessing doctor belongs to. Allowing

individual patient to create his own privacy policies gives flexibility and freedom to a patient in controlling his privacy independent of others.

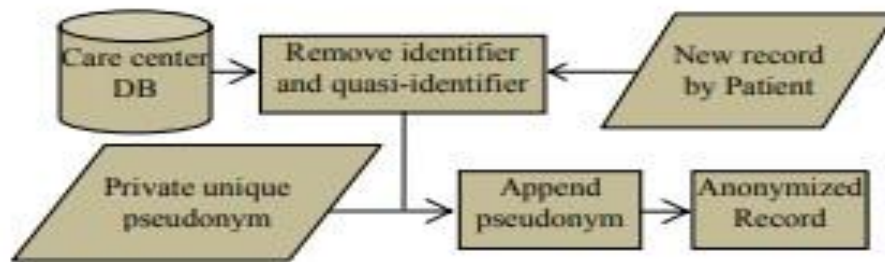


Fig. 2: After identifiable information is removed, a patient appends his private pseudonym with his records.

A patient stores his pseudonym into his encrypted profile. The system accepts a new pseudonym that is not already in use by others. The patient needs to decrypt his pseudonym when he wants to add (or accept from external source) new health record. The system takes the decrypted pseudonym and appends with his new records. A pseudonym is created for the system use only and is visible to its holder only.

Patient Control Over Data Use and Data Transparency

Patients often have limited awareness of how their personal medical data is used beyond direct care delivery (Oh et al., 2018). A survey by the Kaiser Family Foundation found only 8% of Americans believes hospitals and healthcare providers do a good job of protecting patient privacy (Hoffman & Podgurski, 2020). The opacity surrounding data stewardship stands in contrast to privacy principles of openness, transparency and individual participation (Katz et al., 2018). Even when institutions publish privacy policies, the legal language remains too complex for most non-experts to understand how data is actually manipulated or what rights patients can exert (Ohm & Territo, 2019). This lack of transparency risks eroding trust that health information will remain private and secure (Hoffman & Podgurski, 2020).

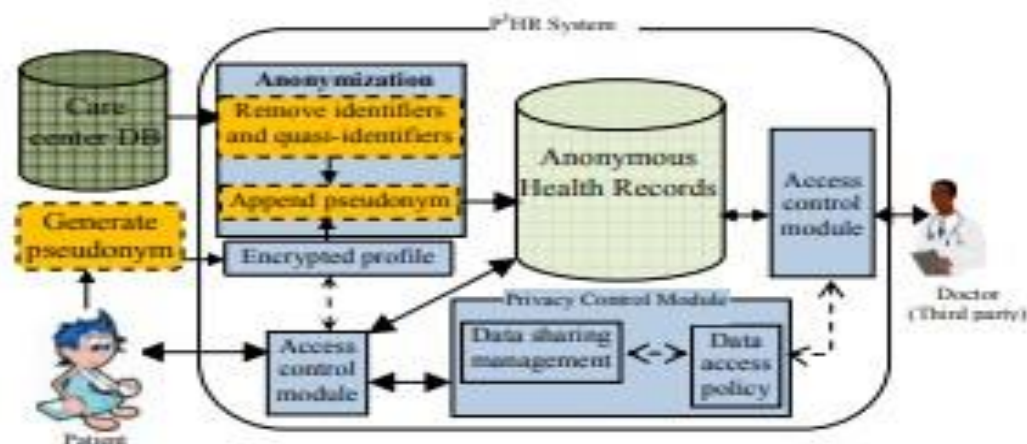


Fig. 3: Architecture of Privacy-aware Patient-Controlled Personal Health Record (P3HR) system.

To preserve patient's privacy from intruders, P3 HR system stores patient's health records in an anonymized form. Before storing health records from a care center database (or from patient's direct input) into the P3 HR database, the anonymization module removes all identifiers and quasi-identifiers E. Ferrari; B. Thuraisingham, A () from the records so that a particular record cannot be associated with a specific identifiable individual. (2005) Thus, even if an intruder gets access to the P3 HR anonymous health database, he cannot determine which record or set of records belongs to a particular patient. To allow an authorized party (e.g., doctor) access a set of records of a particular patient legitimately, the system needs to associate each record to the respective patient. To achieve these two conflicting goals of anonymization and keeping each record associated with the respective patient, the patient creates his unique ID (known as digital pseudonym) using Unique User-generated Digital Pseudonyms mechanism P. Schartner, and M. Schaffer(2005). A patient can generate his pseudonym locally in his personal security environment, e.g. in his smart card or his personal digital assistant. There is no need for any information interchange between the patient and P3 HR system, except P3 HR supplies a unique identifier for each request (e.g., auto increment number). The digital ID is long enough and randomized so that one cannot guess it from patient's background or personal information (e.g. name) obtained through other channel/source. The patient also doesn't need to remember his digital ID.

Factors influencing Data Breaches and Inappropriate Data Sharing in Health Care System

Unfortunately, as the collection of protected health information (PHI) has increased without adequate safeguards, so too have incidents of inappropriate data sharing and breaches. In recent years there have been several highly publicized cases that demonstrate privacy risks when insufficiency with security practices to safeguard breaches. In 2018, over 80 million records were compromised in a breach of Quest Diagnostics, one of the largest clinical lab providers in the U.S. (Lieber, 2019). Hackers gained access to financials, medical tests, and Social Security numbers of patients. A year prior, Premera Blue Cross reported a cyberattack exposing 11 million records including claims, diagnostic codes and bank details (Tschider, 2020).

Beyond hacks, data has also been misused or shared improperly within healthcare organizations. The University of Rochester Medical Center allegedly gave Anthem, an insurance company, full access to its EHR system to data mine patient histories for risk profiles to sell (Hoffman & Podgurski, 2020). DeepMind, a UK AI company, obtained 1.6 million royal free patient records to develop an app without fully informing patients or obtaining consent (Raji et al., 2020). These infractions highlight legitimate fears that sensitive health information could be exploited without oversight if privacy protections are not codified and enforced. Clear legal and technical measures are clearly needed to prevent such inappropriate breaches and uses from continuing to occur.

Health Care System Perspectives of Patient Privacy and Ownership

In light of the ongoing issues with privacy and consent in healthcare data use, experts have called for stronger patient protections and control. One proposed approach is enshrining privacy as a property right through data ownership models (Ohm & Territo, 2019). By allowing individuals to exert more control as the assigned owners of their own health information, it could balance the needs for open data sharing with individual autonomy (Katz et al., 2018).

Some suggestions for implementing data ownership include giving patients' rights to access, correct and delete their own records; to consent or refuse sharing for specific secondary uses; and to receive financial compensation for commercial uses of their data in limited forms (Raji et al., 2020). California recently passed the California Consumer Privacy Act to recognize certain privacy rights and establish an "erasure" option to remove personal information (Oh & Krishnan, 2019). Patient language requesting their data not be used would also hold more legal weight as an individual's property (Tschider, 2020). However, others note full ownership could hamper useful research if taken to an extreme (Hoffman & Podgurski, 2020). A potential compromise model conceptualizes patients as "information fiduciaries" with stewardship but not transaction rights over their data (Ohm & Territo, 2019). Medical organizations would maintain records and use them for approved purposes, yet do so with a legally enforced duty of care, respect and loyalty to individual interests. More debate is still needed to find balanced, practical solutions that support both data sharing and privacy (Katz et al, 2018).

Another key ethical issue is ensuring patients provide informed consent for use of their personal health information, especially as data is increasingly being used to develop and evaluate AI technologies. Traditionally, consent forms notified individuals about direct clinical care rather than ancillary research and long-term database storage (Katz et al., 2018). However, AI models are constantly evolving through self-learning, making it difficult to provide meaningful details upfront (Raji et al., 2020). Obtaining true informed consent poses particular challenges for complex systems like AI. Patients may not comprehend how their de-identified data is analyzed in seemingly anonymous ways that could still reveal insights about their personal health or risk certain outcomes (Ohm & Territo, 2019). Consent language also tends to be legalistic and technical rather than accessible, leaving many individuals unable to make fully informed choices (Oh et al., 2018). This reduces autonomy as the right to control use of one's private information is not substantively enabled.

Some experts argue the notion of a single consent needs rethinking, advocating for models of "dynamic" or "continuous" consent that allow patients ongoing participation as AI applications change over time (Hoffman & Podgurski, 2020). Periodic updates and easy opt-out options may better respect autonomy and build trust in institutions (Tschider, 2020). Ideas incorporate mechanisms like dashboard access to data uses, simple adjustments to consent preferences, and even micro-payments rewarding ongoing contribution (Katz et al., 2018). However, implementing dynamic models at scale remains challenging and requires ongoing research.

Complexities in Current Consent Processes in AI Systems

The dynamic, evolving nature of modern AI technologies has revealed deficiencies in traditional models of obtaining a single informed consent from patients. As AI incorporates continuous learning and refining using vast datasets, the ability to fully comprehend future uses and implications for individuals becomes more limited (Hoffman & Podgurski, 2020). Existing consent forms usually seek approval for broad, vague purposes like "research" or "quality improvement" which do not specifically acknowledge AI applications (Oh & Krishnan, 2019). Even defining the boundaries and timeframes around a single study or model becomes ambiguous (Katz et al., 2018). As algorithms are retrained on new data, predictions and outcomes may subtly shift in unpredicted ways that change associated risks or biases (Raji et al., 2020).

Obtaining truly informed consent also relies on transparently informing individuals about possible future uses and an algorithm's technical specifications or training methodologies that are still being developed (Tschider, 2020). However, even AI researchers acknowledge their own understanding of how models work remains limited (Ohm & Territo, 2019). It is thus unreasonable to expect patients to comprehend algorithmic complexities, much less how data may be deployed years in the future as technologies advance. Some argue the notion of blanket consent for undefined, adaptive uses of personal health information through AI may violate ethical principles of respect for persons by failing to ensure comprehension and voluntariness (Hoffman & Podgurski, 2020). New governance frameworks are needed that move beyond one-time paperwork and toward genuine engagement with individuals over the long-term evolution of these powerful technologies.

Challenges of Patient Notices Given Evolving Algorithms

Even assuming healthcare organizations pursue dynamic models of consent, a major obstacle remains around how to provide patients with genuinely meaningful notice about AI systems and uses of their data. As algorithms continuously learn and update themselves using additional inputs, notice must evolve as well to preserve comprehension and choice. However, accurately forecasting how AI applications will change as technologies mature presents considerable difficulties (Ohm & Territo, 2019). Models often lack interpretability, relying on complex calculations between multitudes of variables in ways their designers cannot fully unravel (Katz et al., 2018). Minor modifications to training data or parameters could transform behaviors and predictions in unseen ways, limiting advance predictions (Raji et al., 2020).

Notice would also need to convey how data is processed and analyzed on the back end without exposing intellectual property or compromising system security that bad actors could exploit (Hoffman & Podgurski, 2020). Overly technical disclosures risk confusing patients no more knowledgeable than providers, while high-level descriptions may be too vague to meaningfully assess implications (Tschider, 2020). Some proposals involve multidisciplinary review boards continually evaluating algorithms as they evolve to flag any revisions warranting notification (Oh et al., 2018). However, this approach poses scalability challenges and does not necessarily clarify notices themselves (Katz et al., 2018). More research and experimentation is still needed to balance informed choice with competing factors in a way that can scale for progressing AI technologies (Ohm & Territo, 2019).

Options for Continuous consent models

Recognizing the limitations of one-time consent, specialists have generated proposals for implementing dynamic or continuous options that maintain patient control over rapidly changing AI. Some examples of these evolving consent paradigms include:

Tiered consent which involves multiple tiers allowing various uses, from clinical care to broad research, that individuals can selectively opt-out over time (Kaye et al., 2015). Preferences are logged within personal data stores accessible to providers. Dashboard interfaces to give patients access to portals so as to monitor ongoing access and uses via simple visualizations, with buttons for easily adjusting participation levels (Kaye et al., 2015) and history tracks past disclosures and usage for transparency.

Layered consent presents core details up front, then links to more technical addendums for those wanting deeper explanations of algorithms or studies (Ohm & Territo, 2019). Disclosures adapt accordingly as models evolve. ResearchStack and similar apps try implementing dynamic features like micro-consent pop-ups for new proposed uses, with options for declining, approving for a set duration, or participation on a study-by-study basis (van Tilburg et al., 2019). However, studies show continuous models can fatigue users if too frequent (Williams et al., 2020). Balancing user control and burden requires further experimentation to identify scalable, sustainable solutions accepted by both patients and institutions. Addressing technical and policy barriers also remains a work in progress.

Challenges of implementation

Overcoming the hurdles that consent present demands substantial collaboration between technologists, researchers and community partners over prolonged pilot programs and review (McCarty et al., 2011). No single institution can solve continuous consent alone. While dynamic consent aims to resolve issues posed by evolving AI, transitioning such models from theory to widespread practice presents its own obstacles. Key challenges include:

- **Resources:** Designing user-friendly interface ensuring comprehension places high demands on development and maintenance budgets that safety-net providers cannot easily afford (Kaye et al., 2015).
- **Interoperability:** Integrating consent preferences across diverse EHR platforms requires agreement on standard APIs and common data models, a task that has long proved difficult for healthcare IT (Kaye et al., 2015).
- **Scalability:** Enabling ongoing choice for millions of patients stresses resources and could cripple research if participation declines precipitously (Kaye et al., 2015). Simple “set and forget” options may better balance interests.
- **Engagement:** Sustaining user involvement over time as notification fatigue sets in risks transforming into an opt-out system by default, undermining autonomy (McCarty et al., 2011).
- **Uncertainty:** How consent applies when algorithms evolve in unforeseen ways or data is pooled with others’ remains ambiguous (McCarty et al., 2011).
- **Regulation:** Laws need clarifying how stored consent data can be accessed, by whom, and for what purposes consistent with privacy expectations (Kaye et al., 2015).

Algorithmic Bias

As AI systems are increasingly utilized to analyze patient data and assist with clinical decision-making, the issue of algorithmic bias has emerged as a serious concern. The biases reflected in the datasets used to train machine learning algorithms can negatively impact some groups if not properly addressed. All data contains cultural, historical, and societal biases that become embedded in AI systems (Obermeyer et al., 2019). For example, if most data come from certain hospitals in affluent areas, algorithms may perform poorer for underserved populations (Char et al., 2018). Differences in treatment rates, variable data quality, and provider behaviors could skew what patterns are learned (Obermeyer et al., 2019).

Recent studies have found algorithms recommending fewer Black patients for certain interventions or healthcare services compared to white patients with the same conditions (Char

et al., 2020). This could exacerbate existing inequities if not corrected. Bias also interacts with other attributes like gender, age, and disease type to impact subpopulations differently (Obermeyer et al., 2019). For AI to augment healthcare equitably, techniques for detecting unfair or undesirable biases must be developed alongside strategies for removing bias from algorithms or adjusting decisions (Char et al., 2018). However, mitigating bias remains an ongoing challenge as data and its social origins evolve (Char et al., 2020). Vigilant monitoring and oversight are needed to ensure technologies support rather than harm vulnerable communities.

Sources of bias in healthcare data and algorithms

- Healthcare data contains many potential sources of bias that can influence algorithmic decision-making if not properly addressed:
- Clinical data bias: Imbalances in care quality and access across demographic groups lead to skewed representation in medical records that models may reinforce (Obermeyer et al., 2019).
- Provider bias: Differential diagnosis and treatment recommendations by physicians due to prejudice, lack of cross-cultural understanding, or corporate incentives introduce biases passed to AI (Char et al., 2020).
- Institutional bias: Underinvestment in digitization at safety net clinics results in their patients being under-represented in databases relative to population ratios (Price Waterhouse Cooper, 2020).
- Social determinants bias: Factors like race, income, environment encoded through correlations with medical conditions rather than direct clinical relevance (Obermeyer et al., 2019).
- Algorithmic bias: Feedback loops where models trained on biased data learn to discriminate can worsen disparities further down the line (Char et al., 2018).
- Utilitarian biases: Prioritizing ease of collection for most prevalent/expensive conditions risks neglecting rarer diseases and marginalized communities (Zech et al., 2018).
- Addressing biases at the source through inclusive data collection, model oversight, and sociotechnical understanding of these influences is key to developing equitable AI capabilities.

Impact of biases on certain patient groups

Negative impacts of algorithmic biases have been observed disproportionately affecting some patient communities such as:

- Racial/ethnic minorities: Studies found less likelihood of Black patients being recommended for cardiac care or pain medication despite identical symptoms as white patients (Obermeyer et al., 2019).
- Women: Models trained on historical patterns where women received less aggressive treatment erroneously denied them opportunities for intervention (Chen et al., 2020).
- Low socioeconomic status: Correlations between poverty and disease outcomes skewed predictions without accounting for root causes (Char et al., 2018).

- Disabled populations: Under-diagnosis and over-look of co-morbidities from models emphasizing generic majorities (Zech et al., 2018).
- Elderly community: Tendency to only highlight expensive services could negate benefit of personalized geriatric support (Marr, 2021).

Proposed Ethical Frameworks for Privacy, Consent And Bias In Patient Data

Considering the mix of technical, procedural and social challenges posed by AI-driven healthcare, experts have begun developing comprehensive ethical frameworks to systematically guide responsible development and deployment of these technologies. One influential example is the Fairness, Accountability, and Transparency in Machine Learning (FATML) framework which outlines objectives like non-discrimination, fairness, transparency, data quality, accountability, privacy and accuracy that systems should aim for (Binns et al., 2018). It also proposes assessment methods at each stage from data to decision-making.

The Hippocratic Oath for AI establishes tenets like beneficence (using AI to benefit patients), non-maleficence (avoiding harm), and autonomy (respecting individual choices) adapted specifically for healthcare contexts (Jobin et al., 2019). Technical principles address explainability, auditability, and oversight to prevent adverse outcomes. More recently, the Digital Health Ethics Consultancy (DHEX) published a guideline calling on considerations of consent, privacy, transparency, oversight, accountability, equity and human oversight to help ensure the welfare, rights and values of all stakeholders are protected (Vayena & Blasimme, 2018). While no single framework solves every issue, together they point to a common set of values like fairness, transparency, accountability and respect for autonomy that should guide an ethical approach. Ongoing refinement and pilot testing will help mature these philosophies into practice.

Ethics of transparency, accountability, fairness

Most ethical frameworks emphasize principles of transparency, accountability, and fairness as foundational to developing AI responsibly. Some ways they aim to operationalize these include disclosure of dataset origins and preprocessing, model architectures, parameters and training methodologies (Jobin et al., 2019). Risks and limitations should also be clearly communicated publicly, impact assessments, audits and oversight into how models actually function (DHEX, 2018). Mechanisms are needed for identifying and remedying harms, biases or flaws, preferably by multidisciplinary groups.

Fairness connects to tangible practices like bias analysis, stakeholder participation in design and testing, and procedural reviews ensuring equitable treatment and outcomes across diverse populations (Binns et al., 2018) and also including technical debiasing techniques. Also "fairness in representation" requiring collection of sufficiently inclusive, representative data (Jobin et al., 2019). The models should avoid further marginalization of vulnerable communities. Adopting standards of transparency enables comprehension and oversight, while accountability reinforces responsiveness, and fairness aims to foster justice and respect for all (DHEX, 2018). Together these principles advance AI aligned with ethics as much as possible given technical constraints.

Ethics of algorithm auditing

In addition to governance structures, proposed frameworks emphasize routine practices facilitating transparency and oversight of AI technologies. Key strategies include: Algorithm auditing involves independent review of models, training methodology, performance on heterogeneous sample data, privacy and security arrangements (Jobin et al., 2019). Audits evaluate adherence to standards through documentation and testing. Impact assessments systematically analyze effects of algorithms on different demographic groups, intended uses, clinical workflows. They flag any biases, risks to safety, well-being or equitable access before and after deployment (Binns et al., 2018). Adversarial testing subjects systems to edge cases intentionally designed to reveal logical weaknesses, unintended responses or associations that could lead to harm if unchecked (Arkowitz et al., 2019).

Implication of Findings

This paper has outlined several ethical dilemmas arising from the use of AI technologies in healthcare settings, with a focus on issues around privacy, consent, and bias. As algorithms are increasingly utilized to analyze sensitive patient data and assist clinical decision-making, navigating these challenges will be vital to ensuring AI is applied in health care responsibly. Key dilemmas examined included questions around how much autonomy patients have in controlling access and use of their data over time; how to obtain truly informed consent for evolving use cases; and addressing algorithmic biases that risk exacerbating healthcare inequities if unchecked. Proposed models of dynamic consent aim to address evolving relationships with data but face practical hurdles. Debiasing algorithms and impact evaluations are ongoing processes that require long-term strategies.

While comprehensive ethical frameworks and oversight structures have been put forth, further piloting is still needed to understand how principles translate to diverse care contexts in a standardized yet adaptive manner. Defining legally binding standards also remains a work in progress as technical capabilities continue advancing. Overall, AI confronts medicine with new frontiers requiring continual collaboration between technologists, researchers, ethicists and affected communities. Areas meriting future study include long-term, real-world impacts of biases that emerge subtly over generations of models; tensions between technical objectives like accuracy, fairness and privacy; scalability of consent preferences and feedback mechanisms across entire populations and care systems. Addressing such uncertainties will be essential to building trust that AI fulfills promises of augmenting healthcare equitably and beneficially for all. With diligent efforts to systematically include voices of stakeholders and remedy emerging issues, AI holds immense potential to positively transform medical practices when guided by principles of transparency, accountability and respect for humanity.

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**EFFECTS OF ADAPTABILITY ON LONG-TERM VIABILITY OF SELECTED
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ABSTRACT

This paper reports the finding of a study of the crucial role of adaptability in enhancing business viability in this ever changing and competitive business environment in Bayelsa State, Nigeria. The study examines how business in this region strategies to adapt to unfavorable conditions to sustain and improve their productivity. The population of the study comprises of 20 firms. Since the population is less than 100 the census sampling technique was adopted, and 2 copies of the questionnaire were given to each firm, which brings the total to 40. The unit of analysis comprises of Top managers, middle managers and junior staff. A structured questionnaire was prepared to get the required data from the respondents. The data collected from respondents were analyzed using descriptive research design and spearman rank correlation coefficient. The finding tells us that there is a positive significant relationship between adaptability and long term viability. It is observed that strategies employed by these organization enhances businesses, contributing useful knowledge for business decision makers and researchers seeking to improve business performance in challenging business environments.

KEYWORDS: Definition of terms: Adaptability, resilience, innovation, viability, sensibility.

Introduction

Accomplishment in life or in business generally is not dependent on too much professionalism or intellectual sensibility as history has adequately shown. Some persons over the years have shown so much resilience in achieving great heights in there endeavour, in other for these

persons to accomplish a very high level of consistency in adapting to whatever conditions they find themselves calls for great determination. Since adaptability is becoming more suitable and essential when it comes to work-related results such as individual performance and achievement, organizational profitability, and development because it believes system provide a different way to understand the human behaviours and attitudes that drive both business and personal success. Makri (2019) reiterates that resilience is requisite requirement for businesses aiming not only to exist but also to blossom in turbulent and unpredictable environments. A major occurrences, is the ever changing business environment which organization must adapt to over economic fluctuation, technological advancement and scarcity of resources and future unknown obstacles in the world.

Organizations that are resilient are very much prepared accept changes and view distortions as opportunities for expansion rather than insurmountable barriers. They possess the agility to adjust their strategies, operations, and even business models in response to shifting circumstances. This adaptability enables them to remain competitive and even gain a competitive edge in the face of uncertainty. Resilience isn't just about reacting to crises; it also involves proactive measures to anticipate potential disruptions and build organizational strength. Resilient businesses invest in risk management, contingency planning, and employee training to ensure that they are well-prepared for various scenarios. By doing so, they are better equipped to minimize the impact of disruptions and continue their operations smoothly. Moreover, the significance of resilience extends beyond the short-term survival of a business. Resilient organizations tend to have a long-term perspective, allowing them to withstand immediate shocks while also positioning themselves for sustainable growth. This can include diversifying revenue streams, fostering innovation, and cultivating strong relationships with stakeholders (Coutu, 2002). In essence, resilience serves as a foundation upon which businesses can build enduring success.

The critical role that resilience plays in the survival and growth of businesses in turbulent environments Resilience encompasses adaptability, proactive preparation, and a forward-thinking approach that empowers businesses to not only weather storms but also thrive amidst uncertainty. As the business landscape continues to evolve and become increasingly unpredictable, cultivating resilience remains an imperative for organizations striving to secure their future in an ever-changing world. (Makri, 2019; and Coutu, 2002).

Consequently, the sustainability of any business is tied to its productivity. Hence, productivity is strongly linked to higher profits and growth for companies (Bloom, Eifert et al. 2013), higher wages (Lazear 2019; Stansbury and Sommers 2017), lower costs for consumers (Alm and Cox 2002), and lower levels of poverty (Byerlee, Diao et al. 2005). For these reasons, productivity recovery is one of the most important factors for business resilience.

A study of Bayelsa

Bayelsa State is one of the 36 states in Nigeria, situated in the South-South part of Nigeria. It has long held a position of great economic importance within the nation. Its strategic location not only offers access to maritime transportation but also places her as major oil exploration location, where oil was first located in Nigeria. The state is located geographical in a the atlantic sphere of the country, therefore it has the advantage of an access way of moving products especially crude oil which plays a crucial part in the economic development of the nation. The is home to most of the oil exploration companys in Nigeria. Though the State is not only endowed with the crude oil alone but also a placed for fishing and farming businesses which is one the major economic drivers of sustainability in the country. However, the economic

activities goes beyond oil and fishing sectors but involves various kinds of industries, such as manufacturing, trade, and services over the period of time. The expanding economic activities led a growing population seeking employment opportunities and economic prosperity. Its thriving economic ecosystem has not only fueled local development but has also contributed significantly to Nigeria's overall economic growth. However, this economic prominence has not come without its problems as the city has faced various adverse circumstances, including economic downturns and security concerns. Understanding how businesses in overcome and thrive in the face of these challenges is critical for sustaining its role as a crucial economic center in Nigeria. (Ibe, 2017).

Organization in Bayelsa State have placed many of challenges, comprising of economic downturns, security concerns, and political instability (Opuene, 2020). These unfavorable conditions have generally constituted a multifaceted backdrop against businesses and have tested their resilience in order to compel and navigate the region. In essence, they constitute a formidable test of the resilience of businesses operating in Bayelsa State.

Statement of the problem

The organizational surroundings is an ever changing one in essence and needs to be studied if organization must accomplish great height in the state of extraordinary challenges, as we observed see in the world today. The capacity resist any environmental organizational threat is backed by the knowledge and strategies adopted by the managers of these firms in times of upheaval. Apart from the major environmental business threats: economic, political, competition, technological, socio-cultural and natural, Africa, and specifically Nigeria, is surrounded with numerous business upheavals that, if not checked properly could lead to the decline of the businesses. In this case, business organizations need to come up with remarkable strategies to resist these challenges and continue in business. The existence of any business will be determined by its competence to build on strategies to overcome these problems. Businesses in Bayelsa needs to adapt and find a way of escaping any environmental business challenges, particularly the non provision of adequate infrastructure, multiple taxes, insecurity, etc. How these organization can continue, in the face of unfriendly conditions and highly competition environment, to enhance and make profit is connected with resilience. To survive in today's challenging environment, businesses must be competitive and resilient. Therefore, the problem of this study is to ascertain the effect of adaptability on the long term viability of enterprises in selected Businesses in Bayelsa State.

Objectives of the study

The aim of the study was to find out the relationship between adaptability and long term viability of selected businesses in Bayelsa State.

While the specific objectives were to:

1. Investigate the effect of adaptability strategy on long term viability of selected businesses in Bayelsa State, Nigeria.
2. Investigate the effect of adaptability on market share on selected businesses in Bayelsa State.

Research Questions

In order to achieve the objective of this study, the following questions will be answered:

1. What is the relationship between adaptability strategy and long term viability on selected businesses in Bayelsa State.
2. What is the relationship between adaptability strategy and market share on selected businesses in Bayelsa State.

Research Hypotheses

Ho1: There is no significant relationship between adaptability strategy and long term viability on selected businesses in Bayelsa State.

Ho2: There is no significant relationship between adaptability strategy and market share on selected businesses in Bayelsa State.

Significance of the study

This research purpose is to reveal the strategies derived in course of the research. The purpose of any research study is to make clear why it was needed and the specific contribution your research made to expanding academic knowledge in your field. The research is beneficial to academic scholars because it will bring to their knowledge the strategies needed to resist and survive business environment challenges in Bayelsa State. Also, for business practitioners, it will reveal the various resilience measures discussed in sustaining long term viability in business.

LITERATURE REVIEW

This portion of the research reviews related literature on the adaptability and long term viability on selected businesses in Bayelsa State.. It covers the theoretical framework where the theory adopted in the study is discussed, some empirical studies are reviewed under the empirical review, the gaps in the empirical review are identified and the conceptual review where the concept of adaptability strategy and its dimensions (leadership, adaptability, innovation, and diversification) are discussed. The concept of productivity and profitability and its measures (increased sales volume, market share, and profitability) are evenly explored under the conceptual review.

Conceptual Review

Concept of Adaptability

Sussman (2004) Stated that adaptability is a social system ability to sense and understand its internal and external environment and take actions that will achieve a fit between the two. Also Dalziel and McManus (2004) defned strategic adaptability as the engagement and involvement of organizational staff so that they responsible, accountable,, and occupied with developing organization resilience through their because they understand the connection between the organization resilience and its long term viability. The definition agrees with the definition of Sussman (2004) by bringing in the dimensions of workers as a tool for resilience and the ability to understand the environment dynamism. Denison (2007) defined adaptability as translating the demand for business environment into action. To survive and to make profit, organizations and their employees need to continuously study the business environment.

