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An Assessment of the Level of Implementation of Sustainable Development Goal 6 (SDG) Water And Sanitation in Kaduna State, Nigeria

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Abstract

The Sustainable development Goal (SDG) was adopted by the United Nations as a global framework to address a range of pressing challenges, including the provision of clean water. SDG six specifically targets the universal and equitable access to safe and affordable drinking water for all. This research work examines the nature of potable water supply and demand in Jema'a Local Government Area of Kaduna State. A total of 390 questionnaires were administered to households in five wards within the study area, although only 381 of these questionnaires were used for the purpose of this study. Finding from the study revealed that Implementation of Sustainable Development Goal did not have significant impact on Access to Clean Water in Jema'a Local Government Area of Kaduna State. This was due to lack of Nigeria's progress toward achieving Sustainable Development Goal (SDG) on Access to Clean Water. Factors that affected non- achievement of this goal in Jema'a Local Government Area includes; poor Political Commitment: If the Nigerian state government prioritizes SDG and recognizes the importance of providing access to clean water to its citizens, it can allocate sufficient resources and implement policies to achieve this goal. Lack of Building and maintaining water supply infrastructure, such as water treatment plants, pipelines, and distribution networks, are crucial for ensuring access to clean water for all communities. Inadequate investment and financial resources necessary to improve water infrastructure, conduct water quality monitoring, and implement projects in remote or underserved areas. Based on the findings, the study recommends SDGs should Implement Water Quality Monitoring; establish a water quality monitoring system to regularly test the water from various sources. This will help in identifying pollution sources and understanding the extent of water contamination. Monitoring data will also be crucial in tracking progress towards SDG 6 targets.

Keywords: Water Availability, Infrastructure, Governance, Public Policy and Policy implementation

Introduction

The Millennium Development Goals (MDGs) were succeeded by the Sustainable Development Goals (SDGs) for the 2016–2030 period, including a self-standing goal—SDG 6—regarding access to water and sanitation. MDG 7c and SDG 6 guide water and sanitation data that are collected worldwide and that determine what we know about access to water and sanitation. The goals influence national policies, donor funding strategies (Cotton and Bartram 2008; Bain et al. 2012) and service delivery to a large part of the world population.

Progress towards MDG 7c was measured by the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF) through the Joint Monitoring Programme for Water Supply and Sanitation (JMP). JMP measures access to 'improved and improved' water sources and 'improved and unimproved'

sanitation facilities as indicators for safe water and basic sanitation access Estimates are based on survey data, including Demographic and Health Surveys (DHS), UNICEF Multiple-Indicator Cluster Surveys (MICS), World Bank Living Standards Measurement Surveys (LSMS), WHO World Health Surveys (WHS) and national censuses and surveys (Bartram, Michael, Clarissa & Rifat, 2014; Cotton and Bartram 2008).

Progress made by MDGs is impressive. To the Report, according to JMP statistics, the targets set for access to safe drinking water were met in 2010, 5 years before the deadline (United Nations MDG Monitor 2017). Between 1990 and 2015, 2.6 billion people gained access to 'improved' drinking water sources, and 2.1 billion people gained access to 'improved' sanitation. The number of people practicing open defecation has gone down by nearly 50% since 1990. Access to safe water and sanitation facilities is considered a basic human necessity for survival and wellbeing, without these basic needs, the health conditions of millions of especially children are at risk, however, 2.3 billion people across the globe lack access to basic drinking water and sanitation facilities respectively, causing 842,000 deaths every year, which is undoubtedly a major public health concern. It has been estimated that overall 9% of the global burden of disease could be prevented through improvement in adequate Water, Sanitation and Hygiene (WASH) facilities. Children are one of the most vulnerable groups affected by lack of water and sanitation facilities. In developing countries, the high mortality rate resulting from diarrhea among children under the age of five was majorly due to WASH challenges. The provision of safe water and sanitation has been greatly influential on people's health status and livelihood; however, the availability of these facilities remains critical in Nigeria especially in rural areas. A large percentage of rural communities in Kaduna state live without access to clean water and sanitation facilities thus the situation has subjected the communities to the utilization of water from Rivers, ponds, and streams for drinking and domestic activities.

The lack of access to clean water is also linked to the practice of open defecation which consequently has often led to illness, spread of water borne diseases and deaths. The few improved water facilities from boreholes and wells with hand pumps available are largely insufficient: women and children mostly travel far distances to access water, which is energy and time consuming thus affecting children education and women household on the other hand hygiene facilities such as excreta disposal (toilets) has also been inadequate for usage at various communities in Kaduna. In Nigeria, public places such as schools, markets and even hospitals have often left people with no alternative but to defecate openly and sometimes in and around water sources with no use of or any cleaning agents for protection moreover, toilet facilities available are poorly maintained and mostly shared among numerous people with no consideration of gender segregation and women integrity.

