



Lead City University, Ibadan



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L E C T U R E

by:

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THIRSTY
C I T I E S





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Thirsty Cities

An inaugural lecture delivered at the International Conference Centre,
Lead City University, Ibadan, Nigeria

by

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Dedication

This inaugural lecture is dedicated to **Late Dn. Moses Akanji Omolewu** (1944-2007), the principal of my alma mater, Okeho/Iganna Grammar School, Okeho, Oyo State, Nigeria who, by the Grace of God, played the roles of a careful steward and an excellent teacher. He implanted disciplinary coaching into my career path.

Preamble

*The Vice-chancellor,
The Registrar,
The Librarian,
The Bursar,
Provost, Postgraduate College,
Provost, College of Medicine,
Dean of Faculty of Environmental Design and Management (myself),
Deans of other Faculties,
Directors of Units,
Professors, Senate Members and Heads of Departments,
Other Members of Academic Communities,
Students (Past and Present),
The President, Nigerian Institute of Town Planners (NITP),
The President, Town Planners Registration Council (TOPREC),
President, College of Fellows (NITP), Chair Person, Women in Town Planning (AWTPN),
Board Members, Water for Life Support Foundation, Nigeria,
Members of Other Professional Bodies in the Built Environment,
My Former Supervisors and Mentors,
Media and Press Officials,
Distinguished Ladies and Gentlemen.*

I am grateful to God for the gift of life and the power to become. I am standing on this elevated platform to narrate the story of my stewardship in academia. I am a product of the grace of God, the divine set-up. He alone raises the poor from dung hills and brings such up to sit with princes. I did not come into academia with great intentionality. There were financial inadequacy, health challenges and some malign educational policies in Nigerian space which, by design, are limitation strongholds. Many brilliant individuals became victims of circumstances of such policies in a country where doors are purposely shut against technical skills but not for academic certificates that may not even have relevance to social change.

This day, 19th October, 2023; I stand here to inaugurate the pioneer Professorial Chair in Urban Planning and Environmental Management, Lead City University, Ibadan, Nigeria. This inaugural lecture is the first on behalf of the Faculty of Environmental Design and Management in which I am the pioneer Staff, the pioneer Head of the Department and the Pioneer Dean. This is the 16th in the Series of Inaugural Lectures at this University. In previous inaugural lectures, scholars have provided highlights of options from Social Sciences, Management and Administration, Applied Sciences, Public Health, Communication Arts and Educational Management all of which can engineer and sustain national development. Today's lecture is coming with environmental science's recipes for the management of Planetary Earth and the sustenance of the Anthropocene.

The title for this lecture was conceived in November 2015 shortly after I submitted my papers for Promotion Assessment to the rank of Associate Professor in Lead City University, Ibadan, Nigeria. I realized that more than 70 per cent of my research and publications focused on water resources planning and management. In that very month, I was invited to a Workshop organised by the United Nations Industrial Organization (UNIDO), Nigerian Breweries and Heineken International to serve as a Guest Lecturer speaking on Water Stewardship. In my meditation on the title of my paper for the workshop, I coined the phrase 'Our Common Thirst' because I realized that all creatures do thirst and water is the only indispensable resource to quench the thirst. When my promotion to the rank of a Full Professor in the discipline of Urban Planning and Environmental Management was announced in November 2020, I modified the topic to read 'Thirsty Cities'. I waited till today to present this inaugural lecture when I could see the emergence, growth and stability of my discipline, Urban and Regional Planning at Lead City University.

1. Introduction

Taking a critical look at the evidence of increased global environmental change (climate stress, land use land cover dynamics, extreme weather events, pandemics, conflicts and human population pressure), it is evident that the available ecosystem resources cannot adequately give necessary services to the human system. Water, the life-giving resource, is particularly threatened to perform all the categories of ecosystem services and these include **supporting, provisioning, regulating and cultural services**. These services are proof that water scarcity at any scale can lead to death, violence and war.

The title of this inaugural lecture is 'Thirsty Cities'. The objective of the lecture is to inform you all about basic issues around water as I take you through my studies and analyses in the past two decades. The research questions are:

1. What is 'thirst' in a city context and what are its drivers?
2. What are the implications of the thirst for ecological and human systems?
3. How are the cities' dwellers coping with the thirst?
4. To what extent can the coping strategies be sustained in the face of a changing urban environment?

To deal with the above questions, I have structured the lecture into six parts and these are:

- i. The basic elements of water as a fundamental resource to quench the thirst and that the thirst is common to all even though the degree of its severity may vary in time and space.
- ii. Urban definers and the thirst. This lecture opines that urban thirst is driven by bio-physical forces of climate, anthropogenic activities and socio-consumption lifestyles.
- iii. The nexus of the impacts of the thirst. The lecture argues that urban water is a connector (within a city system) and that its shortage impacts other sectors of human development.
- iv. Highlights of available coping mechanisms from the autonomous and planned-policy framework
- v. A conclusion with reflections on pathways for water-wise cities.
- vi. Highlights of my key contributions and lessons learnt.

2. Conceptualization of the Issues

Mr. Vice Chancellor, Sir, the conceptualization of this lecture is around two key words: thirsty and cities.

Thirsty is the adjective of thirst (the noun) which is defined as a need for a liquid (especially water). It is a feeling of dryness in the system of a living being reflecting **the shortage of water**. Thirst is also a strong feeling or desire for something. There could be a thirst for knowledge; a thirst for love and a thirst for fulfilment. Thirst is synonymous with dehydration, dryness, craving, longing and yearning.

Of all liquids, water is the most natural and indispensable resource to quench thirst. This is the reason why ill patients will continue to take water (fluid) even if his/her system cannot tolerate food substances. Water makes up 60-70 per cent of the human body's weight. Losing 3 per cent of the water contents leads to dehydration risks. Every cell in the body needs water to function. A general rule of thumb is that a person can survive without water for about 3 days but up to 20 days without food (WHO, 2020).

Symptoms of thirst or dehydration include:

- Sluggishness, confusion
- Headache, heat stroke, stiff joints
- Unregulated body temperature and high blood pressure
- Swollen brain, renal failure and seizures

Levels of dehydration vary from one organism to another. But for this inaugural lecture, the level of dehydration among the homo-sapiens is dependent on age, level of involvement in physical activities, weather conditions and physiological makeups, nature of food intake, etc. For instance, those who live on grains need more water than those who live on fruits.

In aetiology, there are 3 types of thirst: physiological, osmotic and hypovolemic thirst. Generally, the causative conditions are nausea, vomiting, haemorrhage, renal failure, heart failure, fluid and electrolyte imbalances, endocrine disorder and end-stage diseases. For clinicians, thirst is viewed as an early warning, a biochemical signal of osmotic and fluid imbalance. Thirst sensations include dry mouth (xerostomia), hyperosmolarity, and malignant digestive tract obstruction.

Cities: Cities are in the higher order in the human settlement continuum. They are bigger than villages and towns. Cities are **URBAN** spaces characterized by higher densities of housing, population and socioeconomic activities.

Urban Definers

In the literature, there is no consensus on the definitions of cities. The context defines cities based on certain indicators. These are:

Socio-demographic parameters: size, distribution and density. The population threshold as an indicator of urbanism varies from one country to another. For instance, 5,000 population is used in Nigeria (Mabogunje, 1968). In the United Kingdom, an urban centre must have at least 50,000 inhabitants with a population density of 1,500 per square kilometre. Zimbabwe uses a threshold of 2,500 inhabitants or settlements which has more than 50% in non-agriculture occupations (UN Urbanization Prospects, 2018). Cities have social anonymity, non-primary production, white-collar jobs and heavy grey infrastructure.

Legal framework: This is based on the national population law/policy of a country. For example, during the 2006 National Population Census, all LGA headquarters were considered urban centres in Nigeria.

Functionality: Settlements that are established to serve as nodal points for industrialization, transportation and commerce are designated as urban. Cities are providers of higher-order services such as health, education, government and administration, fashion, and commerce. By function, cities are the engines for development. Rural-urban migration is a response to the assumed functionality of these engines (Oloukoi and Oloukoi, 2015).

Cities are organic entities which can be created or formed, grow, die, decay and reform. Cities circulatory system is the transportation network. The excretion is the waste that is generated. Cities are irritable whenever there is a shock or risk. From the history of urbanism, many of the olden prosperous cities, (Medieval Greek and Babylonia cities) which were ancient jewels of civilization have experienced extinction. Only archaeological studies of their remains are with us for reference. In Nigeria, some towns have been and are no more.

Cities have components which are interrelated and function within systems. Alteration of a component will affect the functionalities of other components and with multiplier effects on the whole system as feedback. For instance, when urban air is polluted, it will produce acidic rain. Acidic rain is a contaminated resource and its usage will impair food production, human and ecological health.

Given cities as organic systems, they can die once the essential life services (air, water, food, shelter, safety, and hope) are not adequate. Thirst (shortage of water) is an indication that dehydration may lead to the death of urban settlements. And when a city dies, everyone bears the pain. Again, the urbanization trend is becoming alarming and more people are living in cities, especially in Africa and Asia. This trend will continue in the future as about 68% of the world population is estimated to be urbanized in the year 2050, while Sub-Sahara Africa will have a larger share (Box 1).

Available resources (land, water, forestry, etc.) are reducing and the demand is increasing based on population growth. The challenge is how we get enough resources and infrastructure to support the demands. How do we distribute the resources equitably and sustainably? This is the basis for planning.

Box 1: Global Urbanization Trend

- *The global **urban population** was estimated to have grown by approximately 1.84% per year between 2015 and 2020. With a projection of 1.63% per year between 2020 and 2025, and 1.44% per year between 2025 and 2030.*
- *Together, India, China and Nigeria will account for 35% of the projected growth of the world's urban population between 2018 and 2050.*
- *Today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050.*
- *Projections show that overall growth of the world's population could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa.*
- *By 2050, it is projected that India will have added 416 million urban dwellers, China, 255 million and Nigeria, 189 million.*

Source: OECD, 2021

3. My Research Focus: Urban Planning and Water Resources Management

Spatial Planning, Urban Planning, Town and Country Planning, City and Regional Planning, and Physical/Territorial Planning are synonymous. The nomenclature is based on what each economy adopts. For instance, the United Kingdom (UK) uses town and country planning while Australia uses city and regional planning. In Nigeria, the professional body uses Town Planning and most of our training schools now use Urban and Regional Planning. The nomenclature is not the issue. But, what do we do and how is it impacting society? By a way of definition, Urban planning is the concerted effort of harnessing and allocating available resources to each component of cities to facilitate improved welfare of the citizens, towards conservation and protection of values, ensuring efficient functionality, building aesthetics, convenience and safety (Oloukoi, 2022). Planning is not just about spatial inventory and allocation of land to uses. Rather, it is an orderly arrangement of cities' components (physical, social and economic) for functional, sustainable and equitable uses across generations. Whenever a city's components are not arranged and planned, spatial chaos is inevitable.

Urban planning involves coordination of activities, analysis, monitoring, evaluation, projection, politicking, policy drafting and modelling of ideals thereby reducing the negative impacts of biophysical and anthropogenic forces on urban processes and urban outcomes (Oloukoi and Olakunde, 2015a). Urban planning is the management of complexity (socio-economic and environmental) in a territorial context and securing win-win policy solutions. Planning is a key public activity for regulating land development, harnessing local knowledge through consultation, interpreting evidence and regulating urban design. Planning policies regulate land use, connectivity and density, and grey and green infrastructure to generate pathways to improved health outcomes, improved quality of life and resolving environmental conflicts.

Environmental resources management is one of the sub-disciplines in Urban and Regional Planning in which analysis and monitoring of water, forest, land, air and minerals are the focus. Other sub-disciplines are: transportation studies, housing, regional development studies and urban design. There are cross-cutting areas such as: tourism planning and heritage conservation, environmental health, landscape designing, urban governance and quality of life studies, disaster and risk management,

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mapping and modelling, sustainable development, climate adaptation and resilience.

In my academic sojourn, I have focused on water issues within the environmental system. My works spread to urban water services, management of watersheds, water governance, water stewardship, water and climate change, water and poverty, water rules, water war, water and health, water and women. I have applied environmental science and social science methods for analyses of my research over time.

4. Urban Thirst: A Common Denominator

My Vice Chancellor, Sir, it is clear from the conceptualization of the title of this lecture that thirst occurs whenever the supply to a system is below the required amount of water. The thirst is manifested in the following contexts.

- **A farmer:** Poor water supply means hardness of the arable lands, drought, crop failure, poverty, hunger, food insecurity, famine, war, displacement and loss of livelihoods.
- **A herdsman:** water supply shortage is life-threatening for his/her flock. There is a loss of livelihoods, resource-based conflicts, displacement and poverty.
- **Women:** In most patriarchal societies, women are the main water collectors. The thirst means more time and energy in search of water for the households, productive hours are converted to non-payable household chores, the extra burden of carrying water from long distances, neighbourhood fights over resources, poor sanitation and hygiene, and additional stress in caregiving.
- **Young children:** this group sees the thirst as not just a water supply shortage, but a situation in which they have increased burden. But, more than that, it is an avenue for socialization around water supply sources. During water supply shortages, school attendance is affected. It is also a dangerous moment in which some maidens are vulnerable to sextortion. For instance, it was reported in Kenya, South Africa and Colombia that vendors capitalize on the socioeconomic vulnerabilities of women and girls and the scarcity of water to coerce them into sex for water (Transparent International, 2020).
- **A water vendor:** the livelihood support is threatened whenever there is water inadequacy in his domain.
- **A politician:** water provision is still one of the manifestos slogans of politicians in some African countries when he is appealing to the electorates. 'Vote for our party, there will be constant water supply'. What a campaign promise!
- **A priest:** most purification and initiation ceremonies are done with water. Without a water supply, such activities become challenging.
- **A business:** Beverages and food processing cannot be done without water. No water, no business.

The thirst represents water supply shortages. Water shortage is absolute and it has power dimension. The concept of water scarcity is explained by the UN-Habitat (2003a) thus:

Water shortage: a situation of absolute shortfall between the available water to meet certain defined minimum requirements. The actual quantity has a spatial variation.

Water stress: a symptomatic consequence of scarcity which may manifest itself as increasing conflict between users; differential sectoral usage, a decline in service levels, crop failure and; food insecurity.

Water security: is the situation of reliable and secure access to water over time.

Water variability: is a phenomenon in which the available water supply is dwindling in terms of space, time, quantity and quantity. It is often been influenced by precipitation, river runoff, other hydrological formations, population pressure, land use land cover changes and inadequate infrastructure.

5. The Indispensability of Water to Quench Thirst

Mr. Vice Chancellor, Sir, my geography of water is anchored on the story of creation in the Holy Bible which explicitly revealed that everything was deep waters until God made spaces (the firmament) and the earth (the dry land) to divide water that is above (this comes back to the earth as precipitation) and the one below (the seas and the springs). Without the water that is above and the supply of water from the earth, the earth will not yield its fruits (Gen 1:1-13, NIV). Water as a resource in any of these spaces can appear in the three states of matter: As solid (ice burg on the sea, on the mountain tops and even as snowfall). It can be seen as flowing liquid (in rivers, seas, oceans, springs and lagoons). It can also be in a gaseous state (vapour and steam). This characteristic is captured in the science of the hydrological cycle and the ancient philosophy of, King Solomon David:

'All the rivers flow into the sea but the sea never fills up. The rivers keep flowing to the same old place and then start all over and do it again' (Eccl. 1:7 MSG).

Water is a universal solvent. It is a vector of compound (H₂O) - Hydrogen and Oxygen. Oxygen is the life-supporting element. Water is an irreplaceable and non-substitutable resource for ecosystem services. It is

the basis for the food supply system (crop and animal production). It is a key factor for economic production, transportation, tourism, education, spirituality, energy supply, plant-cooling agents and manufacturing raw materials. It is the first factor for population distribution. All over the world, there are higher population densities in locations that are close to water resources while dry lands are sparsely populated.

In history and the contemporary, water points (wells, rivers, beaches) are points for the actualization of love between a man and a woman. Eliezer (Abraham's servant who was sent to search for a wife for Isaac) and Rebecca (the wife of Isaac); Jacob and Racheal, Moses and Zipporah (Gen. 24, 29; Ex 2). Meeting the Samaritan woman by the well of Jacob was the platform for Jesus to tell of his person as the Living Water that can quench all thirsts.

Water is the main resource for personal hygiene. Health sciences affirm that a human being may survive several weeks without food; he dies within a few days when deprived of water. The reason for this may be because human weight has a proportion of 60% water (UN-Habitat, 2003b). Water connects all creatures and all humans (social and economic) and ecological activities (Figure 1).