Adaptability, often regarded as the linchpin of resilience, stands as an organizational trait that transcends mere survival in turbulent waters; it embodies the capacity to flourish amid adversity. At its essence, adaptability signifies an organization's nimbleness and its ability to

swiftly recalibrate and reposition itself in response to the ever-evolving landscape of challenges and opportunities. This multifaceted concept is intrinsically linked to the notion of organizational agility, where the ability to pivot seamlessly becomes an art form. As Teece et al. (2016) cogently argue, adaptability is not merely a defensive posture but a proactive stance that allows businesses not only to weather storms but to harness them as catalysts for growth and innovation. In a world characterized by relentless change and uncertainty, adaptability empowers organizations to thrive in the face of disruption. This adaptative prowess is manifest in various facets of organizational life. It encompasses the capability to adjust and fine-tune strategies in light of shifting market dynamics, technological advances, and customer preferences. Furthermore, it involves a meticulous reevaluation of internal processes and workflows to ensure that they remain not just relevant but optimized for maximum efficiency. In this regard, adaptability extends to the structural underpinnings of an organization, encouraging it to reconfigure its architecture when necessary, even if it means dismantling long-standing hierarchies or rethinking traditional roles and responsibilities.

Sutcliff and Vogus (2003) stated that the concept of resilience, whether used by an individual or an organization, is generally founded on the notion of performing well, combined with the idea of difficult circumstances threatening to jeopardize such performance. Resilience is also seen as involving the maintenance of positive adjustment under challenging conditions; this is also seen as bouncing back from adversity (William et al., 2017), but also as having the ability to anticipate, avoid shocks, and adjust to their environment (Otiz de Mandojona & Bansai, 2015). Despite the apparently strong foundation, different perspectives have adopted different ways of defining resilience in a business context, some with a focus on the individuals within an organization and some on the organization itself and its characteristics.

In business, the concept of resilience holds critical significance. It can be understood as the inherent strength and capability of an organization to confront and endure unexpected disruptions, rebound swiftly from setbacks, and adeptly adjust its strategies and operations in the face of adverse conditions. This definition, as proposed by Rajhans in 2015, encapsulates the multifaceted nature of resilience in a business context. Essentially, it implies that a resilient company possesses the ability to absorb the impact of various challenges, whether they be economic downturns, natural disasters, or market fluctuations, without collapsing. Moreover, it highlights the importance of not merely surviving such adversities but also leveraging them as opportunities for growth and improvement. In essence, resilience in business is about not just weathering storms but using them as catalysts for continued success and development.

Business resilience signifies an organization's capacity to endure and effectively respond to challenging circumstances, unexpected disruptions, and alterations in its operational surroundings. This resilience is akin to the flexibility and strength of a rubber band, allowing the business to stretch and bounce back even when subjected to significant strains. It involves not only surviving these adverse events but also evolving and adapting in the face of them. Essentially, resilient businesses possess the ability to weather storms, pivot in response to changes, and continue functioning smoothly, all while safeguarding their fundamental operations and ensuring their long-term sustainability. This attribute is essential in an ever-changing and often unpredictable business landscape, where unforeseen challenges can arise at any moment (Wang & Reijers, 2019; Linnenluecke & Griffiths, 2010). This concept encompasses the capacity to anticipate, absorb, recover from, and even capitalize on disruptions, making it a crucial attribute for sustaining competitiveness and ensuring survival in an ever-evolving global marketplace.

Workforce Agility

Workforce agility means the organization or individuals ability to handle the multiple of unexpected and dynamic changes in an uncertain and volatile business environment and can proactively identify viable solution. (Murteanu, Bibu, Nastase, Christache & Matis, 2020).Sohrabi, Asari, and Hozoori (2014) defined workforce agility as an organization ability to rapidly respond and flexibility to cope with the unexpected internal and external environmental changes. Agility can said to be the ability to gain effective advantage, exploit opportunities and withstand threat from frequent and sometimes unexpected changes, responding quickly reconfiguring resources, strategies and people in an efficient and effective manners.

Technology Strategy

Technology innovation is the ability of the organization to successfully utilize its technology infrastructure and innovation resources to derive value to improve firm sustainability (Rajapathirana & Hul, 2018. Zang, Khan, lee & Salik, 2019), It is also the extent to which a firm is knowledgeable about and effectively utilizes information Technology to manage information within the firm. (Mao, Liu & Zhang, 2015). According to Aiken and Keller (2009), technological innovation refers to skills, knowledge, experience body of scientific knowledge and ttools used in the design of production of goods and services. Technological innovation can also be defined as rapidly and timely changing skills that are relevant today and remain relevant in the future and are therefore very desirable (Kiarie, 2014) Chege, Wang &Suntu (2019) posited that features of technology innovation are relative advantage, capability, complexity, agility and observability. Mao,Liu and Zang (2015), Al;so enunciated te merits of technological innovation to include enhanced productivity, increased market share and bringing citizens new and better goods services that improve their over all standard of living.

Long term viability is one of the most substantial goals of all business ventures, and without profitability, the business will not survive in the long run (Hofstrad &Johanns, n.d.). It is a measurement of efficiency and, ultimately, business success. Horton (2021) defined profitability as a business's ability to produce a return on an investment based on its resources in comparison with an alternative investment. Kadian-Baumeyer (2021) saw profitability as the revenue left over after all expenses and taxes had been paid.

A enterprise that is not profitable cannot remain in business, any business that is highly successful in terms of profitability has the capacity to reward its owners with a large return on their investment (Hofstrad &Johanns, n.d.). Hence, organizations, whether big or small, even beverage manufacturing companies, cannot remain without making profits. The success of any business depends on its capacity to always earn profits, and profit equals a company's revenues minus expenses (Johnson, 2019). Earning a profit is important to a business because profitability determines whether a company can secure financing from a bank, attract investors to fund its operations, and grow its business since companies cannot remain in business without turning a profit (Johnson, 2019). A company is profitable by simply producing more finished products and paying less for raw materials and labor (Kadian-Baumeyer, 2021).

Profitability in organizations depends on the inputs made by the employees of that organization. The efficient productive capacity of the employees' results in profitability for the organization; hence, businesses need to make their employees happy and not feel that they are treated unfairly. Eichner (2016) argues that the growing body of research around employee engagement and the link to profitability is irrefutable: happy employees mean improved productivity and increased profits. BussinessBlog (n.d.) states that a business should be aiming

to maximize its profit potential, but getting to that point means having a workforce that is as productive as possible. Therefore, the profitability of any organization depends on the efforts of its employees to drive productivity and service delivery.

Challenges in doing business in Bayelsa

The challenges in doing business in Bayelsa State is so enormous, these challenges includes; economic challenge, insecurity, infrastructure, etc. Since the state is a major center for oil exploration, it became a location for so many oil company that are interested in taking advantage of the endowed natural resources. More so, the city has grappled with infrastructure deficiencies, intermittent power supply, security concerns, and bureaucratic hurdles that can hinder business operations. Moreover, the region's vulnerability to environmental factors, such as flooding and pollution, can also disrupt businesses. Navigating these challenges requires a comprehensive approach that involves risk mitigation strategies, robust contingency planning, collaboration with local stakeholders, and a keen understanding of the complex interplay between economic, political, and environmental factors in the region.

i. Economic Challenges

The economic challenges experienced in Bayelsa State are based on a combination of factors; topmost among these challenges is the vulnerability of the state to depend more on products manufactured outside the state. which affects Bayelsa State, the inability of the state government to put in place the necessary enabling business environment has made so uninteresting for business men to invest in the state. This strong desire to be dependence on goods from outside the state has made businesses to be sensitive to more susceptible' adaptive economic strategy.

ii. Security Concerns

The security matters in Bayelsa State during the Kiama declearation and the rise of militancy is a pointer of the volatile environment business organizations operate. the oil spills resulting from pipeline damage can have devastating consequences for the local ecosystem and communities. This insecurity undermines the stability of the oil industry and hampers economic growth. Even kidnappings have become alarmingly prevalent in Bayelsa State. Criminal gangs frequently abduct individuals, including foreign workers and local residents, often demanding ransom payments for their release. These kidnappings not only endanger lives but also create a climate of fear and insecurity, hindering economic activities and deterring potential investors from engaging in the region. Okeke (2019),

These challenges not only threaten the economic stability of the region but also pose environmental risks and endanger the lives of individuals. Addressing these security concerns requires a holistic approach that combines effective law enforcement, community engagement, and sustainable development efforts to promote stability, safety, and economic prosperity.

THEORETICAL FRAMEWORK

This research is backed up by several theories; we shall briefly look at some of them.

Resource Dependence Theory

This theory according to Pfeffer & Salancik (1978), contributed to the research on how business in Bayelsa State manage their external dependences, such as access to financing and supplier relationships, to improve resilience and adapt to adverse conditions.

However, this work is mainly supported by the Adaptive Cycle Model (Holling, 1973) and the Resilience Engineering Framework (Hollnagel et al., 2006). These theories are often used to analyze organizational resilience.

The Adaptive Cycle Model by Holling (1973)

The Adaptive Cycle Model, as posited by Holling in 1973, and the Resilience Engineering Framework, developed by Hollnagel et al. in 2006, are two major theories used to analyze organizational resilience, each offering distinct perspectives and insights into how organizations navigate and respond to disruptions and change. Holling's Adaptive Cycle Model is rooted in ecological and systems thinking but has been widely applied to understand organizational resilience. The model posits that systems, including organizations, go through four distinct phases in response to change and disturbance: exploitation, conservation, release, and reorganization. The adaptive cycle model provides a valuable framework for understanding the phases that organizations go through in their quest for resilience and adaptation in the face of changing circumstances. The first phase in this cycle is:

Exploitation: at this stage, organizations are mainly concerned with maximizing efficiency and harnessing their existing resources and strategies to their fullest potential. It's a period of relative stability and growth where businesses seek to capitalize on their current strengths and successes. By optimizing their operations, organizations can achieve higher levels of productivity and profitability, setting the stage for expansion and development. However, as the business environment is inherently dynamic, organizations must be prepared for change.

Conservation: When external forces bring about shifts or disturbances that threaten the status quo, organizations enter this phase. Here, their primary goal is to safeguard their existing structures, processes, and resources to maintain stability and minimize risks. Conservation involves careful protection of what has been built, effectively "locking in" elements that have proven successful. This phase is characterized by a defensive mindset, as organizations aim to weather the storm and protect their core assets. Yet, change is often inevitable, and occasionally, organizations encounter disruptions that are too overwhelming to withstand through conservation alone.

Release: When faced with a crisis or disruption that renders their existing strategies and structures obsolete or ineffective, organizations enter the release phase. During this stage, there is a willingness to let go of outdated practices and structures, recognizing that holding onto them may be detrimental. This phase involves a controlled dismantling of what no longer serves the organization's goals, making space for innovation and change.

Reorganization: Here, organizations engage in adaptive learning and actively work on developing new strategies, structures, and processes to respond effectively to the changed environment. It's a period of experimentation and

Empirical Review

In recent years, several studies suggest that resilient business strategies are a strong predictor of an increase in sales volume and market share, which are determinants of business productivity and profitability.

Resilient Adaptability Strategies and Market Share

The relationship between adaptability strategies and market share is a topic of great importance in the field of marketing and business strategy. Several evidences provides valuable insights

into this relationship. It was observed that firms adopting a higher adaptation strategy tend to have a higher market share when operating in Japan (Chung et al., 2012). Furthermore, the study of Fuchs & Köstner (2016), suggests a positive association between adaptation strategies and market share. Similarly, reported that product adaptation to foreign market characteristics is positively related to sales-based export performance measures, indicating a potential impact on market share.

Moreover, Krupka et al., (2017), highlighted that the adaptation of pricing and promotion strategies can drive a brand's market share, further emphasizing the influence of adaptive strategies on market performance. Additionally, found a strong positive relationship between the performance of halal-certified agro-food SMEs, including market share, and marketing strategies and innovative market orientation (Khairuddin et al., 2020). This suggests that innovative marketing strategies can contribute to improved market share.

In the same vein, Haque et al., (2022), discussed how innovative adaptation strategies can facilitate social learning-based actions for building resilience, indicating a potential link between innovative adaptation and market share in the context of community resilience to disasters. These findings collectively suggest that resilient adaptability strategies, including product adaptation, pricing, promotion, and innovative marketing orientation, can have a positive influence on market share.

However, it is important to note that while these studies provide valuable insights into the relationship between resilient adaptability strategies and market share, further research is needed to comprehensively understand the specific mechanisms and contexts in which these strategies impact market share.

Methodology

This section describes the proceedings that was used in guiding the study

Research Design

This study endorse the correlation survey research design. Waters (2017) defined correlation survey research as a quantitative method of research in which the researcher has two variables from the same group of participants and tries to decide if there is a correlation between the two variables. The correlation survey design was applied in this study because the researcher plans to measure the relationship between adaptability and long term viability of businesses in Batelsa State. The population of the study was 40, which consisted of managers and other senior staff of these 20 selected businesses in Bayelsa State, The data for this research was collected from primary sources, the primary data was obtained through the administration of questionnaires to the respondents (managers and other senior staff), of which all the population were taken as sample, since the number is below 100, the study adopted the census technique. A structured questionnaire was used to derive information from respondents of which out of the 40 questionnaire distributed 47 were received.

Empirical Results and Discussion

In this section, the data were analyzed through pearson correlation using SPSS software program and the results are presented below.

Correlations

			adaptability strategy	longterm viability
Spearman's rho	adaptability strategy	Correlation Coefficient	1.000	-.674**
		Sig. (2-tailed)	.	.000
		N	47	47
	Long term viability	Correlation Coefficient	-.674**	1.000
		Sig. (2-tailed)	.000	.
		N	47	47

** . Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS-generated Output 2024

Table 4.1: reveals the result of the bivariate analysis carried out between adaptability strategy and long term viability of selected businesses in Bayelsa State. The result indicated adaptability strategy has a strong positive correlation with long term viability of selected businesses in (rho = .674) and this correlation is significant at the 0.01 level as indicated by the symbol. As a result of this, we then reject the null hypothesis (H_{01}) and accept the alternate hypothesis, which states that there is a strong positive and significant relationship between adaptability strategy and long term viability of businesses in Bayelsa State.

Correlations

			adaptability strategy	market share
Spearman's rho	adaptability strategy	Correlation Coefficient	1.000	-.660**
		Sig. (2-tailed)	.	.000
		N	47	47
	market share	Correlation Coefficient	-.660**	1.000
		Sig. (2-tailed)	.000	.
		N	47	47

** . Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS-generated Output 2024

Table 4.2: reveals the result of the bivariate analysis carried out between adaptability strategy and market share of selected businesses in Bayelsa State. The result indicated adaptability strategy has a strong positive correlation with market share of selected businesses in (rho = .660) and this correlation is significant at the 0.01 level as indicated by the symbol. As a result of this, we then reject the null hypothesis (H_{01}) and accept the alternate hypothesis, which states that there is a strong positive and significant relationship between adaptability strategy and market share of businesses in Bayelsa State.

Discussion of findings

It was disclosed in this research that a significant relationship occur between adaptability strategy and market share of selected businesses in Bayelsa State, Nigeria. This finding was obtained from the result of the correlation analysis carried out on two variables in the first

hypothesis. The result revealed that adaptability strategy is positively correlated to long term viability, and this correlation is significant at the 0.05 level. Based on this result, we then rejected the null hypothesis (H_{01}) and accepted the alternate hypothesis, which states that there is positive and significant relationship between adaptability strategy and long term viability of businesses in Bayelsa State, Nigeria.

This investigation also unveil a significant relationship between adaptability strategy and market share. This finding was obtained from the result of the correlation analysis carried out on the two variables in the second hypothesis. The result showed a positive correlation between adaptability strategy and market share, and this correlation is significant at the 0.05 level (see table 4.2). Consequently, the null hypothesis (H_{02}) was rejected and the alternate hypothesis was accepted. This means that there is a positive and significant relationship between adaptability strategy and the market share of selected businesses in Bayelsa State.

Conclusions and Recommendation

From the results of the analysis, it was established that adaptability strategy has a positive and significant relationship with long term viability of selected businesses in Bayelsa State. The study likewise found a positive and significant relationship between adaptability strategy and market share in selected businesses in Bayelsa State. The researcher recommends that firms should adopt adaptability strategy to accomplish long term viability of their businesses which will also lead higher market share.

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ORGANIZATIONAL GOALS AND EMPLOYEES PRODUCTIVITY (A CASE STUDY OF FEDERAL POLYTECHNIC UKANA, AKWA IBOM STATE NIGERIA)

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ABSTRACT

This study investigated organizational goals and employee productivity in Federal Polytechnic Ukana, Akwa Ibom State, Nigeria. Three research questions and hypotheses were formulated to guide the study. The hypotheses were tested at a .05 level of significance. A survey research design was employed. The population for the study was one hundred and forty-six junior and senior staff of the institution. All the staff were purposively sampled. The instrument for data collection was the questionnaire validated using the face validity method. This method was done by giving copies of the instruments to an expert in the management field. The data was analyzed using descriptive statistics and Pearson Product Moment Correlation (PPMC). The findings revealed a significant relationship between organizational goals and employee productivity. The result further shows that employees perform better when they are motivated. The study concluded that if employees are well motivated and their job criteria clearly stated, their productivity will greatly improve. Based on the findings, it was recommended among others that the management of the institution should integrate individual and corporate objectives to achieve better employee performance and high productivity in the institution.

KEYWORDS: **Organization, Goal, employee productivity, employee performance, Organizational Productivity**

Introduction

Organizational goals are the overall objectives, purpose, and mission of an enterprise or institution that have been established by its management and communicated to its employees. The organizational goals of a company typically focus on its long-range intentions for operating and its overall business philosophy that can provide useful guidance for employees seeking to

please their managers. While goals have long been used as a quantitative measure for employee performance, many organizations find that the goal-setting process takes a huge amount of time and is, frankly, not very effective. However, when done correctly, goal-setting can help improve employee engagement in a way that elevates performance and benefits organizations overall, according to recent McKinsey research.

Steps to Establishing Effective Employee Productivity:

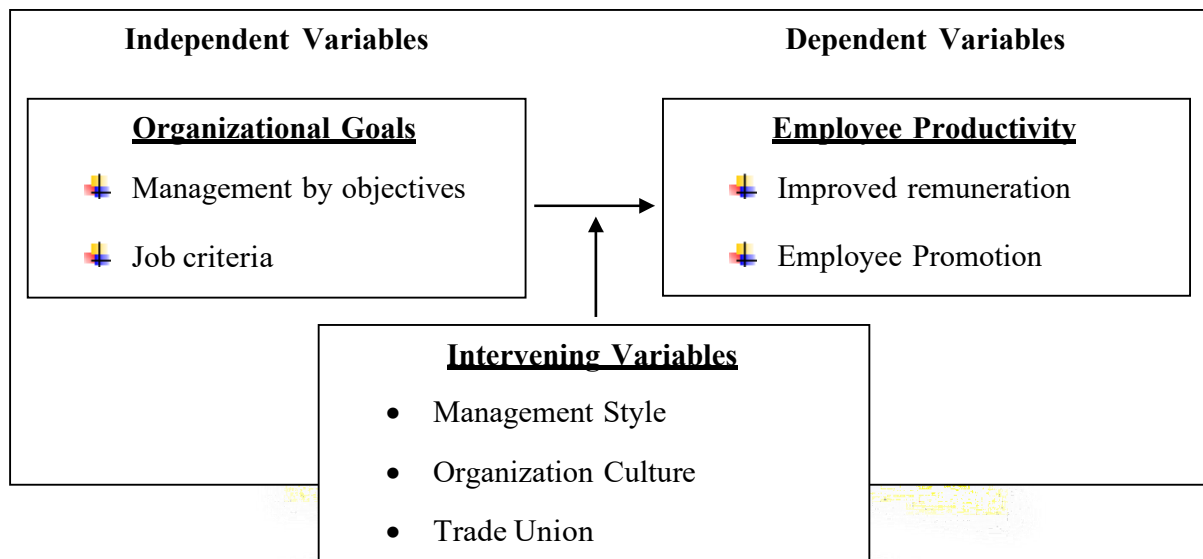
1. **Involve employees from start to finish:** The purpose of goals is to help employees improve – naturally, it makes sense to include them in the entire process. Securing employee buy-in allows you to help develop their short- and long-term goals, and increases the likelihood that they will be achieved. Managers should jointly develop goals that are SMART (specific, measurable, actionable, results-oriented, and time-bound). Doing so inspires commitment and allows individuals a sense of ownership in achieving their goals. Encouraging employees to set stretch goals also helps push performance and serves as a motivator for ongoing development.
2. **Link individual goals to business objectives:** For companies that have effective performance management systems, 91% say that employees' goals are linked to business priorities. The explanation is simple: employees will be more effective if they can see how their individual goals fit into the big picture. In recent years, there has been an uptick in the number of companies linking organizational business goals to functional business objectives, and converting those into team-performance goals. This encourages accountability and better performance as individuals grasp the direct impact of their performance.
3. **Adapt goals in real-time:** Goals should never be seen as stagnant, but dynamic and evolving. One common mistake is setting goals at the beginning of the year and forgetting about them until review season. As realities fluctuate throughout the year, failing to revisit goals can be demotivating. That's not to say goals should become moving targets, but rather that they should be adapted as the environment changes. At one multinational company McKinsey works with, for example, targets are updated if the assumptions used to set them change unexpectedly. This has helped establish a performance-management system that helps motivate performance.

Statement of the Problem

Research into Organizational Goals has gone through periods of setbacks. Recent interest has focused on the importance of Organizational Goals, down to the success of the organization. Whereas, research into Organizational Goals and employee productivity is still at a negligible level; today's activities reveal things that are too divergent. The basic aim of every organization or institution is to achieve its objectives, goals, or targets successfully. Goals set by an organization or institution will only be in vain if much attention is not paid to employee's "effort or performance for successful accomplishment". In order to achieve set goals and objectives successfully, there is a need for performance appraisal. Performance appraisal should be linked to attractive incentives to employees, enabling workers to demonstrate higher productivity. Most organization in the competitive market fails since their workers perform below standard for, they are not encouraged to work harder. Managers and employees are the lifeblood of every business organization. If management does not invest much into the welfare of their workers, problems are bound to arise leading to industrial strike actions, low commitment to work, low morale, and low productivity of goods and services. Attractive appraisal systems are

established by some organizations to help motivate their employees to strive hard to be recognized and rewarded.

Researcher's Conceptual Framework



Source: Researcher, 2024

Purpose of the Study

In the light of the earlier stated problems, the purpose of this study explores organizational goal and employees using Federal Polytechnic Ukana, Akwa Ibom State. In satisfying this purpose, the study sought to: Establish the relationship between organizational goals and employee productivity.

Research Questions

The study sought answers to the following operational research questions.

- 1 Is there any significant relationship between organizational goals and employee productivity?
- 2 Is there any significant relationship between management by objectives and employee productivity?
- 3 Is there any significant relationship between job criteria and employee productivity?

Research Hypotheses

The following Research hypotheses questions were asked.

1. There is no significant relationship between organizational goals and employee productivity.
2. There is no significant relationship between management by objectives and employee productivity.
3. There is no significant relationship between job criteria and employee productivity.

Scope of the Study

Relevant of organizations and institutions in Nigeria cannot be measured as a result of their composition.

The content scope of organizational goals and employee productivity. It concentrated on junior and senior staff of the institution. It established the relationship between organizational goals and employees' productivity.

The geographical scope is Federal Polytechnic, Ukana. The institution is made up of several departments and units that are domiciled in FPU, AKS to show the organizational goals criteria, such inclusion management and retention management. feedback. Rewards also to ascertain the quality of services, and work.

Significant of the Study

This study is significant because it would help in achieving effective organizational goals and employee productivity through efficient management. The result of this study would contribute to knowledge based on essentials, the practice of administration and management thereby, explaining the relationship between organizational goals and employees' productivity. The results obtained would also provide information to managers/administrators based on research and theory to assist them in their managerial and administrative responsibilities.

Managers would learn about organizational goals and their relationship with the employees' productivity that suited the stakeholders.

Finally, it is expected that the entire society as well as individuals will also benefit tremendously from the findings and recommendations of this study as the various societal malaise associated with retrenchment, under-employment, low job satisfaction, and motivation un-productivity etc. will be significantly eradicated.

Moreover, people will get value returns for their money as product quality will continue to improve remarkably.

Definition of Operational Terms

Performance: Refers to the ability of an employee to perform a given task to the satisfaction of its employees or is the accomplishment of the organization.

Appraisal: A structural formal interview between subordinate and supervisor.

Performance Appraisal: This is referred to as an indispensable tool for an organization for the information it provides is highly useful in decision-making regarding various personnel aspects such as promotions and merit increases.

Productivity: It is defined as the quality or volume of the major product or service that an organization provides. It is what comes out of production.

Employee: Refers to any person currently employed, or on leave of absence. The term does not include applicants for employment.

Motivation: To stimulate the interest of a person who needs to do something in a particular way. Allowances: an increase in salary Development: refers to training to provide employees with competencies for anticipated future jobs & roles.

Training: Occurs when one adds new and modifies existing behavior patterns in a way that has some influence on future performance on attitudes.

Salary: wages paid to an employee by an employer for a job being done.

Limitations of the study

The general adoption of organizational goals as considerable tools for decision-making, selection, promotion, and for judging the effectiveness of personnel in an organisation which results in the determination of employee productivity. Research has shown that the predetermination objective of organizational goals has a lot of limitations. Okerie (2013) explains some limitations as follows;

- a. It is very difficult to compare a single individual with human beings having varying behavioral traits.
- b. The task of ranking individuals is difficult when a large number of persons are rated.
- c. It does not eliminate snap judgments, nor does it provide us with a systematic procedure for determining the relative ranks of subordinates in addition.
- d. Time-consuming
- e. Subjects to rate error and biases.
- f. If not done right it can be a complete waste of time.
- g. It can be stressful for all involved.

REVIEW OF RELATED LITERATURE

This will present a comprehensive review of literature related to the study in a bid to position it in a pertinent theoretical framework. Thus, it will discuss the findings of related research to this study. The literature reviews provide the reader with an explanation of the theoretical rationale of the problem being studied as well as what research has already been done and how the findings relate to the problem at hand. This research will provide relevant information on performance appraisal and employee productivity in Federal Polytechnic Ukana, Akwa Ibom State Nigeria. The information provided will enable us to ascertain the following, Quality of services handled by employees, number of customers/ students served, and quality of work/ service per day; the second phase of independent variables will show organizational goals criteria, inclusion management, and goal adaptability.

Conceptual Review

The concept of organizational goals is referring to the accomplishment of a given task measured against present known standards of accuracy, completeness, cost, and speed. In a contract, performance is deemed to be the fulfilment of an obligation, in a manner that releases the performer from all liabilities under the contract.

Performance Appraisal is the process of determining and communicating to an employee how he or she is performing on the job and ideally, establishing a plan of improvement. When properly conducted, performance appraisal not only lets employees know how well they are performing but also influences their future level of effort and task direction.

Employee Promotion: Promotion is the advancement of an employee to a better job- better in terms of greater responsibility, more prestige or status, greater skills, and especially increased rate of pay or salary.” The upward reassignment of an individual in an organizational hierarchy, accompanied by increased responsibilities, enhanced status and usually with increased income

though not always so.” Promotion is the reassignment of a higher-level job to an internal employee with delegation of responsibilities and authority required to perform that higher job and normally with higher pay. Thus, the main conditions of promotion are: -

- 1) Reassignment of a higher-level job to an employee than what he is presently performing.
- 2) The employee will naturally be delegated with greater responsibility and authority than what he has had earlier.
- 3) Promotion normally accompanies higher pay.

Promotion may be temporary or permanent depending upon the organizational needs and employee performance.

Purpose of promotion: Organizations promote the employee to achieve the following purposes.

- 1) To utilize the employee’s skills, and knowledge at the appropriate level in the organizational hierarchy resulting in organizational effectiveness and employee satisfaction.
- 2) To develop a competent spirit and inculcate the zeal in the employees to acquire the skills, knowledge, etc. required by higher level jobs.
- 3) To develop competent internal sources of employees ready to take up jobs at higher levels in the changing environment.
- 4) To promote employee’s self-development and make them await their turn for promotions. It reduces labor turnover.
- 5) To promote a feeling of content with the existing conditions of the company and a sense of belongingness.
- 6) To promote interest in training, development programmers and in team development areas.
- 7) To build loyalty and to boost morale.
- 8) To reward committed and loyal employees.
- 9) To get rid of the problems created by the leaders of workers’ unions by promoting them to the officer levels where they are less effective in creating problems.

Merit as a basis for promotion

Merit is taken to denote an individual employee’s skills, knowledge, ability, efficiency, and aptitude as measured from educational, training, and past employment records. The merits of the merit system of promotion are:

- 1) The resources of a higher-order employee can be better utilized at a higher level. It results in maximum utilization of human resources in an organization
- 2) Competent employees are motivated to exert all their resources and contribute them to the organizational efficiency and effectiveness
- 3) It works as golden hand-cuffs regarding employee turnover,

- 4) Further it continuously encourages the employees to acquire a new skills, knowledge, etc. for all-round development.