Statement of the Problem

A supply of clean, adequate, safe water supply and sanitation facilities are

two of the most fundamental basic human needs and human right. Yet, according to UN estimates (UNWWAP, 2013), "more than 1.1 billion people are estimated to lack access to safe drinking water while 2.4 billion people do not have adequate sanitation". Every minute, 10 people in developing countries die from water related-diseases and it is estimated that at any one time, half of the world's hospital beds are taken up by people suffering from water related diseases associated with dirty water and poor sanitation (DfID & WEDC, 1998), (Water Aid, 2001).

The current water supply and sanitation situation for many poor people in the world is not acceptable. For many people in the developing world, whether in transition from centrally planned economies, emerging countries or semi-industrial countries of the world, access to water is a necessity, for some a daily struggle and in many cases a matter of life or death. Very often, the water collected is dirty or contaminated causing poor health and water-related diseases. For poor/unserved people, the lack of clean water and adequate sanitation further intensifies their financial situation. As they lay in bed, they lose time in opportunities and money while coping with sickness and debilitating illnesses. In the poor countries, this means a total of up to 27,000 deaths each day (WWC, 1998).

Lack of access to water supplies and sanitation facilities becomes therefore an economic, social and cultural barrier to development. Reaching poor unserved communities is often difficult because these groups are remote, dispersed, and have little or no communication facilities. They are often silent, lacking the skills to make their voices heard, and unaware of their legal rights which are too often expensive to follow up.

There are still significant problems in enabling millions of people who lack access to affordable, safe, close and adequate water supply and sanitation facilities to gain these basic essentials for a decent standard of living - regarded by many as basic human rights. One of the issues that are judged to constrain access and provision is the lack of institutional and legal framework which governs water supply and sanitation. While legislation and institutions may be in place, they are often weakly implemented, poorly enforced, and not accessible to those poor communities who suffer most from their inadequate effectiveness.

Nevertheless, the Kaduna state government has laid down some programmes to curb the menace of water sustainability in the state. Efforts to improve drainage across the state have paid off, with the proportion of households lacking drainage falling from 58.6% to 46.8% between 2015 and 2017 (KDBS GHS 2015 & 2017). On water supply, a major milestone in the state's efforts to provide universal access to safe water has been the completion of Zaria 150mld new water treatment plant. This will nearly double the state's current production level of around 171mld. In addition, large-scale water projects have been concluded in Lere and Birnin-Gwari. Statewide, 1,231 hand-pump boreholes and 40 solar-powered boreholes have been constructed or rehabilitated.

Objectives of the Study

The main objective of the study is to assess the level of implementation SDGs (6) in Kaduna State, Nigeria. Specifically, the research sought:

i. To assess the implementation of SDG (6) in enhancing adequate and frequent water supply for the resident of Kaduna State.
ii. To investigate the implementation of SDG (6) in providing safe clean drinking water for the residents of Kaduna state.

Research Hypothesis

$H0_1$: The implementation of SDG6 has not significantly enhanced adequate and frequent water supply for the resident of Kaduna State.

$H0_2$: The implementation of SDG6 has not significantly provided safe clean drinking water for the residents of Kaduna state.

Literature Review

Conceptual Clarification

Concept of Water

Water is a fundamental and essential substance for life on Earth, playing a crucial role in various physical, chemical, and biological processes. It is a simple yet remarkable molecule, composed of two hydrogen atoms and one oxygen atom (H_2O). This unique structure gives water its distinctive properties, making it vital for the existence of living organisms and shaping the Earth's environment.

One of the most remarkable characteristics of water is its ability to exist in three states—solid, liquid, and gas under normal Earth conditions. This versatility is primarily due to hydrogen bonding, a force that occurs between the positively charged hydrogen atoms of one water molecule and the negatively charged oxygen atoms of another. This intermolecular attraction results in a high boiling point and melting point for water, allowing it to exist as a solid (ice), liquid (water), and gas (water vapor) across a wide range of temperatures.

The importance of water extends beyond its physical properties. It serves as a universal solvent, facilitating the dissolution of various substances. This property makes water an excellent medium for chemical reactions, both in natural processes and in biological systems. The dissolving power of water enables it to transport nutrients, minerals, and other essential compounds, contributing to the nourishment and growth of living organisms.