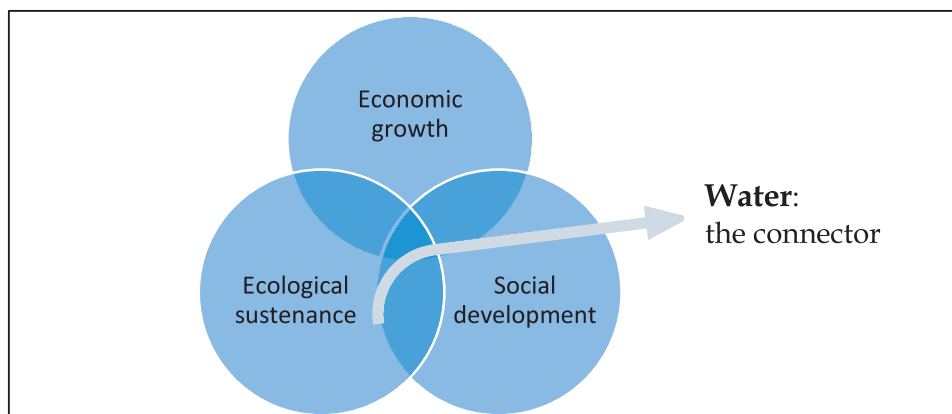


Figure 1: Water is a connector, not a sector
Source: Author's conceptualization

Mr. Vice Chancellor, Sir, it is interesting to note that all creatures befriend water. Water does not have an enemy. Anikulapo Kuti (1975), a Nigerian music legend put it right in one of his albums: 'Water no get enemy'.

*T'ò ri ba n'gbona, omi l'ero re
If your head dey hot, na water go cool am*

*T'omo ba n'dagba, omi l'o ma a lo
If your child dey grow, na water he go use*

*T'omi ba p'omo e, omi na lo ma a lo
If water kill your child, na water you go use*

*Ko s'ohun to'le se, k'o ma lo'mi o
Nothing without water.*

Fela depicted water as a common denominator to all men. Whether you are rich or poor, black or white, honourable or commoner, water is a fundamental friend. No one can do without water. From conception, water is the cushion for the embryo. At the delivery, the water bag must be ruptured for the life to be born. After the delivery, water birth is the real cleansing. As the baby grows, no one teaches him/her how to play with water. It comes naturally. At the close of time for all flesh, the dead body should be birthed with water before burial or cremation as part of the preparation of the departed soul for its eternal journey. From the womb to the tomb, water is essential.

6. Access to Water is a Right

Socialists often argue that water should be treated as a public good because of its health benefits. Economists and conservationists conceptualized water as an economic good because it has values which can be idealized in economic theories of the perfect market (Foye, 2023). The arguments of the two groups are summarized in the Dublin Principle on Integrated Water Resources Management (IWRM) (Figure 2).

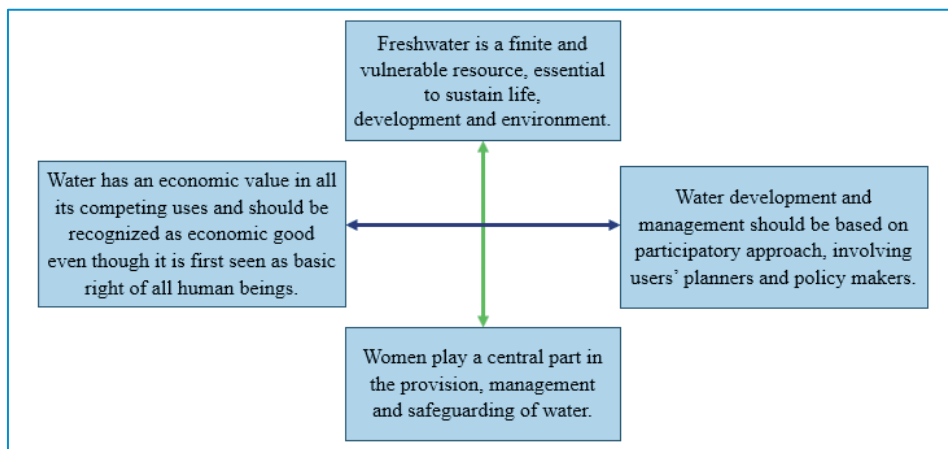


Figure 2: Dublin Principles on Integrated Water Resources Management (IWRM)
Source: Simplified by Adeniji, 2005

In 2002, the United Nations Committee on Economic, Social and Cultural Rights (UNCESCR) declared water as a human right. The human right to water entitles everyone to sufficient, affordable, accessible, safe and acceptable water for personal and domestic uses (UNCESCR 2002, United Nations, 2009). It was in light of this that the Civil and Political (CP) aspects of the human right must be upheld. Water right is making water services work for the poor through a commitment to water and sanitation provision. To do this, water governance that is anchored on citizens' dialogue and negotiation is the key (Agbola and Adeniji, 2007a). Without the right to water, all other rights may become wrong (Oloukoi and Aderinto, 2023).

What then is the value of water? The term "value" is understood by the valuation process based on different views and perspectives of user groups and stakeholders. So, the question "value to whom?" is also a critical one. There are different methods for calculating value and different metrics to express water value. The World Water and Development Report of 2021 described water value in terms of "price", "cost" and "use". The methodologies used five interrelated perspectives: valuing **water sources**, in situ water resources and ecosystems; valuing **water infrastructure** for water storage, use, reuse or supply augmentation; valuing **water services**, mainly drinking water, sanitation and related human health aspects; valuing **water as an input to production and**

socio-economic activity, such as food and agriculture, energy and industry, business and employment; and other **sociocultural values of water**, including recreational, cultural and spiritual attributes.

7. Global Water as an Endangered Resource

Mr. Vice Chancellor, Sir, from elementary geography, we know that closeness to water bodies is critical for the location and expansion of human settlement. Hence, dense populations are commonly found along the coast while dispersed populations are found in the deserts. The global water supply is about 1,386 million cubic kilometres. The sea level is rising (meaning more water), yet ecological and human systems are having a shortage of water supply. The oceans contain 97.5% of water which is saline in nature and unfit for direct usage in human socioeconomic systems. The remaining freshwater (2.5% volume of earth's water) exists as ice caps and glaciers (68.7%), groundwater (30.1%), surface water (0.4%) and other sources. The surface water is contained in lakes (87.0%), swamps (11.0%) and rivers (2.0%). Global water distribution indicates that our planet has water. Yet, there is water scarcity. Barbara (2022) citing the International Water Management Institute's report noted that economic scarcity of water is more pronounced in Western, Eastern and Central Africa. Southern Africa is moving towards physical water scarcity (Figure 3). This scenario is the reality of Samuel Taylor Coleridge's (1798) literary work: **'Water, Water everywhere, nor any drop to drink'**.

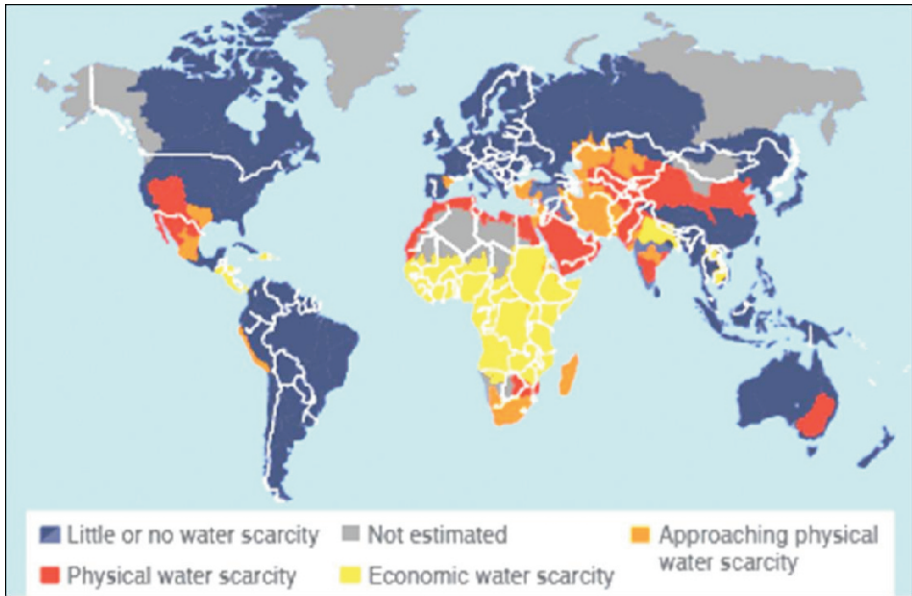


Figure 3: Global Water Distribution and Global Water Scarcity
Source: International Water Management Institute, 2022.

Spatially, water is not equally distributed. The quantity of water used by the various regions of the world differs. Water quality is also not equally distributed; it is connected to the type of use and a region's level of development. Water quality and quantity have shaped the quality of life, livelihoods and culture (Commonwealth of Australia, 2018).

8. Nigerian Water Governance Systems and Blue Economy

Nigeria has abundant water resources which can be developed for domestic water supply, hydroelectricity, navigation, industrial use, fishery and recreation. The surface water potential of the country was estimated at 267.3 billion m³, the groundwater potential was estimated at 51.9 billion m³ while the total annual renewable capacity was 286.2 x 10³ m³ (NHSA, 2014). Annual internally produced resources amount to 221 x 10³ m³, made up of 214 x 10³ m³ surface water and 87 x 10³ m³ groundwater, while 80 x 10³ m³ of the latter is assumed to overlap between surface water and groundwater (AQUASTAT FAO, 2010). Nigeria has a Dam capacity estimated to be 44.2 x 10³ m³ (Akpabio and Iniubong, 2013).

As a service, resource or infrastructure, there are many institutions in charge of water resource management in Nigeria. These are:

- i.* National Council on Water Resources (NCWR)
- ii.* Federal Ministry of Water Resources (FMoWR)
- iii.* Ministries: The Ministry of Environment, Ministry of Health, Ministry of Education, Ministry of Natural Resources and Agriculture etc.
- iv.* National Water Resources Institute (NWRI)
- v.* River Basin Development Authorities/Boards (RBDAs)
- vi.* State Ministries responsible for water resources (SMoWRs)
- vii.* State Water Agencies or Boards (SWAs)
- viii.* Rural Water Supply and Sanitation Agencies (State Rural Water and Sanitation Agencies; RWSSAs)
- ix.* Water and Environmental Sanitation Departments (WES Depts)
- x.* Development/Donor Agencies: e.g., WaterAid, UNICEF and SDGs Office, Development donors such as USAID, the African Development Bank (AFDB), The French Development Bank, the World Bank, and the Japan Development Bank are providing support.
- xi.* Local Government Areas (LGAs)
- xii.* Dam management offices

Blue economy is an economic system that deals with the development and management of water resources (Marine/Coastal, fresh water, rivers, lakes, seas, coasts and groundwater) environment. The emphasis is on the reduction of marine pollution, conservation of aquatic ecosystems for food, and improved livelihood, energy, transportation and tourism. The green economy concentrates on sectors such as energy, transportation,

forestry and agriculture. The blue economy focuses on preserving the health of ocean ecosystems and improving livelihood outcomes for humans (European Commission, 2020).

In some countries, components of the blue economy that are emerging are in these sectors: fishery and aquaculture, ports, coastal tourism and cruise ship industry. Generally, marine regional plans or watershed plans for a blue economy are pursued with the goal of improved access to water for drinking, irrigation for agriculture in a safe organic way and greening of the ocean ecosystem.

The absence of coastal regional plans, weak water governance system and resource degradation are risk factors against the blue economy. I am delighted that the Federal Government of Nigeria under the leadership of President Bola Tinubu is presently raising the issue of working with our water resources for a blue economy. If we do proper planning; Nigerian coastal cities are likely to be placed on the road map for a blue economy. At the basin level, green infrastructure, urban agriculture and flood control will also thrive when proper planning of water resources is schemed.

9. Urban Water System in a VUCA World

Many urban services (including water systems) and their governance are failing. This is because the human race is going through a challenging moment that is categorized as VUCA (Volatility, Uncertainty, Complex and Ambiguity) moment. Bennet and Lemoine (2014) provide a clue on the characteristics of a VUCA world.

Volatility: There are unexpected, unstable happenings, the duration of which is unknown. The outbreak of Coronavirus as a global pandemic is a good example of the volatility of this time all around the world. Many parts of the world had several waves (first, second, third and even fourth). Despite travel bans and lockdowns in many parts of the world, the dilemma of novel COVID-19 is likely to be more severe than the Flu pandemic that happened more than a century ago.

Uncertainty: Despite many scientific analyses and modelling of the cause and effects of the 3Cs (Climate change, COVID-19, Conflicts) in our time. The gravity of the happenings is known in part. Other happenings such as increased terrorism attacks (e.g., operations of Boko Haram, unknown gunmen and banditries in Nigeria), territory invasion, resource-based

conflicts and war. Despite the scenarios' creation, planning with the predictions is almost uncertain.

Complex: The situation is characterised by interconnected variables and parts. Some information to process intervention and prediction may be available, but the degree, the volume and the nature of it can be overwhelming. It is clear that complexity vulnerability is connected with health, livelihoods, food security and migration outcomes of environmental stress (Oloukoi et al., 2022).

Ambiguity: Today, our world is characterized by ambiguities of all kinds. Causal relationships of extreme events and social upheavals are completely unknown. We face 'many unknowns' even though we are in the hyper-information era. We engage scientific methods to understand the cause and effects through various experiments and simulations. Yet, the more we think we know, the more the unknown.

Globally, we are experiencing environmental stress. Since August 1, 2018 (Earth Overshoot Day), humanity has used more from nature than the planet can renew in the entire year. From this assertion, it is clear that the available ecosystem resources (especially water) are depleting and management of these is becoming more challenging. Indeed, our planet is under pressure.

Mr. Vice Chancellor, Sir, I have highlighted recent headlines in the global news that indicate the VUCA world and water regimes (Box 2).

Box 2: Highlight of some VUCA events around the world

- *The Global Risk Report, 2016 indicated that water crises were at the top of global risks in terms of impacts and that this will continue for another decade. Other crises include climate change, food insecurity, extreme weather events and social instability (World Economic Forum, 2016).*
- *September 2023 was the warmest September on record globally, with an average surface air temperature of 16.38°C, 0.93°C above the 1991-2020 average for September and 0.5°C above the temperature of the previous warmest September (Copernicus, 2023). India and Pakistan heatwave are 'testing the limits of human survivability' (CNN, 2022).*
- *Climate extremes that are related to floods, landslides and drought. In February and September, 2023, there were earthquakes in Syria and Morocco. Libya experienced a devastating flood. Currently, coastal cities in West Africa: Lagos, Cotonou, and Lome are experiencing flooding (France24, 2023).*
- *The global food crisis has been reported in many international media. In June 2022, wheat and other staple foods, fuel and gas experienced skyrocketing prices. This was traced to the impacts of the man-made upheaval of the Russia-Ukraine war (BBC, 2022). Displaced farmers are out of jobs. A humanitarian crisis is increasing: water, hygiene, food and social services are becoming critical in the conflicting zones.*
- *Energy crises in many parts of the world were triggered by water stress. In 2022, Christmas trees were noted to be without lights in some parts of Europe. It was a strange happening that had not been so for more than a century.*
- *Terrorism attacks, coup d'état, insurgency and other forms of social unrest are on the increase. There is a thirst for space colonization. Whenever these events occur, social services especially water supply are affected. Sanitation and health crises will emerge.*

10. Water Accessibility

Mr. Vice Chancellor, Sir, there are different types of water accessibility in urban settings as described by the USAID (2010) and Un-Habitat (2003b):

- **“No access”** means that an urban dweller has to walk more than 1 km or more than 30 minutes one way to collect water, or collect less than 5 litres per day.
- **“Sugcient”** means that the water supply for each person is sufficient and continuous for personal and domestic uses (drinking, personal

sanitation, washing of clothes, food preparation, personal and household hygiene).

- **“Safe”** is when the supply is free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person’s health.
- **“Acceptable”** is when the supply has no colour, odour or taste based on acceptable cultural norms for gender, lifecycle and privacy.
- **“Physically accessible”** connotes that the right to water and sanitation services must be physically accessible within, or near the household, educational institution, workplace or health institution (less than 30 minutes' walk to and from the collection point).
- **“Affordable”** means less than 3% of household income. With the emergence of sachet water, bottled water and dispensable water bottles, it may be a great science to investigate how much an average urban dweller spends on water.

There are Standardized Water Needs per Capita per Day (Table 3) and per different institutions (Table 4). When these are not met in a location, water accessibility is questionable.

Table 3: Water Needs and Water Requirements

S/N	Water Needs	Vol. of Water	Source of Variation
1	Survival needs: water intake (drinking and food)	2.5-3 litres per day	Depends on the climate and individual physiology
2	Basic hygiene practices (hands and face washing)	2-6 litres per day	Depends on social, religious and cultural norms
3	Basic cooking needs	3-6 litres per day	Depending on food type, the system of cooking, social as well as cultural norms
Total basic water needs		7.5-15 litres per day	

Source: Adapted after Sphere Project, 2004, 2011; USAID, 2010

Table 4: Minimum Water Requirements for Different Institutions & Groups

S/N	Institution/Activities	Minimum water needs
1	Health centres and hospitals	5 litres/out-patient 40-60 litres/in-patient/day Additional quantities may be needed for laundry equipment, flushing toilets, etc.
2	Cholera centres	60 litres/patient/day 15 litres/carer/day
3	Therapeutic feeding centres	30 litres/in-patient/day 15 litres/carer/day
4	Schools	3 litres/pupil/day for drinking and hand washing (use for toilets not included)
5	Mosques	2-5 litres/person/day for washing and drinking
6	Public toilets	1-2 litres/user/day for hand washing 2-8 litres/cubicle/day for toilet cleaning
7	All flushing toilets	20-40 litres/user/day for conventional flushing toilets connected to a sewer 3-5 litres/user/day for pour-flush toilets
8	Anal washing	1-2 litres/person/day
9	Livestock	20-30 litres/large or medium animal/day 5 litres/small animal/day
10	Small-scale irrigation	3-6mm/m ² /day, but can vary considerably

Source: USAID, 2010.