Despite these advantages, the merit systems suffer from some demerit. They are:

- 1) Measurement or judging of merit is highly difficult.
- 2) Many people, particularly trade union leaders, distrust the management's integrity in judging merit.
- 3) The techniques of merit measurement are subjective.
- 4) Merit denotes mostly the past achievement, efficiency but not the future success. Hence, the purpose of promotion may not be served if merit is taken as the sole criterion for promotion.

Job Criteria and Employees' Productivity

Once the appropriate organizational goals have been established, the organization must determine how best to measure the performance of employees. This raises the critical issue of which rating form to use. In the vast majority of organizations, managers rate employee job performance on a standardized form. A variety of forms exist, but they are not equally effective. To be effective, the form must be relevant and the rating standards must be clear. Relevance refers to the degree to which the rating form includes necessary information, that is, information that indicates the level or merit of a person's job performance. To be relevant, the form must include all the pertinent criteria for evaluating performance and exclude criteria that are irrelevant to job performance. The omission of pertinent performance criteria is referred to as criterion deficiency. For example, an appraisal form that rates the performance of police officers solely based on the number of arrests made is deficient because it fails to include other aspects of job performance, such as conviction record, court performance, number of commendations, and so on. Such a deficient form may steer employee behavior away from organizational goals; imagine if police officers focused only on arrests and neglected their other important duties. When irrelevant criteria are included on the rating form, criterion contamination occurs, causing employees to be unfairly evaluated on factors that are irrelevant to the job. For example, criterion contamination would occur if an auto mechanic were evaluated based on personal cleanliness, even though this characteristic has nothing to do with effective job performance. Performance standards indicate the level of performance an employee is expected to achieve. Such standards should be clearly defined so that employees know exactly what the company expects of them. For instance, the standard "load a truck within one hour" is much clearer than "work quickly." Not only does the use of clear performance standards help direct employee behavior, but it also helps supervisors provide more accurate ratings; two supervisors may disagree on what the term "quickly" means, but both attribute the same meaning to "one hour." To meet the standards described in the previous section, a firm must use an effective rating form. The form provides the basis for the appraisal, indicating the aspects or dimensions of performance that are to be evaluated and the rating scale for judging that performance. Human Resources (HR) experts have developed a variety of instruments for appraising performance. A description of the most commonly used instruments, along with their strengths and weaknesses, is given in the following paragraphs. A summary of these instruments appears in Exhibit 1. It should be noted, however, that companies can create additional types of instruments. For instance, they can rate employees on job task performance using graphic or behavior rating scales.

Theoretical Review

According to Chukwuemeka (2002), a theoretical framework is a broad umbrella made up of theoretical postulations (theories, perspectives, models, or paradigms) that researchers or writers can utilize as guides for understanding and analyzing the reality of a phenomenon under study. Theories are essential tools that the researcher uses in shedding more light on the possible relationship between variables that appear to have logical connections. An examination of the above submissions reveals that a theoretical framework is not just a description of theories existing in a particular field, but it is rather an application of a relevant theory to guide a research endeavor.

The following three theories underpinning performance appraisal have been identified by Buchner (2007); they include Goal theory which was developed by Latham and Locke (1979), the theory highlights four mechanisms that connect goals to performance. These he listed as:

The direct attention to priorities, the stimulated effort, the challenge people to bring their knowledge and skills to bear to increase their chances of success, and the more challenging the goal, the more people will draw on their full repertoire of skills. This theory underpins the emphasis in performance management on setting and agreeing objectives against which performance can be measured and managed.

The second theory focuses attention on feedback as a means of shaping behavior. As people receive feedback on their behavior they appreciate the discrepancy between what they are doing and what they are expected to do and take corrective action to overcome the discrepancy. Feedback is recognized as a crucial part of the performance management process. The third theory was developed by Bandura (1986), it is based on his central concept of self-efficacy. This suggests that what people believe they cannot do powerfully impacts their performance. Developing and strengthening positive self-belief in employees is therefore an important performance management objective.

Behavioural Management Theory

The behavioral management theory was developed in response to the need to account for employee behavior and motivation. This shift moved management from a production-oriented (classical leadership theory) to a leadership style focused on the workers' human need for work-related satisfaction and good working conditions.

A Shift in Theories

Long before theories started writing about employee satisfaction and good working conditions, management considered classical leadership with its sole interest in high production and efficiency, to be the most important to an organization's success. Later, it was a concern for worker satisfaction and good working conditions that formed the foundations for behavioral management. Behavioral management theory relies on the notion that managers will better understand the human aspect of workers and treat employees as important assets to achieve goals. Management taking a special interest in workers makes them feel like a part of a special group. As time went on, things shifted, and management started looking at employee satisfaction and working conditions as a way to increase productivity. Theorists like Elton Mayo and others studied employee productivity under different conditions to determine a connection.

Mayo's Hawthorne experiment provides a good example of this; in the Hawthorne experiment, a group of telephone line workers were separated and observed working in a private room.

During their workday, the group members were given special privileges like the freedom to leave their workstations, changes in pay rates, and even company-sponsored lunches. What they discovered was the control group produced more than other employees. The rationale for this increased production was that the group felt that management was interested in their well-being. This began the human relations movement for management. If all management had to do was spend time, express interest in workers' well-being, and reward them for a job well done, workers would feel motivated to work harder. Behavior towards work would be positive.

Vroom Expectancy Motivation Theory.

Whereas Maslow and Herzberg look at the relationship between internal needs and the resulting effort expended to fulfill them, Vroom's expectancy theory separates effort (which arises from motivation), performance, and outcomes behavior results from conscious choices among alternatives whose purpose it is to maximize pleasure and to minimize pain. Vroom realized that an employee's performance is based on individual factors such as personality, skills, knowledge, experience, and abilities. He stated that effort, performance, and motivation are linked to a person's motivation. He uses the variables Expectancy, instrumentality, and valence to account for this. Expectancy is the belief that increased effort will lead to increased performance i.e. if I work harder then this will be better. This is affected by such things as:

- Having the right resources available (e.g. raw materials, time)
- Having the right skills to do the job.
- Having the necessary support to get the job done. (e.g. supervisor support, or correct information on the job)

Instrumentality is the belief that if you perform well a valued outcome will be received. The degree to which a first-level outcome will lead to the second-level outcome i.e. if I do a good job, there is something in it for me. This is affected by such things as:

- Clear understanding of the relationship between performance and outcome e.g. the rule of the reward 'game'.
- Trust in the people who will make the decisions on who gets what outcome.
- Transparency of the process that decides who gets what outcome

Valence is the importance that the individual places upon the expected outcome. For the valence to be positive, the person must prefer attaining the outcome to not attaining it. For example, if someone is mainly motivated by money, he or she might not value offers of additional time off.

Equity Theory

Equity theory focuses on determining whether the distribution of resources is fair to both relational partners. Equity is measured by comparing the ratio of contributions (or cost) and benefits (or rewards) for each person. Considered one of the justice theories, equity theory was first developed in the 1960s by J. Stacy Adams, a workplace and behavioral psychologist, who asserted that employees seek to maintain equity between the inputs that they to a job and the outcome that they receive from it against the perceived inputs and outcomes of others (Adams, 1963). The belief is that people value fair treatment which causes them to be motivated to keep the fairness maintained within the relationship of their co-workers and the organization. The

structure of equity in the workplace is based on the ratio of inputs to outcomes. Inputs are the contributions made by the employees to the organizations. According to Adams (1965), anger is induced by underpayment inequity, and guilt is induced by overpayment equity (Spector 2008). Payment whether hourly wage or salary, is the main concern and therefore the cause of equity or inequity in most cases.

Equity theory consists of four propositions:

- Groups can maximize collective rewards by developing accepted systems for equitably apportioning rewards and costs among members.
- Individuals seek to maximize their outcomes (where outcomes are defined as rewards minus costs).
- When individuals find themselves participating in inequitable relationships, they become distressed. The more inequitable the relationship, the more distress individuals feel. According to equity theory, both the person who gets “too much” and the person who gets “too little” feel distressed.
- Individual who perceive that they are in an inequitable relationship attempt to eliminate their distress by restoring equity. The greater the inequity, the more distress people feel and the more they try to restore equity. (Walster, Traupmann and Walster, 1978).

RESEARCH METHODOLOGY

Research Design

According to Nwadiane (2007), research design is the structure or plan of research i.e. what to do and how to do it. It involves structuring the variables in a manner that enables their relationship to be determined the relationship between each variable. Thus, in this study, descriptive survey research design was used. The numerals of these variables will be calculated to ascertain their relationship.

The Population of Study

The population of the study will comprise all the staff of the institution. The total number of the staff of the institution is one hundred and forty-six (146). The staff are divided into two categories. The senior and junior staff. There are ninety-seven (97) seniors and forty nine (49) juniors in the institution.

Distribution of population of the study

S/N	Senior Staff	Junior Staff	Total
1.	97	49	146

Sample Size and Sampling Technique

All the staff of the institution were sampled. Therefore, all one hundred and forty-six (146) respondents will be sampled. A purposive sampling technique will be used in the study. The purposive sampling technique is chosen as the sampling technique of this study.

The purposive sampling technique is a non-probability sampling technique or judgemental technique where the sample relies on the judgment of the researcher. The purposive sampling technique is used when the population under study is quite small (Patton, 1990).

S/N	Senior	Junior	Total	Sample %
1.	97	49	146	146

i.e $146 \times 100 \div 146 = 100\%$

Moreover, one hundred and forty-two of the questionnaires were duly filled and returned. Four (4) of the questionnaires were invalid.

Sources of Data

In the course of this study, the data was collected from primary sources. The primary source includes the administration of a questionnaire of some carefully selected staff.

Instrumentation

A structured questionnaire was used to elicit responses from the respondents. The instrument was developed to answer the research questions. The questionnaire will consist of two sections. Section A and Section B. Section A was designed to elicit information such as Gender, Marital status, Age, Educational Qualification, Department, and Position. The questionnaire items in section B were generated in line with the independent and dependent variables. The questionnaire will be developed using a point Likert scale. This involves Strongly Agree (SA), Agree (A), Strongly Disagree (SD) and disagree.

Validity of Instrument

The instrument was validated using the face validity method. This method was done by giving copies of the instruments to an expert in the field of management. The expert carefully assessed the contents of the instrument and made necessary corrections which will be based on their observations. The researcher was guided in the development of the final version of the instrument.

Reliability of Instrument

To ascertain the reliability of the instrument, the questionnaire was administered to twenty (20) staff of another academic institution. This comprises (Ten from the senior and ten from the junior) who were not part of the study. Cronbach Alpha Statistics was used to establish the reliability coefficients.

Administration of the Research Instruments

The researcher will personally administer the questionnaire to the respondents. He will visit the institution under study to distribute the questionnaire. He will ensure that the respondents are properly guided on how to fill out the questionnaires. Completed questionnaires will be collected thereafter.

Method of Data Analysis

The data will be analyzed using descriptive statistics. This involves the use of frequencies and percentages. The data will further be analyzed using Pearson Product Moment Correlation (PPMC) statistics.

The formula for computing Pearson Product Moment Correlation (PPMC)

$$\frac{N\sum XY - \sum X \sum Y}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

DATA PRESENTATION AND ANALYSIS

The main focus of this chapter is to analyze and discuss the findings of the study. The findings are presented and discussed based on the variables of the study. The results of the analysis are presented below.

Analysis of the Data

Research Question 1: Is there any significant relationship between organizational goals and employee productivity?

Table 1: Frequency Distribution and Percentages of organisational goals

	Organizational Goals	SA	A	total	%	D	SD	total	%
1.	The Federal Polytechnic Ukana has well-written goals.	108	30	138	97.2	4	0	4	2.8
2.	The goals are geared toward the growth of the school	110	30	140	98.6	1	1	2	1.4
3.	Staff work toward the actualization of the goals	70	67	137	96.5	2	3	5	3.5

Source: Field Survey 2023

In Table 1 above, it was revealed that Federal Polytechnic Ukana has a well-written goal, and the goals are geared toward the growth of the school. It was further revealed that staff work toward the attainment of the goals. Data analyzed records that 138 (97.2) staff agreed that there are well-written goals, 140 (98.6) asserted that the goals are geared toward institutional growth and 137 (96.5) staff consented that staff works toward the actualization of the goals.

Research Question 2: Is there any significant relationship between management by objectives and employees' productivity?

Table 2: Frequency Distribution and Percentages of Management by Objectives and Employees Productivity

	Management by Objectives	SA	A	total	%	D	SD	total	%
1	The institution's programs are well planned	35	80	85	59.9	20	37	57	41.9
2	Every department in the institution has a standard	31	66	97	68.3	40	5	45	27.7
3	Staff productivity is evaluated based on the standards	40	48	88	61.8	22	32	54	48.2

Source: Field Survey 2023

Data in Table 2 shows that the institution's programs are well-planned. The analysis indicates that 85 (59.9) staff agreed to a well-planned program, 97 (68.3) staff consented to a standardized department and 88 (61.8) staff approved that staff productivity is measured by standards.

Research Question 3: Is there any significant relationship between job criteria and employee-improved welfare package?

Table 3: Frequency Distribution and Percentages of Job Criteria

	Job Criteria	SA	A	total	%	D	SD	Total	%
1.	The school has a method of comparing each staff productivity	61	35	96	67.6	20	26	46	26.4
2.	They are compared based on productivity	60	36	96	67.6	22	24	46	26.4
3.	Their performance is communicated to them	25	30	55	38.7	77	10	87	63.3

Source: Field Survey 2023

In Table 3 above, data shows that the institution has a method of comparing staff productivity, and the productivity is compared based on staff productivity, but staff performance is not communicated to them. Data analysis shows that 96 (67.6) staff agreed to a definite method of comparing staff productivity, 96 (67.6) approved comparison based on productivity while 87 (63.3) opined that performance is not communicated to staff.

Null Hypothesis 1

1. There is no significant relationship between organizational goals and employee productivity.

Table 4: Pearson Product Moment Correlation Analysis of the Relationship between organizational goals and employees productivity in Federal Polytechnic, Ukana.

Variable	$\sum x$	$\sum x^2$	$\sum xy$	r-ratio	Decision
Organizational goals (x)	5587	85967	84066	0.592	Significant
Employees productivity (y)	5467	92623			

Level of significance 0.05, df= 142-2, critical r-value 0.098

The data in Table 4 indicates that the calculated r-value is 0.592, while the critical r-value is 0.098. Since the calculated r-value is greater than the critical r-value, the null hypothesis is rejected. This implies that there is a significant relationship between organizational goals and employee productivity.

Null Hypothesis 2

There is no significant relationship between management by objectives and employees' productivity.

Table 5: Pearson Product Moment Correlation Analysis of the Relationship between management by objectives and employees productivity in Federal Polytechnic, Ukana.

Variable	$\sum x$	$\sum x^2$	$\sum xy$	r-ratio	Decision
	$\sum y$	$\sum y^2$			
Management by objectives (x)	7413	97356	85006	0.612	Significant
Employees productivity (y)	6188	87623			

Level of significance 0.05, df= 142-2, critical r-value 0.098

The data in Table 2 indicates that the calculated r-value is 0.612, while the critical r-value is 0.098. Since the calculated r-value is greater than the critical r-value, the null hypothesis is rejected. This implies that there is a significant relationship between organizational goals and employee productivity.

Null Hypothesis 3

There is no significant relationship between Job Criteria and employees' productivity.

Table 6: Pearson Product Moment Correlation Analysis of the Relationship between Job Criteria and Employee Productivity in Federal Polytechnic, Ukana.

Variable	$\sum x$	$\sum x^2$	$\sum xy$	r-ratio	Decision
	$\sum y$	$\sum y^2$			
Job Criteria (x)	7998	87356	75893	0.573	Significant
Employees productivity (y)	6748	81163			

Level of significance 0.05, df= 142-2, critical r-value 0.098

The data in Table 6 indicates that the calculated r-value is 0.573, while the critical r-value is 0.098. Since the calculated r-value is greater than the critical r-value, the null hypothesis is rejected. This implies that there is a significant relationship between organizational goals and employee productivity.

CONCLUSION

From the findings, it can be seen that organizational goals are a very important management tool when properly conducted and findings implemented, it benefits both the employees and the organization. A good appraisal system helps employees to develop themselves and improve their productivity. Where workers are well motivated, their morale will be boosted and their innovation and creativity will be at its peak. Hostility between superiors and subordinates is reduced. The ability of the management of federal Polytechnic Ukana to appraise each staff performance based on its goals, vision, and mission plans facilitates the attainment of the desired goals and greater employee productivity. Staff works individually and collectively hard to ensure that the organisational goals and objectives are realized.

RECOMMENDATIONS

Based on the study's findings and conclusions, the researcher finds it necessary to give the following useful recommendations.

1. Employees should be made to understand the basis on which their performance is being measured or evaluated. This can be achieved by the use of job descriptions that stipulates employee's job requirements. Alternatively, involving employees in setting goals or targets at the beginning of the year keeps the employees in focus on what is expected of them. This can help them do self-evaluation and identify their weakness and strengths themselves.
2. The management of Federal Polytechnic Ukana should design and implement remunerations, incentives, and welfare schemes that are in consonance with other Federal Polytechnics nationwide and in reality with the cost-of-living index or standard to motivate employees to perform better.
3. Institutional plans should be communicated to staff and a forum should be given to them to contribute towards the attainment of the plans
4. Management of the institution should integrate individual and corporate objectives to achieve better employee performance and high productivity in the institution.
5. Management of the institution should emphasize training, retaining, and development of staff. This is because training is an antidote for better employee performance and productivity.
6. Management should create a forum free from tension where workers can freely express their views or ask questions on issues that affect them.
7. Standard procedures should be put in place for a fair appraisal of employees.
8. Management should provide employees with adequate working tools, resources and environment in order to enhance greater productivity.

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THE ROLE OF PUBLIC ADMINISTRATION IN REBUILDING PRODUCTIVITY IN ECONOMIC RESILIENCE

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ABSTRACT

The paper titled “The role of Public Administration in rebuilding productivity in economic resilience” has been prepared to support its importance in this trying time of Nigerian production life. The adequate role of public administration in this regard is of great importance. The paper relied on secondary sources of information in its exercise. The importance of public administration is presented, and numerous efforts of public administration especially through policies and assistance aimed at enhancing productivity are highlighted. The paper also found out that some policies are still negating the growth of productivity and further recommends among other, provision of social amenities, grants, training and development among others production, as these will enhance productivity.

KEYWORDS: Role, Public Administration, Rebuilding, Productivity, and Economic Resilience

Introduction

The civil service evolved as the bedrock of the executive arm of government. Its main tasks revolve around the formulation, implementation, and execution of the policies as decided by the legislature or those appointed by the legislature to carry on the executive work of government, Obiajulu, and Obi (2004). National development flows in the direction of the public policy trust and administration. Public administration's policy thrust and actions in a given polity will either impede or enhance productivity in such a state.

The government also recognizes that it is not possible to provide paid employment. As such, the government through public administration is to create an enabling environment through fair

policies and provision of adequate amenities to spur individuals and cooperate bodies into productivity and as such provide a way to employment for these citizens.

The grains of fair policies can be showcased in government granting tax holidays, exemption or reduction of tariffs on certain imported raw materials for production, unbundling monopoly, banning the importation of finished goods, or imposition of high tariffs to discourage such importation against stiff competition with local manufacturers. The public administration instituting sound regulatory bodies to oversee the activities of manufacturing firms will stress the issue of qualities to guarantee the confidence of the consumers.

Numerous gains abound when the public administration of a given state promotes an enabling environment for efficient production sub-sections as it stands to benefit the government and the citizens at large. When public administration fails in this endeavor, the multiplier effect will impede on productivity. Again, on the general concept of productivity, this is a measure of how efficiently we work.

Importance of Public Administration

Public administration is an important instrument of governance as well as an important mechanism for preparing and promoting the culture of the community the importance of public administration is presented in this;

1. Public Administration is the vital social process charged with the implementation of great objectives of the state. It has to determine the character and activities of a nation.
2. Public Administration helps to preserve, the desires and aspirations of the people, and therefore the main engine of social change and progress.
3. Public Administration has moved away from being a more coercive regulatory agent to being the protector of the citizens from external danger or internal disorders. It serves as an educator, manufacturer, distributor, helper, and servant on different fronts. Notwithstanding the cases of privatization, public administration still performs enormous functions in most countries.
4. Public administration is involved in all affairs of the individual whether it is health, education, employment, transportation, electricity, sanitation, protection, and the provision of basic amenities. In short, if public administration fails, the whole structure of society and civilization would fall to pieces (Obikeze 2008). He further posited that hence its importance, it has become imperative that the ways and means in learning to keep it alive by making it more efficient must be devised and the need to ensure that the consciousness of the young ones in public administration must be developed.

Productivity. This is the output of goods and services as measured per unit of time, or per person, per company, per industry, or for the whole economy (Harder 1989).

The Role of Public Administration.

As part of its role towards rebuilding productivity, it intervenes through;

- i. **Regulatory policies:** Regulatory policies involve the setting of standards and rules to restrict the activities of some groups in the society in order to prevent undesired consequences of their action. It employs coercion such as fines and incarceration to enforce compliance with prevailing standards of conduct. It is further summed that the primary tools of regulatory policies were rule making, law enforcement and adjudication. In Nigeria some examples of such bodies include, Standards Organization of Nigeria (SON), National Agency for Food, drugs administration and control (NAFDAC), ministry of Industries.

ii. Government policy on financing production

Over the years, the federal government has taken various steps including monetary, fiscal and industrial policy measures to promote the development of productivity especially through small and medium scale enterprises (SMEs). Urom (2013), opined that the government has been active in the following areas.

- i. Funding and setting up of industrial estates to reduce overhead costs.
- ii. Establishing specialized financial institutions, including the small-scale industries credit scheme of industry, Nigerian Bank for Commerce and Industry (NBCI) to provide long- term credit.
- iii. Facilitating and guaranteeing external finance by the World Bank, African Development bank and other international financial institutions.
- iv. Facilitation of the establishment of the National Directorate of Employment (NDE), which also initiated the setting up of new SMEs.
- v. Establishment of National Economic Reconstruction Fund (NERFUND) to provide medium to long-term local and foreign loans for small, and medium scale businesses, particularly those located in the rural areas; and
- vi. Provision of technical training and advisory services through the industrial development centers Urom (2008) went further to present an assessment of their government initiatives and incentives thus;

i. Industrial Development Centers (IDCs)

Essentially, the IDCs were established to provide extension services to the SMEs in such area as project appraisal for loan application, training of entrepreneurs, managerial assistance, product development, production planning and control, as well as other extension services.

The first IDC was established in Owerri in 1962 by the former Eastern Nigeria government, Ministry of Trade and Industry, and was taken over in 1970 by the Federal Government.

Subsequently, more IDCs were established at Benin City, Uyo, Bauchi, Akure, Ilorin, Port-Harcourt, Kano and Ikorodu. The IDCs were poorly implemented as they were inadequately equipped and funded.

ii. Small Scale Industries Credit Scheme (SSICS)

In 1971, the federal Military Government set up the small industries development programme to provide technical and financial support for the SMEs. That led to the creation of the small industries credit Fund (SICF), which was formally launched as the Small-Scale Industries Credit Scheme (SSICS) in the third National Development plan, 1975-1980.

The scheme which operated as a matching grant between the federal and state governments, was designed to make credit available on liberal terms to the SMEs and was managed by the states' ministry of industry, trade and cooperatives. The success of the scheme was constrained by the death of the executive manpower to supervise and monitor projects. Thus, many unavailable projects were funded, leading to massive repayment default.

iii. The Nigerian Bank for Commerce and Industry (NBCI).

The Nigerian Bank for Commerce and Industry (NBCI) set up in 1973 to provide, among other things was financial services to the indigenous business community, particularly the SMEs. The NBCI operated as an apex financial institution for the SMEs and also administered the SME. World Bank Loan Scheme under which total credit accounting to N241.8 Million were approved between 1981 and 1988. The bank financed a total of 126 projects under the World Bank Loan Scheme some of which who however cancelled due to the failure of the project sponsors to contribute their counterpart funding. The NBCI suffered from operational problems, cultivating in a state of insolvency in 1989 and absorption into the bank of industry in 2002.

iv. The Nigerian Industrial Development Bank (NIDB)

The Nigerian Industrial Development Bank was established in 1962 with the primary mandate of providing medium to long-term loans for investments in industrial activities. Although its loan portfolio covers mainly large-scale industries, the bank established special units to focus on SMEs.

An attractive feature of NIDB's financing programme was its policy of equity participation in some of the projects it's financed. It disbursed a total of N174.6 million to the SMEs between 1980 and 1988 and was also responsible for the bulk of credit delivery to the sector under the World Bank II loans scheme, accounting for more than 80 percent of the total amount of disbursements arising from financial and other constraints, NIDB was merged with similar institutions to form the Bank of Industry, BOI.

v. Central Bank of Nigeria (CBN)

The Central Bank of Nigeria has since its inception been instrumental to the promotion and development of Small and Medium Scale Enterprises. The CBN credit guidelines required that banks allocate a specified minimum percentage share of credit to important sectors including the SMEs at preferential interest rates. For instance, in 1979/80 the CBN directed that at least 10 percent of the loans and advances granted to indigenous borrowers be allocated to the sector. This was subsequently raised to 16 and 20 percent in April 1988 and 1990, respectively, Loans and advances to the SMEs as a percentage of total loans rose from 1.8 percent in 1980 to 9.3, 22.9, 40.0, 28.6, 6.6 percent in 1986, 1990, 1992, 1996, 2001 respectively.

However, given the risks attendant to such loan and the high cost of its administration, banks preferred to pay prescribed penalties for non-compliance rather than give credit to SMEs. The CBN reacted by transferring the shortfall taken from defaulting banks to NBCI for on-lending to the SMEs this brought about a remarkable improved performance on compliance with bank lending to the SMEs.

Due to the inherent weakness and inefficiency of direct credit control by the CBN, this practice was discontinued and replaced by a system of market mechanism, supported by moral suasion.

vi. World Bank Assisted SME II Loan Project

In order to further expand credit allocation to the SMEs the federal government in 1989, negotiated a programme of financial assistance with the World Bank to complement other sources of funding the SMEs. Altogether, this facility involved a total of US270 million for on-lending to the SMEs through the participating banks. The credit components and other related activities of the World Bank loan were administered by the CBN, which in 1990 established

an SME Apex Unit for its efficient implementation. The SME apex office approved loans for 211 firms valued at US\$132.8 million between 1990 and 1994 when further approval was stopped. A total disbursement of US\$107.1 million had been recorded as at June 1996 in respect of 102 projects.

vii. Technical Training and Extension Services Programme

Institutions such as the Industrial training Fund (ITF), raw materials research and development Council (RMRDC), Federal Institute of Industrial Research, Oshodi (FIIRO) Project Development Agency (PRODA), and Centre for Management Development (CMD) have in their activities supported the promotion of SMEs by extension productivity in the country.

viii. The National Economic Reconstruction Fund (NERFUND).

Following the adoption of the Structural Adjustment programme (SAP) in 1986 and the subsequent tightening of monetary policy, many SMEs found it difficult to secure finance for their working capital and investment purposes. In order to bridge the observed widening resources gap for the SMEs, the Federal Government set up the National Economic Reconstruction Fund (NERFUND), effective 9th January, 1990 with the CBN as the facilitating institutions. It was aimed at providing medium to long-term. Loans (5-10 years), to SMEs at concessionary rates of interests, thereby caps to SMEs development. Between 1990 and 1998 NERFUND disbursed US\$144.9 million (foreign exchange component) and N681.5 million (Naira component) to support 218 projects. NERFUND lending activities were seriously constrained by the impact of naira devaluation which worsened the burden of debt-servicing merits the programme in 2001. NERFUND was merged with two other Direct Foreign Investments (DFI) to form the Bank of Industry.

Challenges of Efficient Productivity.

Numerous reasons have been observed to have been negating efficient productivity in the Nigerian State. The implication remains that the production sub-section will not efficiently drive our economy to an enviable status that is expected of it. Collaborating, Adekoya (2016), opined that, small and medium sized enterprises for economic growth in Nigeria have not performed estimably well and hence has not played the expected vital role in the economic growth and development in the country, this situation however has been of great concern to the government, operators, citizen, practitioners and the organized private sector, we discovered that over the years public administration at all levels through budgetary allocation, policies, and pronouncement have signified interest and acknowledge the crucial roles of production sub-sector of the economy. Adekoya (2016) and Malla et al (2018) have presented some of challenges confronting the production of sub-sector to include;

- i. **High cost of Doing Business:** One of the major challenges faced by small and medium seized enterprises in Nigeria is the high cost of running their operations, some of these problems can be attributed to poor state of infrastructure. In Nigeria, poor infrastructure is a major factor in the country, we find out that most of our local investors have eloped the country due to poor infrastructure in place. Example of these are physical infrastructures like road, power supply, communication system and good health case system, majority of the foreign investors have left the country to pitch there tent elsewhere, the 2023 GSK (Drug Company) exit from Nigeria is a case in point. Some have relocated to Ghana. Some of these reasons boil down to the issues of epileptic power supply and the high cost of running gasoline generators for their business.

- ii. **Multiple Taxation:** The multiple taxation has impeded growth of small and medium sized enterprise in Nigeria. An enterprise takes investment decisions based on long run returns on capital the cost of multiple taxation however, reduce the size of the stock-up capital and aggregate output in the economy which in turn discourage investment.
- iii. **High cost of legal documentation:** There is high cost of legal documentation of credit facilities at both state land registries and Corporate Affairs Commission (CAC) Nigeria. Charges has been a major issue of small and medium sized enterprise in Nigeria as a result of this, it has discouraged so many investors in the private sector of the economy. It was discovered that most small businesses were faced with the problem of high cost of attaining legal document from (CAC) Corporate Affairs Commission.
- iv. **Difficulties encountered in obtaining Credit Facilities:** The reluctance of banks to extend credit to small and medium sized enterprise can be traceable inadequate documentation of business proposal, lack of appropriate collaterals, high cost of administration as well as high interest rates and fixed charges on loans.
- v. **Unstable government policies:** Constant change in government policies is one of the major problems disrupting the operations of productions subsector, leading to discouragement in ventures into the sector.
- vi. **Corruption:** The wide spread of corruption and harassment of small and medium sized enterprises by some government agencies over unauthorized levies and charges imposed is quite alarming.