In the Earth's hydrological cycle, water undergoes continuous movement between the atmosphere, oceans, rivers, lakes, and the land. This dynamic process, driven by solar energy, regulates weather patterns, sustains ecosystems, and shapes the Earth's surface through erosion and deposition. The availability of water also influences the distribution of life on Earth, with different organisms adapting to specific water conditions.

Water plays a vital role in maintaining the temperature balance of the planet. Its high specific heat capacity allows it to absorb and store large amounts of heat, regulating temperature changes in the environment. This property is crucial for stabilizing climate conditions and creating a habitable range for life on Earth. The significance of water in biological systems cannot be overstated. It is a key component of cells, tissues, and organs, serving as a

medium for biochemical reactions. The unique properties of water, such as capillary action and surface tension, play essential roles in plant physiology, blood circulation in animals, and numerous other biological processes.

Unfortunately, despite its abundance, access to clean and safe water remains a global challenge. Water scarcity, pollution, and inadequate sanitation are issues that impact human health, ecosystems, and economic development. Sustainable water management practices, conservation efforts, and technological innovations are essential for addressing these challenges and ensuring the responsible use of this precious resource.

In conclusion, water is a fundamental and irreplaceable component of life on Earth. Its unique physical and chemical properties make it indispensable for various natural and biological processes. Understanding and appreciating the importance of water are crucial for promoting responsible stewardship of this invaluable resource and addressing the challenges associated with its availability and quality (Bellamy, 2017)

Concept of Sanitization

The business dictionary (2022) defines the term sanitation as the process of keeping places free from dirt, infections, disease etc., for the well-being of people.

These conditions include:

- Clean and safe water supply
- Clean and safe ambient air
- Efficient and safe animal, human and industrial waste disposal
- Protection of food from biological and chemical contaminants and
- Adequate housing in clean and safe surroundings. Also called environmental hygiene.

For Bellamy (2017: 382), sanitation is "a general programme of environmental health to provide a safe source and distribution of portable water and proper collection of waste-water". In Uchegbu (2020:76), "sanitation is the arrangement for protection of health, especially the removal of human, industrial and domestic waste". It is important to note that sanitation is not limited to issues that deals with clean and portable water. In its broad sense, it includes the whole process and procedures of keeping the environment clean from waste (both domestic and industrial), keeping the surrounding air, and land free from all that could harm them and make them unfit for human usage and thus cause harm to human and persons and other living organisms in the ecosphere and biosphere. It is called sanitation because it has to do with the environment. The term environment is here understood as defined by Hook (2018:77) to "refer to the entire global system. That is everything from the outermost reaches of the atmosphere to the earth's inner core.

Inherent in this are all the factors that influence the environment, from its geology to the fauna and flora as well as the entire prevailing climate." Michaels (2004:71) corroborates this by affirming that the sanitation is "the sum of all external conditions and influences affecting the development and life of organisms". The Federal Republic of Nigeria (2015) in National sanitation policy declares that:

Sanitation is defined as the principles and practices of affecting healthful and

hygiene conditions in the environment to promote public and welfare, improve quality of life and ensure a sustainable environment.

It could be seen from the above comprehensive definition that sanitation is a very broad and comprises all that is involved in keeping every environment clean and in good condition for flourishing of life and the planet. The environment here is inclusive of social, economic, cultural, physical and every form of environment. Sanitation is a key factor than enhances human security.

Environmental Sanitation

The Business Dictionary (2022) defines the terms environmental sanitation as:

Activities aimed at improving or maintaining the standard of basic environmental conditions affecting the well-being of people. These conditions include (1) clean and safe water supply, (2) clean and safe ambient air, (3) efficient and safe animal, human, and industrial waste disposal, (4) protection of food from biological and chemical contaminants, and (5) adequate housing in clean and safe surroundings. Also called environmental hygiene. Bellamy (2017) Opined sanitation as "a general programme of environmental health to provide a safe source and distribution of portable water and proper collection of waste-water".

1) Health Effect of Drinking Water Contaminated with Heavy Metals

The World Health Organization estimated that 80% of diseases are waterborne. These contaminated water-associated diseases include cancer, respiratory disease, neurological disorder, cardiovascular disease and diarrheal disease (Ullah et al., 2014), which are caused by different chemical constituents among which are heavy metals. Cancer and blue baby syndrome are associated with nitrogenous chemicals in water (Krishnan and Indu, 2006) and drinking of different chemicals in contaminated water during pregnancy has been associated with increased rate of low birth weight which eventually affects the fetal health (Currie et al., 2013).