11. Contextualizing Urban thirst

Mr. Vice Chancellor, Sir, in this section, I want to present the realities of urban thirst across spaces and time. It is clear from the literature that in many cities, the recent trend of increasing water demand in the face of limited supplies has raised the fear of a global water crisis. Groundwater depletion, low or non-existent river flows and worsening pollution levels are among the more obvious indicators of water stress. In sub-Saharan Africa, an estimate by WHO and UNICEF (2022) revealed that about 265 million lacked safe water. The situation is worse in some drought-affected areas where renewable freshwater has dropped per person by more than 65% over the past forty years.

Given the urbanization rate, the global population living in cities will increase to 68.4% in 2050 (UN, 2020). The present water stress in cities is generally a function of higher demand than availability as a result of increased population size, increased socio-economic drivers, poor infrastructure, pollution and climate stress in many countries (Figure 4). The implication is that development agendas such as the Sustainable

Development Goals (SDGs #1, 6,11, 14 and 15) may be mirages in many countries of the world.

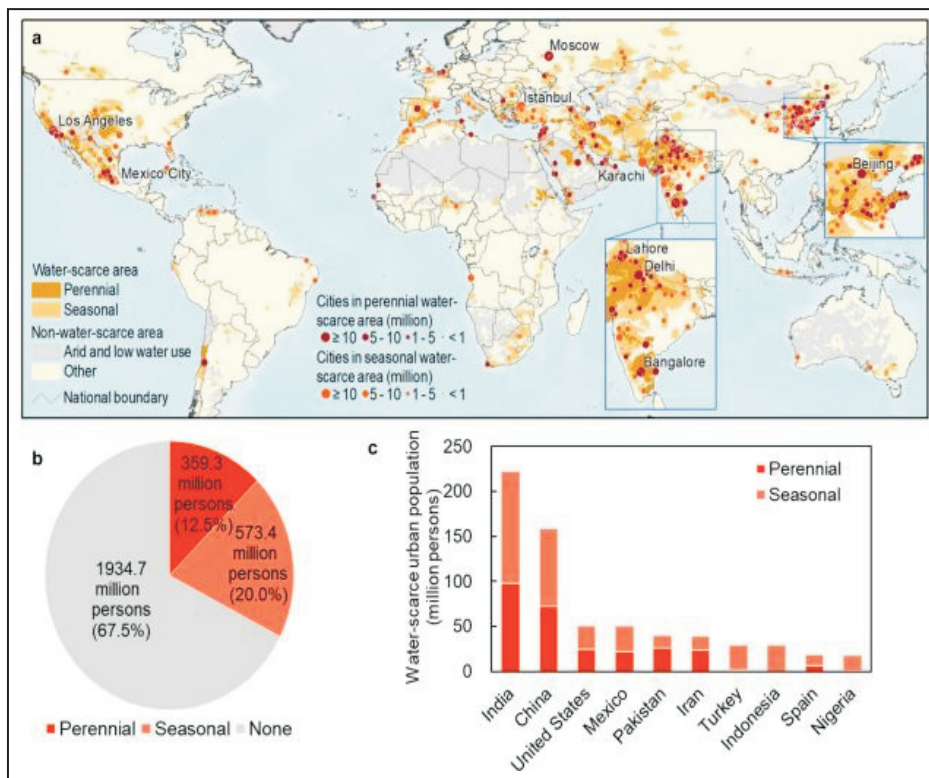


Figure 4. Urban water scarcity at a global scale
 a Spatial pattern of large cities in water-scarce areas (cities with a population above 10 million in 2016 were labelled). b Water-scarce urban population at the global scale. c Water-scarce urban population at the national scale (10 countries with the largest values were listed). Please refer to Supplementary Data for urban water scarcity in each catchment. Source: He et al. (2021 p.4)

In Nigeria, a progressive proportion of the urban population with improved water supply was recorded between 2015 and 2020 (Table 5). There is a spatial variation of urban access to water and sanitation. Access to the public water system reduces as one moves from the residents of affluent to the home of the poor; and from the districts around water treatment plants to the remaining parts of the city (Oloukoi, 2018).

Table 5: Basic and Improved Access to Water in Nigeria (2015-2020)

Year/ / at least basic Access	Population,000	Percentage of Urban population	National						Rural						Urban					
			The proportion of the population using improved water supplies						The proportion of the population using improved water supplies						The proportion of the population using improved water supplies					
			Safely managed	Accessibility on-premise	Available when needed	Free from contamination	Piped	Non-Piped	Safely managed	Accessibility on-premise	Available when needed	Free from contamination	Piped	Non-Piped	Safely managed	Accessibility on-premise	Available when needed	Free from contamination	Piped	Non-Piped
2015/ 69	181,137	48	20	25	61	22	13	63	16	16	46	20	8	53	24	35	78	24	18	74
2020/ 78	206,140	52	22	29	67	24	10	72	18	18	52	23	8	61	25	40	81	25	12	83

Source: Compiled from WHO/UNICEF, Joint Monitoring Programme (JMP, 2021)

The rate of urban infrastructure planning is lower than the rate of urban population growth. With increased environmental pollution, weak governance and inadequate financial/budget strength of municipalities in Sub-Saharan Africa, a heavy water-related health crisis is inevitable. The emergence of a 'slum of hope' in most peri-urban areas is more dangerous than the 'slum of despair' that is already in existence in the core areas of our cities. It is very devastating that most communities that are springing up as slums of hope in the hinterlands because they are without water and sanitation services. This adds up to the challenges of slums of despair far are in the city centres (Oloukoi and Ogundiji, 2013). Individuals in this self-help zone are the 'local government chairman' of their respective homes in terms of the provision of services: road, power, security, water etc.

Access to water in educational institutions in Nigeria is also worrisome. A study in one of the Campuses in the Southwest, Nigeria revealed that residents (the majority of whom are elites) have resulted to self-help by investing in personal boreholes and deep wells because the institutional treatment plant, distribution pipes and the management structure are all in deplorable state (Oloukoi, 2016). My worries, if the elites in this space

are facing such a thirst, where will the residents of urban margins (the poor, the disabled, the voiceless) be?

Problems affecting water supply in Nigerian cities were summarized by Oloukoi (2015) which include:

- i. Managerial problems in the form of improper planning and administration, inadequate manpower of the Water Corporations
- ii. Inadequate data on hydrologic, recharge, population distribution and consumption patterns. Presently, there are no official data on Nigerian' demographic patterns, except estimates by various agencies. This is worrisome. How will a father plan for his household, when he lacks knowledge of the number of children he has?
- iii. Obsolete and non-functional plants and equipment.
- iv. Inadequate funding and low revenue generation as a result of the unwillingness of utility consumers to pay because they often regard water as a social good.
- v. Weak water governance system (weak enforcement of water laws, political interference, weak basin management, community/resource-based conflict, fragmented data, competing water use, poor funding, fragmented municipal water corporations, poor human capacity, lack of awareness and lack of monitoring and evaluation of public policies).
- vi. Poor maintenance culture and misuse of watersheds etc.

To explain the contexts of urban thirst in Nigeria, I have generated 3 indicators. These are:

(i) Urban water access per capita

Joint Monitoring Programme of the WHO/UNICEF (2021) reported that 86% of the urban population have safely managed drinking water services while there are just 40% in the rural area. Most often, national aggregates (like the one in Table 5) may show progress over a given period. However, such aggregates are too general for location-specific policy in the water sector. For instance, Oloukoi (2014a) computed the Water Accessibility Index (WAI) for the Oke-Ogun region in Oyo State Nigeria. The WAI revealed that water access varies across space in communities that are not connected to public water taps. Explanatory factors with higher value include water use, physical availability of water resources and the financial capacity of households to develop new water supply sources. The result of the analysis shows informal neighbourhoods have low WAI (Figure 5).

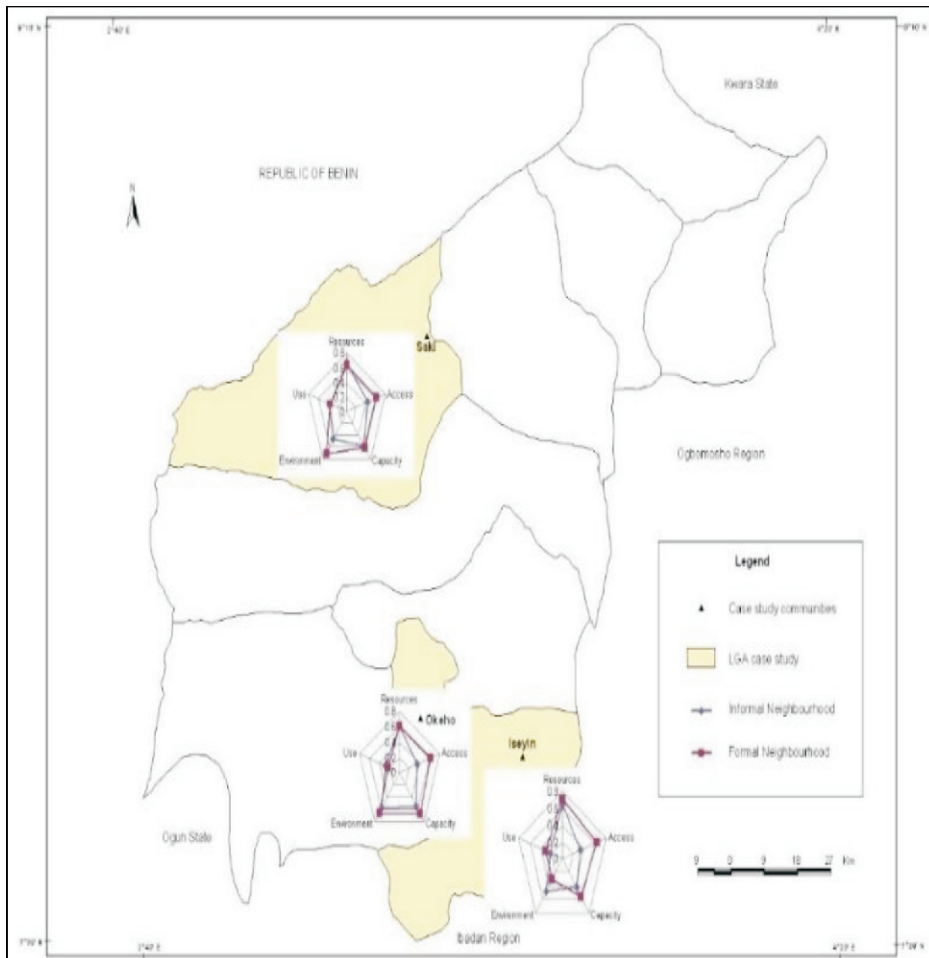


Figure 5: A Pentagram of the components of the Water Access Index in Oke-Ogun Region, Nigeria
 Source: Oloukoi, 2014a

These informal neighbourhoods are characterized by:

- Supply sources are located outside building premises,
- Household members spent more than 30 minutes round trip to get water;
- The supply is not available when needed;

- Less than 300 LPD is available for more than 75 % of households per week.

At a city scale, the analysis of Oloukoi (2018) on household access to public water supply revealed a state of concern. For instance, in communities where there are water networks, only 14.6% of residents of Ibadan received a daily supply, 7.3% received water once a week and 73.2% indicated that the supply comes any day/time. More than 75% of households in this group indicated a willingness to pay if the supply is regular and of improved quality. Locations of water sources, availability at all times and affordability are critical explanatory factors for improved water access (Adeniji, 2005; Oloukoi and Agbola, 2014).

ii. Urban water quality

Water quality is critical to public health. It is used for the Environmental Performance Index (EPI). For instance, Yale University's report on EPI for the year 2022 indicates that ten European countries have 100% access to safe water while many African countries are placed at the dangerous end of the index. For example, Nigeria has 4.3%, Cote d'Ivoire has 17%, Philippines has 34.4%, Jamaica has 47.3%, Ukraine has 55.1%, United Kingdom, Norway and Netherlands have 100%. This implies that, even though, Nigerians are having improved access to water as reported by the JMP report of 2021, the quality of our drinking water needs to be looked into.

It is important to state that while we strive to meet the required volume (quantity) of water per person per day, the question of the quality of what is supplied is critical. Environmental pollution is a human problem that emerged after the Industrial Revolution, an emergency of consumption with the generation of waste far above the carrying capacity of the earth. Water pollution is the natural or man-made induced change in the quality of water and leads to health especially when pollutants are directly or indirectly an ecological risk. Using a social survey method, Adeniji (2001, Oloukoi and Adeyonu, 2023) asserted that indiscriminate waste disposal into river channels, open defecation and use of agro-chemicals are the main sources of pollution of surface water in Nigerian cities.

In urban centres, a study by the Water Stewardship Team in Ibadan in 2018 revealed that urban water (rivers, aquifers and underground) pollutants have high concentrations of Green House gases (GHG): methane (CH₄), nitrous oxide (N₂O) and dissolved oxygen. Health costs

to manage outbreaks of diseases (water-borne, water-related) represent more than one-third of the income of the African poor. With water pollution, more than half of the world's population (mostly in vulnerable regions) and about 45% of the global GDP will be at risk by the year 2050 (WHO, 2019). The multiplier effects of water pollution are on both the social and ecological systems of our cities (Oloukoi and Adeyonu, 2023). Quality of water for domestic and industrial uses must be guaranteed.

Using a comparative analysis of water quality, Oloukoi and Agbola (2014) studied physical, chemical and bacteriological properties of samples of two major sources of public water treatment plants (Eleyele and Asejire) and natural springs which were developed in four communities (Agbadagbudu, Onipasan, Sango and Adegbayi under the Sustainable Ibadan Project (SIP). To determine the significant difference between the qualities of water from these sources, the WHO benchmarks was the basis of comparison for all the parameters. Bonferroni's Method of ANOVA was adopted because it provides a comparison of samples from natural springs, and municipal water and with the WHO standard as a control. The result (Table 6) shows that there is a variance in the quality of water from public tap sources (after treatment) and the one coming to the end user.

Three out of the four studied natural springs water sources are contaminated with chemical pollutants and coliform. Physical observation of the environmental condition of these water sources showed that they are closer to dump sites and auto-mechanic workshops. Higher cases of water-related diseases were recorded in these communities despite access to water from the spring sources (Adeniji, 2005).

Considering the bacteriological test results, it was observed that only Agbadagbudu Spring with zero value of total coliforms is potable for drinking. Other spring water sources are contaminated with faecal substances. For some other surface water, observation of the physical environment revealed risks from adjoining land uses: plastic pollution, indiscriminate refuse dumped in the stream channels, open defecation, industrial wastewater discharge and waste disposal sites closer to some natural springs are potential risk factors (Plates 1 and 2).



Plate 1: (a) Plastic pollution on the water channel (Road 7, OAU Campus, Ile-Ife)
(b) Industrial wastewater discharge into river channel (Orisumbare, Lagos)
Source: Oloukoi, 2018



Plate 2: (a) Solid waste deposit in Ogbere, Ibadan;
(b) Open defecation at Oluyoro, Ibadan.
Source: Oloukoi and Agbola, 2014.

Table 6: Qualitative characteristics of water supply sources in Ibadan

Parameters (mg/L)	Public Water Sources		Natural Spring Sources				WHO Allowable Level
	Asejire	Eleyele	Agbadagbudu	Onipasan	Adegbayi	Sango	
Physical							
Appearance	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Odour	Fishy	Fishy	Unobjectionable	Objectionable	Objectionable	Objectionable	Objectionable
Colour	1.24	0.5	0	0	0	0	5-50 units
Turbidity	5.0	4.66	0	0	0	0	5-25 units
TSS	0	0.15	0	0	0	0	580-1500
PH	7.2	6.8	4.59	5.13	4.70	6.04	7.0 – 8.5
Chemical							
Alkalinity	38	58	20	50	50	65	0.5 – 1.0
Total Hardness	64	84	115	60	45	130	0 – 120
Calcium ion	44	25.6	16	20	6	40	50 – 150
Calcium Hardness	64	64	40	50	15	100	75 – 200
Chloride	17.6	30	60	18	52	91	200 – 600
Bacteriological							
Total Coliforms/100ml	0	0	0	170	330	490	0

Source: Oloukoi and Agbola (2014).

Qualitative analysis for other supply sources such as well, boreholes and rain harvest were not carried out. However, for the natural spring source in the city of Ibadan, Oloukoi and Agbola (2014) concluded that alternative water supply sources are potable only when the location is sanitarilly certified and is in line with the WHO qualitative standards. Water quality is critical. Without it, progress towards SDG 14 (life below water) which focuses on the conservation and sustainability of marine resources for development will be a policy mirage.

(ii) Investment in water education

Education is all about awareness creation, and capacity building to build a healthy and developed society. Many education platforms are dealing with water resources management, water engineering, water politics and governance. Universities, Monotechnic, specialized institutes (e.g., Institute for Water Education, Delft; National Water Resources Institute, Kaduna). The challenge is what is the level of investment in training and how much of the outcomes of the training experiments are integrated into national and regional water plans. Water literacy is not just reading and teaching about water issues, but the knowledge that translates into water action: conservation of water resources, reduction of pollution and degradation. Water policy without adequate water literacy and water stewardship plan will mar the progress of water-related SDGs.