The challenges to efficient productivity having been so heightened, another dimension to it, is to proffer solution attainable solutions to these challenges. In line with this, Obasi (2013) and Malla et al (2018), did present these streams of solution.

- i. **Provision of adequate infrastructure:** Inadequate infrastructure is no doubt the major constraints militating against the progress and development of malfunctioning sub-sector of the economy. Efforts should be made by government to ensure that adequate physical infrastructure like good road networks, adequate supply of electricity, good health care system and good communication system are all in place in a bid to further encourage the production sub-sector. This will definitely reduce cost of doing business and also attract foreign investment.
- ii. **Elimination of Multiple Taxation System:** Government should to eliminate multiple taxes and levies imposed on small and medium sized enterprise in order to further encourage business owners to actively in the private sector of the economy. Furthermore, effort should be made to remove any sort of unnecessary dues, levies and taxes which are aimed at frustrating small and medium enterprise owners, and replace them with single tax system.
- iii. **Provision of Adequate Capacity Building:** Capacity building arguably one of the major constraints of small and medium business in Nigeria. However, effort should be made to address. The issue of marketing, accounting, administrative information and technology and technical problem in order to further enlighten entrepreneurs. The role of Industrial Training Fund (ITF), Centre for Management Development (CMD), National Directorate for Employment (NDE), Project Development Centre (PRODA) etc all are laudable government agencies to promote productivity.

- iv. **Provision of Accessible Credit Facilities:** Government should make sure that entrepreneurs have easy access to credit facilities either through government agencies like SMEDAN (Small and Medium Enterprises Development Agency of Nigeria). This will eliminate the hassle associated with obtaining interest loan from banks. In addition to the above mentioned, the paper adds that efficient manpower development, reduction of tariffs on diesel, raw materials for production machines and equipment's for production processes will suffice.

Gains of Training and Development: Hence, the word productivity is involved, we should not should limit it to the manufacturing sub-sector alone, we should see productivity in line with efficient service delivery. To promote services delivery, it is evident that the gains derivable from training and development are not far-fetched in the running of an organization and by extension to its employee. Rao (1987) and Onichakwe (2013) have given the gains to include;

- i. **Reduced supervision:** When adequately trained, the employee will discharge his or her functions with less supervision leading to higher output.
- ii. **Esteemed Organizational Harmony/Stability:** The organization that has a reasonable number of trained and developed staff stands to weather the storm of high labour turnover.
- iii. **Waste Reduction and Increased Output:** The employee with adequate skills and development will work against increased waste generation thereby, giving a higher output with better quality.
- iv. **Morale Boosting:** The trained employee counts self as a member of the organization. This satisfies his safety, security, and ego needs.
- v. **Reduced Accidents at Work:** The trained worker is conversant with the job dynamics and precaution which when followed promote accident free work environment.

Furthermore, Njoku (2007) has justified training and development and asserts that it propels growth of both the organization and its employees. He presents the objectives of training and development to include;

- i. To assist the employee to acquire the required skills for the changing work methods in the work society.
- ii. Assisting the employees to increase their performance at work.
- iii. As an organization culture to enable new employees key into the organizational vision
- iv. To bring to the force each job-related proper attitudes in the employee.
- v. To prepare the employee for a higher job demand and tasks.
- vi. As a motivational factor, it reinforces the cordial relationship between employees and employers.
- vii. It helps in preparing the employees to take care of jobs in the absence of the key operators. This is done in the spirit of job enlargement findings.

Conclusion

It has been observed that productivity in a developing economy like Nigeria has not attained an enviable high in economic resilient. Any state that imports less and manufactures more for local and foreign consumption is striving towards a balanced economy. Again, highly trained workforce will showcase high productivity in service delivery, while a nation that imports more than local production will be at the receiving end poor growth, rising inflation, poor exchange regime, the current (November, 2023) naira/dollar exchange rate is a case on point.

Recommendations

The place of efficient productivity in any state cannot be overemphasized. The paper recommends that

- The Promotion of good measure of employment, provision of needed foods and services, generation of funds through taxes and levies by the public administration are assured.
- In that repair, the public administration should put fair and adequate modalities in place aimed at promoting productivity in a state like Nigeria.
- Dynamic public policy needed to accommodate system's challenges
- Consideration of the interest of team players in production sub-sector in public policy formulation.
- Adequate training and development of the employees.
- Judiciously supporting the manufacturers in the situation of comparative advantage.
- Continuous evaluation of public policies implementation on the activities of the manufacturing sub-sector.

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INNOVATIONS IN OFFICE TECHNOLOGY AND MANAGEMENT IN SUSTAINABLE DEVELOPMENT GOALS IN DIGITAL ERA

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ABSTRACT

This study explores the relationship between sustainable development, invention in office technology and effective operation practices. Sustainable development has become a pressing global precedence and it's pivotal to examine how invention in office technology and operation can contribute to achieving this target or goal. The study aims to identify the crucial factors that stimulate sustainable development within the office terrain, with a specific focus on innovative technological results and operation. The exploration design employed in this study involves an inclusive literature review and analysis of case studies. The analysis concludes that invention in office technology, similar as energy-effective bias, digitalization and robotization significantly aid office directors harness reduction of resource consumption, waste generation and environmental impact. It's also incompletely concluded that effective operation practices are viewed as vital in promoting sustainable development because it promotes and nurtures hand engagement and mindfulness programs, enforcing recycling enterprise, and espousing eco-friendly procurement processes which are pivotal way. This to a lesser extent enhances the overall sustainability performance of associations. The paper saliently recommends among others that government agencies should encourage their workers to effectively emplace use of electronic communication and cooperative tools for internal and external communication. Flexible work arrangements towards remote work options which reduces exchanging and office space conditions should also be promoted.

KEYWORDS: Innovation, Office Environment, Digitization and Automation,
Sustainable development, Office Technology

Introduction

The Sustainable Development Goals (SDGs) were adopted by all United Nations Member States in 2015 as a universal call to action to address social, economic, and environmental challenges worldwide. They aim to end poverty, protect the planet, and ensure prosperity for all by 2030. Innovation refers to introducing new ideas or processes that bring about positive change across various domains such as technology, business, science healthcare and more with

different types of innovation - product improvement through new products; enhancing efficiencies through process improvements; reinventing how a company creates value via innovative models: addressing societal needs which require novel approaches called "Social Innovations". Organizational office management courses prepare students for positions available within technological offices including computer networking administration systems analyst roles among others requiring technical proficiency like managing payrolls/sales records while utilizing communication tools/software efficiently ensuring maximum benefit can be achieved from adoption!

2.0 Sustainable Development Goals (SDGs)

The Feasible Improvement Objectives (SDGs) are a set of 17 worldwide objectives received by all Joined together Countries Part States in 2015 (UNICEF, 2017). They are outlined to be an inclusive call to activity to address the social, financial, and natural challenges confronting our world. The SDGs construct on the victory of the Thousand years Advancement Objectives and point to realize three primary goals by 2030: conclusion destitution, secure the planet, and guarantee success for all. Here are the 17 Sustainable, Sustainable Development Goals:

1. No Poverty, End poverty in all its forms far and wide.
2. Zero Hunger End hunger, achieve food security, and promote sustainable husbandry.
3. Good Health and Well- being insure healthy lives and promote well- being for all at all periods.
4. Quality Education insure inclusive and indifferent quality education and promote lifelong literacy openings.
5. Gender Equality Achieve gender equivalency and empower all women and girls.
6. Clean Water and Sanitation insure vacuity and sustainable operation of water and sanitation for all.
7. Affordable and Clean Energy insure access to affordable, dependable, sustainable, and ultramodern energy for all.
8. Decent Work and profitable Growth Promote sustained, inclusive, and sustainable profitable growth, full and productive employment, and decent work for all.
9. Assiduity, Innovation and structure figure flexible structure, promote inclusive and sustainable industrialization, and foster invention.
10. Reduced Inequalities Reduce inequality within and among countries, and insure equal occasion and equity for all.
11. Sustainable metropolises and Communities Make metropolises and mortal agreements inclusive, safe, flexible, and sustainable.
12. Responsible Consumption and product insure sustainable consumption and product patterns, aiming for more effective use of coffers.

13. Climate Action Take critical action to combat climate change and its impacts.
14. Life below Water Conserve and sustainably use the abysses, swell, and marine coffer. 15. Life on Land- thing.
15. Aims to cover, restore, and sustainably manage timbers, combat desertification, halt and rear land declination, and halt biodiversity loss. It focuses on promoting the conservation of terrestrial ecosystems, icing sustainable use of land coffer, and taking critical action to help the extermination of hovered species.
16. Peace, Justice, and Strong Institutions it focuses on promoting peaceful and inclusive societies, furnishing access to justice for all, and structure effective, responsible, and inclusive institutions at all situations. It targets reducing violence, icing access to justice, combating corruption, and promoting the rule of law.
17. Hookups for the pretensions it emphasizes the significance of collaboration and hookups to achieve the SDGs. It focuses on strengthening global hookups and means of perpetration, enhancing transnational cooperation, and marshaling coffer to support sustainable development (UNICEF, 2020).

Concept of Office Technology and Management

Office Technology and Management (OTM) programme in Nigeria was designed by the National Board for Technical Education (NBTE) to replace the Secretarial studies programme. Office Technology and Management programme was designed to equip scholars with ultramodern chops in office technology and operation and socio-cerebral work skill for employment in colorful fields of bid(NBTE, 2004). According to Nwosu(2007), Office Technology and Management programme in Nigeria include; office operation, office technology, business and administration operation, numeric element, general studies and scholars artificial work experience scheme(SIWES). Baba and Akarahu(2012) asserted that Office Technology and Management programme is used as a comprehensive term pertaining to aspects of the educational process involving, in addition to general education, the study of technologies and related lores, and the accession of practical chops, stations, understanding and knowledge relating to occupations in colorful sectors of profitable and social life. The author submitted further that the design of the OTM programme factors also appears to be in response to a global action with an ideal that portends new academic direction in favour of new technologies for tutoring OTM. New technologies are especially inestimable in chops-affiliated education programme similar as OTM where graduates are needed to demonstrate chops and capabilities demanded in a 21st century that is largely competitive and technology- driven(Amiaya, 2014).

Office Technology and Management(OTM) is a title that replaces secretarial studies(as it was formally called). According to Okoro and Amagoh(2008), as(Ogbusuo, 2016) cited in her book, it's an effective, effective, productive and functional education which leads itself to tone-employment, tone- reliance, paid employment and accordingly tone- fruition. It focuses on combining office information specialized chops with acceptable and applicable business knowledge in working association wide problems. Baba and Akaraha(2012), were of the view that it's aimed at accession of applicable chops, capacities and capabilities both internal and physical as outfit for individual to live and contribute to the development of the society. To

NBTE,(2006) OTM programme was designed to equip scholars with secretarial/ office chops for employment in colorful fields of bid. The current OTM programme lays important emphasis on computer and computer related courses. These courses are divided into;

1. Special area which includes secretarial studies, fashion in office operation and control.
2. Information and communication technology operation which includes ICTs, word processing, computer appreciation, web runner design, desktop publishing, database operation.
3. General education relating to contemporary problems generally called general studies(Ogiagah, 2009).

The pretensions and objects of OTM according to the National Board for Technical Education(NBTE, 2004), include

1. Equip the scholars with the knowledge, capabilities and specific chops that will enable them to successfully hold position as registers, directors and executive adjunct in both public and private sectors of the frugality.
2. Expose pupil to artificial experience thereby swinging them the occasion to practicalize their chops.
3. Develop the pupil's capabilities for farther academic and professional pursuit.
4. Develop in the scholars an occupational intelligence that will make them protean and adaptable to the changing situation in the world of work.

Roles/Duties of an Office Manager

The functions and duties of an office manager is not different from what religious organistions or supermarket manager does. In an attempt to discuss what an office technology and management entails, Free Encyclopedia (2012) outlined the duties of an office technology manager to include:

1. Using a range of office software, including email, spreadsheets and databases.
2. Managing filing systems.
3. Depending on the organisation, duties of the role may extend to the management of social media.
4. Developing and implementing new administrative systems, such as record management.
5. Recording office expenditure and managing the budget.
6. Organizing the office layout and maintaining supplies of stationery and equipment.
7. Maintaining the condition of the office and arranging for necessary repairs.

8. Organizing and chairing meetings with staff - in lower paid roles this may include typing the agenda and taking minutes, but senior managers usually have an administrative assistant to do this.
9. Overseeing the recruitment of new staff, sometimes including training and induction.
10. Ensuring adequate staff levels to cover for absences and peaks in workload, often by using temping agencies.
11. Carrying out staff appraisals, managing performance and disciplining staff.
12. Delegating work to staff and managing their workload and output.
13. Promoting staff development and training.
14. Implementing and promoting equality and diversity policy.
15. Writing reports for senior management and delivering presentations.
16. Responding to customer enquiries and complaints.
17. Reviewing and updating health and safety policies and ensuring they are observed,
18. Arranging regular testing for electrical equipment and safety devices.
19. Attending conferences and training.

Considering the diversity of functions, office technology managers are expected to have many talents. Some of the competencies expected to be possessed emphasizes on problem solving, decision making abilities, integrity, assertiveness, flexibility, accuracy and the ability to cope with pressure. Ugwoke (2010) stated that office manager's functions are greatly needed for the socio-economic development of the country because of the new forms of work processes and organization which are introduced by globalization and Information and Communication Technology (ICT).

Sustainable development through innovations in office technology and management

In today's rapidly evolving world, the concept of sustainable development is more important than ever. The role of innovation in office technology and office management is becoming increasingly important as companies strive to maximize efficiency and productivity while minimizing their environmental impact. Integrating sustainable practices into office operations can make a huge positive difference, not only from an environmental protection perspective, but also from an economic growth and social responsibility perspective. The aim is to explore the remarkable transformations that sustainable development can bring about through innovations in office technology and office management. We look at the different ways companies can use innovation to introduce environmentally friendly practices, streamline operations, reduce waste, and promote a healthier, more sustainable working environment.

Additionally, we analyze the long-term benefits of adopting sustainable practices, including: Improved resource management, increased employee engagement, and enhanced company reputation.

The Sustainable Development Goals (SDGs) are universal goals adopted by all member states of the United Nations and intended to be achieved by 2030. These goals provide a blueprint for addressing global challenges, including poverty, inequality, climate change, and environmental degradation.

Relative innovation in office technology and office management will play an important role in achieving these goals. Here are some common examples you can refer to:

1. **Goal 8: Decent work and economic growth:** Innovations in office technology, including automation, artificial intelligence and digital platforms, will increase productivity, streamline processes and create new job opportunities.
2. **Goal 9: Industry, innovation and infrastructure:** Innovation in office technology can contribute to the development of sustainable infrastructure, efficient supply chains and smart cities. For example, sensors, data analytics, and Internet of Things (IoT) devices can be used to optimize energy consumption. This goal is best achieved by working with the office's technology and management team in all respects.

It is very important to note that innovation plays an important role in improving office technology and management practices. This helps companies streamline processes, improve efficiency, and adapt to the evolving needs of the modern workplace. The key areas where innovation has the greatest impact are listed below

1. **Communication and Collaboration Tools:** Innovation has led to the development of a variety of communication and collaboration tools, including instant messaging apps, video conferencing platforms, project management software, and cloud storage solutions. These tools enable effective collaboration and information sharing between team members, including office technology managers, regardless of their physical location.
2. **Data Analytics:** The use of data analytics tools and techniques has changed the way businesses manage and use data. Innovations in data analytics enable companies to track and measure key performance indicators. This can also be of great help to office technology managers in their research studies regarding record management and general business practices.

Digitization vs. Automation: What is the difference?

Automation vs. Digitalization: Automation and digitization have revolutionized office management by reducing time-consuming manual tasks. Innovations such as robotic process automation (RPA), workflow management systems, and digital document management platforms have streamlined administrative processes, improved accuracy, and accelerated decision-making. This promotes usage and improves and expands office management practices.

The terms "digitization" and "automation" are similar in theory, but in practice they are quite different.

Digitization is the process of converting something from paper form into digital form. For example, converting copies of paper patient records into a digital format that computers can process. Digitization is the first step towards automation. To automate information, it must be available and digestible by automation technology.

Automation

Automation improves approaches that existing era already gives. It leverages gadgets or software. It accomplishes tasks with none human intervention by counting on guidelines written by means of business subject count number specialists.

By appearing tasks — together with mechanically sending customers reminders and customized cut price codes — automation allows businesses stay competitive in the market. Automation also frees up people to awareness on fee-upload activities.

What does it imply to digitize a commercial enterprise manner?

Digitizing a enterprise method converts a non-virtual procedure right into a digital layout. Digitization shifts from a paper storage model to cloud-primarily based statistics warehouses. It additionally reduces bodily locations in choose of growing on line presence.

Take banks, for instance: Not long ago, customers had to go to a physical branch, stand in line, and engage with a teller to deposit a paper check. Digitizing these transactions has made banks a ways greater green and purchaser-centric. Purchasers opt for the ease of serving themselves on their financial institution's website or app.

Except making enterprise methods faster, digitization can also make them greater specific. Pharmaceutical organizations are a high example. In pharma, digitization has:

Dramatically decreased time to marketplace. Expanded compliance

Digitized research and development strategies have lessened human errors

On pinnacle of that, digitizing drug development processes has organized lifestyles technological know-how businesses for future automation.

What does it mean to automate a enterprise manner?

Automating a commercial enterprise process entails using era to carry out repetitive responsibilities systematically. Automation additionally replaces manual techniques. While it's accomplished proper, automation frees personnel to attention on extra impactful commercial enterprise and creative tasks.

Generating reports is a enterprise technique that a enterprise can automate. Leaders want reviews to stay knowledgeable, but middle control can also spend an inordinate quantity of time supplying the facts. Instead of typing and emailing popularity reports manually, why now not enter the facts right into a centralized database? From there, a business can consolidate facts mechanically.

With automation, middle managers can check information more significantly and present the insights they discover more efficiently. With higher and more frequent submissions of enterprise-critical statistics, management can take more meaningful motion.

Digitization and automation: The aggregate each company wishes

In trendy, businesses that include digitization find it less complicated to technique and keep critical records. Their systems are simpler to keep, and that they meet customer wishes extra correctly. Automation shifts operational recognition away from repetitive tasks and closer to greater complicated responsibilities that add fee to the commercial enterprise.

Agencies that digitize their operations can use emerging technology like synthetic intelligence to find out new approaches of optimizing and personalizing automatic strategies. As a end result, digitization may gift possibilities for extra sales streams or elevated customer loyalty.

Conclusion

By way of the above descriptive annotations, integration of sustainable improvement practices thru innovation in office technology and management is crucial for groups to gain lengthy-time period achievement at the same time as minimizing their environmental effect.

Through adopting sustainable practices, groups can lessen useful resource consumption, enhance operational performance, and make contributions to a more fit planet. Innovation in office generation can play a great position in accomplishing sustainable development goals.

Via the use of power-green devices, digitalization of approaches, and implementation of smart workplace answers, businesses can lessen their ecological footprint. Streamlining operations, optimizing aid usage, and implementing renewable power sources can make a contribution to sustainable improvement.

Effective management practices also are pivotal in promoting sustainable improvement. Encouraging worker engagement and recognition programs, imposing recycling projects, and adopting green procurement approaches are critical steps.

Additionally emphasizing faraway paintings opportunities and flexible schedules can substantially decrease pointless commuting and energy use to which if well explored may be availed by means of the workplace era managers.

Recommendations

The subsequent suggestions are positioned into improve in promoting sustainable improvement via innovation in workplace technology and management:

1. Governments at Federal and nation degrees have to inspire using strength-efficient office gadget or technology along with LED lighting fixtures, smart strength strips, and energy-saving computers. Those technologies now not only can drastically reduce strength intake and decrease carbon emissions, therefore addressing our Nigerian energy challenges, but can equally aid office era managers adapt with the technology for enhance paintings efficiency.

2. In view that digital document management systems reduce paper utilization, this paper suggests government agencies to inspire their employees to effectively installation use of digital communication and collaborative tools for internal and outside verbal exchange. This no longer best improves communication performance of workplace generation managers however similarly saves paper usage and improves efficiency and reduces office management expenses.
3. It additionally recommends merchandising of flexible work arrangements toward far off work options which reduces commuting and office area necessities.
4. Authorities is also encouraged to spend money on dependable video conferencing equipment allows in the direction of digital meetings which reduce enterprise travels. This helps to reduce greenhouse gas emissions at the same time as enhancing paintings-lifestyles stability for personnel, at the same time as lowering fee of administration and control and fasten workplace paintings. If explored this can harness and enhance workplace control as nicely, being an era that hyperlinks stakeholders within the workplace.
5. The paper recommends workplace technology managers to installation utilization of complete waste control era machine that focuses on recycling, composting, and reducing office waste. Companies have to offer recycling boxes all through the office era managers who have to train different personnel approximately right waste disposal practices.
6. The paper also proffered that authorities groups to aid office generation managers via giving them precedence in buying eco-friendly office supplies and equipment, such as energy-efficient computers, recycled paper, and environmentally-friendly cleaning products. This can guide worldwide attempt in support providers that adhere to Sustainable practices.

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GEOGRAPHICAL STRUCTURE OF THE NIGERIAN POWER SECTOR

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ABSTRACT

The research main objective was to investigate the imbalance in the system due to increasing load demand surpassing supply. The research result is as follows; Table 4.1 shows that the south-south zone consist of total plant installed capacity of 5,879MW, total available capacity of 3,234MW and total grid load of 1,786.92MW. Table 4.2 shows that the south-east zone consist of total plant installed capacity of 504.4MW, total available capacity of 240MW and total grid load of 113.8MW. Table 4.3 shows that the south-west zone consist of total plant installed capacity of 2,724MW, total available capacity of 1,894MW and total grid load of 708.1MW. Table 4.4 shows that the north-west zone consist off total plant installed capacity of 1,938.4MW, total available capacity of 1,332MW and total grid load of 957MW. Table 4.5 shows that the north-central zone consist of; total plant installed capacity of 858MW, total available capacity of 858MW and total grid load of 414MW. Table 4.6 shows that the north-east zone consist of total plant installed capacity of 0MW, total available capacity of 0MW and total grid load of 0MW.

KEYWORDS: Geographical, Structure, Nigeria, and Power Sector

1.1 INTRODUCTION

It is worth knowing that only 12 states, at of the 36 states in Nigeria and Federal Capital Territory, Abuja, generate the entire power utilized in the country. The geographical spread of Nigeria electricity generation sources is basically located in the South with the exception of Niger and Kogi states, which host three hydro power Gencos. Having the country's energy concentrated in one region consequently increases transmission and distribution cost with addition of lower supply to the required demand to serve the entire country. It is worth knowing that every region in Nigeria possess sources of electricity that could be exploited, but these potentials are not being maximized.

This research is to basically to expose our laxity in exploiting the available energy sources across every region in Nigeria that would be of immense benefit to Nigeria to expand its energy supply mix. It is imperative to eminently initiate regulations that would facilitate investment in the various energy sources in the country across all region.

Also, utilizing the different clean and reliable renewable energy sources will be a great value in enhancing and increasing generation in the country thereby decentralizing its energy generation and supplies to meet up demand. The abundant sun energy in the North is wasting

without being exploited. There are hydro potentials in both the North and South of Nigeria; there is also potentials for wind. Generating electricity through all the various energy sources across the country will significantly decentralize electricity generation and distribution across Nigeria to boost and complement the grid power supply. If utilized, our clean energy resources and potentials are enough to meet and surpass our power demand and reach even more of the most remote communities in states and regions across Nigeria.

2.1 Review of Related Works

Numerous research studies of geographical structure of the Nigerian power sector have been carried out by different scholars in past years but because of the continued increase in demand surpassing supply by miles has open more research on the power sector in order to mitigate and narrow down the demand and supply.

Olakunle A., & Kehinde A. (2018). They worked on an overview of the Nigerian power sector, the challenges of its National Grid and Off-Grid development as a proposed solution. They found out that Nigeria can increase its electrification rate through the provision of off-grid energy services to rural households and businesses using the country's abundant renewable energy resource potential. This paper analyses the current electrification rates in the different geopolitical zones of Nigeria and proposes the application of off-grid solar PV in the North of Nigeria as the quickest way to increase electricity access in the country. Likewise, this paper then examines relative successes of rural electrification programs in Kenya, Peru and Chile and applies the lessons learnt from these countries to provide recommendations to accelerate the pace of rural electrification through off-grid development.

Oladimeji A., al. et. (2019). They worked on Nigeria electricity power supply system: The Past, Present and the Future. They found out that electric power system in Nigeria has undergone a lot of transformation both in its physical structure and organization. From a small generating station, it has metamorphosed into its present form of 16 generating stations, a transmission company and 11 distributed companies. Considering its present state and the need to harness the abundant renewable energy resources in the country, it is envisioned that the transformation will continue into the future to meet the ever increasing load demand of Nigerians. The survey revealed that with the right policies in place private sector participation will be encouraged, leading to the rapid development of the Power Sector.

2.2 Overview of Nigerian Power System

Nigeria electricity supply started in 1896 during the erstwhile Colony era in Lagos when two small (60KW) generating sets were installed for their use. In 1978, an imbalanced between electricity generation capacity and load demand emerged, thereby causing power outage occurrence frequently. In view of this, the establishment of the Niger Dams Authority (NDA) was set up through its scheme, the construction of three hydro and three thermal generating plants was done. Nigeria population grew to 73.7 million in 1980 but was lacking available power growth pegged at 783MW. Available power was later increase to 1273MW in the year 1988 and subsequently, total available increase to 3,000MW in year 1992 with her population rose to 80 million. In 2001, because of poor maintenance culture, the existing generating plants were already depreciating and this dropped the available generated power. In order to combat the depreciating available generated power and power shortage challenges, the Independent power producers (IPPs) and National Integrated Power Projects (NIPP) were established. Nigeria was only able to account for approximately 6,861MW of installed electric generating capacitor as at 2005. (Oladimeji, *et al.*, 2019)

The unbundling resulted in 6 generating companies and IPP which are jointly referred to as Gencos. With average available capacity of 3736.55MW in 2005 and a total PHCN installed capacities of 6656.40MW having a percentage availability of 56.13%. The total PHCN installed generating capacities was increased in 2009 to 9,914.4MW while IPPs (Okpai, Afam and Omoku power plants) contributed 1,115MW. The total generating power installed capacities was still at 8,876MW in 2014 while the available capacity at 3,795MW. Thus, load shedding resulted due to the increasing power generation deficit. (Oladimeji, *et al.*, 2019)

In 2016, there were available seventeen functional grid connected generating plant in Nigeria, eight (8) owned by federal government with a total installed generating capacity of 6,256MW with 2,484MW available capacity, while NIPP and IPP jointly owned nine (9) with a total generating installed capacity of 2,809MW with an available capacity of 1,336.5MW. The Nigerian thermal generating plant contributes up to 83% (4116MW) of the total available generation capacity. But then, as at that 2016, the total generating installed capacity was 10,396MW while total available power was 4,959. (Oladimeji, *et al.*, 2019)

Table 2.1 shows the high difference between the load demand and actual electricity supply. Using 2014 and 2016 as a reference point where the difference between the load demand and load supply were 21,639MW and 23,401MW respectively, courtesy of population growth without corresponding load supply growth representing about 15% and 17% of power availability. (Oladimeji, *et al.*, 2019)

Table 2.1: Nigeria Power Demand and Generated Power (Source: Oladimeji, *et al.*, 2019)

Year	Population (Million)	Estimated Demand (MW)	Generated Power (MW)	Available Power (MW)
1896	2.0	0.050	0.060	0.060
1980	73.7	5,085	2,240	783
1985	83.9	6,863	4,574	1,273
1990	95.6	8,291	4,960	2,400
2010	159.7	21,624	6,904	3,358
2014	165.0	25,434	8,876	3,795
2016	190.0	28,360	10,396	4,959

Presently, in 20 August 2020, there was a press release by the Transmission Company of Nigeria that the power sector recorded a new improved all time peak available load of 5,420.30MW which was effectively transmitted through the national grid at a frequency of 50.10Hz.(source: Transmission Company of Nigeria) while according to Nigeria energy sector released in 2020, Nigeria has a total installed generating capacity of 22 grid-connected generating plants in Nigeria is approximately 12,500MW, being largely dependent on both hydro power plant which account for about 15.7% with a total installed generating capacity of 1,967MW (3 Hydro plants) and fossil (gas) thermal power plants account for about 69.5% with a total installed generating capacity of 8,685MW (22 Gas Plants). Lack of maintenance and repairs reduced the installed capacity to 7,141MW available capacity while other issues such as gas constraint, water constraint, high frequency, line constraint and other constraint reduced the available capacity to the peak available load of 5,420.30MW. (Source: Nigeria Energy Sector).