Drinking water contaminated with heavy metals has been reported to cause liver cirrhosis, hair loss, neural disorder and renal failure (Salem et al., 2000). They are also implicated for various illnesses like hemorrhage, nausea, skin irritation, ulceration and dermatitis which may be lethal (Abah et al., 2013). The ingestion of large quantities of Fe results in hemochromatosis. Nickel is a ubiquitous metal but its high concentration is frequently responsible for allergic skin reactions and has been reported to be one of the most common causes of allergic contact dermatitis (Kitaura et al., 2003), apart from being also carcinogenic (McKenzic and Smythe, 1998).

Hexavalent Cr on the other hand is highly toxic, mutagenic, as well as carcinogenic (Lee et al., 2008). Copper on the other hand is an essential trace element for all organisms and can be used in metabolic pathways, however, young children are easily intoxicated by it.

There have been records of kidney failure in young children exposed to elevated Cu concentrations. Lead is the most toxic heavy metal (Ferner, 2001) and Pb poisoning causes teratogenic, mutagenic, and carcinogenic effects as well as the inhibition of the synthesis of hemoglobin, dysfunction in the kidneys,

joints, reproductive systems, cardiovascular system, chronic damage to the central nervous system and peripheral nervous system (Ogwuegbu & Muhanga, 2005).

Concept of Sustainable Development Goals

The concept of Sustainable Development Goals (SDGs) emerged from the United Nations' 2030 Agenda for Sustainable Development, which was adopted by world leaders in 2015. SDGs are a set of 17 interlinked global goals that aim to address the most urgent economic, social, and environmental challenges facing the world. They build upon the Millennium Development Goals (MDGs) and cover a broader range of issues. The key concept behind the SDGs is the notion of sustainable development, which is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. It recognizes the interconnectedness of economic, social, and environmental aspects of development and strives for a balanced and inclusive approach. The SDGs are designed to be universal, meaning they apply to all countries regardless of their level of development. They tackle a broad range of issues, including poverty eradication, quality education, clean water and sanitation, renewable energy, social inclusion, gender equality, climate change mitigation and adaptation, sustainable cities, responsible consumption and production, and biodiversity conservation, among others.

The SDGs are integrated and indivisible, meaning progress in one goal supports progress in others. They aim to address the root causes of various global challenges and promote coherent and holistic approaches to development. The goals are interconnected, and achieving one goal often requires progress in multiple other goals.

Concept of Open Defecation

Open defecation refers to the practise of defecating in fields, forests, bushes, bodies of water, or other open spaces. Defecating in the open is an affront to dignity and risk to children's nutrition and to community health. The elimination of open defecation is recognized as a top priority for improving health, nutrition, and productivity of developing country populations and is explicitly mentioned in SDG target 6.2.

Open defecation rates have been decreasing steadily. From 2000-2020, the number of people practising open defecation declined from 1,229 million to 494 million, an average decrease of 37 million people per year. All SDG regions saw a drop in the number of people practising open defecation, except for Oceania, where open defecation increased from 1.1 to 1.8 million. In 2020, more than 5% of the population still practised open defecation in 55 countries. Nine out of ten people practising open defecation lived in two regions: Central and Southern Asia (233 million) and Sub-Saharan Africa (197 million).

According to the findings from the 2018 WASH National Outcome Routine Mapping (WASHNORM) survey, 47 million people in Nigeria practise open defecation. Consequently, Nigeria loses about 1.3% (N455 billion) of GDP annually due to poor sanitation.

Additionally, more than 100, 000 children under the age of five die each year because of water and sanitation related diseases.

Empirical Review

Johanna, Geske, Jasper and Alberto (2018) undertook a study on The Sustainable Development Goal on water Sanitation: Learning from the Millennium Development Goals. The objectives of their study were to provide an overview of criticism of MDGs target 7c and contribute to the ongoing debate on the SDGs, the study used a PRISMA systematic literature reviewed. According, to the data collected by the Joint Monitoring Programme in charge of measuring progress towards MDG 7c, 2.6 billion people gained access to safe water and 2.3 billion people to basic sanitation. Despite these optimistic figures, many academics have criticized MDG 7c. Their study provided an overview of this critique by performing a systematic literature review of 62 studies conducted over the MDG implementation period (2002—2015) and shortly after. The academic debate on MDG 7c mainly focused on the effectiveness of the indicators for safe water and sanitation and on the political dynamics the selection of these indicators. Their study revealed that SDG 6 addresses some of the concerns raised on the indicators for safe water and sanitation but fails to acknowledge the politics of indicator setting. Thus, their study recommended that additional indicators and reflect on the limitations of using only quantitative indicators to measure progress towards SDG 6.