Mr. Vice Chancellor, Sir, I would like to move to the drivers of thirst in cities.

12. Drivers of Urban Thirst

These are climate change, land cover dynamics, population pressure, inadequate water infrastructure and water-related disasters.

i. Climate change and climate variability

The science of climate change explains that global concentrations of Green Houses Gases (GHGs) have increased in the atmosphere substantially since pre-industrial times and beyond the absorbing rate. The impacts of climate change on water resources and water infrastructure are getting stronger and more frequent as anthropogenic activities continue. At present, humans contribute 4% of the total emissions, but this 4% is causing a destabilizing effect (IPCC, 2022). Implications of climate change in water affairs include extreme rainfall, drought, rainfall variation, loss of livelihoods, sea level rise, emergency

and re-emergence of diseases, breaking down of water infrastructure, increased water-poverty syndrome etc.

Water crises are among the top global risks for the coming decade with intensifying crises and conflicts (IPCC, 2018). According to the WMO's State of Climate Services (2021), more than 20 % of the world's river basins experienced either rapid increases or declines in their surface water area in 2020. Since 2000, flood-related disasters have increased by 134 per cent, compared with the two previous decades. The number and duration of droughts also increased by 29 per cent. And it will get worse as the planet warms up. The Intergovernmental Panel on Climate Change (IPCC, 2022) assessment report, indicated that continued warming will intensify the global water cycle, including its variability, global monsoon precipitation and the severity of wet and dry events. Greater impacts will be felt in developing countries not just because of the severity of the extreme weather events but because they have low coping capacity.

“People will feel the impacts of climate change most strongly through changes in the distribution of water around the world and its seasonal and annual variability” (Stern 2006: 2).

Climate parameters such as rainfall and temperature are majorly used to investigate water variability. Adeniji-Oloukoi et al. (2013) explained that communities that depend on springs, wells and rivers are significantly impacted during dry season as a result of climate seasonal variability. For instance, an annual increase of 12.97 mm in Shaki and 2.831 mm in Iseyin were recorded between 1989 and 2008 (Figure 7) resulting in two peak periods: June/July and September (Figure 8). The surplus water received during the wet season offers potential benefits in Oke-Ogun, provided that adequate harvesting and conservation are put in place at the household and community levels. In comparison, northeast Nigeria (a Sahel ecological zone) traditionally receives less than 400 mm of total annual rainfall.

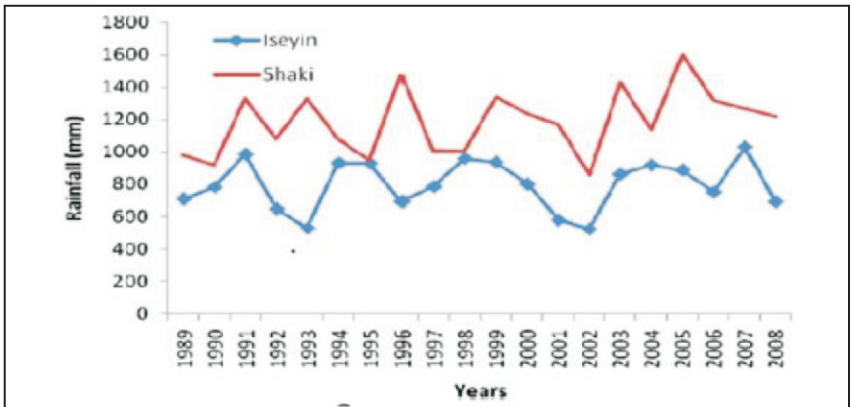


Figure 7: Trends of rainfall in Oke-Ogun region, Nigeria (1989-2008). Source: Adeniji-Oloukoi et al., 2013.

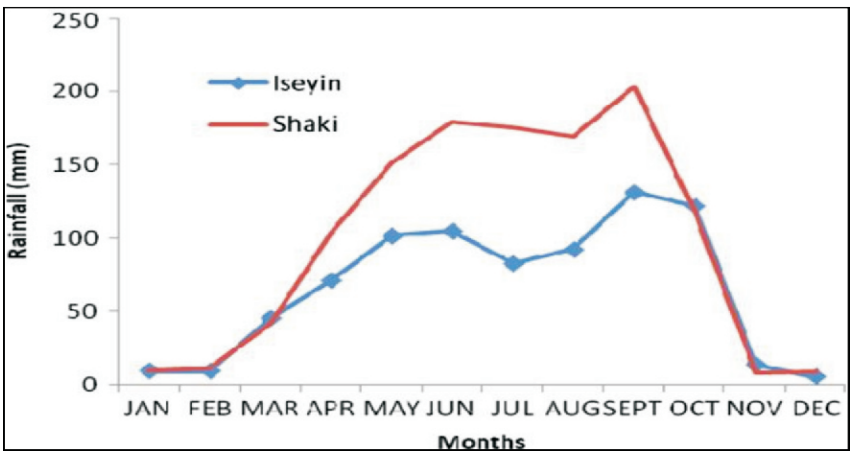


Figure 8: Double peak periods during the rainy season in Oke-Ogun (1989–2008). Source: Adeniji-Oloukoi et al., 2013.

There are variations in the number of wet and dry seasons per annum. It is becoming unpredictable to know the time for the onset of rain. The analysis implies that heightened reliance on well water, which is quite sensitive to seasonal rainfall variability often leads to unreliable access and insufficient supplies for Oke-Ogun residents during severe dry seasons.

ii. Land-Cover Change

Land-use and land-cover (LULC) change is a significant alteration/modification of covers with anthropogenic or natural activities which may impact the ecological systems of a setting. LULLC have been studied with its nexus with public health, biodiversity loss, water resources, environmental pollution, livelihoods and liveability in human settlements at different scales to show the spatial and temporal distribution of the phenomenon.

There are studies in Nigeria which indicated that at the basin level urban land use modifications have impacts on available water resources. For instance, rainfall variability, climate change and land use change were reported as factors of resource degradation in Lake Chad between 2001 and 2020 (National Space Research and Development Agency, NASRDA, 2021).

Oloukoi (2018) reported that urban land uses are modified by the forces of urbanization and increased socio-economic activities. To this, forested and fallow land is changed to built-up areas; water bodies reduce in coverage area and the water footprint also increases. A city-scale study of three water dams revealed that emerging sprawls are along the intra-transportation axis of Ibadan. Designated forest reserves that are supposed to protect water bodies are removed. For instance, the initial buffer zones for Eleyele Dam are now an industrial/commercial hub. Presently, production from the treatment plants is reducing because the dam capacity has been reduced.

With financial support from UNIDO and Heineken International, a study of Land cover change of urban watersheds was carried out using Earth Observation techniques and analysis of satellite imageries from Landsat TM of 1986, Landsat ETM+ of 2000 and Landsat OLI-TIRS of 2017. The effects of the urban expansion of Ibadan city and the changes that occurred in the available surface water from 1986 to 2017 indicate that the area coverage of water bodies is reducing while the built-up area increased (Table 5 and Figure 9). The average annual rate of change of the built-up areas is 8.94 (positive) while that of the water body is -4.05 (negative). In the same manner, light and dense vegetation have -1.16 and -12.80 annual rates of change respectively (Oloukoi, 2018).

Table 5: Rate of change of land cover units

Land use	1986	2000	2017	Annual rate of change (1996-2000)	Annual rate of change (2000-2017)	Annual rate of change (average)
Farm Land & Fallow	32076.99	33940.62	35026.92	1.41	0.19	0.8
Waterbody	1029.06	719.01	833.67	-8.96	0.87	-4.05
Build up area	12652.02	22262.31	42069.78	14.13	3.74	8.94
Light vegetation	63591.39	63910.08	42119.91	0.12	-2.45	-1.16
Dense vegetation	17645.4	6157.89	6942.87	-26.32	0.71	-12.81

Source: Oloukoi, 2018.

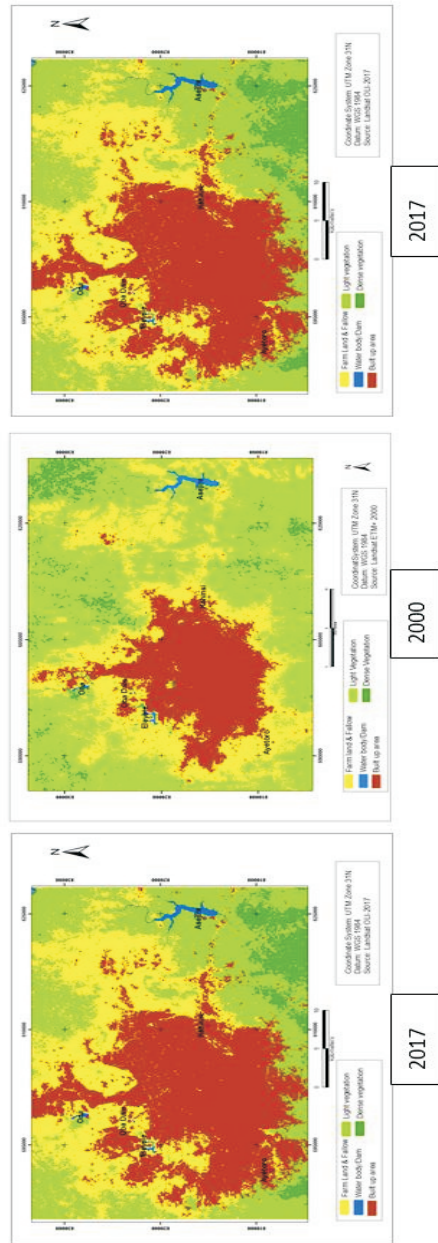


Figure 9: Spatial dynamic of Ibadan
Source: Oloukoi, 2018.

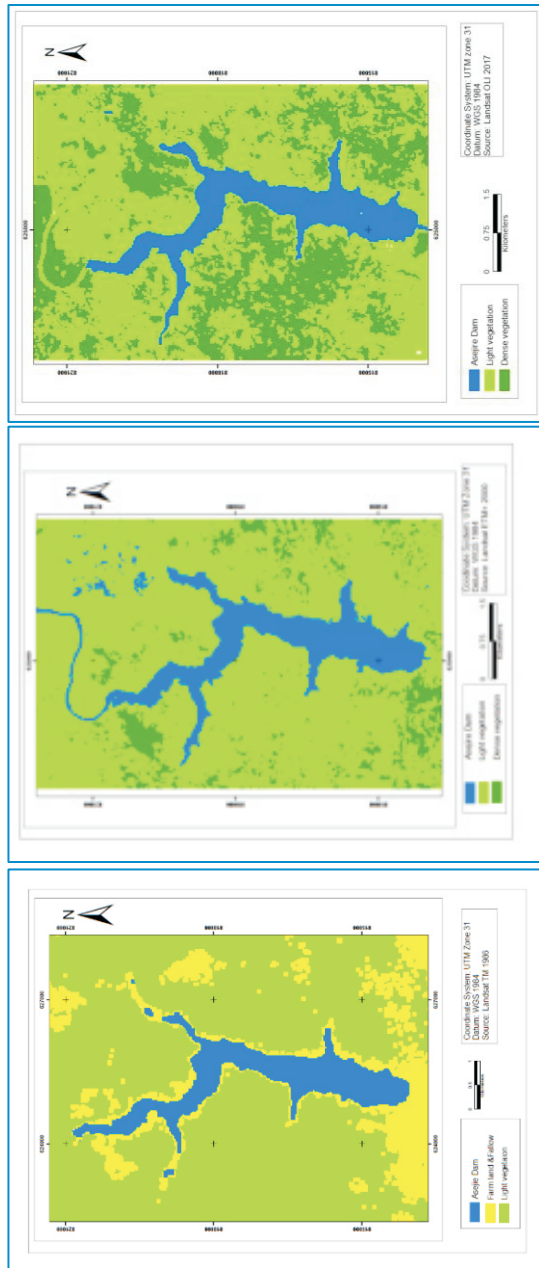
The analysis also reveals that the area of the surface water in Ibadan seriously decreased especially from 2000 to 2017. There was a reduction rate of -14.95 % with Eleyele Dam between 1986 and the year 2000. Of course, this changed to -4.49 % between 2000 and 2017 (Table 3.9). Available water resources are reducing while the demand is increasing. Urban spatial growth and land use modifications impact water resources including agriculture, forestry, urbanization, recreation, and industrialization. The increase in the global urban population is putting pressure on available resources and infrastructure. Oloukoi (2018) reported that the expansion of the built-up is increasing while the water bodies are decreasing in the city of Ibadan. Again, it has been established that urban land use is the major source of water pollution (Camara et al., 2019).

Table 6: Spatial dynamics of surface water resources in Ibadan

Major Dams	1986	2000	2017	Annual rate of change (1996-2000)	Annual rate of change (2000-2017)	Annual rate of change (average)
Asejire	441.72	570.78	474.93	6.41	-1.08	2.7
Oba dam	51.39	54.99	43.11	1.70	-1.43	0.11
Eleyele Dam	201.78	110.97	48.06	-14.95	-4.49	-9.94
Total	694.89	736.74	566.1			

Oloukoi (2018).

Considering the three dams (Asejire, Eleyele and Obwa) as represented in Figures 10, 11 and 12, Eleyele had mostly suffered depletion in terms of area coverage with a -9.94 % average annual rate of change. Occupation of the buffer zones and the flood plains by built-ups is the main challenge (Plate 4).



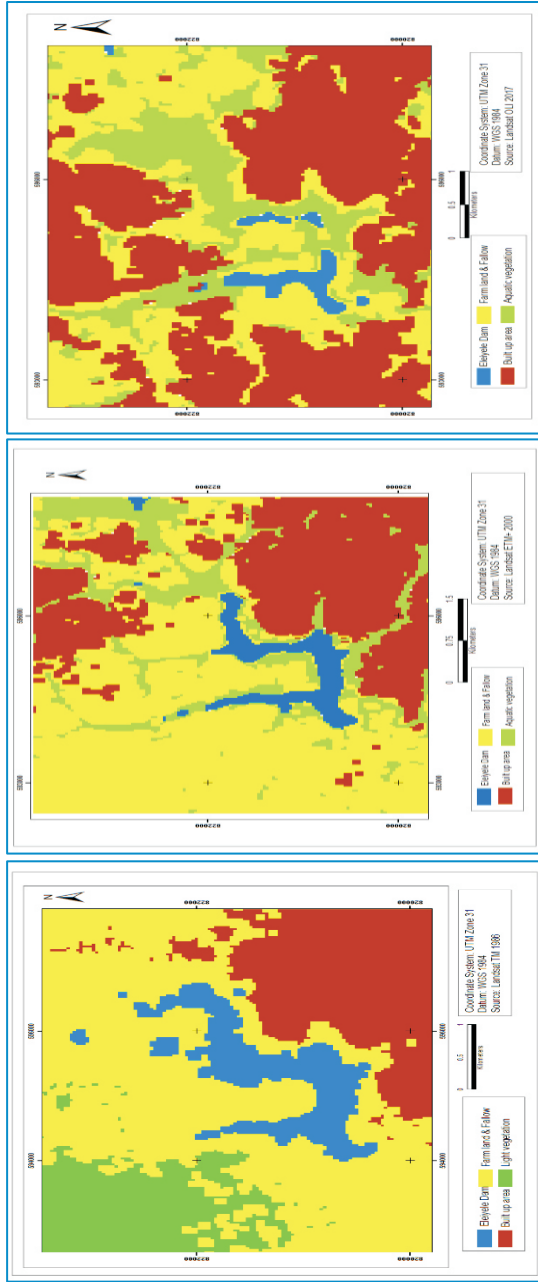


Figure 11: Vegetation cover of Eleyele Dam in 1986, 2000 and 2017. Source: Oloukoi (2018).

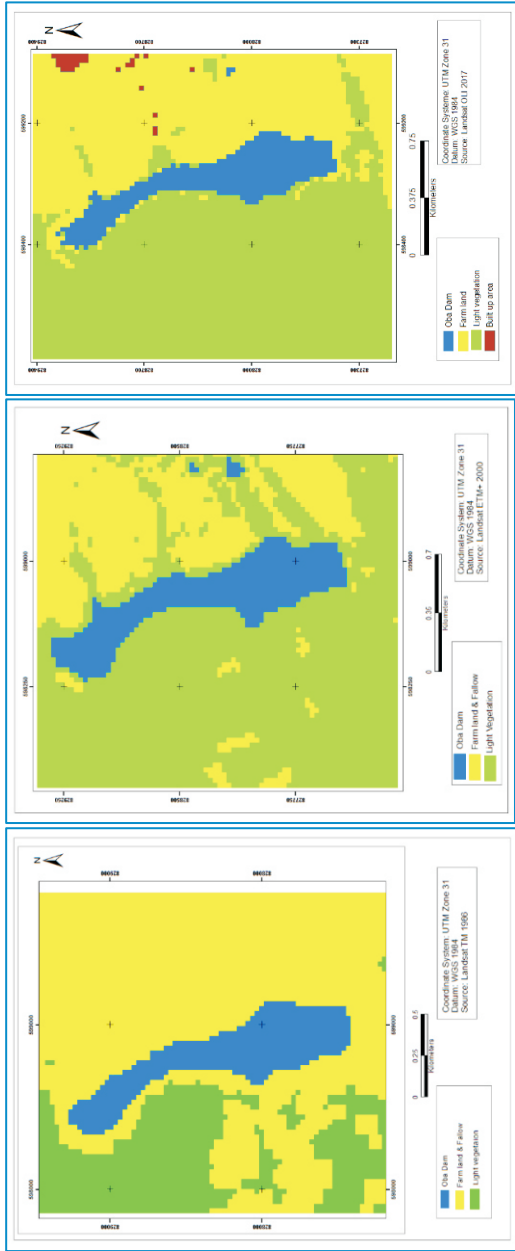


Figure 12: Vegetation cover of Obwa Dam in 1986, 2000 and 2017.
Source: Oloukoi (2018).