Base on updated and latest information gotten from generating companies and Transmission Company of Nigeria is presented below:

- (i) installed gross capacity of existing power plants is now about 13,000MW
 - (ii) About 1967MW giving 15.7% from Hydroelectric power plant (HYDRO)
 - (iii) About 8685MW giving 69.5% from gas-fires Gas Turbine Power plants
 - (a) 6749MW (77.7%) in Open Cycle Gas Turbine Plants (GT OC)
 - (b) 1936MW (22.3%) in Combined Cycle Gas Turbine Plants (GT CC)
 - (iv) About 1848MW giving 14.8% from conventional Steam Power Plants (STEAM)
- (Source: Nigeria Energy Sector)

Table 2.2 below depicts the existing Nigerian generation plants and status of availability.

Table 2.2: Existing Nigerian Generation Plants and Status of Availability

(Source: Transmission Company of Nigeria)

NCC No	Name of Station	Primary Energy Resource	Power Plant Type	Commercial Operation Date	No. of Units	Units Capacity (MW)	Units Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Outage due to Gas Constraints (MW)	Outage due to Repair/Maintenance (MW)
1	Kainji-G7-10	Hydro	Hydro	1978	4	80	320	160	160		160
1	Kainji-G5-6	Hydro	Hydro	1968	2	120	240	240	154		
1	Kainji-G11-12	Hydro	Hydro	1976	2	100	200	100	100		100
2	Jebba	Hydro	Hydro	1983-88	6	96.4	578.4	482	336		96.4
3	Shiroro	Hydro	Hydro	1990	4	150	600	450	207		150
4	Egbin	Gas	Steam	1985-1987	6	220	1320	880	437	220	220
5	Sapele	Gas	Steam GT OC	1978-1981	6-4	120-75	1020	120	50	300	600
6	Delta GT3-8	Gas	GT OC	1975	6	25	150	100	60	25	25
6	Delta GT9-14	Gas	GT OC	1978	6	25	150	120	80		25
6	Delta GT5-20	Gas	GT OC	1990	6	100	600	400	357	100	100
7	Afam GT13-18	Gas	GT OC	1982	6	75	450	150	80		300
7	Afam GT19-20	Gas	GT OC	2002	2	138	276				276
7	Afam ST1	Steam	GT OC	2005	1	200		650	650	215	
	GT13-E2	Gas		2008	3	150					
8	Geregu FGN 1	Gas	GT OC	2007	3	138	414	414	300		
8	Geregu NIPP 1	Gas	GT OC	2013	3	148	444	148	96		
9	Omotosho 1	Gas	GT OC	2007	8	42	335				335
9	Omotosho 11	Gas	GT OC	2012	4	125	500	480	100.1		
10	Alaoji-NIPP	Gas	GT OC	2013-14	4	126.1	504.4	240	113.80	120	120
11	Olorunsogo 1	Gas	GT OC	2007	8	42	335	126	90		210

NCC No	Name of Station	Primary Energy Resource	Power Plant Type	Commercial Operation Date	No. of Units	Units Capacity (MW)	Units Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Outage due to Gas Constraints (MW)	Outage due to Repair/Maintenance (MW)
11	Olorunsogo 11	Gas Steam	GT CC	2011-2012	4	125	750			750	
12	Calabar/Odukpani	Gas	GT OC	2015	5	113	565	226	116		339
13	IHOVBOR (Eyaen)	Gas	GT OC	2013-14	4	113	452	225	8	225	113
14	Okpai IPP	Gas Steam	GT CC	2005	2	150	450	300	294		150
15	Ibom 1	Gas	GT OC	2009	1	42	42				42
15	Ibom 1	Gas	GT OC	2016	1	40	40	40	4.42		
15	Ibom 1	Gas	GT OC	2010	1	114	114	114			
16	Ebute Barge	Gas	GT OC	2002	9	30	270				270
17	Omoku IPP	Gas	GT OC	2006	6	25	150	75	51		75
18	Trans-Amadi IPP	Gas	GT OC	2002-2009	3-4	12-25	136	75	42.5		62
19	Rivers IPP	Gas	GT OC	2012	1	180	180	180	153		
20	Gbarain GT2 NIPP	Gas	GT OC	2016	1	113	113	113			
21	Paras Energy	Gas	GT OC		6	9	54	45	45	9	
22	Azura-Edo IPP	Gas	GT OC	2018	3	153	459	459	284		
TOTAL							12,861.8	7,037	3,937.82	1,505	4397.8

Table 2.2 reveals a detailed existing Nigerian generation plants and status of availability inclusive of unplanned/planned outages for maintenance or others reasons. From the information given in table 2.2, it shows that:

- (i) 7953MW giving 63.6% of the total installed capacity is shown as being available
- (ii) About 3850MW giving 30.8% of the total installed capacitor or 48.4% of the available could be utilized for the purpose of power evacuation
- (iii) About 3674MW giving 29.4% of the total installed capacity was out for maintenance/repair (long term as well as short term)
- (iv) About 3708MW giving 29.7% of the total installed capacity was not available due to gas constraints/vandalism.
- (v) About 1267MW giving 1267 MW giving 10.1% of the total installed capacity were out or reduced infeed capacity for other reasons.

(Source: Transmission Company of Nigeria)

Materials and Method

Method applied in carrying out the research is investigation of the Nigerian electricity generation sector and energy sources available across the geographical regions in Nigeria. The geographical impact of every region was utmost importance to ascertain the utilization of all available energy sources across the country.

The materials used include:

- (i) Generating station data sought from the following generating stations via transmission company of Nigeria: Shiroro G/S, Afam G/S, Egbin G/S, Sapele G/S, Delta G/S, Alaoji G/S, Kainji G/S, Omotosho G/S, Odukpani G/S (Calabar), Jebba G/S, Okpai G/S, Olorunsogo G/S, Ihovbor G/S and Geregu G/S.
- (ii) Nigerian 330kV grid network diagram.
- (iii) Microsoft Excel

Data Collection

The data utilized in this research were collected from Transmission Company of Nigerian (TCN). Also, oral interaction and site visitation with senior engineers from Transmission Company of Nigerian (TCN). The data comprises of existing Nigerian generation plants and status of availability.

Geographical Structure of the Nigerian Power Sector

There is an imbalance in the system due to generation mainly concentrated in the southern part of the country (Thermal stations in Port Harcourt, Delta, Enugu, Benin and Lagos) and Central west (hydro stations of Jebba, Kainji and Shiroro region). While there is a total absence of generating stations in the Central North, North East, though the load demand is mainly in South and South West. Long 330KV transmission lines are built (radial system) for the sole purpose of supplying load to little or no generating zones such as North East thereby leading to voltage regulation problems with excessive reactive power flowing through these lines which requires large reactive power compensation equipment (reactors) at the corresponding stations (Kano, Gombe, Maiduguri). Also, additional compensation equipment at Yola, Jalingo, and other substations necessitated because of aggravated overvoltage issues resulting from additional 330KV lines running in parallel. (Source: Transmission Company of Nigeria, 2017).

Figure 2.1 depicts the Geographical structure of the transmission company of Nigeria

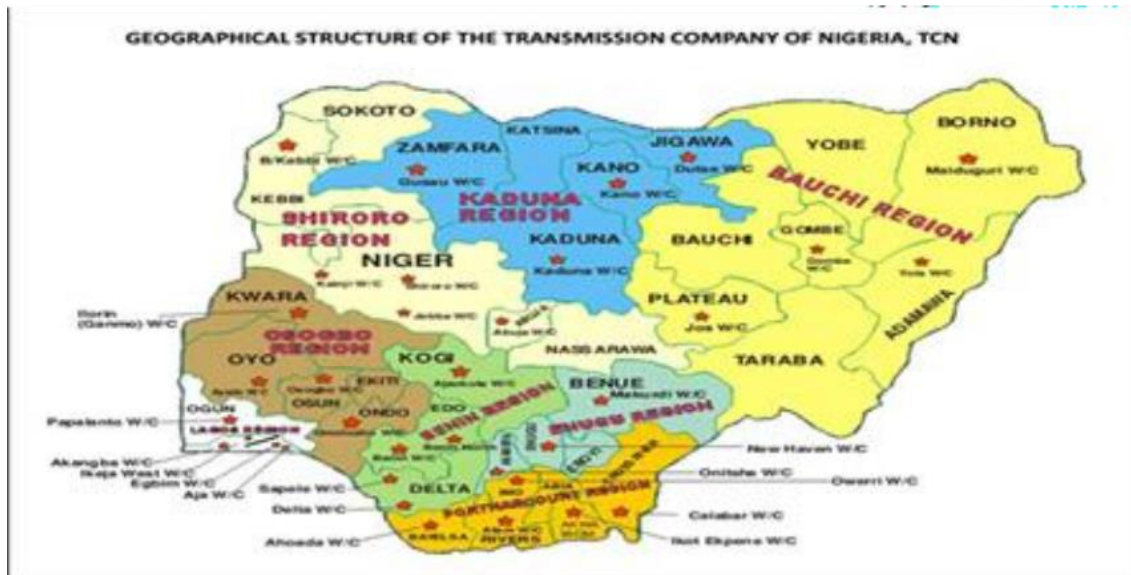


Figure 2.1: Geographical structure of the transmission company of Nigeria
(Source: Transmission Company of Nigeria)

Nigeria is divided into 6 geopolitical zones as shown in Figure 2.1 comprising of; South-South, South-East, South-West, North-West, North-East and North-Central. The tables below depict the total plant capacity, total available capacity, total grid load and voltage magnitudes of each zone.

Result and Discussions

Result

The geographical structure of the Nigerian generating company is listed in tables below.

Table 4.1: Generating Stations in South-South and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Sapele G/S	Gas	1020	120	50	330
2	Delta G/S	Gas	900	620	497	330
3	Afam G/S	Gas	1376	800	295	330
4	Odukpani G/S	Gas	565	226	116	330
5	Ibom G/S	Gas	191	40	4.42	330
6	Ikot Ekpene Bus	-	-	-	-	324.72
7	Omoku IPP G/S	Gas	150	75	51	330
8	Transamadi IPP G/S	Gas	136	75	42.5	330
9	Azura-Edo G/S	Gas	459	459	284	330
10	Benin Bus	-	-	-	-	330
11	Okpai IPP G/S	Gas Steam	450	300	294	330
12	Ihovbor	Gas	452	339		330
13	Rivers IPP G/S	Gas	180	180	153	330
14	Adiabor Bus	-	-	-	-	324.786

15	Aladja Bus	-	-	-	-	329.934
16	Asaba Bus	-	-	-	-	329.538
17	Benin Bus	-	-	-	-	329.868
18	Sakete Bus	-	-	-	-	327.69
Total			5,879	3,234	1,786.92	

Table 4.1 shows that the south-south zone consist of; total plant installed capacity of 5,879MW, total available capacity of 3,234MW and total grid load of 1,786.92MW with all the voltage buses within the statutory voltage stability limit of 313.5kV – 326.5kV.

Table 4.2: Generating Station in South – East and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Alaoji G/S	Gas	504.4	240	113.8	325.116
2	Alaoji T/S Bus	-	-	-	-	325.116
3	New Heaven Bus	-	-	-	-	323.697
4	Onitsha Bus	-	-	-	-	329.505
5	Ugwaji Bus	-	-	-	-	323.697
Total			504.4	240	113.8	

Table 4.2 shows that the south-east zone consist of; total plant installed capacity of 504.4MW, total available capacity of 240MW and total grid load of 113.8MW with all the voltage buses within the statutory voltage stability limit of 313.5kV – 326.5kV.

Table 2

4.3: Generating Stations in South – West and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Omotosho G/S	Gas	835	784	100.1	330
4	Ebute Barge G/S	Gas	270	-	-	-
5	Paras Energy G/S	Gas	132	45	45	300
6	Ayede Bus	-	-	-	-	328.812
7	Ikeja West Bus	-	-	-	-	328.977
8	Aja Bus	-	-	-	-	329.967
9	Akangba Bus	-	-	-	-	328.944
10	Alagbon Bus	-	-	-	-	329.868
11	Lekki Bus	-	-	-	-	329.967
12	Okearo Bus	-	-	-	-	329.142
13	Oshogbo Bus	-	-	-	-	328.845
Total			2,724	1,894	708.1	

Table 4.3 shows that the south-west zone consist of; total plant installed capacity of 2,724MW, total available capacity of 1,894MW and total grid load of 708.1MW with all the voltage buses within the statutory voltage stability limit of 313.5kV – 326.5kV.

Table 4.4: Generating Stations in North – West and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Kainji G/S	Hydro	760	400	414	330
3	Shiroro G/S	Hydro	600	450	207	330
4	Birnin Kebbi	-	-	-	-	320.463
5	Jebba TS Bus	-	-	-	-	330
6	Kumbotso	-	-	-	-	323.07
7	Mando	-	-	-	-	327.591
Total			1,938.4	1,332	957	

Table 4.4 shows that the north-west zone consist of; total plant installed capacity of 1,938.4MW, total available capacity of 1,332MW and total grid load of 957MW with all the voltage buses within the statutory voltage stability limit of 313.5kV – 326.5kV.

Table 4.5: Generating Stations in North – Central and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Geregu G/S	Gas	858	858	414	330
2	Ajakuta Bus	-	-	-	-	328.317
3	Gwagalada Bus	-	-	-	-	328.383
4	Jos Bus	-	-	-	-	313.566
5	Katampe Bus	-	-	-	-	328.383
6	Lokoja Bus	-	-	-	-	328.218
7	Markudi Bus	-	-	-	-	321.057
Total			858	858	414	

Table 4.5 shows that the north-central zone consist of; total plant installed capacity of 858MW, total available capacity of 858MW and total grid load of 414MW with Jos bus violating the statutory voltage stability limit of 313.5kV – 326.5kV.

Table 4.6: Generating Stations in North – East and Voltage Magnitude

(Source: Transmission Company of Nigeria)

S/N	Name of Station	Primary Energy Resources	Plant Capacity (MW)	Available Capacity (MW)	Infeed to Grid (MW)	Voltage Magnitude (KV)
1	Damaturu Bus	-	-	-	-	292.149

2	Ganmo Bus	-	-	-	-	328.977
3	Gombe Bus	-	-	-	-	327.36
4	Jalingo Bus	-	-	-	-	292.314
5	Maiduguri Bus	-	-	-	-	287.562
6	Yola Bus	-	-	-	-	293.568
Total		0	0	0	0	

Table 4.6 shows that the north-east zone consist of; total plant installed capacity of 0MW, total available capacity of 0MW and total grid load of 0MW with Damaturu bus, Jalingo bus, Maiduguri bus and Yola bus violating the statutory voltage stability limit of 313.5kV – 326.5kV.

5.1 Conclusion

The research main objective was to investigate the imbalance in the system due to generation mainly concentrated in the southern part of the country (Thermal stations in Port Harcourt, Delta, Enugu, Benin and Lagos) and Central west (hydro stations of Jebba, Kainji and Shiroro region). While there is a total absence of generating stations in the Central North, North East, though the load demand is mainly in South and South West. The conclusion of the research is listed below:

- (i) Table 4.1 shows that the south-south zone consist of; total plant installed capacity of 5,879MW, total available capacity of 3,234MW and total grid load of 1,786.92MW.
- (ii) Table 4.2 shows that the south-east zone consist of; total plant installed capacity of 504.4MW, total available capacity of 240MW and total grid load of 113.8MW.
- (iii) Table 4.3 shows that the south-west zone consist of; total plant installed capacity of 2,724MW, total available capacity of 1,894MW and total grid load of 708.1MW.
- (iv) Table 4.4 shows that the north-west zone consist of; total plant installed capacity of 1,938.4MW, total available capacity of 1,332MW and total grid load of 957MW.
- (v) Table 4.5 shows that the north-central zone consist of; total plant installed capacity of 858MW, total available capacity of 858MW and total grid load of 414MW.
- (vi) Table 4.6 shows that the north-east zone consist of; total plant installed capacity of 0MW, total available capacity of 0MW and total grid load of 0MW.

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PROFILE WEBSITE FOR THE MANAGEMENT STAFF (DELTA STATE SCHOOL OF MARINE TECHNOLOGY, BURUTU)

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ABSTRACT

Profile Website for the Management Staff (Delta State School of Marine Technology, Burutu) Profile website is a website that displays full information about person, in particular the management staff of Delta State School of Marine Technology, Burutu which is the Rector, Registrar, Bursar and Librarian of the above mention institution. The problem of the study is the difficulty associated with reaching out to any management officer in most institution, but in particular Delta State School of Marine Technology, Burutu with new comers and those who which to make inquiry about the institution as these information are not ready available on the internet, hence the aim of the study, to give detailed information about the management Staff and give create links to their contact information. This study follows an empirical order where the website is design with Hypertext Markup Language (HTML) for text display, image display and links creation and Cascading Style Sheet (CSS) for text presentation and Google Chrome to test the software. The scope of the study is limited to Delta State School of Marine Technology, Burutu and the design tools of HTML, CSS and Google Chrome for test running. The study is proofs to be effective as it is able to meet the aim of the study which is been able to display the management staff information and create links to contact them. In recommendation, it is recommended that all organization should build a profile website for their staff if not all but for the management staff, in conclusion an easily contact organization have high probability of productivity, hence profile website is a welcome mechanism for all institutions.

KEYBOARDS: Profile Website and Management Staff

1.0 INTRODUCTION

A profile website is a website that contains information about company, organization, institution and personal that is display on the internet, this could be to create awareness of goods for organization, and services for any of the above, it could also be to display personal information, that could help employees to match their requirement for purpose of easy inquiries and contact Bedford and Cooker (2015), Spencer.

A profile website for management staff (Delta State School of Marine Technology, Burutu) is not different from the above content; hence a website is built to display information for the

management staff of the institution, in other to curb the problem of difficulty to make inquiries from management staff by possibly contacting them for new comer (seeking for admission).

1.1 Analysis of the Existing System:

Currently the school is operating on manual system to contact the management staff of the institution; that is by first of all looking for someone who has their contact before contacting them which takes a lot of time and cost and could demand more effect than simply googly through the internet.

1.2 Advantages of the Proposed System

The proposed system has some advantages such as easy and quick access that can lead to minimize admission fraud, because first hand information will be given to the first comers

1.3 Analysis of the Proposed System

The proposed system is to build a website that will display the management staff information on the internet anytime anywhere as far as you have access to the internet.

The website display the profile information of the four management staff of the institution which is the rector, registrar, bursar and librarian by clicking on view profile and as well put call through to them by clicking on the call link and to massage them on whatsapp through the whatsapp link.

2.0 REVIEW OF RELATED LITERATURES

Below are literatures viewed on this study, they include:

Profile website is not just pertaining to companies or institutions but academic staff also uses this medium to display their profile; that can aids students and others to know those in their field of study to associate with Mogaji (2021).

Profiling also helps employees to distribute tasks based on their employers' records by viewing their profile to ascertain most qualify staff to handle tasks Rafae and Errital (2023).

Mohammed (2020) carried out a project on creating an employee management system that will help to store employees' information in a database that will enable managers to easily retrieval and communication.

3.0 MATERIALS AND METHOD

The website is design with Hypertext Markup Language (HTML) for text display, image display and links creation and Cascading Style Sheet (CSS) for text presentation and Google Chrome to test the software.

The website contains only a title which is profile website, and a welcome write up that says welcome to Delta State School of Marine Technology, Burutu and four photos, one each for the four management staff (Rector, Registrar, Bursar and Librarian) and view profile link is created for each of them to display their profile information and also call and whatsapp link for call and whatsapp respectively. Below are codes for the website

(a) Html code

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Profile Website</title>
  <link rel="stylesheet" href="styles.css">
</head>
<body>
  <h1> Welcome to Delta State School of Marine Technology, Burutu</h1>
  <DIV class="container">
    <DIV id="RECTOR">
      
      <P>RECTOR</P>
      <A HREF="RECTOR PROFILE">VIEW PROFILE</A>
      <p><a href="tel:+1238054726223">CALL</a></p>
      <p><a href="WHATSAPP:+1238054726223">WHATSAPP</a></p>
    </DIV>
    <DIV id="REGISTRAR">
      
      <P>REGISTRAR</P>
      <A HREF="REGISTRAR PROFILE">VIEW PROFILE</A>
      <p><a href="tel:+1238054726223">CALL</a></p>
      <p><a href="WHATSAPP:+1238054726223">WHATSAPP</a></p>
    </DIV>
    <DIV id="BURSAR">
      
      <P>BURSAR</P>
      <A HREF="BURSAR PROFILE">VIEW PROFILE</A>
      <p><a href="tel:+1238054726223">CALL</a></p>
      <p><a href="WHATSAPP:+1238054726223">WHATSAPP</a></p>
    </DIV>
    <DIV id="LIBIRIAN">
      
      <P>LIBRARIAN</P>
      <A HREF="LIBRARIAN PROFILE">VIEW PROFILE</A>
      <p><a href="tel:+1238054726223">CALL</a></p>
      <p><a href="WHATSAPP:+1238054726223">WHATSAPP</a></p>
    </DIV>
  </DIV>
</body>
</html>
```

(b) CSS code