In another study by Morenike, Mary and Atinuke (2020) on Association between water, Sanitation, General hygiene and oral hygiene practices of street-involved young people in southwest Nigeria. The objective of the study was to determine if there is an association between oral hygiene practices and water and sanitation hygiene (WASH) practices among street-involved young people (SIYP). A cross-sectional study recruited SIYP age 10-24 years in two States in Nigeria recruited through respondent-driven sampling in December 2018. Interviewer-administered questionnaires were used to collect data on water access, sanitation, personal and oral hygiene. The instruments used for collecting the data were standardized tools for measuring the phenomena studies the association between knowledge and practice of oral hygiene; oral hygiene and water, sanitation and hygiene (WASH); and indicators of good oral hygiene were determined using binary logistic regression guided by two models.

Their study revealed that the proportion of SIYP with good knowledge of oral hygiene was low (31.2%), and fewer had good oral hygiene practice (8.9%). There were significant associations between knowledge and practice of tooth cleaning, use of fluoride-containing toothpaste, dental flossing, consumption of sugar between meals, and frequency of dental check-ups (p 0.001 respectively).

Theoretical Framework

The study adopts Sustainable Urban Development theory, the theory refers to a conceptual framework and approach that seeks to promote

environmentally sustainable, socially equitable, and economically viable urban development. It emphasizes the integration of environmental, social, and economic considerations in urban planning and decision-making processes. While the theory does not have a specific proponent or a single origin, it has been shaped by the work of various scholars, organizations, and policy frameworks.

Key principles and concepts within sustainable urban development theory include:

i. **Environmental Sustainability:** Sustainable urban development theory recognizes the importance of environmental conservation and the need to mitigate the negative impacts of urbanization on ecosystems. It emphasizes the promotion of sustainable resource use, reduction of pollution and waste, preservation of green spaces, and the conservation of biodiversity within urban areas.

ii. **Social Equity and Inclusivity:** The theory emphasizes the importance of social equity and inclusivity in urban development. It seeks to address social disparities and promote equitable access to essential services, housing, education, healthcare, and cultural amenities. It also recognizes the importance of community participation and engagement in decision-making processes.

iii. **Viability:** Sustainable urban development theory acknowledges the need for economic viability and resilience in urban areas. It emphasizes the promotion of sustainable economic practices, job creation, entrepreneurship, and the integration of economic considerations into urban planning and development strategies.

iv. **Compact and Efficient Urban Form:** The theory promotes the development of compact, mixed-use, and well-connected urban forms that minimize resource consumption, reduce energy use, and promote efficient transportation systems. It encourages the creation of walkable neighborhoods, access to public transit, and the reduction of urban sprawl.

v. **Integrated Planning and Governance:** Sustainable urban development theory emphasizes the importance of integrated planning and governance approaches. It calls for the collaboration and coordination of various stakeholders, including government authorities, community organizations, private sector actors, and civil society, to ensure holistic and coordinated urban development strategies.

vi. **Long-term Thinking and Resilience:** The theory encourages long-term thinking and resilience in urban planning and development. It emphasizes the consideration of future needs, climate change adaptation, disaster risk reduction, and the ability of cities to withstand shocks and stressors.

Sustainable urban development theory has influenced policy frameworks and guidelines at various scales, including international initiatives such as the United Nations Sustainable Development Goals (SDGs) and the New Urban Agenda. It serves as a guiding framework for researchers, policymakers, and practitioners in addressing the complex challenges

of urbanization while promoting the long-term well-being and sustainability of urban areas.

Research Design

Survey and documentary research design were adopted for this study. These designs were adopted because they seek to generate quantitative data from a large population among residents of Kaduna State. Documentary research design was adopted because; it seeks to review the work of past researchers and official records from the SDGs office of Kaduna State. The real attractions of this design are its moderately minimal effort, considering the way that valuable data were gathered from the large number of populations. Existing data are data collected for research purposes, such as total number of household's beneficiaries with a specific period of time.

Population, sample size and sampling techniques

Kaduna state is one of the states in the North West geopolitical zone in Nigeria. The study employed the random sampling technique to select one local government from each of the three (3) senatorial districts in Kaduna state (Zaria, Chikun, Jaba). The total population of the selected local government is 1,449,000. With Zaria having 736,000, Chikun having 502,500 and Jaba 210,500 persons (National Bureau of Statistics, 2021). The total sample size of 399.89 was obtained using the formula of Taro Yamane (1964), as it provides a simplified formula for calculating sample sizes.