Plate 4: Block-making industry and residential building within the flood plain of Eleyele Dam

Source: Oloukoi, 2023.

iii. **Population dynamics**

Given the historical trends of surge from 10.1 to 58.3% that was recorded between 1950 and 2020, Nigeria's urban population is likely to be one of the largest three against 2050. The drivers of this growth include higher fertility rate, rural-urban migration city annexation into the hinterlands. The uncontrolled growth has implications for water services. The challenge is that in the last four decades, there has been no significant expansion of water infrastructure that could meet up with urban expansion. For instance, analysis by Oloukoi and Agbola (2014) and Adeniji (2005) revealed that despite the expansion of water infrastructure in Ibadan city, there is a declining trend in the per capita per day. There are continuous deficits in supply while the demand is increasing based on population growth (Table 7).

Table 7: Population Growth and Trend of Water Supply Status in Ibadan

Year	Daily demand (m3)	daily supply (m3)	Population Served (%)		Deficit (%)	Volume Per capita per day (litres)
			Peri-urban	Urban		
1942	ND	167,001.5	ND	65.1	ND	32
1965	ND	149,094.2	ND	43.2	ND	21.7
1972	331,359.6	134,096.7	ND	35.1	59.5	17.4
1990	389,280.4	146,396.9	3.1	37.2	62.4	18.4
1991	406,681.0	135,096.0	3.2	24.8	65.9	15.7
1992	424,838.0	115,838.0	2.8	30.0	72.7	15.6
1993	443,792.4	107,219.8	2.4	25.6	75.8	15.4
1994	349,948.3	107,218.8	2.2	24.3	69.4	15.1
2004	359,613.5	97,879.0	1.2	22.8	72.8	12.5
2012 - 2016	401,289 420,000	21,800 12,900	ND ND	ND ND	94.7 96.9	15.8 ND

Source: WCOS (2017); Adeniji (2005)

Again, there is no significant increase in functional water distribution networks even though the city is expanding spatially (Figure 13). Other drivers include; social affluence (with household use of bath showers, heaters, washing machines, swimming pools etc.). As shown in Figure 14, population growth and the attending socio-economic drivers make estimates of water demand in Ibadan for the years 2017 and year 2037 are worrisome (Oloukoi, 2018).

iv. Water infrastructure

Infrastructure mediates between societies and their environments. In the most general sense, urban planners are concerned with the allocation and location of the water infrastructure system which consists of dams, levees, canals, pipes, pumps and water treatment plants (machines). In terms of public water infrastructure, there are established dams and treatment plants in Nigerian cities, many of which are producing deficits of up to 50% (Adeniji and Oloukoi, 2011; Oloukoi, 2018).

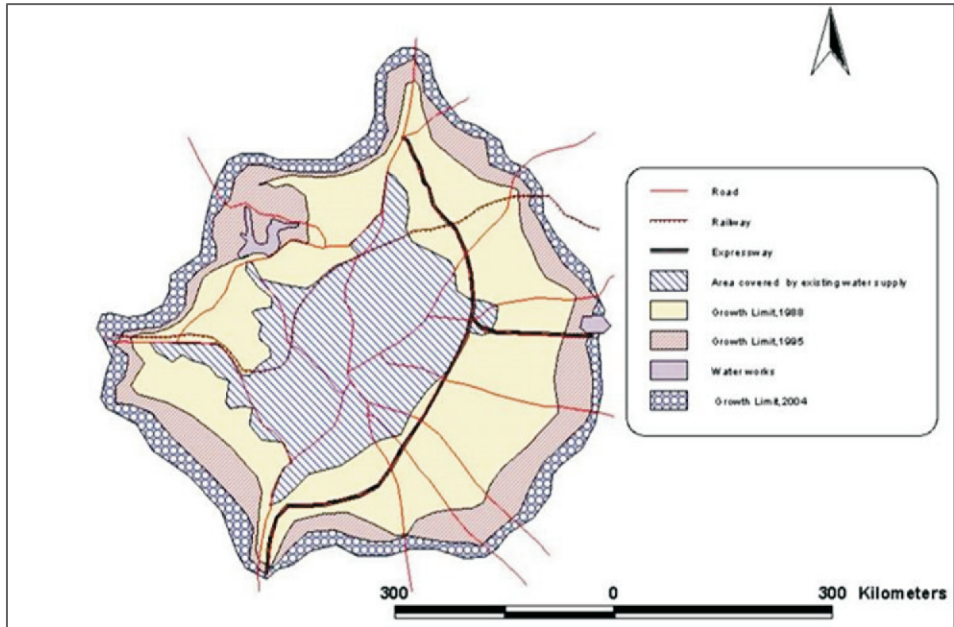


Figure 13: Spatial expansion and water service network coverage in Ibadan
Source: Adeniji (2005)

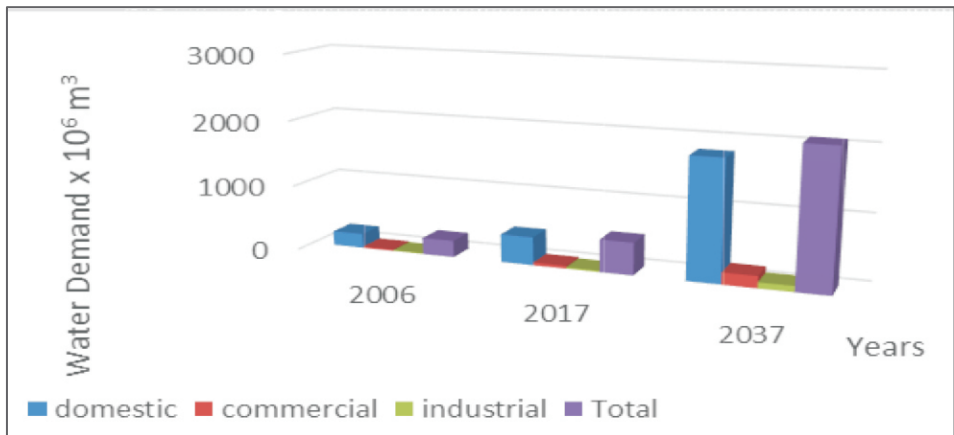


Figure 14: Estimates of water demand for Ibadan (2006-2036).
Source: Oloukoi (2018).

There are many interventions by the government in terms of experimental mini schemes that are never scaled up or translated to improved water access. For instance, the Water Corporation of Oyo State (WCOS) has more than 10 dams for public water supply. Some of these dams have functioning treatment plants with outdated infrastructure in comparison to the realities of today's technology in water services. There is also the challenge of unaccounted-for-water, representing more than 40% of the treated water which are lost as a result of leakages and unlawful connections (AfDB, 2009). The tariff is worrisome because it is based on estimates rather than metered use.

$$\text{Unaccounted , for water (\%)} = \frac{(\text{Production , metered use}) \times 100\%}{(\text{Production})}$$

Reservoir sedimentation is another force that impacts water infrastructure by reducing water storage capacity, especially during the rainy season. It leads to a perturbation of the operating intake, greatly accelerating the abrasion of hydraulic machinery, decreasing their efficiency and increasing maintenance costs. A study on Eleiyele and Asejire in Ibadan revealed a derived R² of 83.7 % for Eleyele and 83.1% for Asejire. The highest rates were observed during peak periods (July-August) of the rainy season (Figure 15). This shows that rainfall trends have a 'direct cause and effect' on the sedimentation rate and with implications on flood control, quality and quantity of water that will be available for treatment (Oloukoi, 2021).

However, there may be some other factors (about 27 %) that trigger sedimentation apart from rainfall parameters since the desilting procedure is not periodically carried out in the two reservoirs.

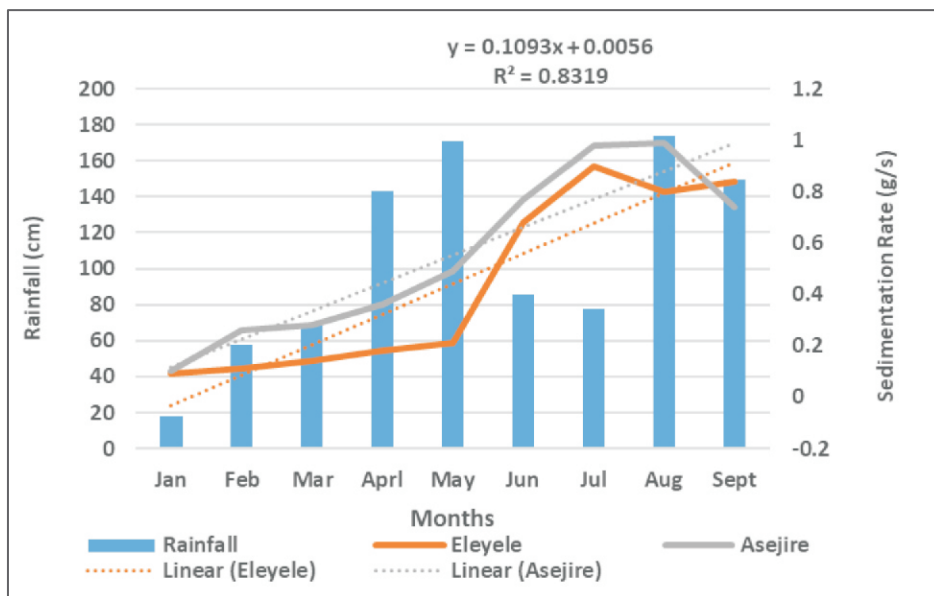


Figure 15: Monthly mean rainfall and sedimentation rate of Eleyele and Asejire Dam. Source: Oloukoi (2018).

v. **Water-related disasters and extreme events**

Today, the term ‘natural disaster’ in environmental discourse is almost forgotten. This is because water-related disasters are now common in terms of frequency and severity. More than 90 % of climate impacts and natural disasters are water-related (UNEP, 2021). Water-related disasters have implications for food security, pollution, the eruption of carbon dioxide present in deep waters, wildfires, aridification, extreme cold, storms, poor hygiene, poverty, environmental degradation (loss of natural buffer, loss of biodiversity, extinction of some fauna and floral), livelihoods, public health, liveability and governance as a result of further stress/damage of urban infrastructures.

The number of weather-related disasters has increased by a factor of five over the past 50 years, claiming, on average, the lives of 115 people and causing \$202 million in economic losses every day. Since 2000, flood-related disasters have increased by 134 %, and the number and duration of droughts also increased by 29 %. (WMO, 2021).

The following data are evidence of water-related extreme events across West African cities:

- The intensity of the flood event in 2022 was more than that of 2011/2012 across the West African coast. It is caused, less by local rainfall within the Nigeria territory, but more by the high rainfall in the headwaters of the Niger River (in Guinean highland), Benue rivers. (Zachariah et al., 2022). It was very devastating because 34 out of 36 states of the federation were flooded. An estimate of 612 deaths and 195 fatalities which was one of the deadliest experiences in Africa were recorded. Over 3.2 million people were affected, including 1.5 million displaced and 2.776 injured (The Punch, 2022).
- During the onset of rain and peak periods, rainstorms often destroy houses and public infrastructure. For instance, the Esa-Odo and Ilare communities of Osun state were affected by a rainstorm on January 27, 2023 (Radio Nigeria, 2023). Ekiti and Osun States in Nigeria witnessed heavy rainstorms in February and March of 2023 just at the onset of the rainy season. Many houses and public infrastructure were damaged (The Punch, 2023).
- In some parts of KwaZulu-Natal Province and Eastern Cape in South Africa. flooding in May 2022 was terrific. According to the national authority, 443 people died in KwaZulu-Natal and over 40,000 are missing. More than 40,000 people have been displaced. The most urgent needs are food, clean water and hygiene packs for emergency responses (Government of South Africa, 26 April, 2022).
- In Chad, the heaviest rains in the last 3 decades got to the peak in 2022. France24 (2022) reported that the Republic of Chad was declared a State of Emergency exactly a year ago (October 19, 2022) when nearly half a million of the 1.1 population of the country were displaced, 22 deaths were recorded and 18 out of 23 provinces were affected. More than 56,000 homes, 465, 000 hectares of arable crops and huge infrastructure were swept away.



Plate 3: 2022 Flood disasters in Nigeria: (a) Kanji, September 14.
(b) Ibadan, September 28.

Source: Sahelnet (2022), Oloukoi (2022).



Plate 4: 2023 Flood disasters in Nigeria.
(a) Residents of Olodo in Ibadan got stranded when the bridge collapsed, on July 24
(b) Floating vehicle and gridlock in Lagos Island, September 18

Source: Channels TV, 2023.

13. Impacts of Urban Thirsty

Mr. Vice Chancellor, Sir, there are implications of urban thirst. I am using water-nexus to discuss some of these impacts within social and ecological systems as revealed in some of my studies. These include:

i. Water vulnerability

In climate studies, vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects (magnitudes character, and rate of variation) of climate change, and extremes to which a system is exposed, its sensitivity and its adaptive capacity. To determine the water-related vulnerability of a system, the application of indicators that can integrate contextual bio-physical, social and economic parameters are often generated. These include the Water Poverty Index (WPI), the Development Index (HDI) the Climate Vulnerability Index (CVI) and the Water Stress Index (WSI).

Nigeria's First National Communication in 2003 reported that the Nigerian water system is highly vulnerable to climate change impacts. The projection was laudable but had the tendency to miss the demographic and biophysical factors that may be specific to some local communities and which have significant contributions to vulnerability assessment and adaptation mapping of such localities. To address this gap, Oloukoi (2014b) generated a Water Vulnerability Index (WVI) for Oke-Ogun region, Oyo State, Nigeria using composite methodology. The result of her study is helpful for local policymaking since most often, regional or national policy may not integrate some local specifications such as demographical, biophysical and environmental factors.

The WVI was designed as a composite, interdisciplinary tool, linking indicators of water and human welfare to indicate the degree to which combined using the following mathematical expression:

$$WVI = \frac{\sum_{i=1}^N w_i X_i}{\sum_{i=1}^N w_i} \dots \dots \dots (1)$$

This can be re-written as:

$$WVI = \frac{wrR + waA + wcC + wuU + WeE}{w1 + wr + Wa + Wc + Wu + We} \dots \dots \dots (2)$$

Where *w* is the weighted average of the five components: Resources (R), Access (A), Capacity (C), Use (U), and Environment (E). Each component is first standardized so that it falls in the range of 0 to 100; thus, the

resulting WVI value is also between 0 and 100. The highest value, 100, is taken to be the best situation (or the lowest possible level of water vulnerability), while 0 is the worst.

The result of the study (Table 4) indicates that within the study region, there are significant variances in the WVI of each community depending on land and water-related livelihoods and in relation to different socio-demographic characteristics. The critical areas with less WVI are the informal neighbourhoods where residents are predominantly agrarian, pointing to the fact that households living in most biophysically vulnerable places are mostly affected by water scarcity and need critical interventions for adaptation (Oloukoi, 2014b).

Table 4: Aggregates of subcomponents of WVI for neighbourhood types in Oke-Ogun

Local Communities		Informal neighbourhoods	Formal neighbourhoods
Indicators	Subcomponents	Total N=225	Total N=172
Resource (R)	Water quality	0.673	0.717
	Water Reliability	0.383	0.356
	Protection of water sources	0.880	0.872
Access (A)	Access to water (type)	0.397	0.630
	Access to sanitation facilities	0.267	0.349
	Access to bathroom facilities	0.571	0.715
	Percentage of water carried by women	0.643	0.542
	Time spent in water collection	0.205	0.675
	Proximity of water point	0.224	0.878
Capacity (C)	Household's head monthly income	0.375	0.444
	Education level of household head	0.561	0.753
	Occurrence of water-related illness	0.495	0.480
	Access to climate information	0.780	0.909
	Membership in social networks	0.397	0.449
Environment (E)	Waste disposal methods	0.980	0.163
	Human population	0.782	0.948
	Population density (room density)	0.357	0.760
	Building structural condition	0.613	0.878
	Percentage of households living in risky zones	0.271	0.512
Use (U)	Quantity of water per person per day	0.294	0.297

Note: Formal neighbourhoods are those which have been planned by local authorities and have some degree of service provision while informal are the indigenous areas and others which are being developed spontaneously without spatial planning.

Source: Oloukoi (2014b)

i. Water and women: more than gender sentiments

Gender is a socio-cultural construction of the characteristics, norms, practices, behaviours, roles and power displays that are connected with masculinity and femininity in a sociological context (WHO, 2023). Today, gender identities now occur in a spectrum not necessarily based on biological sexuality, changing over time and with a resultant socialization crisis. Gender sentiments in psychology refers to the emotional, and cognitive difference between male and female.