```
h1 {
  text-align: center;
}
body {
  background-color: aqua
}
```

```

}
DIV.container{
  display: flex;
  margin-top: 5%;
  margin-bottom: 5%;
  height: 500px;
  width: 100%;
  border: 1px solid black;
}
DIV #RECTOR {
  position: relative;
  margin-top: top 5pixel;
  padding: 10pixel;
  margin-right: 10pixel;
  height: 500px;
  width: 25%;
  border: 1px solid black;
}
DIV #REGISTRAR {
  position: relative;
  padding: top 10pixel;
  padding: 10pixel;
  margin-right: 10pixel;
  height: 500px;
  width: 25%;
  border: 1px solid black;
}
DIV #BURSAR {
  position: relative;
  padding: top 10pixel;
  padding: 10pixel;
  margin-right: 10pixel;
  height: 500px;
  width: 25%;
  border: 1px solid black;
}
DIV #LIBIRIAN {
  position: relative;
  padding: top 10pixel;
  padding: 10pixel;
  margin-right: 10pixel;
  height: 500px;
  width: 25%;
  border: 1px solid black;
}
P {
  text-align: center; color: white;
}
}

```

4.0 RESULTS AND DISCUSSIONS

4.1 Profile Website for the Management Staff, Delta State School of Marine Technology:

This is the entire website being display, from here one click on view profile on any of the management staff to view his profile, call to put a call through and whatsapp to make a whatsapp message.

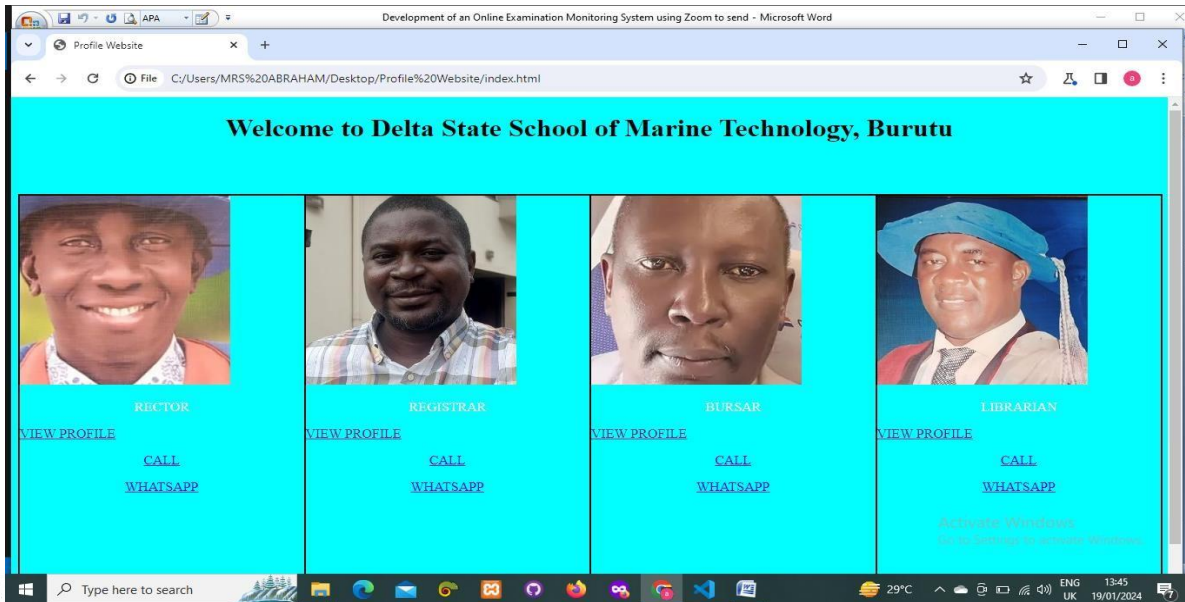


Fig. 1 Profile Website

4.2 Rector's Profile

Below is the rector's profile being display

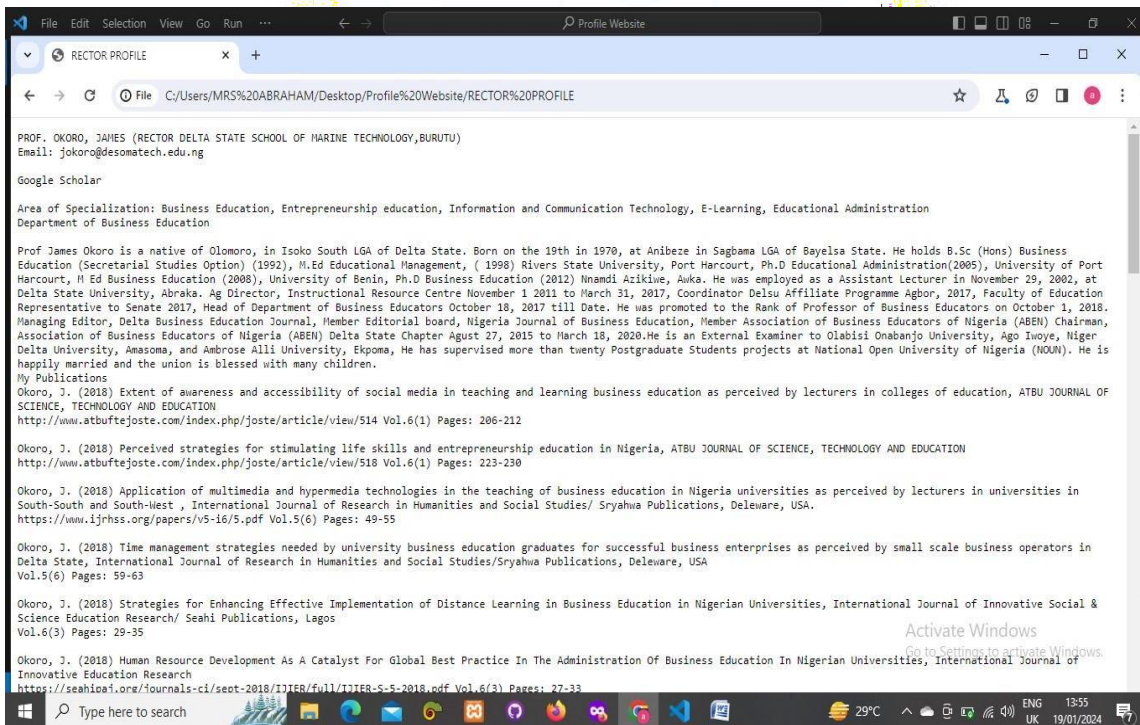


Fig. 2: Rectors Profile

4.3 Librarian's Profile

The institution librarian profile being display

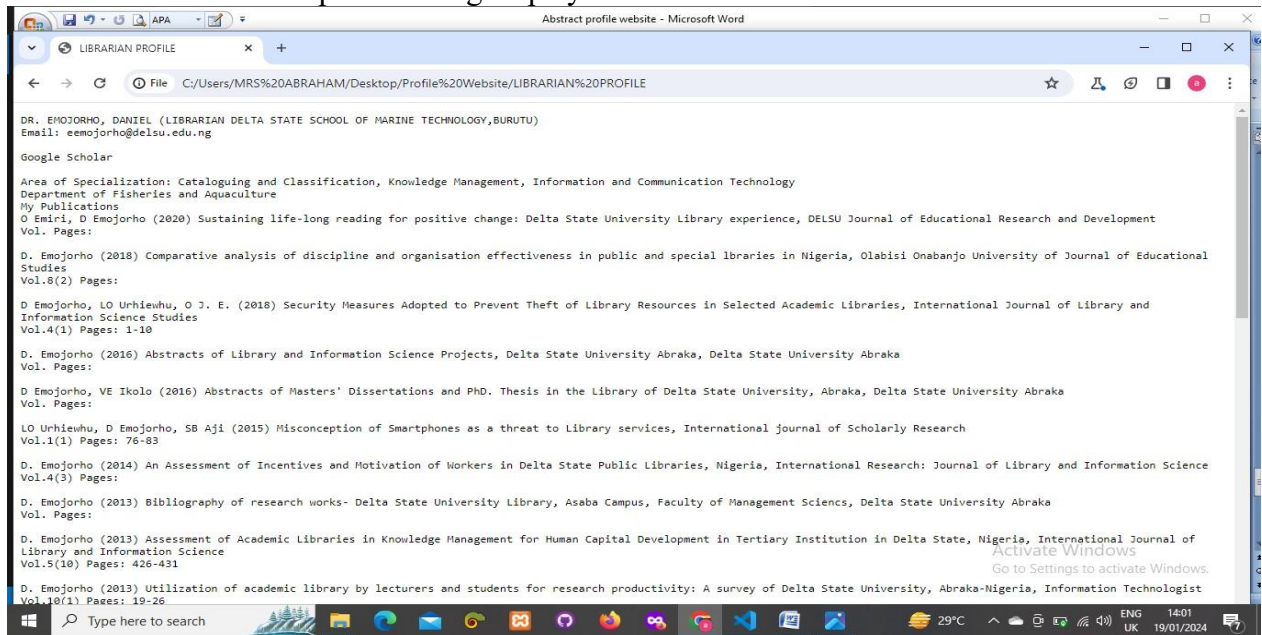


Fig. 3: Librarian Profile

4.4: Call link

By clicking on call, this will open up the call link to make a call

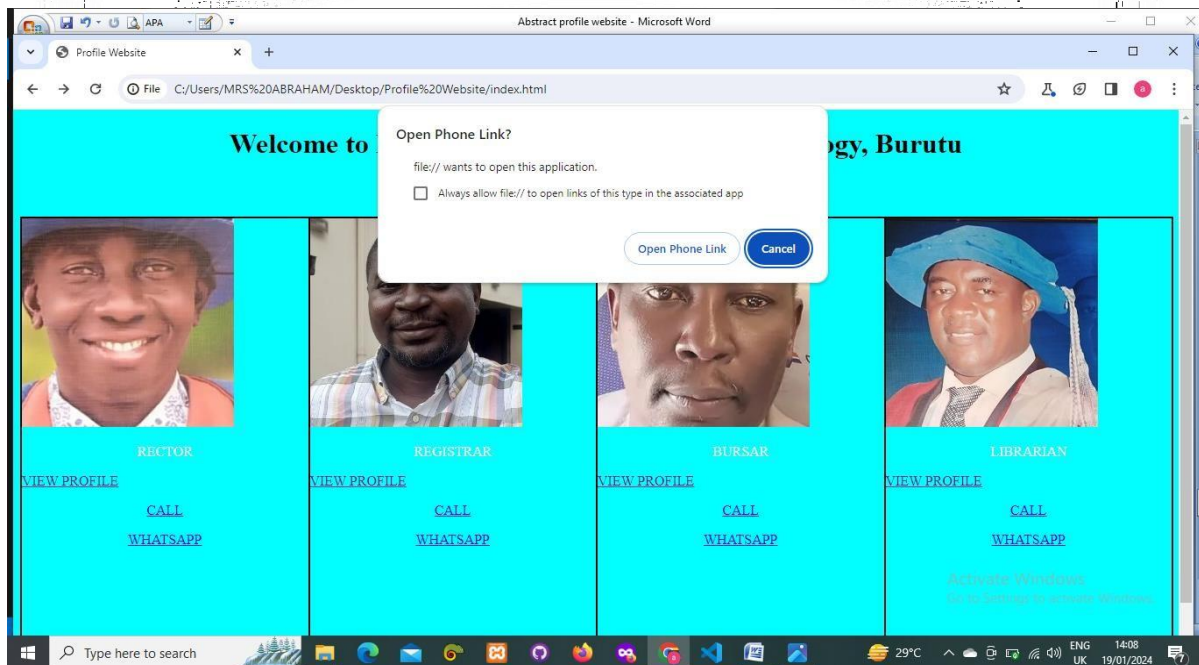


Fig. 5: Call link

4.6 Whatsapp link

By clicking on whatsapp, this will open up the whatsapp link to send whatsapp message.

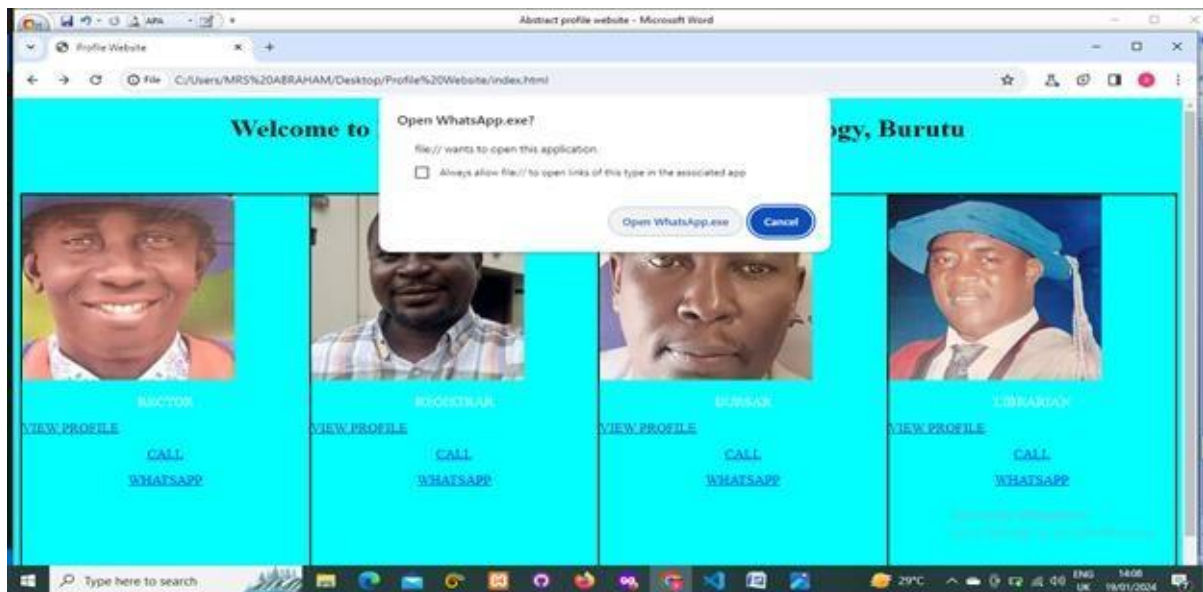


Fig. 6: Whatsapp Link

CONCLUSION

It is clear that the aim of this study is meant, that is to show case the profile and create contact for the management staff for easy inquiries and contact, the tools used where excellent for the study as well, therefore it is recommended that, website like this should be encourage in any organization be it institutional or otherwise.

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E-GOVERNANCE AND EFFICIENCY: HARNESSING DIGITAL PLATFORMS FOR TRANSPARENT AND RESPONSIVE GOVERNANCE

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ABSTRACT

In an era of rapid digital transformation, governments worldwide are increasingly turning to electronic governance (e-governance) to enhance efficiency, transparency, and responsiveness in their operations. This paper examines the role of digital platforms in facilitating transparent and responsive governance and explores how e-governance initiatives contribute to overall efficiency in public administration. The paper discusses the concept of e-governance and its significance in the modern administrative landscape. It highlights the potential of digital platforms to streamline bureaucratic processes, reduce administrative overheads, and foster greater citizen engagement. The paper explores how e-governance fosters responsiveness by enabling real-time interactions between citizens and government agencies. It discusses the role of online service delivery mechanisms, such as e-filing systems and digital feedback platforms, in addressing citizen needs promptly and efficiently. Overall, this paper underscores the transformative power of e-governance in modernizing public administration and improving service delivery to citizens. By harnessing digital platforms effectively, governments can build more accountable, inclusive, and efficient governance systems that meet the evolving needs of society.

KEYWORDS: E-Governance, Efficiency, Digital Platforms, And Responsive Governance

Introduction

In the contemporary era, as the world becomes increasingly digitized, governments worldwide are embracing electronic governance, or e-governance, as a transformative tool to enhance efficiency, transparency, and responsiveness in their operations (Malodia et al., 2021). E-governance entails the use of information and communication technologies (ICTs) to streamline government processes, deliver services to citizens, and foster participatory governance. By leveraging digital platforms, governments aim to bridge the gap between the state and its citizens, ensuring better service delivery, increased accountability, and a more inclusive decision-making process (David et al., 2023)

The advent of e-governance represents a paradigm shift in the way governments interact with their constituents. Traditionally, bureaucratic procedures often led to inefficiencies, delays, and opaqueness in government operations (David et al., 2023). Citizens faced numerous challenges in accessing public services, obtaining information, and engaging with government authorities (Asogwa, 2013). However, with the proliferation of digital technologies, governments now have the opportunity to overhaul their administrative mechanisms, making them more agile, accessible, and accountable (Chen, 2016).

One of the fundamental pillars of e-governance is transparency. Digital platforms enable governments to disseminate information swiftly and comprehensively, empowering citizens with access to crucial data about government policies, expenditures, and performance (Ali, 2023). Through online portals, open data initiatives, and interactive dashboards, citizens can scrutinize government actions, hold officials accountable, and actively participate in the decision-making process. Transparent governance fosters trust between the state and its citizens, strengthening the social contract and enhancing the legitimacy of democratic institutions (Faura-Martínez & Cifuentes-Faura, 2020).

Moreover, e-governance facilitates efficiency gains by streamlining administrative processes and reducing bureaucratic bottlenecks. By digitizing paperwork, automating routine tasks, and implementing online service delivery mechanisms, governments can eliminate redundancies, minimize delays, and optimize resource utilization (Menzel, 1998). For instance, electronic tax filing systems enable taxpayers to submit returns seamlessly, reducing processing times and administrative costs for government agencies. Similarly, online permit applications, license renewals, and procurement portals expedite transactions, fostering a more conducive environment for business and economic growth (Menzel, 1998).

Furthermore, e-governance promotes responsiveness by enhancing communication channels between the government and its constituents. Through digital platforms such as social media, mobile apps, and online forums, citizens can voice their concerns, provide feedback, and engage in dialogue with policymakers in real-time (Dooley, 2021). Governments, in turn, can leverage these channels to solicit public opinion, gather input on policy decisions, and address grievances promptly. By fostering a culture of responsiveness, e-governance enables governments to adapt to evolving citizen needs, prioritize issues of public interest, and deliver tailored solutions effectively (Chaudhry et al., 2020).

However, the successful implementation of e-governance initiatives requires careful planning, robust infrastructure, and capacity building. Governments must invest in ICT infrastructure, cybersecurity measures, and digital literacy programs to ensure widespread access and adoption of digital services (Ali Mashuri, 2019). Additionally, policymakers need to address concerns regarding data privacy, digital inclusion, and cybersecurity to build trust and confidence among citizens. Moreover, e-governance initiatives should be accompanied by regulatory reforms, institutional restructuring, and stakeholder engagement to maximize their impact and sustainability Ali, (2023).

e-governance represents a transformative opportunity for governments to enhance efficiency, transparency, and responsiveness in their operations. By harnessing digital platforms, governments can bridge the gap between the state and its citizens, foster trust, and promote inclusive governance. However, realizing the full potential of e-governance requires concerted efforts from policymakers, stakeholders, and citizens alike to overcome challenges and capitalize on the opportunities presented by the digital age Ali, (2023).

Overview of E-Governance and Efficiency

In an era where technology pervades every aspect of human life, governance has not remained untouched. Electronic Governance, or E-Governance, has emerged as a transformative force reshaping administrative processes, citizen engagement, and public service delivery. The integration of information and communication technologies (ICTs) in governmental operations promises greater efficiency, transparency, accessibility, and accountability. This overview explores the concept of E-Governance, its components, benefits, challenges, and the role it plays in enhancing efficiency in public administration.

Understanding E-Governance

E-Governance refers to the utilization of ICTs to facilitate the interaction between government and citizens (G2C), government and businesses (G2B), government and employees (G2E), and between different government agencies (G2G). It encompasses a wide array of applications, including online service delivery, digital communication channels, electronic record-keeping, data analytics, and decision support systems. The primary goal of E-Governance is to streamline processes, improve service delivery, foster transparency, and empower citizens through digital means.

Components of E-Governance

Digital Services: Governments provide various services online, ranging from tax filing and permit applications to passport renewals and bill payments. Digital platforms enable citizens to access these services conveniently from anywhere, reducing bureaucratic hurdles and processing times.

Open Data Initiatives: Governments release datasets pertaining to demographics, budgets, infrastructure, and other public information for free access and use by citizens, researchers, and businesses. Open data initiatives promote transparency, accountability, and innovation while facilitating evidence-based decision-making.

Mobile Applications: Mobile apps serve as accessible interfaces for citizens to engage with government services and receive real-time updates. These apps often provide functionalities such as reporting civic issues, tracking government projects, and accessing informational resources.

E-Participation Platforms: Online forums, social media channels, and interactive websites enable citizens to participate in policymaking, share feedback, and collaborate with government agencies. E-participation platforms enhance democratic processes by fostering dialogue and inclusivity.

Digital Identity and Authentication: Secure digital identity systems authenticate users' identities for accessing government services and conducting online transactions securely. Biometric authentication, digital signatures, and multi-factor authentication methods bolster security and trust in digital interactions.

Benefits of E-Governance

Enhanced Efficiency: By automating processes and reducing paperwork, E-Governance streamlines administrative procedures, resulting in cost savings, faster service delivery, and improved resource allocation.

Improved Accessibility: Digital platforms enable citizens, especially those in remote areas or with disabilities, to access government services conveniently without the need for physical presence.

Transparency and Accountability: E-Governance promotes transparency by making government operations and data easily accessible to the public. This fosters accountability as citizens can monitor government activities and hold officials accountable for their actions.

Citizen Empowerment: Through E-Governance, citizens have greater access to information, participation in decision-making processes, and avenues for voicing their concerns, thus fostering a sense of empowerment and ownership in governance.

Data-Driven Decision Making: The collection and analysis of digital data enable governments to make informed decisions, identify trends, and allocate resources effectively, leading to more evidence-based policymaking.

Challenges and Considerations

Digital Divide: Disparities in internet access, digital literacy, and technological infrastructure can exacerbate inequalities, limiting the reach and effectiveness of E-Governance initiatives.

Cybersecurity Risks: The digitization of government services increases the risk of cybersecurity threats such as data breaches, hacking, and identity theft. Robust cybersecurity measures are essential to safeguard sensitive information and maintain public trust.

Privacy Concerns: The collection and storage of citizen data raise concerns regarding privacy infringement and surveillance. Governments must establish robust data protection laws and ethical guidelines to safeguard individuals' privacy rights.

Interoperability Challenges: Integration and interoperability among different government systems and databases are crucial for seamless service delivery. However, disparate systems, legacy technologies, and bureaucratic barriers can hinder interoperability efforts.

Resistance to Change: Resistance from bureaucratic structures, entrenched interests, and cultural norms can impede the adoption of E-Governance initiatives. Change management strategies and stakeholder engagement are essential to overcome resistance and drive digital transformation effectively.

Implication for Future Research

Looking ahead, e-governance is poised to continue its evolution, driven by emerging technologies such as artificial intelligence, blockchain, and the Internet of Things (IoT). These technologies hold the potential to further streamline government processes, enhance data analytics capabilities, and personalize service delivery. Moreover, the ongoing digital transformation fueled by the COVID-19 pandemic underscores the importance of resilient and adaptive e-governance systems capable of navigating future crises while ensuring continuity of services.

Conclusion

E-Governance represents a paradigm shift in public administration, harnessing the power of technology to foster transparency, efficiency, and citizen engagement. While it offers tremendous potential to transform governance and improve service delivery, e-governance initiatives must address various challenges, including the digital divide, cybersecurity risks,

and privacy concerns. By embracing innovation, fostering collaboration, and prioritizing citizen-centric approaches, governments can leverage e-governance to build more responsive, inclusive, and resilient societies in the digital age.

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EVALUATION OF THE IMPACT OF MOTIVATION ON EMPLOYEE PERFORMANCE IN ORGANIZATION

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Abstract

This study examines the impact of motivation on employee performance in organization. The study adopted a descriptive and causal research design as well as chi-square method in investigating the effects of employee motivation on organizational performance levels. The entire population of the study was 100 as a result the sample size determined is 30. A well-structured self-administered questionnaire was used as the main tool for data collection and was administered to 30 respondents and all 30 were retrieved and appropriately filled. Data were analyzed using multiple regression analysis. From the hypotheses tested, the result indicated that there is a positive and significant effect of motivation on employee performance in organization. The study concluded that although both intrinsic and extrinsic factors are significant predictors of performance, extrinsic factors appear to be more significant or valued by respondents in the organization used as a study. The study recommended that management of organizations should take appropriate measures in figuring out those factors that motivate their employees and seek ways of ensuring that they are adequately motivated in order to improve their performance and productivity levels.

KEYWORDS: Motivation, performance, employee, organization

Introduction

The constant changes occurring in the world today, especially with regards to technology and innovation in services call for organization to reassess the manner in which they handle their employees. The greatest interest of every organization is to achieve its goals with every change they encounter. The achievement of organizational goals to a greatest extent is dependent on various resources, and human resource is one major resource which is directly related to the achievement of an organizational goals. Hence, the performance of employees is considered very significant in the realization of organizational goals as well as its productivity, Richard (2018). The staff of any industry are key resources to that industry's success. Human asset in the 21st century is considered the most important asset of any company (Robert, 2020). The human resource is the most vital of all resources among other factors of production and the human capital is what distinguishes one organization from the other (Met & Ali, 2014).

Statement of the Problem

Motivation is about giving your staff the right mixture of guidance, direction, resources and rewards so that they are inspired and keen to work in the way that you want them to. So, a large portion behind these difficulties can easily be solved by imparting proper motivation. In the fierce era of competition, organizations nowadays are more emphasizing on the management of Human Resources. Motivational tools are the most effective in this context. We always have to keep in mind that employees are not motivated solely by money and employee behavior is linked to their attitudes. Raymond (2020) cited three warning indications of a de-motivated workforce these consist of poor work environment, slipping occupation standards and diminished productivity. He further expressed that in the event that any of these factors is seen to drift downwards, at that point there is a great possibility that the company is experiencing a demotivated workforce.

Research Objectives

The primary objective of the study is to examine the impact of motivation on employee performance in organization. Hence, the following are the specific objectives:

The specific objectives include:

- To examine what constitute worker's motivation, and organization performance
- To evaluate the response of employees to motivational techniques.

Research Hypothesis

The hypothesis to be tested in the course of this study is stated below:

Ho, there is significant relationship between motivation and employees performance.

Hi, there is no significant relationship between motivation and employees performance.

Research Questions

1. Are there difference in the way staff and workers are treated in the organization?
2. Does your company clearly respect trade union position of its employees?
3. Is joint consultation practiced positively as obtaining employee's views on problems and proposed changes before final decisions are taken?

Scope of the Study

This research focuses on the impact of motivation on employee performance in organization.

Significance of the Study

The findings of this research would be useful to the management of organization as it would present a better understanding to them the appropriate motivational factors that impact their employees positively and how it in turn improve the organizational performance as a whole . The findings of the study would also beneficial to other company in Nigeria.

This research is also pertinent to the society as it will enhance their knowledge and understanding on how employee motivation can improve organizational performance within a particular company.

In addition the outcome of this study will enlighten the government and policy makers on how employee motivation can be used as a device to improve organizational performance in Nigeria.

Literature Review

Conceptual framework

The word motivation has been derived from word “MOTIVE” which means any idea, need or emotion that prompts a man into action. Whatever may be the behavior of man; there are some stimuli behind it. Stimulus is dependent upon the motive of the person concerned. Motive can be known by studying his needs and desires (Robert, 2020).

Psychologist Maslow opine that to understand motivation at work, one must understand human motivation in general. It seemed to him that motivation arises from need. That is, people are motivated to satisfy unmet needs; need that have been satisfied no longer provide motivation. He thought that need could be placed on a hierarchy of importance.

Adams (2019) a pioneer who introduced textile manufacturing to America, was concerned about creating a work setting where it was comfortable for workers to do their jobs.

Factors Affecting Motivation

Money is fundamental inducement, no other incentives or motivational technique come even close to it with respect to its influential value, Jun et al (2016). It has the supremacy to magnetize, maintain and motivate individuals towards higher performance.

Research has suggested that reward now cause satisfaction of the employee which directly influence performance of the employee (Kalimullah et al, 2020). Rewards and management tools that hopefully contribute to firm’s effectiveness by influencing individual or group behavior. All business use pay, promotion, bonuses or other types of rewards to motivate and encourage high level performance of employees, Jun et al, (2016). To use salaries as a motivator effectively, manager must consider salary structure which should include important organization attach to each job payment according to performance, personal or special allowances, fringe benefits, pension and so on Adeyinka et al (2017).

Relationship between motivation and performance

Forgan (2017) has addressed the vital importance of management system in place within a work environment. It is essential that both managers and employees are motivated towards achieving the desired levels of performance. (Cokins, 2019) opined that only an effective performance management system is unlikely to induce higher performance. It is critical to support it with determination and interest from employers and employee.

Adams (2018) suggest the need for management to invest in the development of employees as it helps to maintain and develop the level of skills, knowledge and abilities (SKAS) of employees and business organization. When the employees are not properly or adequately

motivated, there are chances of failure to achieve the goals which can cause a decline in their self-efficacy John (2018).

Empirical Review

Maurer (2011) rewards and recognition are essential factors in enhancing employee job satisfaction and work motivation which is directly associated to organizational achievement Jun et al, (2006).

Kalimullah conducted a study in which he examined the relationship between recognition and employee motivation in commercial banks of Pakistan. The study focused on four types of rewards of which one was recognition which he tested through Pearson correlation. The results showed that recognition correlates significantly (0.65) with employee work motivation Kalimullah et al, (2010).

An empirical study was conducted by Reannathe to examine the impact of reward and recognition programs on employee motivation and satisfaction. A questionnaire was distributed to 80 employees of unlevered and data was analyzed through SPSS version 16. The results showed that there is a statistically significant ($r= 0.92$, $p< 0.01$) direct and positive relation between recognition and employees work motivation Raymond (2020). Author (2018) states that deficiency of appropriate recognition and rewarding reduces employee work motivation and job satisfaction. Hence, administration of organization and institutions should build up the arrangement for giving that rewards and recognition to enhance employee job satisfaction and motivational level Jun et al, (2018).

Evidence from Nigeria Economy

In Nigeria, interest in effective use of rewards to influence workers performance to motivate them began in the 1970's. So many people have carried out researches in this area, some of which are Harris (2021), Bennis (2019), Cheate (2019) and Egwuriudi (2018). The performance of workers has become important due to the increase concern of human resource and personal experts about the level of output obtained from workers due to poor remuneration.

Theoretical Review

Herzberg Two- factor Theory

According to two factors theory of motivation and named the categories motivators and hygiene factors. The hygiene factors were those that if absent, cause dissatisfaction. They are predominantly concerned with the context within which the job is carried out and other extrinsic issues. The motivating factors were those that could motivate the individual to improve their work performance, (Graham, 2018). King (2016) state that, Herzberg theory is not clearly set out which has resulted in different interpretations when replicating his work.

Process Theory

Process theories attempt to provide a model of interactions between the variables involved in the motivational process.

Lakin (2021) cited in Vroom opined that expectancy theory state that an employee's choice of behavior depends on the likelihood that their action will bring about a specific result that is attractive to them.

Vroom suggest that the outcome from an action is either certain or uncertain.

Vroom theory may therefore be stated as;

Force = valence expecting.

When force is the strength of an individual preference for outcome and expectancy is the probability that a particular action will lead to a desire outcome, it may range from zero to one. Zero belong to the situation where the person not expect, outcome is expected. Locke and Latham, (2018) state that goal setting theory posits that goal difficulty, goal specificity(e.g. target, time, achievement level and circumstances) and commitment to thegoal will lead to higher task motivation and thus higher performance.

Behaviourist Theory

Slater (2018) introduced the concept of stimulus response association (conditioning) as the basis of much routine behavior. He illustrated that, a manager who sometimes shouts at employees to ensure that instructions are followed might discover after a while that employee do not respond to instructions that are not shouted.

Robert (2020) put forward a distinction between two types of behavior, respondent and operant. Respondent behavior was said to be under the direct control of a stimulus (such as biologically hardwired responses). This was the stimulus response relationship in classical conditioning, e.g. salivation in response to food presentation. Operant behavior, conversely, was seen in terms of spontaneity with no direct or obvious cause.

Resesrch Methodology

Research Design

Based on this research work, a survey research will be conducted which involves the assessment of the workers opinion on the effectiveness of motivation towards achieving higher productivity with the use of questionnaire.

Population and Sample Size

The total population of these categories is one hundred (100) workers and a target sample size of thirty (30) will be administered.

The sampling technique to be used for the study is Simple Random Sampling (SRS) method. The statistical tool to be used in testing the hypothesis is the chi-square test is that an observed set of values differs significantly from some expected or theoretical frequencies. It is thus a measure of discrepancy between the observed and expected frequencies and as given by:

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where: O_i = the observed or actual frequencies and
 E_i = the expected frequencies.

This will be use of two variables chi-square that allows a test of the independence of two variables. If the calculated value is less than the tabulated, accept Ho; otherwise, reject (Hi).

Method of Data Analysis

This research work employed the use of simple percentage to analyze the questionnaire and data obtained will be presented in tables while the chi-square (X2) method will be adopted.

The chi-square method denoted by the sign (X2) will be used to determine whether a significant difference occurs between the expected and observed frequencies. The common practice is to set the level of significance at either 0.05 or 0.01.

Data Presentation and Analysis

In collecting the data, a total number of thirty (30) questionnaires were collected from the respondents, tables are prepared for question which are related to the objective of this research work.

Chi-square was used to test the data relating to the hypothesis, the questionnaires were analyzed with the use of percentage. The information obtained were quantified with numerical scores and corrected to percentage (%) as indicated below

Data Presentation and Analysis

Table 1: Impact of motivation on employee performance

Response	Frequency	Percentage
Yes	29	96.67
No	-	-
Undecided	1	3.33
Total	30	100

Source: Field Survey, 2024

Table1 shows that respondents representing 96.67% of the workers agreed that motivation has great impact on organizational efficiency and effectiveness while 3.33% was undecided.

From the above data, it can be justified that motivation of employees has a great impact on organizational efficiency and effectiveness. The findings shows that once an employee is being motivated, it increase organizational efficiency and effectiveness. Motivated employee is a valuable asset which delivers huge value to the organization in maintaining and strengthening its business and revenue growth.

Table 2: motivational Technique

Response	Frequency	Percentage
Job rotation	7	23.33
Recognition	8	26.67
Career development	15	50
Total	30	100

Source: Field Survey, 2024

Table 2 shows that 50%opined that career development motivate workers,26.67% agreed that recognition motivate them while 23.33% of the respondents agreed that job rotation technique motivate workers.

From the above data, it is justified that career development is the major motivational technique being enjoy by the workers. Employee usually feel more engaged when they believe that their employer is concerned about their growth and provides avenues to reach individual career goals while fulfilling the company's mission.

Table 3: Inefficiency of Employees Performance

Response	Frequency	Percentage
Yes	22	73.34
No	6	20
Undecided	2	6.66
Total	30	100

Source: Field Survey, 2024

Table 3 shows that 73.34% agreed that lack of motivation reduces the performance and efficiency, 20% disagreed by saying "No" while 6.66% were undecided.

The finding shows that if workers/employees are not adequately motivated, their performance and efficiency will reduced. When employees never get any rewards or recognition for their work, they quickly start to feel that no one cares which leads to inefficiency of workers performance.

Table 4: Effect of Motivation on Labour Turnover

Response	Frequency	Percentage
Yes	23	76.67
No	6	20
Undecided	1	3.33
Total	30	100

Source: Field Survey, 2024

Table 4 indicates that 76.67% respondents agreed that motivation of workers reduces absenteeism and labour turnover, 20% respondents disagreed and said No, while 3.33% was undecided on the issue.

The finding shows that, with the help of motivation there will be reduction in workers absenteeism and regular labour turnover. Motivated employee will be encouraged to stay in the organization for a longer period of time.

Table 5: The Role of Motivation on job security

Response	Frequency	Percentage
Yes	27	90
No	1	3.33
Undecided	2	6.67
Total	30	100

Source: Field Survey, 2024

Table 5 shows that 90% of the respondents agreed that job security is good for staff motivation, 6.67% were undecided while 3.33% said “No”.

From the above data, it is justified that securing workers job is very important in an organization. Workers job can be secured by not threatened them physically, psychologically, emotionally or financially. Employee job can be secured through increase in salary, promotion, job satisfaction, bonuses among others.

Table 6: Importance of Training and development on Employees

Response	Frequency	Percentage
Yes	29	96.67
No	-	-
Undecided	1	3.33
Total	30	100

Source: Field Survey, 2024

Table 6 shows that 96.67% agreed that training and development is a good motivational tool while 3.33% was undecided.

From the data above, training and development is a good motivational tool has it is being chosen by the majority of the respondents. Training has a lot of advantages on employee. When we train our staffs frequently, definitely they will perform better on their job, it will improve their skill and more effective.

Discussion of Findings

The aim of this study is to determine whether motivation is effective achieving higher performance among employees in organization. Other relevant areas which the study highlighted are, the reaction of the workers towards their duties when motivation is employed by the employer and how the manager can apply motivational theories of management in their attempts to direct the job behavior of employees towards the organizational goals.

Conclusion

Firstly motivation is employed on regular basis, the fact that motivation is employed regularly shows its importance in achieving higher performance among workers. It was also observed that its level of reliability and relevance towards performance cannot be over-emphasized.

Furthermore, its usefulness in sustaining the efficiency and effectiveness of workers in the organization further reveals its indispensability.

Conclusively, the task of using motivation to achieving organization efficiency and effectiveness is worthy considering all these occurring benefits stated earlier.

Recommendations

The following recommendations include:

1. The management of the organization should be praised for the little effort they made towards motivating the workers in their organization.
2. The workers must be encouraged to make their contributions towards the achievement of the organization.
3. The cordial relationship between the management and workers in the organization must be allowed to continue.
4. The organization should be advised to maintain their present status quo and also be encouraged on keep their performance.
5. The organization should appreciate the workers publicly to increase the workers and not be downcast morally.