Data Presentation

Table 4.1.1: Responses on the implementation of SDGs Six (6) in Kaduna state

Question	S/A	A	N	D	S/D	Total
The implementation of SDG 6 has improved access to clean and safe drinking water for the residents of Kaduna State.	12 3.1%	22 5.7%	17 4.4%	273 71.3%	59 15.4%	383
Efforts aimed at achieving SDG 6 have led to enhanced awareness among residents of Kaduna State about the importance of water conservation and responsible usage.	26 6.8%	75 19.6 %	35 9.1%	207 54.1%	40 10.4%	383
The collaborative initiatives for SDG 6 have positively influenced waste management practices in Kaduna State, contributing to a cleaner environment and reduced pollution.	34 8.9%	59 15.4 %	48 12.5%	216 56.4%	26 6.8%	383
The implementation of SDG 6 has resulted in decreased open defecation incidents, leading to improved sanitation and public health conditions for residents of Kaduna State.	24 6.3%	47 12.3 %	42 11%	221 57.7%	49 12.8%	383
Collaborative efforts among various stakeholders for SDG 6 have positively impacted the overall quality of life for residents of Kaduna State by providing better access to clean water, sanitation, and sustainable environmental practices.	11 2.9%	27 7.1%	37 9.7%	198 51.7%	110 28.7%	383

Source: Field Survey, 2023.

Data Presentation and Analysis

Based on the data presented in the table, majority of respondents (86.7%) either disagreed or strongly disagreed with this statement, indicating that they do not perceive a noticeable improvement in access to clean and safe drinking water due to SDG 6 initiatives.Although a higher percentage (26.4%) agreed with this statement compared to the first statement, the majority (64.5%) still disagreed or strongly disagreed, indicating a lack of perceived awareness enhancement regarding water conservation and responsible usage.

There was more diversity in responses here, but the majority (63.2%) still disagreed or strongly disagreed with the statement, suggesting that waste management practices were not perceived to be positively influenced by collaborative initiatives.

While perceptions vary, the data indicates that the collaborative initiatives might not have had a significant positive impact on waste management practices, cleaner environments, or reduced pollution.A substantial majority (70.5%) disagreed or strongly disagreed with this statement, indicating that the SDG 6 implementation did not result in decreased open defecation incidents or improved sanitation and public health conditions.

A significant majority (80.4%) disagreed or strongly disagreed with this statement, suggesting that collaborative efforts have not positively impacted the overall quality of life for residents in terms of clean water, sanitation, and sustainable environmental practices. The overall conclusion drawn from the data is that there is a prevailing sentiment of disagreement or scepticism across all statements regarding the impact of SDG 6 initiatives in Kaduna State. The data indicates a lack of perceived positive impact in terms of improving access to clean water, enhancing awareness, influencing waste management, improving sanitation, and enhancing overall quality of life.

Table 4.1.2: Responses on the Implementation of SDGs 6 and Safe Clean Drinking Water

	Question	S/A	A	N	D	S/D	Total
1.	The implementation of SDG 6 has increased the availability of safe drinking water for the residents of Kaduna state.	16 4.2%	21 5.5%	27 7.1%	267 69.7%	52 13.6%	383
2.	The efforts directed at achieving SDG 6 have positively impacted the quality and safety of drinking water sources in Kaduna state.	19 5%	32 8.4%	26 6.8%	249 65%	57 14.8%	383
3.	The implementation of SDG 6 has contributed to a notable decrease in the prevalence of waterborne diseases among residents of Kaduna state.	20 5.2%	39 10.2%	28 7.3%	281 73.4%	15 3.9%	383
4.	The collaborative efforts between Kaduna State government and non-governmental entities for SDG 6 have positively influenced equal access to safe drinking water	24 6.3%	36 9.4%	22 5.7%	284 74.2%	17 4.4%	383

across different areas of Kaduna state.						
5. The on-going implementation of SDG 6 has raised awareness among the residents of Kaduna state about the importance of using safe drinking water sources.	23 6%	46 12%	37 9.7%	255 66.6%	22 5.7%	383

Source: Field Survey, 2023.

Based on the data presented the majority of respondents (72.9%) either disagreed or strongly disagreed that implementation of SDG 6 has noticeably increased the availability of safe drinking water for the resident of Kaduna State. This suggests that the respondents do not perceive a noticeable increase in the availability of safe drinking water due to SDG 6 initiatives.

While a significant percentage (23.4%) agreed (S/A and A combined), the majority (79.8%) still disagreed, indicating a lack of perceived positive impact on the quality and safety of drinking water sources due to SDG 6 efforts.

The majority (77.3%) disagreed or strongly disagreed with this statement, indicating that the implementation of SDG 6 was not perceived to have notably decreased waterborne diseases among residents.