The 1975 United Nations First World Conference on Women, at the launch of the International Women's Decade (1975 - 1985) provided a framework that makes consideration for male and female during water resources management and water services interventions. The sentiment by many conferences has been instrumental in promoting the role of women in water management because women are primary water collectors in most indigenous communities; their dependency on water for their livelihoods and that they are disproportionately impacted when the resources are depleted in quality and quantity. Women around the world spend a collective 200 million hours collecting water, and an additional 266 million hours each day are lost because they have no toilet at home (UN-Water, 2023).

In my studies on water and women, I have focused on gender roles and power dynamics (of male and female) at the household and community level in the Nigerian context. The water crisis is personal to women because of their traditional domestic roles: cooking, sanitation, water collection and hygiene maintenance. In their efforts to get water for their families, they often face impossible choices, waste time (which could have been used for economic productivity) and are burdened by carrying heavy containers of water over a long distance.

Beyond sentiment, Adeniji (2010) reported that women are the main water collectors except for communities where women are in *Puddah* for religious or cultural reasons. Women are vulnerable to emotional and physical trauma which are often associated with sextortion when they are in search of water for household use (Adeniji-Oloukoi et al., 2013). Lack of improved Water, Sanitation and Hygiene (WASH) is also linked to absenteeism of girls from school during their menstrual periods and when they have to walk for kilometres in search of water. In terms of women's reproductive health, carrying heavy water containers has been reported to cause premature labour during pregnancy, disruption of postpartum recovery for women (McDonald, 2013) with increased demand on the musculoskeletal system and damage to some other organs (Koyuncu et al., 2021).

Water scarcity in relation to rainfall patterns and water for domestic use does not mean the same to men and women in farming communities. Men who are engaged in crop farming are more concerned about delays in the

onset of rainfall and its impacts on the planting. Women on the other hand are concerned about how delays in the onset of rainfall affect the harvesting of fruits and food processing (Oloukoi et al., 2014d). Interventions in water provision in such communities in Oyo state have resulted in improved livelihood capital for women and enhanced health and well-being of their households (Adeniji-Oloukoi and Afolabi, 2011).

Operationalizing the UN-Habitat acceptable index for improved access to water in the Oke-Ogun region of Nigeria, Oloukoi (2014c) reported that the condition of water source (whether protected or not) has a greater contribution to women's access to water. Other factors include time spent on water collection, location of the source (proximity to homes) and availability of storage facility (Table 8).

Using a binary regression model for the same analysis, it was reported that the reliability of water supply sources alone has a contribution value of 95%, while the type of neighbourhood a woman stays in and time spent on water collection is also very important as explanatory variables for women's improved water accessibility.

ii. Water-health nexus

In the 19th century, the Water- Energy-Food (WEF) nexus was extensively studied because it was adopted by the United Nations donor agencies and research community as a concept and analytical tool. Today, the Water-Health nexus is brought into the equation mostly from MEDLINE, Health and Place, Disaster medicine, green space and health to indicate a correlation between environment and health. For instance, access to water and sanitation is one of the parameters for healthy cities. Most public health promotions and space planning in the form of housing programmes, density control are related with provision of water and sanitation with great intentionality. For instance, in Great Britain, Housing Legislation was enacted when the politicians saw a need to combat housing and sanitation challenges while the Public Health Acts of 1848 and Water Acts of 1852 were also proclaimed to reduce the impacts of the Cholera epidemic. Pan American Sanitary Bureau of 1902 was established to deal with public health issues. In Nigeria, the Town Planning Ordinance of 1963, the Cantonment promulgation of 1893-1904 and the Planning Legislation of 1904 focused more on the protection of colonial settlements from health risks even though planning standards

were developed in mapping and establishing Government Reservation Areas (GRAs).

Table 80 Women’s water access index in OkeOgun

Variables	Value labels	Freq. (N _{pop} = 397)	Percent ages	% within the acceptable index
Condition of water supply source	Protected with cover	348	87.7	87.7
	Not protected with a cover	49	12.3	
Availability of improved large water storage facility	Yes	51	21.9	21.9
	No	182	78.1	
Reliability of water supply sources	Yes	61	31.3	31.3
	No	134	68.7	
Average time spent on water collection (daily)	At most 30 minutes	51	13.6	49.4
	30 – 45 minutes	134	35.8	
	45 60 minutes	44	11.8	
	More than 60 minutes	145	38.8	
Location of water sources to residence	Within the compound	55	13.9	43.9
	In the next compound	119	30.0	
	Neighbourhood Centre	172	43.3	
	Another neighbourhood	51	12.8	
Distance covered for water collection (km /daily)	Less than 0.5	11	2.9	18.2
	0.5 – 1.0	57	15.3	
	1.01 – 1.5	52	13.9	
	More than 1.5	253	67.8	
Period of the day when water collection is done	Morning	286	79.0	1.9
	Afternoon	28	7.7	
	Evening	41	11.3	
	Any time of the day	7	1.9	
Weighted Average				36.3

Source: Oloukoi, 2014c.

Understanding water-health interlinks is important to raising concerns for inter-generational health equity and the non-medical determinants of health (Nwokoro and Oloukoi, 2020). Studying the link is significant because, 24% of the global disease burden is associated with environmental risk factors (biological pathogens, chemical pollutants, physical hazards and resource degradation); 10% of global illnesses are water-borne and one-fifth of children born in the developing nations are likely to die during infancy due to water-borne diseases (WHO, 2022). Plastic pollution in the water ecosystem has made its way into the food

chain generating a third of greenhouse gas emissions and a high risk of cancer (WHO, 2023)

Oloukoi and Ogundiji (2009, 2013) provided a link between housing quality, socio-economic index and environmental health Index of Ibadan. Access to WASH services and security of tenure showed a higher contribution to slum formation. Neighbourhoods in the core areas were regarded as 'slums of despair' while the illegal squatters in the hinterlands were considered as 'slums of hope'. Oloukoi et al. (2018), studied on Livelihood Capital and Environmental Vulnerability of Ile-Ife, Nigeria. The studies concluded that communities with poor WASH services are susceptible to environmental health hazards even though they have higher metrics for social and cultural capital. For these vulnerable communities, the real urban renewal and improved quality of life is the provision of WASH services (Oloukoi, 2021)

Focusing on climate and health feedback, Oloukoi et al. (2014b) studied trends of water-related diseases during water shortages based on seasonal variation in the Oke-Ogun region for the period 2006 and 2008. The result revealed that:

- Trends of perceived and observed cases of health risks related to seasonal climate variability are similar.
- Cases of diarrhoea, cholera, measles and malaria with a decrease in rainfall pattern (Figure 16).
- Cases of flu increase during the onset of harmattan and monsoon of the rainy season (Figure 17).
- Coping and adaptation strategies are ensured when ill-health impacts are perceived by the study population.
- Indigenous therapy is mostly autonomous, preferred and approved based on long-term experiences of the study population.

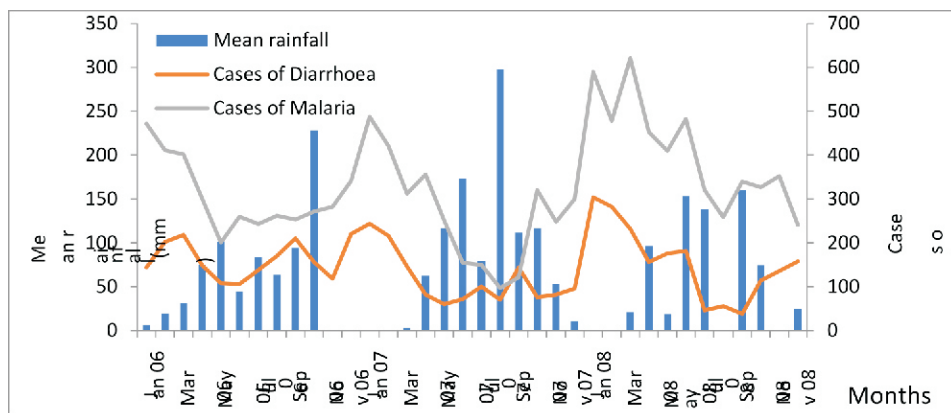


Figure 16: Cases of diarrhoea and cholera against monthly rainfall in Iseyin (2006-2008).

Source: Oloukoi et al. (2014b).

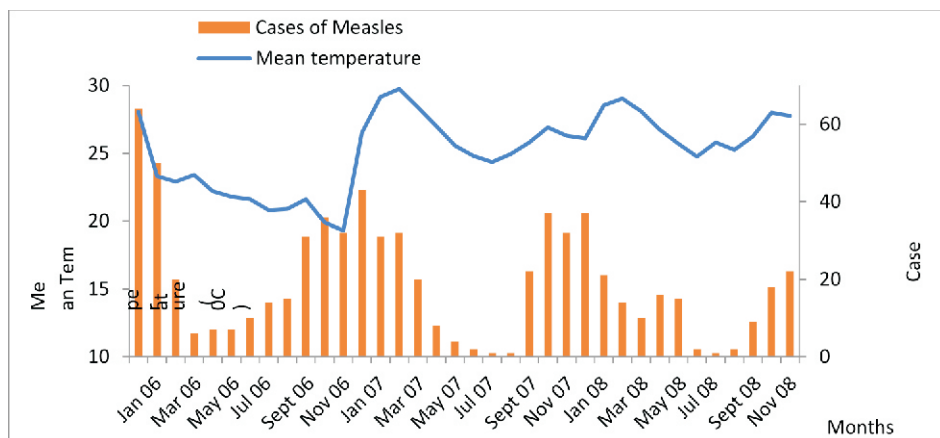


Figure 17: Cases of measles against monthly rainfall in Shaki (2006 - 2008).

Source: Oloukoi et al. (2014b).

iii. Water-poverty nexus

“Water is the dividing line between poverty and prosperity” (Kalpanatai Salunkhe, 2003).

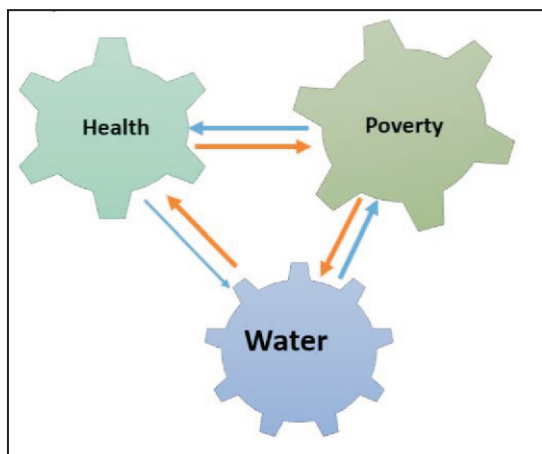


Figure 18: Water-Health and Poverty Nexus
Source: Conceptualized after Oloukoi and Aderinto (2023).

The conceptualization of poverty has moved from income-based to other issues that influence the quality of life such as health outcomes, access to basic services and empowerment (UNDP, 2006). For instance, poverty and low human development is linked to health risk especially in community with water scarcity. The poor cannot afford good water. He drinks the polluted one. Health crises comes in and he pays heavy medical bill. The poverty cycle continues (Oloukoi and Aderinto, 2023). Cases of malaria remain inextricably linked with poverty of the six highest burden countries (in order of estimated number of cases): Nigeria, Congo, Tanzania, Uganda, Mozambique and Cote d'Ivoire. These six countries account for an estimated 103 million (or 47%) of malaria cases in the sub-Saharan Africa region. Africa carries 25% of the world's disease burden, yet has only 3% of the world's health workers and 1% of the world's economic resources to meet the challenge (WHO, 2012). At a micro-scale, Oloukoi (2010 and 2013) adopted the Rural Rapid Appraisal (RRA) technique of participatory research for co-knowledge production to conceptualize a pentagon of Water Poverty Index (WPI) based on the Livelihood Assets (Table 9).

Table 9: WPI Components and Livelihood Assets/Capitals

WPI Component	Livelihood Assets
Resource	Natural capital water infrastructure.
Access	Social capital, financial capital
Capacity	Human and social capital, including (institution issues, and financial capital for investments
Use	Physical capital; financial capital
Environment	Nature capital

Source: Oloukoi (2013)

The WPI derived is presented with a pentagon showing R (Resources) in terms of finance and water infrastructure as the highest contribution. This is followed by E (environment) which represents natural capital. The lowest factor is U (use) which represents physical that (Figure 19).

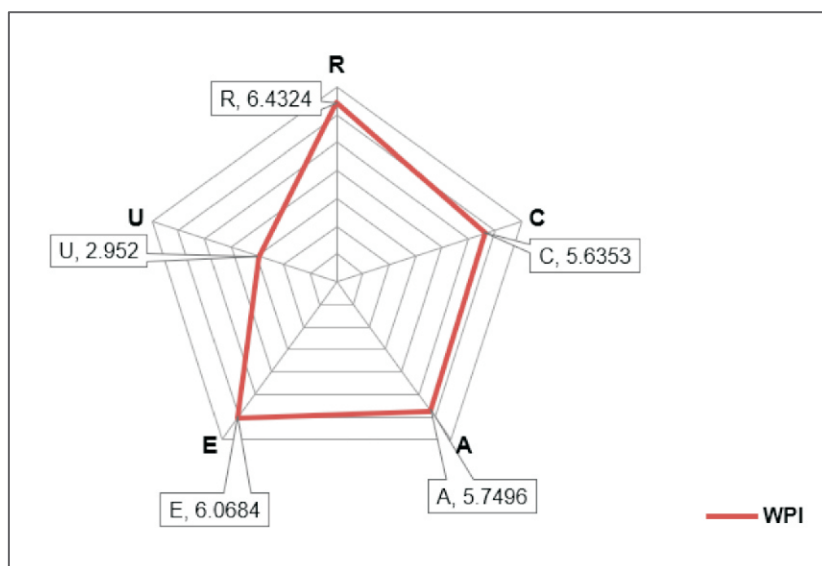


Figure 19: Derived Water-Poverty Index (WPI) based on available livelihood assets in Oke-Ogun region, Nigeria
Source: Oloukoi (2013)

iv. Water services during pandemics and emergencies

The global journey to the SDGs suffered a huge attack with the emergency of COVID-19 (coronavirus) which rampaged the whole world between 2019 and 2022. Despite the removal of lockdowns travel bans and other restriction as the world recovers from its damage, its diffusion and its effects are still on in some countries as the world transitions from the pandemic (WHO, 2023). COVID-19 and its effects on the global space amplified other risks (climate change and conflicts) and environmental risk factors do not have boundaries either across gender groups, sectors or levels of human society. For instance, women are at risk of infectious diseases because more than 75% of the health workforce are women (Human Resources for Health, 2020). Female migrants and those in the informal economy were also affected.

Again, in such a critical period, all medical attention was on the pandemic, and other healthcare services such as reproductive health, and child care do suffer. Moreover, with the increase in the cases of COVID-19, frontline workers women and girls who are the main caregivers became burdened with extreme stress and trauma. More than ever, the pandemic revealed that water, sanitation and hygiene are central to public health. Provision of hand washing (water and soap) in all outdoor and indoor spaces is the pathway and women are better managers because of their roles in domestic affairs.

The argument is that health is at the heart of the Water-Energy-Food (WEF) nexus. Water-health nexus is usually evidenced during public health crises. For instance, the Ebola Virus epidemic in West and Central Africa was better contained with adequate hygiene solutions (Hand washing with soap and running water). Apart from lockdowns and social distancing, immediate measures to reduce the spreading of coronavirus infection were mostly based on WASH interventions (Oloukoi, et al., 2022). In Informal settlements, higher cases and mortality were recorded because of their vulnerability based on conditions for survival and good health (UN-Migration, 2022). The COVID-19 pandemic has had poverty effects on 40 to 50 per cent of the population in some African countries (World Bank, 2018).

During the displacement of the population either as a result of violence, disasters, climate stress, or refugee camps, Internal Displaced Population (IDP) settlements face dire challenges of WASH services. In these locations, women, children and the disabled are on the margins. They are vulnerable to ill-health, raping and death. This shows that beyond

response planning, there is a need for integrated options that accommodate the WASH needs of the vulnerable during emergencies.

v. Water/ livelihoods and food security

Water is one of the ecosystem resources that support livelihoods. For instance, fishing, rain harvesting, business, beverages, water vending, water engineering works and plumbing. In Sub-Sahara Africa, rain-fed agriculture is the main model of crop farming and livestock keeping. Oloukoi (2011) identified water resources as the pillar for livelihood patterns in communities where their livelihoods are based on the ecosystem. During water shortages, the economic lives of such communities are impacted.

Concerning food security, the water-food-energy nexus is a good framework that is used by development agencies. In this regard, Fasona et al. (2013) revealed that availability and access have significant impacts on food security in the Nigerian Savannah zones because their livelihoods are ecosystem-based. Coping options include; livelihood modification (irrigation techniques, use of water-efficient seed, waste water treatment, improved water management to prevent water logging erosion and leaching calendars, water harvest and soil moisture conservation), displacement, appealing to the sovereignty of nature with prayers and sacrifices (Oloukoi et al., 2014c).

vi. Water and development

From classical political economy (in the 1800s) to modernization theory in the 1950s, including structural reforms and pathways for partnership in the last three decades, development is all about improved human systems. This is the reason why access to environmental services (water in particular) is an integral part of many global development agendas. These include: the International Conference on Water and Environmental Issues in Dublin and Rio-de Janeiro in 1992, the Agenda21 (chapter 18) recommendation of Sustainable Development., the United Nations Water Conference in Harare and Paris in 1998, the United Nations International Drinking Water Supply and Sanitation Decade (1981–1990) were all global reawakening on water issues for improved health.