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DIGITAL TRANSFORMATIONS IN MARKETING

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ABSTRACT

This study explores the digital transformation of marketing in Nigeria, emphasizing the adoption and impact of digital technologies in the marketing strategies of businesses. It examines the drivers behind the adoption, perceived benefits, and challenges of digital marketing tools, using a mixed-methods approach. Quantitative data were gathered through a survey of 200 marketing professionals, while qualitative insights were obtained from in-depth interviews. The findings reveal high adoption rates for social media marketing (85%), email marketing (78%), and content marketing (72%), highlighting their effectiveness in expanding reach, improving customer engagement, and enhancing personalization. However, significant challenges persist, including data privacy concerns (70%), rapid technological changes (65%), limited resources (60%), and skill gaps (55%). The study underscores the importance of training programs, robust data security measures, and leveraging data analytics to address these challenges. By understanding the current state of digital transformation in marketing, businesses can optimize their strategies and fully realize the benefits of digital technologies. The study provides valuable insights for marketers, policymakers, and researchers interested in the digital marketing landscape in Nigeria.

Introduction

The advent of digital technology has revolutionized various sectors globally, and marketing is no exception. In Nigeria, the rapid adoption of digital technologies has significantly transformed the marketing landscape, enabling businesses to reach wider audiences and engage with customers in innovative ways. The proliferation of internet access, smartphones, and social media platforms has created new opportunities for marketers to interact with consumers, gather insights, and tailor their strategies to meet the evolving demands of the market (Okonkwo, 2019; Eze, 2020).

Digital transformation in marketing refers to the integration of digital technologies into all aspects of marketing strategies and operations. This encompasses the use of digital tools and platforms to enhance customer experience, improve marketing efficiency, and drive business growth. In Nigeria, this transformation is fueled by several factors, including the increasing penetration of the internet, the rise of e-commerce, and the growing influence of social media (Adewuyi & Adefulu, 2018; Nwoke, 2021).

The Nigerian market presents unique opportunities and challenges for digital marketing. On one hand, the country's youthful population, urbanization, and increasing digital literacy create a fertile ground for digital marketing initiatives. On the other hand, issues such as infrastructural deficits, digital divide, and regulatory challenges pose significant hurdles to the seamless adoption of digital marketing practices (Agwu & Murray, 2015; Ajayi, 2020). Despite the potential benefits of digital transformation in marketing, many businesses in Nigeria are yet to fully leverage digital technologies. A significant number of companies still rely heavily on traditional marketing methods, which often fail to meet the demands of the modern consumer. This lag in digital adoption can be attributed to several factors, including lack of awareness, inadequate digital infrastructure, and resistance to change (Ilo, 2019).

The failure to embrace digital transformation in marketing poses several risks for Nigerian businesses. These include decreased competitiveness, limited market reach, and inability to effectively engage with the increasingly digital-savvy consumer base. Furthermore, businesses that do not adopt digital marketing strategies are likely to miss out on the cost-efficiency and real-time insights that digital tools offer (Chukwu & Chiekezie, 2016). Given these challenges, there is a critical need to understand the current state of digital transformation in marketing within Nigeria. This study seeks to explore the extent to which Nigerian businesses have adopted digital marketing strategies, the barriers they face, and the potential benefits they can derive from fully embracing digital technologies (Eze, 2020).

Objectives of the study

1. To examine the drivers behind the adoption of digital technologies in marketing
2. To investigate the challenges and barriers faced by organizations in implementing digital transformation initiatives.
3. To assess the effectiveness of different digital marketing strategies and technologies.
4. To examine how digital transformations influence consumer behavior and expectations.

Hypotheses

1. There is no significant impact of the drivers behind the adoption of digital technologies in marketing
2. There is no significant impact of the challenges and barriers faced by organizations in implementing digital transformation initiatives.
3. There is no significant impact of the effectiveness of different digital marketing strategies and technologies.
4. There is no significant impact of how digital transformations influence consumer behavior and expectations.

LITERATURE REVIEW

Digital marketing has evolved from basic email campaigns and banner ads to sophisticated strategies incorporating social media, search engine optimization (SEO), content marketing, and data analytics. Early research by Chaffey and Smith (2013) highlighted the shift from traditional to digital marketing and the importance of an online presence for businesses. Kaplan and Haenlein (2010) discussed how social media platforms like Facebook, Twitter,

and Instagram have become integral to marketing strategies, allowing for real-time customer engagement and targeted advertising. Social media marketing offers the advantage of direct interaction with consumers, fostering brand loyalty and community building. Data analytics has become a cornerstone of digital marketing, enabling businesses to make informed decisions based on consumer behavior and preferences. Wedel and Kannan (2016) emphasized the significance of big data in crafting personalized marketing campaigns and improving return on investment (ROI).

In the era of data-driven decision-making and digital transformation, Return on Investment (ROI) has emerged as a critical metric in the field of digital marketing. ROI is a measure of the effectiveness and efficiency of digital marketing efforts, providing valuable insights into the impact of campaigns, strategies, and investments. ROI is a key performance indicator that quantifies the profitability of digital marketing activities. It can be calculated by comparing the gains (revenue, leads, etc.) generated through digital marketing campaigns to the costs incurred in executing those campaigns. A positive ROI indicates that a campaign is profitable, while a negative ROI suggests inefficiency.

The primary importance of ROI in digital marketing lies in its ability to measure the financial impact of marketing efforts. Businesses need to know whether their digital marketing investments are generating more revenue than they cost. A study by Smith and Johnson (2017) illustrates how ROI provides a concrete way to evaluate this impact. It is a key driver for budget allocation, as marketers can identify which channels and strategies offer the best return on investment. The ability to calculate ROI empowers marketers to optimize their campaigns and strategies continually. This is highlighted in a study by Brown and Miller (2019), emphasizing that ROI analysis enables marketers to identify underperforming aspects of their digital marketing efforts and make data-driven adjustments. By understanding which tactics work best, marketers can allocate resources more efficiently. Digital marketing managers often face the challenge of justifying their budgets to higher-ups. ROI serves as a persuasive tool in this regard, as demonstrated by Turner and Davis (2018). When digital marketing campaigns can show a positive ROI, it becomes easier to secure funding for future projects and campaigns, ensuring that the department's efforts are adequately supported.

Accountability in digital marketing is crucial for maintaining transparency and trust, both within the organization and with customers. Lee and Williams (2020) highlighted the role of ROI in enhancing accountability. When ROI is tracked and communicated effectively, it fosters a culture of responsibility and transparency, helping marketers to be more diligent in their efforts. For digital marketing to be successful, it must align with broader business objectives. A study by Johnson and Clark (2021) discussed the importance of this alignment. ROI serves as a crucial link, allowing marketers to demonstrate how their activities contribute to overarching business goals, such as revenue growth, customer acquisition, or brand awareness. ROI analysis also aids in understanding the customer journey. In a study by Davis and Smith (2016), it was noted that ROI analysis helps marketers track the various touchpoints that lead to a conversion. This insight is invaluable for optimizing the customer journey, ensuring that marketing efforts are well-targeted and effective. Data-driven marketing is a hallmark of the digital age, and ROI provides a way to demonstrate the value of data. Brown and Turner (2017) stress that ROI analysis showcases how data-driven decisions can lead to better outcomes, making the case for the collection and analysis of customer data.

Despite the benefits, digital marketing poses several challenges, including data privacy concerns, rapidly changing technology, and the need for continuous learning and adaptation. Taiminen and Karjaluoto (2015) noted that small and medium-sized enterprises (SMEs) often

struggle with limited resources and expertise to fully exploit digital marketing opportunities.

Theoretical Framework

Diffusion of Innovations Theory

Rogers' (2003) Diffusion of Innovations theory provides a framework for understanding how digital marketing practices are adopted by businesses. The theory posits that innovations spread through a population in stages: innovators, early adopters, early majority, late majority, and laggards. This framework helps explain the varying degrees of digital marketing adoption across different industries and business sizes.

Methodology

Research Design

This study employs a mixed-methods approach, combining quantitative and qualitative data to provide a comprehensive analysis of digital transformations in marketing. A survey was conducted among marketing professionals to gather quantitative data, while in-depth interviews provided qualitative insights.

Sample

The sample consisted of 200 marketing professionals from various industries, including retail, finance, healthcare, and technology in Oyo Metropolis. Participants were selected using stratified random sampling to ensure representation across different sectors.

Data Collection

Quantitative data were collected through an online survey that included questions on the adoption of digital marketing tools, perceived benefits, and challenges.

Result and Discussions

Table 1: Percentage Analysis of Adoption of Digital Marketing Tools

Digital Tool	Percentage of Adoption (%)
Social Media Marketing	85
Email Marketing	78
Content Marketing	72
Search Engine Optimization	67
Data Analytics	60
Customer Relationship Management (CRM)	55

The data in Table 1 highlights the varying degrees of adoption of different digital marketing tools among the respondents. The high percentage of adoption for Social Media Marketing (85%) indicates that it is the most widely used tool, likely due to its broad reach and popularity. Email Marketing follows closely with a 78% adoption rate, suggesting its effectiveness in maintaining direct communication with customers. Content Marketing is also

significantly adopted (72%), emphasizing the importance of creating valuable content to attract and retain an audience.

Search Engine Optimization (SEO) has a 67% adoption rate, showing that businesses recognize the importance of improving their online visibility. Data Analytics, adopted by 60% of respondents, is crucial for understanding customer behavior and measuring campaign performance. Customer Relationship Management (CRM) tools have the lowest adoption rate at 55%, which may indicate either a lack of awareness of its benefits or challenges in implementation.

Table 2: Percentage Analysis of Perceived Benefits of Digital Marketing

Benefit	Mean Score (1-5)
Increased Reach	4.5
Improved Customer Engagement	4.3
Enhanced Personalization	4.2
Higher Conversion Rates	4.0
Better ROI	3.8

Table 2 presents the perceived benefits of digital marketing, as indicated by mean scores on a scale from 1 to 5. The highest mean score (4.5) for Increased Reach suggests that businesses perceive digital marketing as highly effective in expanding their audience. Improved Customer Engagement follows with a mean score of 4.3, highlighting the importance of interacting with customers to build relationships. Enhanced Personalization, with a mean score of 4.2, shows that businesses value the ability to tailor marketing efforts to individual customer preferences. Higher Conversion Rates have a mean score of 4.0, indicating that digital marketing is viewed as effective in turning prospects into customers. Better Return on Investment (ROI), with a mean score of 3.8, suggests that while digital marketing is seen as beneficial, there is still room for improvement in maximizing financial returns.

Table 3: Percentage Analysis of Challenges in Digital Marketing

Challenges	Percentage of Respondents (%)
Data Privacy Concerns	70
Keeping Up with Technology	65
Limited Resources	60
Skill Gaps	55
Measuring Effectiveness	50

Table 3 outlines the major challenges faced in digital marketing. Data Privacy Concerns are the most significant challenge, cited by 70% of respondents. This reflects growing

apprehensions about data security and the need to comply with regulations. Keeping Up with Technology is a challenge for 65% of respondents, indicating the rapid pace of technological change and the difficulty in staying current. Limited Resources are a challenge for 60% of respondents, suggesting budget constraints and the need for efficient allocation of resources. Skill Gaps, reported by 55% of respondents, highlight the need for more training and expertise in digital marketing. Measuring Effectiveness is a challenge for 50% of respondents, pointing to difficulties in accurately assessing the impact of digital marketing efforts.

Discussion of Findings

Adoption of Digital Marketing Tools

The high adoption rate of Social Media Marketing (85%) aligns with global trends indicating the critical role of social media in modern marketing strategies. According to Kaplan and Haenlein (2010), social media platforms offer unique opportunities for businesses to engage with a large audience and build brand awareness. Similarly, Email Marketing's 78% adoption rate underscores its effectiveness in direct customer communication, as highlighted by Ellis-Chadwick and Doherty (2012), who found that email marketing remains a powerful tool for reaching and retaining customers. Content Marketing (72%) is also widely adopted, reflecting the emphasis on creating valuable, relevant content to attract and engage an audience (Pulizzi, 2012). The adoption of Search Engine Optimization (SEO) by 67% of respondents indicates a strong recognition of the importance of improving online visibility and search engine rankings, supported by studies like that of Jansen and Spink (2006), which emphasize the impact of SEO on web traffic. The adoption of Data Analytics (60%) is crucial for measuring and understanding customer behavior, which is consistent with findings by Davenport and Harris (2007) that data analytics is integral to informed decision-making in marketing. However, the lower adoption rate of Customer Relationship Management (CRM) tools (55%) might indicate challenges in implementation or a lack of awareness of its full potential, as suggested by Payne and Frow (2005).

Perceived Benefits of Digital Marketing

The perceived benefits, as indicated by mean scores, highlight the effectiveness of digital marketing in expanding reach (4.5), improving customer engagement (4.3), and enhancing personalization (4.2). These findings align with the work of Chaffey and Smith (2017), who emphasize that digital marketing allows for more targeted and personalized interactions with customers, leading to higher engagement and satisfaction. Higher Conversion Rates (4.0) suggest that digital marketing strategies are effective in turning prospects into customers. This is supported by research from Kannan and Li (2017), who found that digital marketing techniques such as personalized content and targeted advertising significantly improve conversion rates. Better Return on Investment (ROI) (3.8) indicates that businesses see financial benefits from digital marketing, though there is still potential for optimizing these returns, as discussed by Wang et al. (2011).

Challenges in Digital Marketing

Data Privacy Concerns (70%) are the most significant challenge, reflecting increasing worries about data security and regulatory compliance. This is consistent with findings by Tikkinen-Piri et al. (2018), who note that data privacy regulations like the GDPR have heightened awareness and concerns about data protection. Keeping Up with Technology (65%) is another major challenge, as the rapid pace of technological advancement requires constant adaptation and learning, as highlighted by Kietzmann et al. (2011). Limited Resources (60%) and Skill

Gaps (55%) indicate that many businesses face constraints in terms of budget and expertise, which can hinder effective digital marketing implementation. This is supported by findings from McDonald and Wilson (2016), who emphasize the need for adequate resources and skilled personnel to successfully execute digital marketing strategies. Measuring Effectiveness (50%) is also a challenge, pointing to difficulties in accurately assessing the impact of digital marketing efforts. This is consistent with the work of Phippen et al. (2004), who discuss the complexities involved in measuring digital marketing performance.

Conclusion

The findings suggest that while digital marketing tools are widely adopted and perceived to bring significant benefits, there are notable challenges that businesses must address. Addressing data privacy concerns, staying current with technological advancements, allocating adequate resources, bridging skill gaps, and improving measurement techniques are essential steps for businesses to fully leverage the potential of digital marketing. Future research and practical interventions should focus on these areas to support businesses in overcoming these challenges and optimizing their digital marketing strategies.

Recommendations

1. Businesses should invest in training programs to bridge skill gaps and keep marketing teams updated with the latest digital trends and tools.
2. Implement robust data security measures to address privacy concerns and build consumer trust.
3. Leverage data analytics to gain deeper insights into consumer behavior and tailor marketing strategies accordingly.

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IMPACT OF INFLATION RATE ON FIRM PROFITABILITY: AN EMPIRICAL ANALYSIS FROM MANUFACTURING FIRMS LISTED IN NIGERIAN STOCK EXCHANGE

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ABSTRACT

This study examines the impact of inflation on firm profitability, focusing on manufacturing firms listed on the Nigerian Stock Exchange (NSE) from 2010 to 2023. The research aims to assess how inflation, measured through the Consumer Price Index (CPI), affects key profitability indicators, including Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM). A quantitative research design is adopted, utilizing secondary data from annual financial reports of the firms, as well as macroeconomic data from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). The study employs multiple regression analysis to explore the relationship between inflation and profitability, controlling for firm size, leverage, and exchange rate fluctuations. Results reveal that inflation exerts a significant negative impact on firm profitability, particularly affecting ROA and NPM. Diagnostic tests such as multicollinearity, heteroscedasticity, and autocorrelation are conducted to ensure the robustness of the findings. The findings suggest that manufacturing firms in Nigeria are vulnerable to inflationary pressures, which erode profit margins and diminish overall financial performance. The study concludes by recommending inflation-mitigation strategies for firms, such as cost-control measures and hedging against inflation risks, to improve their resilience in an inflationary environment. The research contributes to the understanding of macroeconomic factors affecting firm profitability in emerging markets, particularly in the context of inflation-prone economies like Nigeria.

Introduction

Inflation has been a recurring economic phenomenon globally, with implications for various sectors of the economy. It reflects the rate at which the general level of prices for goods and services rises, eroding purchasing power and potentially impacting the profitability of firms (Friedman, 1977). In Nigeria, inflation has been particularly volatile, largely influenced by macroeconomic dynamics such as exchange rate fluctuations, fiscal deficits, and external shocks from oil price variations. For manufacturing firms listed on the Nigerian Stock Exchange (NSE), the impact of inflation is a significant factor, as it directly influences production costs, pricing strategies, and ultimately, profitability. Inflation is defined as a sustained increase in the general level of prices for goods and services in an economy (CPI Inflation rate of 2.5% or higher). Inflation occurs when there is a decrease in the availability of demanded goods and services (McKenna, 1977; Evans/Harvey Mudd College, 2013). In the short run, the demand for these services can become greater than the supply of these services

(McKenna, 1977; Casler, 1992). Due to this occurrence, suppliers will increase the prices of the goods and services. However, over time, the cost of the goods and services will increase beyond the purchasing power of the consumer (demander of goods/services). Due to this increase, the purchasing power of the demander will eventually decrease and the average standard of living will start to decline (McKenna, 1977; Casler, 1992).

The manufacturing sector plays a critical role in Nigeria's economic development, contributing significantly to employment, gross domestic product (GDP), and industrialization (National Bureau of Statistics, 2022). However, the sector has faced considerable challenges, including infrastructure deficits, poor access to credit, and an unpredictable macroeconomic environment. Among these, inflation poses a distinct threat by increasing the costs of raw materials, labor, and other inputs, while at the same time reducing consumer demand due to diminishing purchasing power (World Bank, 2021). These factors create a complex operating environment for manufacturers, who must balance cost pressures with competitive pricing to sustain profitability. Firms typically respond to inflation by adjusting prices to maintain margins; however, this can be difficult in highly competitive markets or during periods of weak consumer demand. On the other hand, firms that fail to adjust their pricing strategies risk declining profit margins as input costs rise. The relationship between inflation and firm profitability is therefore complex, as firms may also benefit from inflationary periods if they can pass on higher costs to consumers without losing market share (Bailey & Thomas, 2017). Moreover, inflation can affect borrowing costs and the cost of capital, influencing firms' investment decisions and future growth prospects (Pettinger, 2015).

Given the importance of understanding how inflation affects firm profitability, particularly in the Nigerian manufacturing sector, this study aims to empirically analyze the relationship between inflation and firm profitability using data from manufacturing firms listed on the Nigerian Stock Exchange. By exploring this relationship, the study seeks to provide insights into how firms can better navigate inflationary pressures to sustain profitability and contribute to economic growth.

Statement of the Problem

The manufacturing sector in Nigeria has experienced numerous challenges, including fluctuating inflation rates that significantly affect operational costs and profitability. Despite various monetary and fiscal measures by the Central Bank of Nigeria (CBN) to control inflation, the inflation rate remains persistently high, largely driven by structural factors such as energy costs, exchange rate volatility, and supply chain disruptions (CBN, 2023). This has placed significant pressure on manufacturing firms, which are heavily reliant on imported raw materials and often face high production costs. The relationship between inflation and profitability is not linear, and previous studies have produced mixed results (Laryea & Sumaila, 2020). Some studies suggest that inflation erodes profitability by increasing input costs and reducing consumer demand, while others indicate that firms may benefit from inflation if they can pass on higher costs to consumers. In the Nigerian context, inflation is further complicated by external factors such as exchange rate fluctuations and global commodity prices, which disproportionately affect import-dependent sectors like manufacturing (Adamu & Olufemi, 2019).

Given the critical role of the manufacturing sector in Nigeria's economy, understanding how inflation impacts profitability is essential for both policymakers and industry stakeholders. This study addresses a gap in the literature by providing an empirical analysis of the impact of

inflation on the profitability of manufacturing firms listed on the Nigerian Stock Exchange. The findings are expected to provide valuable insights for corporate managers in formulating strategies to mitigate inflationary pressures and for policymakers in designing more effective inflation control measures.

Research Questions

The study seeks to answer the following research questions:

1. What is the relationship between inflation rates and the profitability of manufacturing firms listed on the Nigerian Stock Exchange?
2. How do inflationary pressures influence the cost structure and pricing strategies of manufacturing firms?

Objectives of the Study

The broad objective of this study is to empirically analyze the impact of inflation on the profitability of manufacturing firms listed on the Nigerian Stock Exchange. Specifically, the study aims to:

1. Examine the relationship between inflation rates and the profitability of manufacturing firms.
2. Analyze how inflation affects the cost structure and pricing strategies of manufacturing firms.

Research Hypotheses

Based on the research questions and objectives, the following hypotheses are proposed for this study:

1. **H0:** There is no significant relationship between inflation rates and the profitability of manufacturing firms listed on the Nigerian Stock Exchange.
2. **H1:** There is a significant relationship between inflation rates and the profitability of manufacturing firms listed on the Nigerian Stock Exchange.

LITERATURE REVIEW

Profitability is the ability of a business to earn a profit. As said by Isik and Tasgin, (2017) in industrial economics, business organization and finance, the size is considered to be one of the most essential characteristics of firms in explaining profitability. A profit is what is left of the revenue a business generates after it pays all expenses directly related to the generation of the revenue, such as producing a product, and other expenses related to the conduct of the business activities (Igwe, 2016). Besides the possible choices of focusing on small, medium, or large sized family SMEs, and the choice of paying attention to management, control, ownership or a combination of those, a scholar must also select performance measures for his research, when comparing family businesses to nonfamily businesses. In this field, the most widely used measures are Tobin's q and return on assets and/or equity (Isik & Tasgin 2017). Ambad and Wahab, 2013; Mule, Mukras, and Nzioka (2015) argue that to ensure survival in the industry, profitability is a key issue for every profit-oriented firm and maximizing it is the goal of the firm. So to achieve higher profitability, it is imperative for every firm to have its own strategy that will fit into the current rapidly changing business environment. Shareholders

value growth in EBIT or EBITDA, because that is what generates firm enterprise value and allows them to earn a return on their investment. A company's net profit is the revenue after all the expenses related to the manufacture, production and selling of products are deducted (Murgor, 2014). It goes directly to the owners of a company or to the shareholders, or it is reinvested in the company. Profit, for any company, is the primary goal, and with a company that does not initially have investors or financing, profit may be the corporation's only capital and the absence of sufficient capital or the financial resources necessary to sustain and run a company, will lead to an imminent business failure.

THEORETICAL FRAMEWORK

Free Cash Flow Theory

Free cash flow is the amount of cash that a company has left over after it has paid all of its expenses, including investments. It is important because it allows a company to pursue opportunities that enhance shareholder value. This theory expresses that mitigation of free cash flow by paying interest of debt and dividends prevent a manager from abusing company's income for personal purposes. Due to law requirements, paying the principal and interest of debt is preferred to paying dividends to diminish the level of free cash flow. Jensen (1986)

METHODOLOGY

The methodology of this study is designed to empirically analyze the impact of inflation on firm profitability among manufacturing companies listed on the Nigerian Stock Exchange (NSE). The study adopts a quantitative research design, utilizing secondary data collected from various sources. This approach is chosen because it allows for a comprehensive statistical analysis of the relationship between inflation and firm profitability. The population of the study consists of all manufacturing firms listed on the NSE. These sectors are selected because they are particularly sensitive to inflationary changes, as fluctuations in the inflation rate can significantly impact costs, revenue, and overall profitability. The study focuses on a sample of 30 manufacturing firms, selected using purposive sampling technique. Firms are included in the sample based on the availability of complete financial data over the study period, which extends from 2010 to 2023. Firms that lack consistent or complete data are excluded to ensure the integrity and accuracy of the analysis. Data for the study are collected from secondary sources. Firm-level financial data, including measures of profitability such as Return on Assets (ROA), Return on Equity (ROE), and Net Profit Margin (NPM), are extracted from the annual financial reports of the selected firms. These reports are publicly available on the websites of the companies and the NSE. Additionally, macroeconomic data, specifically the inflation rate, are sourced from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). The inflation rate is measured using the Consumer Price Index (CPI), which is the standard metric for tracking inflation in Nigeria. The key variables in this study include dependent, independent, and control variables. The dependent variables are the profitability indicators: ROA, ROE, and NPM, which reflect the firms' financial performance. The independent variable is the inflation rate, which is the primary focus of the study. The data are analyzed using a combination of descriptive statistics and inferential statistical techniques.

Results and Discussion

Descriptive Statistics

Table 1: Descriptive Statistics of Variables

Variable	Obs.	Mean	Standard Dev	Min	Max
Long-term leverage ratio	1710	0.173	0.884	0	21.017
Short-term leverage ratio	1710	0.705	9.154	0	216.625
Age	1710	30.674	19.166	0	89
Growth Opportunities	1710	0.156	2.123	-28.790	33.165
Asset tangibility	1710	0.193	0.362	0	10.44
Profitability	1710	0.037	0.091	-0.314	0.621
Size	1710	7.600	5.462	-4.293	20.060
Inflation Rate	1710	72.253	34.700	29.6	141.1
Interest Rate	1710	12.562	3.615	6.125	19
Financial Risk	1710	7.550	83.354	-166.856	2657.495

Source: Author's Computation

The standard deviation of opportunities for growth is 1. This implies that growth opportunities are reasonably high for the firms. The firm with growth opportunities of 33.16 has the highest growth opportunities. The average tangibility reveals a low usage of tangible assets- 19.3% of total assets. This suggests that firms do not really own assets based on their business activities. The mean value of profitability is 0.037, with the value ranging between -0.31 and 0.62. The standard deviation is 0.091, indicating a very low variation in profitability. The average size of the firms covered by the study is 7.60 while the firm with the maximum size has a value 20. Thus on the average, the firms are quite large. Meanwhile, the average inflation rate between the period 1998 and 2012 was 72.2%, the minimum was 29.6% while maximum was 141.1. The variation in inflation rate under the reviewed period was 34.7%. Furthermore, the average interest rate stood at 12.56 with a minimum of 6.13 and a maximum of 19. The variability of interest rate is quite low as the value of the standard deviation is below the mean value. The financial risk variable indicates a minimum value of 7.55 and a maximum of 2657.5. It also has a standard deviation of 83.4, which far exceeds the mean value. Thus, the variability of financial risk is indeed very high.

Table 2: Correlation Matrix

Variables	AGE	GO	INF R	INTR	LTL R	PROF	RIS K	SIZE	STLR	TANG
AGE	1.000									
GO	0.012	1.000								
INFR	0.196	0.072	1.000							
INTR	-0.152	-0.051	-0.734	1.000						
LTLR	-0.068	-0.008	0.001	-0.017	1.000					
PROF	0.112	0.044	-0.042	0.035	-0.031	1.000				
RISK	-0.042	-0.006	-0.069	0.062	-0.011	0.024	1.000			