The majority (78.4%) disagreed or strongly disagreed with this statement, suggesting that collaborative efforts did not positively influence equal access to safe drinking water across different areas. While a substantial percentage (18%) agreed (S/A and A combined), the majority (72.3%) still disagreed, indicating a lack of perceived awareness-raising regarding the importance of using safe drinking water sources.The overall data trends depict a consistent pattern of disagreement across all statements regarding the positive impact of SDG 6 initiatives on safe drinking water in Kaduna State. The majority of responses suggest a lack of perceived improvement in the availability, quality, safety, disease reduction, equal access, and awareness-raising concerning safe drinking water due to the implemented initiatives.

Data Analysis and Results

Test of Relationship and Hypothesis

Hypothesis 1: There is no significant relationship between the implementation of Sustainable Development Goal 6 and safe drinking water in Kaduna State.

Model Specification1:

$Y = \mu + error$ …… (1)

$SDW = \mu + error$ …… (2)

$f(\mu) = a + b_1SDG$ …… (3)

$SDW = a + b_1SDG$ …… (4)

Where;

SDW= Safe Drinking Water

a= intercept

b_1= slope of Sustainable Development Goal

SDG= Sustainable Development Goal

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	14.321			
Final	16.743	5.745	1	.048

SOURCE: SPSS OUTPUT, 2023.

The chi-square test results indicate that there is a statistically significant difference in model fit between the "Intercept Only" model and the "Final" model. In other words, the "Final" model, which includes additional predictor variables, provides a better fit to the observed data compared to the baseline model that includes only an intercept term. The significance level (p-value) of 0.048 suggests that this difference in model fit is significant at the conventional significance level of 0.05.

This information suggests that the "Final" model, which likely incorporates additional explanatory variables, is a better fit for explaining the relationship between the predictors and the outcome variable compared to a model with no predictors (Intercept Only).

Simple Regression Output

	B	Spearman Ranking(rho)	Nagelkerke(R^2)	Wald
Value	-0.568	-0.242 (0.047)	0.127	1.764 (0.163)

Source: Author's Computation from SPSS Output (See Appendix 3a-3d).

From the result of the regression analysis displayed in table 4.3.2, the parameter of SDG explains the strength and probability odds of the relationship between Sustainable Development Goal 6 and safe drinking water. The parameter figure of (-.568) clearly shows negative relationship between Sustainable Development Goal 6 and safe drinking water. Hence, for every one unit in Sustainable Development Goal, there is a predicted decrease of .568 in the odds of a higher level in Safe drinking water in Kaduna. The Wald test indicates the significance of the independent variable in predicting a change in the dependent variable. From the table above, the (0.163) is above the 0.05 critical values. Hence, the null hypothesis and it is therefore concluded that there is no significant relationship between Sustainable Development Goal 6 and safe drinking water in Kaduna state.

The pseudo-R-square gives the coefficient of determination. Adopting the Nagelkerke R^2 (0.127) indicates that 12.7% of the change in safe drinking

water in Kaduna State. Spearman's rho measures the strength and direction of the association between the two variables. A value of 1.000 represents a perfect positive monotonic correlation, while a value of -1.000 represents a perfect negative monotonic correlation. In this case, ϱ (SDG, SDW) is approximately -0.242, which indicates a weak negative monotonic correlation. This suggests that as one variable tends to increase in rank, the other tends to decrease in rank, but the relationship is not strong.

Importantly, the p-value of 0.047 is less than the conventional significance level of 0.05. This means that there is statistical evidence to support the presence of a meaningful correlation between "SDG" and "SDW" in this dataset. The correlation is statistically significant. In summary, while the correlation between "SDG" and "SDW" is weak, it is statistically significant, suggesting that there is a consistent negative relationship between the two variables based on the ranks of the data in the dataset. This result supports the test of relationship where it shows that SDG 6 has no significant relationship with Safe drinking water in Kaduna State.

Hypothesis 2: There is no significant relationship between the implementation of Sustainable Development Goal 6 and frequent water supply in Kaduna State.

Model Specification1:

$$Y = \mu + error \quad \ldots\ldots(1)$$

$$FWS = \mu + error \quad \ldots\ldots(2)$$

$$f(\mu) = a + b_1 SDG \quad \ldots\ldots(3)$$

$$FWS = a + b_1 SDG \quad \ldots\ldots (4)$$

Where:

FWS= Frequent Water Supply

a= intercept

b_1= slope of Sustainable Development Goal

SDG= Sustainable Development Goal

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	5.763			
Final	6.325	3.744	1	.039

Link function: Logit.