Many frameworks for Demand-Side Management (DSM) such as, Integrated Water Resources Management (IWRM) and Dublin Principles were formed to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems. Global Water Partnership and the World Water Council were established in 1996, to coordinate policies and programmes of different international agencies and stakeholders. The Ministerial Declaration of the 2nd World Water Forum in 2000, the 3rd Congress of the International Geosphere-Biosphere Program (IGBP) and Africa Water Vision for 2025 by the African Union emphasised the need for effective participation, governance, improved water wisdom and strengthening water finance. The Millennium Summit in September 2000 and the states of the United Nations agreed on a set of Millennium Development Goals (MDGs), which addressed water issues in the context of ensuring environmental sustainability. The two goals are:

Target 10: To halve, by 2015, the proportion of people without sustainable access to drinking water.

Target 11: To achieve by 2020, a significant improvement in the lives of at least 100 million slum dwellers.

At the end of the MDGs term, the UN came up with the Sustainable Development Goals (SDGs) as a global agenda for 2030. Nearly all SDGs targets are water-connected in terms of poverty reduction, improved quality of life, gender equity and protection of the ecosystem (Table 10). Analysis by Oloukoi et al. (2023) showed that actions that result in improved access to water will reduce gender inequality, reduce hunger, raise health outcomes and build a sustainable future.

Table 10: A gender dimension to Water-Related SDGs

S/N	Goals	Benefits of reducing gender inequality for the SDGs
1.	End poverty in all its forms everywhere	Investments in water infrastructure/services will reduce the poverty level of rural women because the time they spend on water collection can be used for other economic productivity.
2	End hunger, achieve food security and adequate nutrition for all, and promote sustainable agriculture	In terms of food security, women who are engaged in irrigation farming will have more production when water is available. Urban food production from home gardens and livestock keeping by women will be improved irrigation water will be available.
3	Attain a healthy life for all at all ages	Improved health is also possible when water is available for caregiving and the capacity to absorb nutrients in food. Sufficient quantities of clean water for washing pre-post-birth cut down on life-threatening infections. Pain and stress of water collection by women and girls will be gone when water service is improved. Higher rates of child survival are a precursor to the demographic transition toward lower fertility rates; having fewer children reduces women's reproductive responsibilities
4	Provide equitable and inclusive quality education and life-long learning opportunities for all	More girls will attend regularly when water and sanitation are available at the household level. Improved sanitation facilities (with optimum privacy) in schools will increase school attendance for girls
5	Attain gender equality, empower women and girls everywhere	Active participation of women in water-related decisions is a form of empowerment. Improved water services will reduce sextortion and other forms of violence against women when they go about looking for water.
6	Secure water and sanitation for all for a sustainable world	Improved water and sanitation is a right of all women. When it is lacking, human (women's) right is violated.
7	Ensure access to affordable, sustainable, and reliable modern energy services for all	Hydro-power supply is an efficient energy for cooking and lighting at the household level. This is a form of gender equity.
8	Promote strong, inclusive & sustainable economic growth and decent for all	Water is a factor of production in agriculture, industry and economic activities. When water is accessible to women, they are empowered to pursue economically productive activities
9	Promote sustainable industrialization	There is no industrialization with water resources. Many women will engage in industrial activities when technology is in place to manage water, especially irrigation, tourism and navigation.
10	Reduce inequality within and among countries	Water pollution treatment at the point of generation will reduce environmental racism and toxic colonialism.

S/N	Goals	Benefits of reducing gender inequality for the SDGs
11	Build inclusive, safe and sustainable cities and human settlements	Improved domestic water supply and sanitation and better water management reduce the biological pathogens and chemical hazards to which slum dwellers are exposed.
12	Promote sustainable consumption and production patterns	Improved water services in homes, schools, and public spaces will reduce the amount of plastic waste (from bottled & sachet water). This will reduce the burden of waste clearing by vendors
13	Promote actions at all levels to address climate change	Most climate extremes are water-related. Climate actions in cities that embrace flood control, drought management, and heat-wave control will have positive impacts on women's lives, liveability and livelihoods in cities.
14	Attain conservation and sustainable use of marine resources, oceans and seas	Women and girls are eco-friendly. They can be the real managers for the protection of marine resources. The development of integrated management within river basins creates a situation where sustainable ecosystem management is possible and upstream-downstream conflicts are reconciled. Biodiversity conservation, and combating desertification are furthered by sound water management.
15	Protect and restore terrestrial ecosystems and halt all biodiversity loss	Improved water management, including pollution control and water conservation, is a key factor in maintaining ecosystem integrity. When the ecosystem is improved, women whose livelihoods are ecosystem-based are better off
16	Achieve peaceful and inclusive societies, rule of law, effective and capable institutions	Partnership for the management of transboundary rivers is a key to achieving an inclusive human society. Women's vulnerability is reduced in societies with inclusiveness and functional institutions for the rule of law.
17	Strengthen and enhance the means of implementation and global partnership for sustainable development	Global partnership through finance, capacity building and negotiations are key formulas for improved water access to women and have a multiplier effect on their households, their communities, and their nations. Global sustainability is anchored on individuals (especially women) and their nations).

Source: Oloukoi et al. (2023).

vii. Water Governance

Water governance is the systematic arrangement of institutions to regulate the use, provision, administration and management of water using political, economic and social powers to maximize the benefits of improved welfare of the society. In governance, citizen participation and coordination are critical. Water governance outcomes include inclusion and adaptive management accountability, fairness, risk management, transparency, sustainability, and security equity (Agbola and Adeniji, 2007, Oloukoi and Olakunde, 2015b).

Finance is critical in governance. Using an administrative River Basin as a case study, Oloukoi (2018) studied water infrastructure and water finance. The study revealed the financial capacity of state to support water services is dwindling. Actual expenditures on water are far below the budgeted allocation (Figure 20).

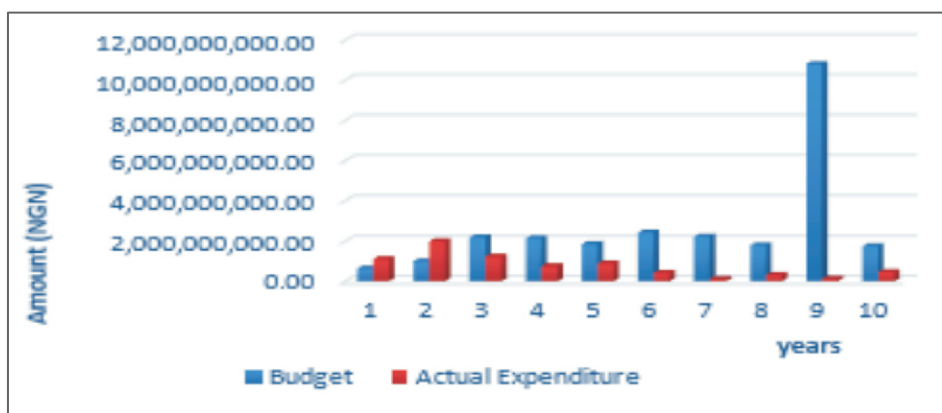


Figure 20: A Typical Budget-Expenditure Trends for a State Water Corporation in Nigeria (2007-2017).

Source: Oloukoi (2018).

The reason for the anomalies includes:

- Low Internal Generated Revenue: the IGR is mostly used for the purchase of treatment chemicals and minor repairs of equipment are far low compared to expenditure on water treatment.
- Water pricing is based on estimates by the water agency not necessarily according to consumption.
- Implementation of the National Water Policy is far from reality.

By experience, the adoption of the Water Working Group (WWG) during the demonstration project of the Sustainable Ibadan Project (SIP) showed that whenever the water governance system is decentralized and there is the active participation of users; cost recovery, responsive maintenance of infrastructure and sustainability of water project is achieved (SIP, 2004; Agbola and Adeniji, 2007a).

14. Coping with Urban Thirst

Mr. Vice Chancellor, Sir, in this section, I will highlight some adaptive strategies that are available at city and regional scales.

Coping with water shortages include all actions for adaptive resources management which are designed by individuals, communities, municipalities, and even nations or region to enable continuous functionality in the face of water supply shortages. Coping strategies are location-specific and dependent on the availability of the necessary social, economic technical resources and political will to take advantage of water resources. Therefore, tactical planning promotes effective and efficient use of water in the face of supply shortages. Coping ability or adaptive capacity and resilience are expressed as livelihood capitals: access to water information, social networks, socio-economic status and strong water institutions (Oloukoi, 2015; Adeniji and Oloukoi, 2011).

In most African cities, local knowledge has provided a bedrock for coping based on accumulated experiences in the form of autonomous coping actions and planned actions. Adeniji-Oloukoi et al., (2013) identified some Coping strategies at household level. These are: policies and institutions arrangement for development of water supply schemes, land use management, river channelization, protection of natural springs and ponds, rainwater harvesting, use of less water-intensive sanitation techniques, water treatment methods, water transfer from the coast to arid land for irrigation, and strategic aqua tourism activities (Figure 21).

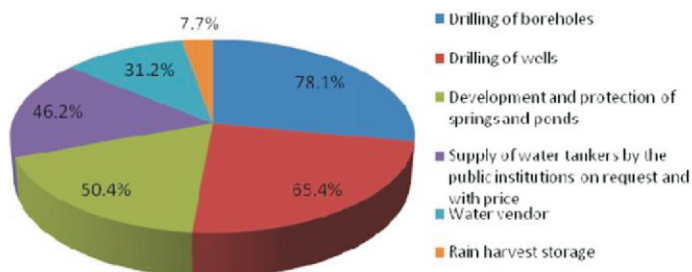


Figure 21: Household's coping strategies for water supply strategies
Source: Adeniji-Oloukoi et al., 2013.

Autonomous coping strategies in Nigeria are self-help initiatives by individual households, communities and even municipalities. For domestic water use, Gbadegesin and Olorunfemi (2011) reported that rural communities in Oyo State Nigeria adopt indigenous conservation strategies of traditional water sources (e.g., streams and rivers). Given the amount of rainfall in Nigeria, rain harvesting that is being done can be scaled up with infrastructure for collection, storage and transfer to arid zones instead of heavy run-offs that result in floods. China and Malaysia are already thriving with this adaptive water management strategy.

Underground water extraction in the form of boreholes, and hand-dug wells are commonly adopted in both rural and urban areas where public water system has failed. This is unique because available options are locally designed and they can easily be implemented at individual household levels. Presently, each homeowner provides his water services based on his affluence and economic capacity. The challenge with this approach is that there can be 10 boreholes in 10 residential plots. This creates more stress on the underground water resources and other implications on the tectonic forces of the earth.

Another autonomous coping option is adoption of Indigenous Knowledge System (IKS) inform of myths that forbid dumping of refuse into water channel in some local communities (Oloukoi and Adeniji, 2015). Provision of mini water schemes are also initiated by the political class in some communities. Assessment of such water services showed that they are provided just to score political points. Some of such water schemes are not properly constructed with the consent of the targeted communities. Again, some are abandoned once there is a change of government's regime. Then, the thirst continuous. In the light of these highlights, are we really coping? Can these coping options be sustainable given the multidimensions of water stress in a VUCA world?

15. Summary of My Research and Contribution

i. Fellowship and Scholarship

I have successfully written grant proposals and carried out researches independently and as a member of multidisciplinary teams some of which

I led. The first one that shot me up and raised my confidence was a fellowship grant from the International Science Foundation (IFS), Global Water Security and Sanitation Partnership (GWSP) and Cooperative Programme on Water and Climate (CPWC) which facilitated my training on Global Environmental Change and Water Resources Vulnerability under START International capacity building scheme at the Institute for Water Education (UNESCO-IHE), Delft, the Netherlands in 2007.

In 2009, I received a fellowship grant from the Internal Human Dimension Programme, (IHDP, Germany) to participate in training on 'Urbanization and Health at the University of Jawar Nehu, India. In 2009, START International awarded me a doctoral fellowship grant with funding from the Canadian International Development Research Centre (IDRC). During the fellowship, my work focused on 'Women and Water variability in the context of climate variability' at the Discipline of Geography, University of KwaZulu-Natal (UKZN), Durban, South Africa. During my stay at UKZN, I initiated two modules of training for the Masters class focusing on: Cities and climate change; Climate stress and rural livelihoods.

My team worked on Community-based management of ecosystems and natural resources for improved food security in the Nigerian Savannah from 2011 to 2012. The project was funded by the International START Secretariat through the grant for the Global Environmental Change (GEC) Africa Project from the Climate and Development Knowledge Network (CDKN), National Science Foundation (NSF) and Climate Change and Food Systems (CCFS). In 2014, I was part of a team that studied 'Land use dynamics in the Sudano Savanah of West Africa with a grant from the Council for the Development of Social Science Research in Africa (CODESTRIA).

Presently, I am part of a consortium which focuses on Pan-African and Transdisciplinary Lens on the Margins: Tackling the Risks of Extreme Events (PALM-TREES). This project is one of the Climate Adaptation and Resilience (CLARE) Schemes with a grant from the International Development Research Centre (IDRC), Canada and the UK's Foreign, Commonwealth and Development Office (FCDO).

Without a doubt, these research grants and international collaborations have given me scholarly exposure and the opportunity to contribute to scientific discourse at many international forums. Outputs from many of

these research projects are also published in reputable scientific outlets. One of the outputs gave me global recognition by Elsevier as the most popular article in 2013: **'Households' coping strategies for climate variability related water shortages in Oke-Ogun region, Nigeria'**, *Environmental Development*, 5(2013): 23-38.

My research collaborations have translated to action plans for businesses and public institutions, especially on Water stewardship in collaboration with the United Nations Industrial Organization (UNIDO). My laboratory experiments have covered the city scale with a focus on Ibadan, and the regional scale with a focus on Oke-Ogun, the Nigerian Savannah and the West African coast.

ii. Professional practice

As a professional Town planner, I am bold to declare that I found fulfilment in this noble call. After my training at the Polytechnic, Ibadan, I was admitted for graduate training at the Nigerian Premier University where I was the Best Graduating Student and the Candidate with the Best Dissertation in the MURP class of 2005. Surely, the training in the two planning schools was solid, courtesy of my seasoned teachers. I became a full member of the Nigerian Institute of Town Planners (NITP) in 2005. I was inducted as a licenced Urban Planner with the Town Planners Registration Council of Nigeria (TOPREC) in 2006. I became a Fellow of the NITP in 2022 as one of the foremost female indigenes of Oyo State to have this honour. In professional services, I was privileged to serve as a consultant for Osun State Urban Renewal Projects (O'renewal) and as a reviewer for the Ibadan Master Plan Project. I also served as part of Teams for the preparation of the Master Plan of some private universities in Southwest Nigeria. Many thanks to the Institute for Human Settlement and Environment (IHSE) which gave me such an opportunity at the very onset of my professional practice.

iii. Capacity building and pedagogy in environmental management

I have worked as an academic for 20 years in the field of Urban and Regional Planning with a focus on the Environmental Resources Management sub-discipline. In my service as a teaching staff of Lead City University, I introduced the training modules on climate change for the Environmental Management and Toxicology programme. I developed courseware for the general class of Research Design and Methods for the

Undergraduate and Postgraduate. I have served as a facilitator for the training of supervisors and Compliance Assessors for the Postgraduate School. As a pioneer staff of the Faculty of Environmental Design and Management (EDM), I have contributed immensely to the building of the faculty in terms of leadership, programme initiation and scholarship. I initiated and developed some tailor-made postgraduate training programmes for professionals in the built environment as part of my contribution to capacity building. I am bold to say that PhD in Built Environment; MSc. and Ph.D. in Land Administration and Development, MSc. and Ph.D. in Environmental Management; MSc. and Ph.D. in Environmental Governance and Sustainable Development are my contributions to pedagogy at Lead City University. It is delightful that I am a foremost instrument and champion of these new frontiers in Nigerian university education.

Outside Lead City University, I have served as external examiner graduate these and also as an Arbitrator to PhD thesis at UKZN, South Africa. I have also worked as an environmental advocate in collaboration with some media houses. I founded the Water for Life Support Foundation, a Non-Governmental Organization (NGO) with a vision for improved water access in marginalized communities. The NGO provides WASH facilities to schools and it has an endowment award for the best graduating student of BSc. Environmental Management in Lead City University.

16. The Lessons from My Academic Trajectory

Mr. Vice Chancellor, Sir, in this section, I want to itemize useful experiences which have come to me with great lessons. These experiences came as drops of water, initially to wet my dryness but each of them later soaked me in amazement:

i. The lesson of time and chance

*I have seen something else under the sun: The race is not to the swift or the battle to the strong, nor does food come to the wise or wealth to the brilliant or favour to the learned, but **time and chance** happen to them all (Ecce 9:11 NIV).*

The bible verse above is very true in my life. My becoming is not a result of brilliance or swiftness. I would love to share a few instances that captured my experiences of the working of time and chance as an academic. In June 1994, during my Senior Secondary School Examination (SSCE) organized by the West Africa Examination Council (WAEC), I did not want to write a Geography paper. The reason was that we did not have a stable teacher for the subject throughout the three years of senior secondary school. My school managed to get one NYSC member to teach us during the final year but I was not on the same page with the young man. So, I did not want to stress myself with the subject. However, my Principal, Late Dn. M.A. Omolewu (1944-2007) insisted that I must write the paper. I can still remember his voice, 'My Senior Girl, you must write this Geography paper, because it was scheduled for all science students'. He provided me with a pencil and other materials needed for Map Reading on the scheduled day for Geography Paper 2. His intervention that day was very unusual but I know better now. Despite my little preparation for the examination, I scored Credit 4 in the SSCE of June 1994. It was a happening of **time and chance**. If I did not write the Geography Paper that day, maybe today may not exist in my story.