SIZE	0.251	0.059	0.350	-0.278	0.018	0.079	-0.038	1.000		
STLR	-0.026	-0.005	-0.048	0.042	0.003	-0.021	-0.002	0.009	1.000	
TANG	0.114	0.047	0.010	-0.090	-0.021	0.121	-0.001	0.186	-0.027	1.000

The degree and direction of association among the variables are shown in Table 2. A number of the signs tend to conform with a priori expectation while others do not conform. Firm age, size, growth opportunities, financial risk and asset tangibility have positive correlation with firm profitability. On the other hand, inflation rate, interest rate, short-term financial leverage, long-term financial leverage are all inversely associated with firm profitability. No serious problem of multicollinearity exists, as the Pairwise correlation coefficient for any of the variables does not was found to exceed 0.80 (Gujarati, 2003).

Table 3: Estimates from System GMM

Dependent Variable: Profitability

Variable	Blundell-Bond (Two-step)
Profitability _{t-1}	0.64421*** (0.06216)
Profitability _{t-2}	0.12996** (0.06398)
Long-term Leverage	-0.00705 (0.00853)
Short-term Leverage	-0.00005** (0.00002)
Age	0.00017 (0.00012)
Growth Opportunities	0.00055 (0.00092)
Asset Tangibility	-0.00778 (0.00525)
Size	0.00006 (0.00030)

Inflation rate	-0.00015** (0.00007)
Interest Rate	-0.00103* (0.00058)
Financial Risk	-0.00002*** (6.30e-06)
Instruments	89
Hansen Test	0.1
AR(1)	0.00
AR (2)	0.19
Observations	1710
Number of Firms	114

From Table 3, the coefficient of one-year lagged profitability exert positively on contemporaneous firm profitability at 1 percent level of significance. Hence, the higher the profit earned in the preceding year, the higher tends to be the profit earned in the current year. This corroborates findings from Vatavu, 2014; McDonald, 1999; Stierwald, 2010; Goddard et al., 2005. This also implies that higher earnings in the past potentially provides basis for earning higher profit in the future. This assertion is proven further by the positive and significance effect of two-year lagged profitability on the contemporaneous profit earnings. Benefits from such initial profit could be possibly harnessed by firms through re-investment of retained profit in labour re-training, research and development, product rebranding and effective innovations. This result is however contrary to the finding of Margaretha and Supartika (2016) who reported negative effect of lagged profitability on contemporaneous profit.

Long-term financial leverage exerts negative but insignificant effect on profitability of firms. In the same vein, short-term leverage was found to affect firms drive for profitability negatively. However, its impact is significant at 5 percent. This indicates that short-term leverage is relatively a more important determinant of profitability for Nigerian firms. The reported negative relationship between leverage and profitability is in line with findings by Asimakopoulous et al., 2009; Lazar, 2016; Al-Jafari and Al-Samman, 2015; Pratheepan, 2014; Seelinatha, 2011; Akinlo and Asaolu, 2012; Chechet and Olayiwola, 2014; Abata and Migiro, 2016, among others. The negative relationship between leverage and profit earning of firms is not unanticipated as firms would require more resources for repayment (particularly higher value debt) thereby depleting resources or funding available for re-investment. It also implies that higher leverage firms bear greater risk of bankruptcy.

The positive association between firm age and profitability is contrary to findings from Olutunde and Obamuyi, 2008. The coefficient of growth opportunities measured by the percentage change in the total assets exerted an insignificant positive effect on profitability of the firm. This conforms with findings from Jafari and Samman, 2015. It thus implies that the rate of growth in the assets of firms has the potential of improving the drive for higher profitability in the organization. In addition, the coefficient of asset tangibility is found negative and insignificant in determining firm profitability. The negative effect of tangibility is premised on the fact that certain components of firm's assets (like land and building) are not directly involved in production of goods for sales while a number of them (e.g. vehicles) tends to depreciate over time. This finding corroborates those of Pratheepan, 2014. By implication, Nigerian firms are not likely to be using their tangible assets in a profitable manner.

The results in Table 3 also indicate that firm's size exerted positively on profitability. This corroborates findings from Zaid et al., 2014; Yazdnafar, 2013; Mistry, 2012; Malik, 2011; Akinlo, 2012; Olutunla and Obamuyi, 2008; Asimakopoulous *et al.*, 2009. Thus, large firms tend to be more profitable than smaller firms are. This is because firms with bigger size have more advantage in negotiating the price for their inputs, thereby reducing unit cost and thus increase their profitability (Asimakopoulous et al., 2009). Furthermore, the relatively better adaptation of larger firms to the macroeconomic environment may likely improve their profitability. However, studies by Ramasamy, 2005; Dhawan, 2001; Lazar, 2016; Al-Jafari and Samman, 2015; Margaretha and Supartika, 2016, reported a negative relationship between firm size and profitability. Meanwhile Seelanatha (2011) gave mixed results consequent upon the dependent variable used to measure firm profitability in his study.

The coefficient of inflation, which is a measure of prevailing economic condition or economic stability, is negative and significant at 5 percent. This finding corroborates that of Vatavu (2014) for Romania. This vividly reveals that the macroeconomic environment in Nigeria exerts negatively on the ability of firms to earn more profit. When inflation rate soars unabated (like in the case of Nigeria), it increases the costs of production and eventually reduces the profit margin of firms. In the same vein, the coefficient of interest rate exerted negatively on profitability at 10 percent level of significance. This indicates that the high interest rates charged by financial institutions are highly inimical to profitability of Nigerian firms. When the cost of borrowing is high, it increases the cost of production of firms, and eventually reduces the profit margin of firms. This is also a reflection of the prevailing macroeconomic policy in Nigeria. This finding runs contrary to Olutunla and Obamuyi (2008) that reported a positive effect of interest rate on profitability using a fixed-effect model. The coefficient of financial risk exerts negatively on profitability at 1 percent level of significance. This supports results from GMM estimation for Romania by Vatavu, 2014. It is therefore plausible to contend that firms experiencing higher financial risk tend to record poor profit. This may cause disincentive for investment, particularly for highly risky businesses. This indicates that investments in Nigeria are financially riskier. The probability values obtained for the Arellano-Bond tests for the first and second order autocorrelation i.e. AR (1) and AR (2) are 0.00 and 0.19 respectively.

Conclusion

This study explores the impact of inflation on the profitability of manufacturing firms listed on the Nigerian Stock Exchange (NSE) from 2010 to 2023. The findings reveal a significant negative relationship between inflation and firm profitability, particularly in terms of Return on Assets (ROA) and Net Profit Margin (NPM). As inflation rises, the purchasing power of consumers diminishes, leading to higher production costs and reduced profit margins for firms. Manufacturing firms in Nigeria are especially vulnerable to inflation due to their reliance on imported raw materials, energy costs, and fluctuations in the exchange rate, which further exacerbate the negative effects of inflation on profitability.

The results of the study also highlight that other macroeconomic factors, such as exchange rate volatility, firm size, and leverage, play a crucial role in determining profitability. Firms that are highly leveraged or operate on a smaller scale tend to experience greater negative impacts from inflation. In summary, inflationary pressures erode firm profitability, making it more difficult for Nigerian manufacturing firms to achieve financial stability and sustainable growth. The study's empirical evidence underscores the need for firms to adopt strategic measures to mitigate the effects of inflation and other external economic forces.

Recommendations

1. Manufacturing firms should focus on improving operational efficiency to reduce production costs. This can be achieved by optimizing supply chain management, adopting cost-effective technologies, and exploring energy-efficient practices. By lowering production costs, firms can better cope with inflationary pressures without significantly raising prices, thus protecting their profit margins.
2. Firms should explore financial instruments that provide protection against inflation. For instance, adopting inflation-indexed contracts and hedging against rising input costs through futures contracts or options can help mitigate the risks associated with inflation. By doing so, firms can safeguard their profitability from unexpected inflationary shocks.
3. To minimize their dependence on imported raw materials and reduce exposure to exchange rate fluctuations, firms should consider diversifying their input sources. Sourcing raw materials locally or exploring alternative suppliers in stable currency environments can lower the impact of exchange rate volatility on profitability.
4. Firms can adopt more flexible pricing strategies that allow them to adjust prices in response to inflationary trends. Dynamic pricing models, which take into account cost fluctuations, can help firms maintain profitability during periods of high inflation. However, firms should also balance this with customer retention strategies to avoid losing market share due to excessive price increases.

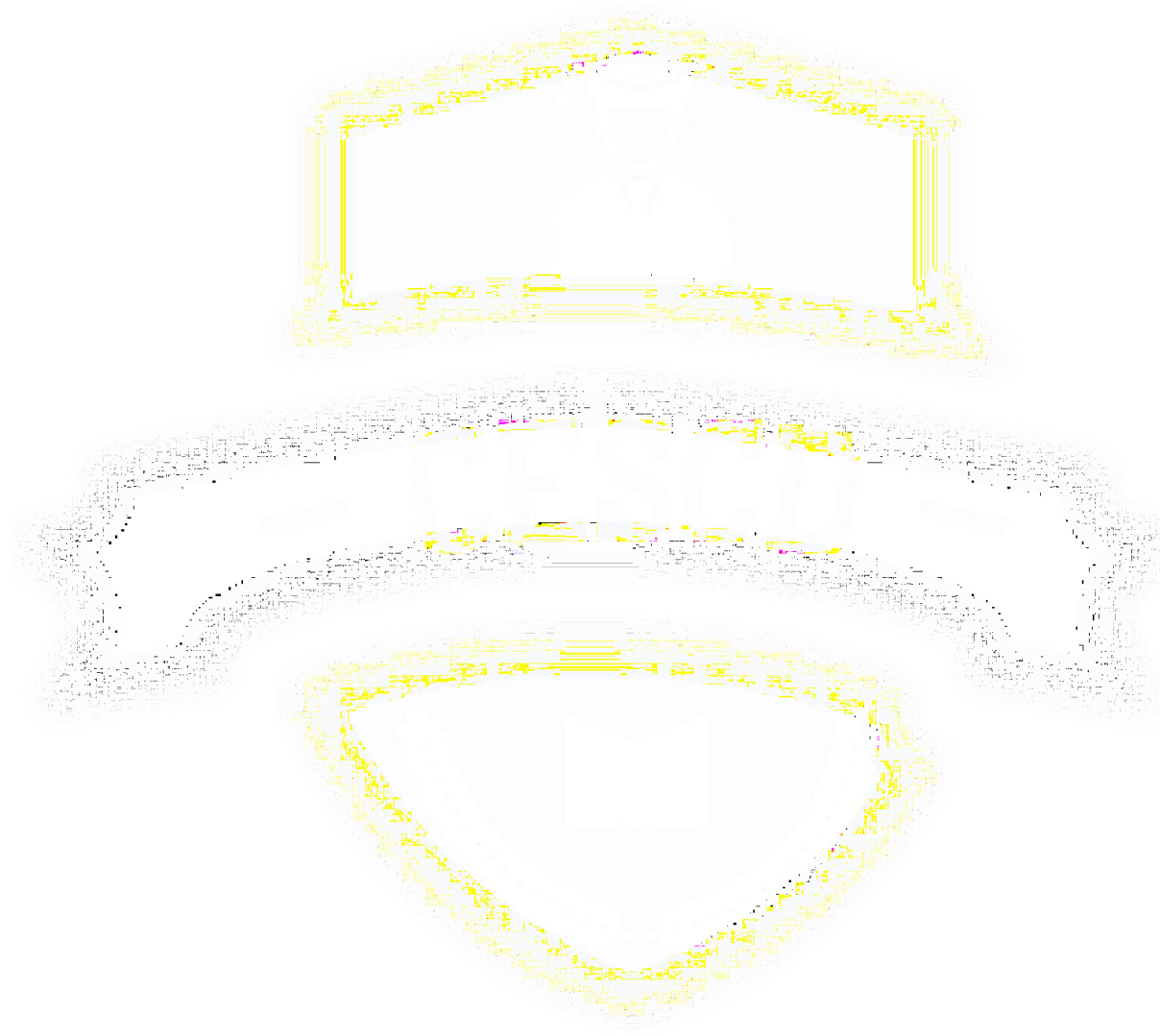
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CRITERIA RELATED TECHNIQUES FOR SOFTWARE EVALUATION

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ABSTRACT

The paper examines a review of techniques and criteria for software evaluation. It reveals software evaluation as a serious aspect of software engineering process that involves choosing one software product amongst other alternatives. Techniques for software evaluation are discussed such as Analytic Hierarchy Process (AHP) Software Evaluation Technique, weighed average sum and Fuzzy Based Approach Software Evaluation Technique. The strength and weakness of each technique is presented to give a broad understanding of the techniques for software evaluation. Criteria to be considered for software evaluation are usually classified in several groups. Several groups of evaluation criteria are needed for software evaluation such as vendor, hardware/software, cost/benefits, security and reliability. It is concluded that software evaluation is important as it enables Software companies and individuals/organizations that make use of software to make sure they provide software solutions that are reliable and can meet the needs of users.

KEYWORDS: Software evaluation, Fuzzy Based Approach, Evaluation Criteria, Software Quality, Decision-Making Techniques

Introduction

Evaluation is a task, which results in one or more reported outcomes, evaluation is an aid for planning, and therefore the outcome is an evaluation of different possible actions and finally evaluation is goal oriented. The primary goal is to check results of actions or interventions, in order to improve the quality of the actions or to choose the best action alternative. Evaluation is dependent on the current knowledge of science and the methodological standards. Evaluation as an aid for software development has been applied since the last decade, when the comprehension of the role of evaluation within Human-Computer Interaction had changed. The activities “Task analysis”, “Requirement specification”, “Conceptual and formal design”, “Prototyping”, “Implementation” are each supplemented by an activity “Evaluation” which helps to decide progression to the next step. Software can be evaluated with respect to different aspects, for example, functionality, reliability, usability, efficiency, maintainability, portability (Benjamin, 2019).

Software evaluation is a serious aspect of software engineering process, choosing one software product amongst other alternatives requires a careful line of multiple actions through a well guided criteria-based procedure. A successful evaluation is not simply picking a product based on intuition. It involves a formal process, the right mixture of evaluators, and a

specific quantifiable set of evaluation criteria. The process should include how to handle differences in scoring by the evaluators. The task of choosing a software component for a specific function in order to integrate it in a software system is a typical case of multi-criteria decision making that frequently occurs in Software Engineering. Consider a decision maker with a set of components to fulfill a function in a software system, for example, creating digital signatures on files. A number of decision factors will come into play such as functional suitability, security, performance efficiency, interoperability and costs. Some of these may pose conflicts: For example, increased security may come at the price of decreased performance efficiency or increased price. The decision maker has to follow a trustworthy and repeatable procedure to choose the component that best fulfils the objectives at hand (Benjamin 2019, Onyema et al, 2025). Software can be evaluated with respect to different aspects, for example, security functionality, reliability, usability, efficiency, maintainability, portability using different techniques or methods. In earlier times evaluation of software took place at the end of the developing phase, using experimental designs and statistical analysis. Evaluation is nowadays used as a tool for information gathering within iterative design: “Explicit human-factors evaluations of early interactive systems (when they were done at all) were poorly integrated with development and therefore ineffective. They tended to be done too late for any substantial changes to the system still be feasible and, in common with other human-factors contributions to development, they were often unfavourably received. Instruments for evaluation are not primarily used for global evaluation of an accomplished product, but these instruments are applied during the development of a product. Indeed, most experts agree nowadays that the development of usable software can only be done by a systematic consideration of usability aspects within the life-cycle model. One prominent part is the evaluation of prototypes with respect to usability aspects, employing suitable evaluation techniques in order to find usability errors and weaknesses of the software at an early stage (Benjamin, 2019).

Software Evaluation Techniques

Software evaluation is multi-criteria decision making problem that refers to making preference decisions over the available alternatives (Figueira, Mousseau& Roy, 2016). At this point, the various software evaluation techniques are discussed and their strengths and weaknesses are examined.

1. **Analytic Hierarchy Process (AHP) Software Evaluation Technique:** AHP has been widely used for evaluation of the software packages. AHP has been identified as an important approach to multi-criteria decision making problems of choice and prioritization. AHP is based on a hierarchical framework of criteria. The upper level deals with the goal of the selection process. The next level defines the major factors which are subdivided into their constituents in lower levels of hierarchy. The bottom level contains the alternatives to be analyzed. Local priorities are established for each factor on a given level with respect to each factor on the level immediately above it. This is done by pairwise comparison between the factors at each level. The application of AHP to the evaluation of software package has been successfully applied in many research studies (Ramírez-Nafarrate, Marín-Raventós and Montoya- Torres, 2019).

Strengths of Analytical Hierarchy Process (AHP): The strength of this process are:

- i. AHP enables decision makers to structure a decision making problem into a hierarchy, helping them to understand and simplify the problem.

- ii. It is flexible and powerful tool for handling both qualitative and quantitative multi- criteria problems.
- iii. AHP procedures are applicable to individual and group decision making.

Weaknesses of Analytical Hierarchy Process (AHP): The weaknesses are:

- i. AHP is time consuming because of the mathematical calculations and number of pair- wise comparisons that increases as the number of alternatives and criteria increases.
- ii. The decision makers need to re-evaluate alternatives when the number of criteria or alternatives are changed.
- iii. Ranking of alternatives depends on the alternatives considered for evaluation hence adding or deleting alternatives can lead to changes in the final rank (Koziolek, 2009).

2. Weighted Average Sum (WAS) Software Evaluation Technique: Another technique used for evaluation of software package is the weighted scoring method. In this method weights and rating scales are assigned to each criterion. The weight reflects the relative importance of each of the criteria while the rating scale indicates how easily each package is able to meet the specific criterion. The rating scales are then multiplied by weight factor of each criterion. Using this scheme a score is calculated for every criterion for each tool. These scores are then totaled to produce a score for each criteria category and the average is also computed. Finally, the categorical scores are compared to determine the highest (Benjamin, 2019). The overall score for an alternative, is the weighted sum of the criteria utilities aggregated across the hierarchy of objectives. This approach combines objective evidence measured in specific scales, subjective assessment represented in explicitly defined scenario-specific utility functions, and relative weights across the goal hierarchy. As such, it is a flexible model, but it requires a profound understanding of the intricacies of decision making scenarios. Furthermore, a careful distinction between the key concepts of evidence, utility, and weighting is expected from the decision maker (Rafique and Mišić, 2019).

Strengths of Weighted Average Sum Software Evaluation Technique

- i. Main advantage of WAS is its ease of use.

Weaknesses of Weighted Average Sum Software Evaluation Technique:

- i. Weights to the attribute are assigned arbitrary and it is very difficult to assign weight when number of criteria is high.
- ii. To obtain a score using this method a common numerical scaling is required.
- iii. Difficulties emerge when WAS is applied to multi-dimensional MCDM problems.

3. Fuzzy Based Approach Software Evaluation Technique: A fuzzy based approach for software evaluation has been used in different studies. This technique is used when performance rating and weights cannot be given precisely (Goztepe, Karaman, Catalkaya, 2015, Tran et al, 2024). In such cases the fuzzy set theory is used to model the uncertainty of human judgments and such problem is known as fuzzy multiple criteria decision making

(FMCDM). In daily life people usually make decisions based on imprecise or uncertain knowledge rather than some computer algorithms that require exact data. Fundamental elements of fuzzy logic are human language rules. The fuzzy systems convert these rules to their mathematical equivalents. Outcomes of fuzzy systems are more accurate representations than logic. The real world is not precise and certain. Thus, fuzzy sets handle uncertainty by reducing it and develop precise conclusions for real life problems (Mansoor, Streitferdt and Fubl, 2015, Sucharitha et al, 2023). The general architecture and components of a fuzzy rule based inference system is shown in Figure 2.1. The main modules of a fuzzy rule based system are fuzzification, fuzzy rules, inference system, data base and defuzzification.

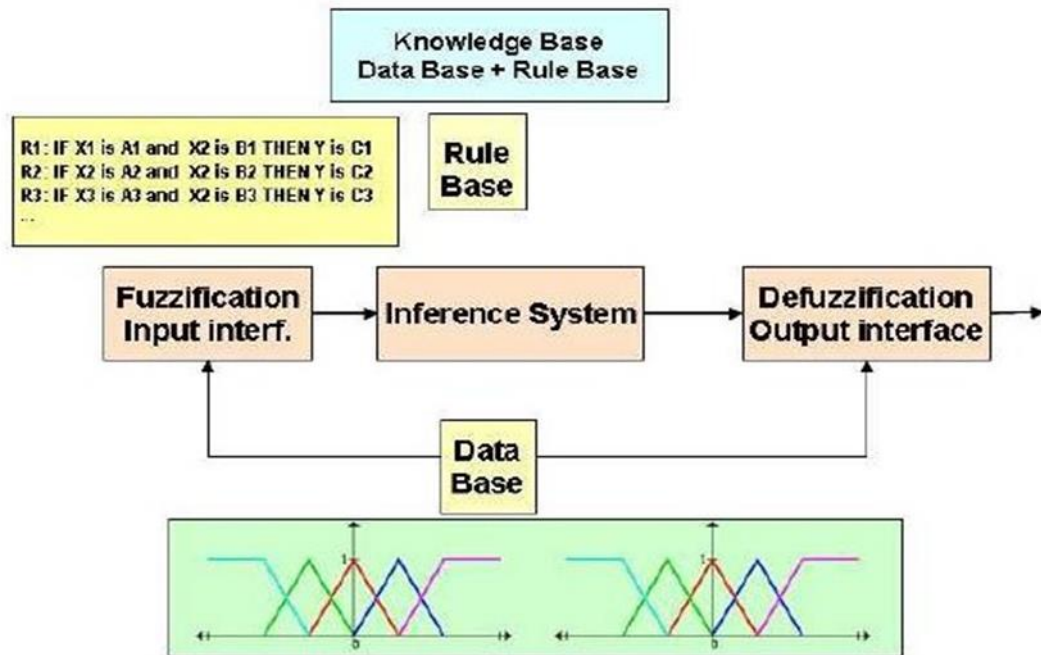


Figure 2.1: Fuzzy based approach model (Source: Goztepe, Karaman and Catalkaya, 2015)

Fuzzy rules consist of IF-THEN statements. Proposed model consisted of number of rules, and they make a group which forms the basis of ERP evaluation. The following fuzzy rules have been taken with the combination of linguistic variable values for ERP evaluation process.

Defuzzification: Fuzzy outputs need to be converted into a scalar output quantity in a fuzzy ruled model. The nature of the action can be evaluated by the system by this way. The converting process of the fuzzy output is called defuzzification. Whole fuzzy outputs of the system are aggregated with a union operator before an output is defuzzified. Standard defuzzification methods are bisector, centroid, mean value of maximum values, smallest value of maximum values and largest value of maximum (Mansoor et al., 2015, Karpagam, Christy, and Edeh, 2024).

Strengths of Fuzzy Based Approach Software Evaluation Technique:

- i. The decision makers can use linguistic terms to evaluate alternatives easily and intuitively.
- ii. It improves decision making procedure by accommodating the vagueness and ambiguity occurred during human decision making.

Weakness of Fuzzy Based Approach Software Evaluation Technique:

- i. Difficult to compute fuzzy appropriateness index values and ranking values for all alternatives.

Software Evaluation Criteria

Criteria to be considered for software evaluation are usually classified in several groups. Quality characteristics of the software package such as functionality, reliability, usability, efficiency, maintainability, and portability have been used as evaluation criteria group in several studies. The following are used as criteria for evaluation of software A and B in Benjamin (2019):

- (1) Vendor
- (2) System requirements (hardware and software)
- (3) Cost and benefits of the software packages

Vendor: Vendor assessment is an evaluation and approval process that businesses can use to determine if prospective vendors and suppliers can meet their organizational standards and obligations once under contract. The end goal is to secure a low-risk, best-in-class vendor and supplier portfolio. Vendors and suppliers both furnish services or goods, but there is a distinction: The term vendor applies to business-to-business (B2B) and business-to-consumer (B2C) sales relationships, while supplier applies only to B2B relationships (Goepel, 2018).

Benefits of Vendor Assessment: Although the vendor assessment process can be challenging, the benefits include finding low-risk sources for high-quality goods and services, as well as the development of mutually beneficial, long-term business relationships (Kumar & Singh, 2020). Additional benefits of vendor assessment include the following:

- a) **Risk Mitigation:** By carefully vetting vendors and suppliers, you can lower the regulatory, contract, and security risks of working with entities outside your company.
- b) **Lower Regulatory Compliance Risk:** Confirm compliance with the laws, regulations, and standards that apply to your business. If your vendor is in another country or you sell to another country, check those countries' legal requirements, too. For example, if you do business in the European Union, the General Data Protection Regulation (GDPR) applies.
- c) **Scope of Service and Contract Compliance:** Conduct a legal review of contract terms, nondisclosure agreements (NDAs), or partnership agreements to ensure that you've set favorable conditions and mitigated any risks.
- d) **Decrease Security and Cyber Risk:** The threat of cyber risk grows as we increasingly move our work to the cloud. Therefore, it's crucial to protect all your customer and company data. Your selection process should focus on assessing a third-party vendor or supplier to store your data. First, identify and evaluate the type of data that vendors and suppliers may need to access, and decide whether they need to access all, some, or none of it to do their work. It's crucial to ensure the vendor takes the proper measures to encrypt and protect your data. Once you identify potential partners, have them complete a questionnaire that thoroughly covers security management system details.

2. Hardware/Software Evaluation Criteria: Selecting hardware and software for implementing information system in an organization is a serious and time-consuming process that passes through several phases (Zhu, Ali, & Chu, 2021). The main steps of the selection process are listed below:

1. Requirement Analysis: – System configuration requirements are clearly identified and a decision to acquire the system is taken in this step.
2. Preparation of Tender Specifications: – After studying the feasibility and deciding upon the configuration, tender documents are prepared for the benefit of vendors to clarify the details of various specifications.

Hardware Selection Factors to Consider

1. Hardware must support current software as well as software planned for procurement over the next planning interval (1 year, 18 months, 3 years).
2. Hardware must be compatible with existing or planned networks.
3. Hardware must be upgradeable and expandable to meet the needs of the next planning interval.
4. Hardware warranties must be of an appropriate length.
5. Hardware maintenance must be performed by (local/remote vendor, in-house personnel).
6. Whenever feasible, hardware standards will dictate procurement of like brands and configurations to simplify installation and support.
7. Routine assessments of installed infrastructure will feed an upgrade/replace decision process.

Software Selection Evaluation Criteria

Typically, software evaluation criteria include the following things

End-user requirements: When evaluating the software end-user's requirements are considered to be the first priority. The software must be designed in a way to facilitate the users of all skill levels. Other than that, the software should clearly tackle the problem that it is designed to do. For example, if a software targets the audience that suffer from disabilities then it should have features to entertain such an audience. Like having built-in letter templates and supporting voice typing are must-haves for the software (Agh, &Dombi, 2019).

Functionality: Another key aspect of software evaluation is checking the functionality of the software. The software must perform the function that is required by the user. Having other related features in the software also improves the evaluation score of the software. For example, having the feature to create graphs and charts in a spreadsheet application improves the quality by a lot (Nahid and Susmita, 2019).

Performance: The performance of the software also plays a huge role in the software evaluation. The performance of the software is compared with the existing software models and the results are stored in the form of benchmarks for future use. The software needs to be perfectly optimized in order to deliver maximum performance which makes the optimization a key feature for the app.

User-Friendly: The software with a user-friendly interface is always better. The ease of use and built-in help panels add more value to the app in terms of user-friendliness.

3. Cost-benefits Software Evaluation Criteria: Cost-benefit analysis (CBA), sometimes also called benefit-cost analysis, is a systematic approach to estimating the strengths and weaknesses of alternatives. It is used to determine options which provide the best approach to achieving benefits while preserving savings in, for example, transactions, activities, and functional business requirements. A CBA may be used to compare completed or potential courses of action, and to estimate or evaluate the value against the cost of a decision, project, or policy. It is commonly used to evaluate business or policy decisions (particularly public policy), commercial transactions, and project investments. For example, the U.S. Securities and Exchange Commission must conduct cost-benefit analyses before instituting regulations or deregulations (Yadav & Mehta, 2020).

Cost-benefit analysis is often used by organizations to appraise the desirability of a given policy. It is an analysis of the expected balance of benefits and costs, including an account of any alternatives and the status quo. CBA helps predict whether the benefits of a policy outweigh its costs (and by how much), relative to other alternatives. This allows the ranking of alternative policies in terms of a cost-benefit ratio. Generally, accurate cost-benefit analysis identifies choices which increase welfare from a utilitarian perspective. Assuming an accurate CBA, changing the status quo by implementing the alternative with the lowest cost-benefit ratio can improve efficiency. Although CBA can offer an informed estimate of the best alternative, a perfect appraisal of all present and future costs and benefits is difficult; perfection, in economic efficiency and social welfare, is not guaranteed. The value of a cost-benefit analysis depends on the accuracy of the individual cost and benefit estimates (Sousa and Rocha, 2018).

Security Evaluation Criteria

One of the target of this work is to investigate evaluation methods related to software security, which is a critical extra-functional property directly and significantly impacting different development stages (i.e., requirements, design, implementation and testing). Security in software can be defined as engineering software so that it continues to function correctly under malicious attack. The high diversity of components and complexity of current systems makes it almost impossible to identify, assess and address all possible attacks and aspects of security vulnerabilities (Ransome&Misra, 2022). An extensive body-of-knowledge already exists on software security and many studies have already investigated security assessment as well. For example, the U.S. National Institute of Information Standards and Technology (NIST) developed a performance measurement guide for information security and in particular how an organization through the use of metrics can identify the adequacy of controls, policies and procedures. The approach is mostly focused on the level of technical security controls in the organization rather than the technical security level of specific products (National Institute of Standards and Technology, 2021).

Software Reliability Evaluation Criteria

Software Reliability can be defined as the probability of failure-free software operation for a specified period of time in a specified environment. Software Reliability is a very important factor that affects system reliability. It is quite different from hardware reliability because it shows the design perfection, rather than manufacturing perfection. The high complexity of most software is the major contributing factor of Software Reliability problems. Various approaches can be used to improve the reliability of software. Software has no shape, color, material, mass. It cannot be seen or touched, but it has a physical existence and is crucial to system functionality. Software can also have small unnoticeable errors or drifts that can culminate into a disaster. On February 25, 1991, during the Gulf War, the chopping error that missed 0.000000095 second in precision in every 10th of a second, accumulating for 100 hours, made the Patriot missile fail to intercept a scud

missile. 28 lives were lost. While any system with a high degree of complexity, including software, will be hard to reach a certain level of reliability, system developers tend to push complexity into the software layer, with the rapid growth of system size and ease of doing so by upgrading the software. For instance, large next-generation aircraft will have over one million source lines of software on-board; next-generation air traffic control systems will contain between one and two million lines; the upcoming international Space Station will have over two million lines on-board and over ten million lines of ground support software; several major life-critical defense systems will have over five million source lines of software (Ransome and Misra, 2022).

Conclusion

Software evaluation is important as it enables Software companies and individuals/organizations that make use of software to make sure they provide software solutions that are reliable and can meet the needs of users. This cannot be achieved without an effective decision support system for software evaluation. The need to evaluate the reliability of software system has become clearer in this era of intensive software application in different sectors of life. Many papers provide a preferred list of evaluation criteria for evaluation of specific software package; however, a lack of common list is apparent. Software evaluation criteria may differ from one evaluator to another. The exact meaning of a criterion is open to the evaluator's own interpretation. Sometimes the terminology used by author(s) for a criterion in one literature is different than another author(s) for the same criterion. This may lead to ambiguity and gives unclear picture to the evaluator. There is need to develop a framework including a software selection methodology, an evaluation technique, an evaluation criterion, and a system to support evaluation and selection of any software package. A common evaluation technique than can be adopted by software evaluators to determine the effectiveness of the software is weighted sum evaluation technique. In this approach values or weights are assigned to the criteria used in determining the effectiveness of the software and the total weight is used to determine which is more effective than the other.

Recommendations

The following recommendations are offered based on the study:

1. The criteria utilized in making decision on the effectiveness of a software should be expanded to include more aspects so as to improve the reliability information.
2. Proper testing and debugging should be done before software systems are published or placed in the market.
3. More criteria categories should be added to boost software evaluation and selection.
4. Trial versions of software are important for users to assess the effectiveness of the software.

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