The result of model fitting above measures the overall fitness of the regression model for the analysis. The p-value of (0.039) is less than the 0.05 significant levels; hence, this clearly shows that the model is statistically significant and fit well.

Simple Regression Output

	B	Spearman Ranking(rho)	Nagelkerke(R^2)	Wald
Value	-1.234	-0.159 (0.051)	0.294	1.837 (0.743)

Source: Author's Computation from SPSS Output (See Appendix 4a-4d)

Nagelkerke pseudo-R-squared value of 0.294 indicates that Sustainable Development Goal 6 explains about 29.4% of the variability in frequent water supply. In addition, this indicates that the logistic regression model has a reasonably good fit to the data and explains a significant portion of the variability in the outcome variable based on the predictors included in the model. From the result of the regression analysis displayed in table above, the parameter of SDG explains the strength and probability odds of the relationship between Sustainable Development Goal 6 and frequent water supply in Kaduna State. The parameter figure of (-1.234) indicates a negative relationship between Sustainable Development Goal 6 and frequent water supply. Hence, for every one unit in Sustainable Development Goal, there is a predicted decrease of 1.234 in the odds of a higher level in frequent water supply in Kaduna State.

On the other hand, the Wald test shows how significantly the independent variable predicts a change in the dependent variable. From the table above, the (0.743) is above the 0.05 critical values. Hence, the null hypothesis and it is therefore concluded that there is no significant relationship between Sustainable Development Goal 6 and frequent water supply in Kaduna state.

The correlation coefficient ϱ= (SDG, FWS) is approximately -0.159, indicating a weak negative monotonic relationship. This suggests that as SDG tends to increase in rank, the FWS tends to decrease in rank, but the relationship is not strong.

The p-value of 0.051 is slightly greater than the chosen significance level of 0.05. While it suggests some evidence of a potential correlation, it does not reach the typical threshold for statistical significance ($p < 0.05$). Therefore, we do not have strong statistical support to conclude that the observed correlation between "SDG" and "FWS" is statistically significant. This means that while there may be some indication of a correlation, it is not strong enough to be confidently considered as statistically significant in this dataset.

Discussion of Findings

The findings revealed several potential areas for discussion and reflection. Firstly, the findings highlight the complexity and multifaceted nature of sanitation and hygiene challenges that cannot be directly correlated with the efforts aligned with SDG 6 within the region. It points to the possibility that existing interventions may not be sufficiently tailored to the specific needs, cultural practices, and infrastructural realities of Kaduna State, thereby limiting their effectiveness in materially improving sanitation and hygiene outcomes.

Secondly, the results underscore the importance of considering other factors and variables that could influence sanitation and hygiene practices, such as local governance structures, community engagement levels, economic conditions, and public health education. These factors may play a crucial role in shaping the effectiveness of SDG 6-related initiatives and should be integrated into

a holistic approach to improving sanitation and hygiene.

Thirdly, the findings call for a reevaluation of the strategies and methodologies used to implement SDG 6 in Kaduna State. This includes assessing whether resources are being allocated efficiently, whether interventions are adequately addressing the root causes of poor sanitation and hygiene, and whether there are sufficient mechanisms in place to monitor and evaluate the impact of these interventions over time.

Recommendations

i. From the observed negative impact on the odds of achieving higher levels of safe drinking water with each unit increase in SDG 6 efforts, it is recommended that policymakers, international organisations, and local government authorities in Kaduna critically re-evaluate and diversify their approach towards achieving SDG 6. This includes conducting a comprehensive analysis to identify the specific aspects of current SDG 6 implementation strategies that are not effectively contributing to the improvement of safe drinking water access. The goal should be to develop a multifaceted strategy that not only focuses on infrastructure development but also on sustainability aspects, community engagement, efficient resource allocation, and the integration of innovative water purification and conservation technologies. Tailoring interventions to the unique socio-economic and environmental context of Kaduna will be crucial in reversing the negative trend and ensuring a positive impact on the availability of safe drinking water.

ii. It is recommended that the local and state governments of Kaduna, in collaboration with international development organisations focused on SDG 6, design and implement targeted interventions aimed at enhancing the capacity of water supply infrastructure and services, thereby making investments in water infrastructure, policy and regulatory reforms, community engagement and awareness, and monitoring and evaluation mechanisms. By addressing the identified negative relationship between SDG 6 and the frequency of water supply through these targeted interventions, Kaduna State can make significant strides towards ensuring that all its residents have access to clean and safe water, thereby contributing to the achievement of Sustainable Development Goal 6.

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