In 1996, as a way to assist my mother, I was busy hawking goods along the Okeho-Ilero road when I came across one of my secondary school teachers, Mr. Dapo Olayanju (now a Principal Lecturer at Emmanuel Alayande University of Education, Oyo, Nigeria). He expressed his concern about the delay I was experiencing in securing university admission. He gave some advice on Polytechnic study options which I acted upon without much hesitation. I could not secure admission to my desired course because admission processes for the academic year had closed. By **chance**, my father met Mr. Folorunso Adesina, an officer at the Registrar's Office of the Polytechnic, Ibadan. He volunteered to help and I was admitted for a five-year Full Town Planning (FTP) Course which was later changed to a Professional Diploma in Urban and Regional Planning with my name on the final batch (known as the Rector's list) of the admission list for the 1995/1996 academic year. The credit pass in Geography became an advantage. In the course of my training at the Polytechnic, Ibadan, I met many wonderful lecturers, and friendly course mates, yet, I had many questions about Urban and Regional Planning as a discipline. In 1998, my meeting with Dr Bolanle Wahab (now a professor of Urban and Regional Planning and a former Dean of the Faculty of

Environmental Design and Management, University of Ibadan) who just returned from his PhD study leave provided answers to my questions. I was fascinated by his professional acumen, diction and dressing sense. Bullet points from our conversation that day shaped my desire for excellence in Urban and Regional Planning.

In 2005, after completing my Master of Urban and Regional Planning (MURP) degree at the University of Ibadan, I could not pay the tuition fees and the Dissertation VIVA was to be cancelled. The external Examiner, Prof. Kayode Oyesiku intervened and the examination was conducted. It was at the end of the examination that one of the panel members, Prof. Tunde Agbola gave me a bank cheque to take care of the fees. The happening was a function of **time and chance**. If not, I would not have been able to graduate that year.

Shortly after Lead City University (LCU) got the approval of the Federal Government of Nigeria to start a university, one of my coursemates, Muyiwa Ayeni informed me of an advert that LCU has a vacancy for an urban planner to fill the position of a technologist. I applied and I was called for a writing test which was followed by an oral interview. During the interview, I was asked many questions about campus planning. Thence, the following conversation played out between myself and the Chairman of the interview panel, the Vice Chancellor, Prof (now Emeritus) Johnson Aladekomo.

VC: *'Young Lady— what did you apply for'*

My response: *'Technologist Sir'*.

VC: *'You are not talking like a technologist, can you teach'*

My response: *'Yes, I can. But I do not have NCE, B. Edu or M. Edu'*.
(There was great laughter among the panel members)

VC: *Okay. Can we consider her for a teaching appointment* (he directed the question to a man who was seated adjacent to the panel). I later got to know that the man is the Chairman of Eduserve Foundation, the proprietor of LCU, in person of Professor Babajide Owoeye.

I was later scheduled for another interaction and teaching demonstration. Prof. (Emeritus) Johnson Aladekomo is a graceful leader who provided hope for emerging scientists. I am one of such. I was offered the position of Assistant Lecturer, first as Adjunct staff in December, 2005. After a series of teachings and examinations based on the 6-week Block Modular system that LCU ran in those days, I was given a full-time appointment in April, 2006.

These highlighted events were not random occurrences. They were more than “right happenings”. They were **divinely orchestrated**.

ii. The Lesson of Golden Scar

In the Netherlands a group of fashion designers offer a “Golden Joinery” workshop. Inspired by the Japanese technique Kintsugi where broken porcelain is visibly repaired with gold, participants collaborate in mending clothes in ways that highlight the mending work rather than trying to mask it. Those who are invited bring “a dear but broken garment and mend it with gold.” As they remake their clothes the repair becomes ornamental a “golden scar.” (Amy Peterson in Daily Bread, October 20th, 2020).

My story can relate to the testimony in the narrated commentary. It was difficult to get a PhD admission into some Nigerian Universities because of the malevolent policy that is deliberately designed against non-university first-degree holders no matter their academic performance. At the completion of my training at the University of Ibadan, I was the best graduating student and I was the candidate with the best dissertation in my class during my Master of Urban and Regional Planning (MURP) study at the University of Ibadan. I did not see it as an issue because both the MURP and the MSc. were in the same class. We went through the same procedures and I was still the best. In my pursuit for a PhD admission, a drama was staged in my interaction with a professor in my discipline in one of the Nigerian Universities in August 2006 (Six months after the application for a graduate study was submitted) which I summarize as follows:

Grace: Good morning, Prof.

The Professor: Good morning, Grace (I was surprised that he knows me by name).

Grace: I am here concerning my application for a PhD study.

The Professor: Sorry, here is your application (he brought out my submission from a file). You will not do a PhD. You cannot do it.

Grace: May I know the reason, please? I have waited for the processing of the application in the last 6 months.

The Professor: You are still asking questions. While I am here, no Ph.D. admission for you. Your polytechnic background of course.

Summarily, his voice pierced my soul and my garment of career uplifting was torn. I was wounded!

A few days later, I regained my confidence. The wound was healed. But the scar was there. I started writing my Ph.D. project proposal even when admission was not in view. The only anchor for me was;

*Farmers who wait for perfect weather never plant. If they watch every cloud they never harvest....so you cannot understand the activity of God, who does all things (**Ecclesiastes 11:4–6; NIV**)*

In January 2007 by divine providence, Arc. Kunle Ifesanya's enquiry facilitated an opportunity for a PhD study for me at the University of Ado-Ekiti (now, Ekiti State University), Nigeria. Shortly after the first-year registration, many international opportunities in the form of scholarships, grants and fellowships came to facilitate my career. First was the scholarship by the International Science Foundation (IFS) and START International for training on Global Environmental Change and Water Resources at the UNESCO-IHE, in Delft the Netherlands in 2007. The International Human Dimension Programme (IHDP, Germany) sponsored me for special training on urbanization and health at the University of Jawaharlal Nehru, India in 2008. Of great value addition was the Doctoral Fellowship, sponsored by the IDRC, Canada under the first set of START African Climate Change Fellowship Programme (ACCFP). I was hosted by Prof. Urmilla Bob, the Discipline of Geography, University of KwaZulu-Natal, Durban, South Africa in 2009. These international exposures and experiences cumulated to assure me that **I can**. The broken garment was mended. The scar was painted with gold.

As part of the gold painting, I had the opportunity to bag a B.Sc. Geography from Joseph Ayo Babalola University (JABU), Nigeria in 2015, five years after completion of my doctoral study. Truly, the scar was

designed to limit my potential. *'By God's help I have made a way through the wall which was shutting me in; by the help of my God I have gone over a wall' (Psalms 18: 29, BBE)*. It is a journey that has been paddled with a painting hand of grace. I arose above the limitations.

iii. The Lesson of Pioneering

The philosophy of pioneering according to Merriam-Webster Dictionary is to begin something new or take part in the early development of something. Pioneering the establishment of a Private University in Nigeria was tough. It was the breaking of fallow grounds for proprietors of which EduServe Foundation was one. For me, being a part of LCU from scratch is a big lesson. I joined the University just nine months after the license of operation was obtained from the Federal Government of Nigeria. I witnessed the exodus from Jericho Campus, to Adegoke Campus, to Block A at Toll Gate Campus and now to where we are. The journey was quite rough and demanding for nearly all pioneer staff (teaching and non-teaching). In this regard, I acknowledge a few of such pioneers that we were together in the teaching line (at Adegoke and Jericho campuses): Profs. Olusola Ladokun, Tunde Adebo, Lambert Ihebuzor, Donald Ighodaro, Omolara Cambell, Akeem Amodu, Drs. Foluke Abimbola, Yemi Oginni and many others who endured and stood as the historic pillars of LCU.

When I joined LCU, my appointment letter did not specify the department I was to domicile. I thought it was an omission. But as things unfold, I realized it was designed to be so. I have laboured as a pioneer staff for many programmes at LCU. These include Introduction to Tourism and Hospitality Studies in 2005, Environmental Management in 2007, Department of Sociology and Psychology and Environment in 2009, Environmental Management and Toxicology in 2015, and Architecture and Estate Management in 2017. In 2021, I led the EDM faculty in the establishment of a BSc. Programme in Building, Urban and Regional Planning, Surveying and Geo-informatics, Tourism and Hospitality Management. In terms of administrative responsibilities, I have served as the pioneer Head of the Department for Architecture and Estate Management in 2017/2018, Head of the Department of Estate Management for 5 years (September 2017 to January, 2022), Head of the Department of Environmental Management and Toxicology in 2019. I have also served as Acting Dean of the Faculty of Environmental Design and Management 2019-2020. During these periods, I provided leadership for my team in presenting these programmes for both NUC and

Professional accreditations and with brilliant successes. In September 2020, I was appointed as a substantive Dean of EDM.

In addition, LCU allowed me to conceptualize and pioneer tailor-made Postgraduate Studies in the Built Environment, Environmental Management, Environmental Governance and Sustainable Development, Land Administration and Development. The development of courses and the synopsis of these programmes are my intellectual properties and contribution to higher education at Lead City University and in the Nigerian University graduate training. LCU gave me the platform to pioneer and lead the team that was teaching the general class for Research Design and Methods in which I developed the modules for both undergraduate and postgraduate levels (2017-2021). I was appointed as a PG thesis Compliance Assessor (2018-2021). I do not take these pioneering opportunities for granted. They have contributed to my making in the school of wisdom. The wisdom is that the beginning may be very simple, rough and timid. Yet, the impacts are growing in the process of time. From experience, I know that many pioneer staff of this University who are still privileged to be on stage now were faced with many challenges. Yet, they laboured to build a system. Again, I also know that such individuals are strong foundational assets without whom the building of the university system that we now have would have lacked structural pillars. I thank God, that I am one of the pioneer staff of Lead City University. My prayer is that this university will conquer more territories as we pursue total quality and societal relevance.

18. Conclusion: Water Wise Cities

As I conclude this lecture, we must be wise in conserving water resources. We must plan with water stakeholders based on some key messages that this inaugural lecture has highlighted. These include:

- Water is life. It is more than a sector. It is a connector that provides ecosystem services, supports living and livelihoods, facilitates social economic activities, gender equity, and poverty reduction and ensures political collaboration.
- Water is a main factor for settlement location. Its presence is an attractive force for population agglomeration in cities. Its supply shortages (in terms of quality or quantity) lead to urban thirst (dehydration, dryness, deadness and even extinction of human settlements) and amplification of other urban VUCA experiences.

- Natural climate systems and anthropogenic forces impact water regimes. The dimension of impacts of climate change is better explained with water shortages (including drought) and water surplus (including floods and other extreme weather events).
- Urban watersheds are losing their resources as a result of modification of land cover and urbanization trends in cities.
- Water stress amplifies the vulnerability of women (because they are the main water collectors in most indigenous communities), reduces ecosystems-based livelihoods and leads to the emergence and re-emergence of seasonal climate health risks.
- Water is related to poverty. The water poverty Index of informal communities is higher because her population has low coping capacity, weak social capital and poor resource governance.
- Autonomous coping and adaptation mechanisms that are already in use in most Nigerian cities are weak, uncoordinated and unsustainable.
- Adaptive water management must be formalized, planned and institutionalized as a critical development agenda.
- Africa Water Agenda is possible when the multidisciplinary nature of water is embraced.

I, therefore, call on all stakeholders to respond and build Water Wise Cities' through:

1. Scientific data which must be generated through co-production of knowledge to plan for urban water resources, needs and demands. When there is no data, there will be no plan. Water phenomenon must be harnessed through interdisciplinary science and collaboration of all stakeholders for urban water security.
2. Institutional radicalization of water agencies to govern water better through responsive localized policies.
3. Developing a water stewardship plan which should be anchored on water literacy for knowledge, attitude change and actions for sustainable use of water resources at all levels and for all purposes. When there is no plan, we have planned to die of thirst. This way, water-wise Africa will be achievable when we all wake up to the realities of being good water stewards
4. Let water breath. Stop wasting water. Do not dumping refuse into the water channels. Whatever you do to water resources has multiplier effects on human and ecological systems.
5. Drink water often. As an individual, do not wait until you are very Dehydration is real. Be a water wise citizen.

Acknowledgement

I have tried to document this acknowledgement according to some categories based on the chronology of events that culminate into this day. I sincerely apologize for the omission of names of individuals who deserve to be in this catalogue.

Mr. Vice Chancellor, Sir, my story is similar to the experience of Jethro's daughters in the Holy Bible, I arrived here because there were men of purpose from whom I received help.

First, my father, Pa. Micheal Abayomi Adeniji (JP), I appreciate your devotion and meticulous training of all your children in Western education and archival management. You believed in hard parenting and you followed it through with all the seeds from your loins. I thank you for your doggedness in checking my notebooks on each school day till I graduated from high school. You insisted that your children must work hard in all faithfulness to get to the top. I cannot forget the adage you gave to all your seeds very early: "no shortcut, the shortcut is with a long ruin in the long run" (*Ona Abuja o jana*).

My mother, Mama Racheal Adenihun Iyabode Adeniji (Mama Alaro No. 1), I thank you for your passion and virtue of support to see that your children become literate even though you did not have the opportunity of a formal education. I am grateful to God because your dreams are fulfilled right in your eyes. None of the seeds of your loins is without a university education. Amid many challenges, you taught us to hold faith, that better days are coming. '*Ojo n bo l'Oluwa wi*' was your slogan. I am delighted that you are alive to witness one of such good days.

I appreciate my siblings for their love, togetherness and support at different times. Engr. Gbadebo Adeniji, thank you for your input at the first registration of my graduate study at the University of Ibadan. Engr. Adeyemi Adeniji, thank you for the push, you brought out the best in me. Mrs. Adebukola Abiola, thank you for your prayers and the sisterhood love we shared. Engr. Anthony Adeniji (PhD) and Robert Adeniji (PhD in view), you are my darling brothers. You volunteered to be my field assistants very early in my career. Your devotion meant a lot. Mrs. Benedicta Adeleke, my nurse per excellence. You forfeited your admission to the School of Nursing in 2003 to stay with me during a critical ailment. I have

not stopped to be amazed at your caring virtue. I celebrate Mrs. Olukemi Adedokun, my aunt with a zealous heart for family affairs.

My journey has been helped by capable teachers. I thank all my teachers at Second Baptist Primary School, Okeho (Sukuu Gaa) and Okeho Iganna Grammar School, Meseole, Okeho. In particular, I appreciate Pastor Sangotoye Adeleye Amos (he led me to know the saving grace of Jesus in 1991). That single step made a huge difference in my life. I thank Pastor. Abraham Ojetunde (who encouraged my class to try the General Certificate Examination (GCE) when we were in SS2 Class. I celebrate my dear principal, late Dn. Moses Omolewu. This inaugural lecture is dedicated to him. I wish he could be here today to see the report card of his Senior Girl. As he continues to rest with his maker, may God preserve his seeds.

I am grateful to Mr Folorunso Adesina who facilitated my admission into the foremost Nigerian Planning School, The Polytechnic, Ibadan to undertake the Professional Diploma in Urban and Regional Planning (PDURP) in 1996 when all hopes were lost. I thank all my lecturers for their input. My training at the Polytechnic Ibadan is a total package for professionalism. Dr Adeniji-Soji, my project supervisor did well. Worthy of note is Prof. Bolanle Wahab who explained the career prospects of Urban and Regional Planning to me in 1998.

Deep appreciation for all my lecturers at the Department of Urban and Regional Planning, University of Ibadan. First to be appreciated is Prof. Olayiwola Egunjobi (Emeritus) who served as a prophet-teacher to me in 2003. I already gave up the idea of continuing my postgraduate study because of health challenges. He told me that he had a dream of what and who I could become. I appreciate God for his dream, the accurate interpretation of the dream and the hope to see a fulfilment of the dream. Where Herods and Pharaohs are busy killing dreams and the dreamers because of their megalomania tendencies, Prof. Olayiwola Egunjobi stood to see a dream coming to pass. For the seed of hope he planted in me, I am grateful.

I acknowledge the investment of Prof. Babatunde Agbola and his wife, Mrs. Eniola Agbola in my career's trajectory. Prof. Agbola stirred me up with great energy until the best of me was evident. He mentored me with passion in the art and craft of scientific writing right from when he supervised my MURP dissertation. He graciously edited the manuscript of this lecture.

I thank Dr. Femi Jolaoso for the language editing I am grateful to Dr. Segun Falola for the layout design of the manuscript of this lecture.

Prof. C.O Olatubara, thank you for the impactful knowledge of quantitative techniques, which has been a tool for my research and consultancy over the years.

I am grateful for the opportunity given to me by the Department of Geography and Planning Science, the Postgraduate School, University of Ado-Ekiti for my PhD study. I am deeply thankful to all my lecturers, in particular, Prof. Wole Adebayo and Prof. Wale Ibimilua for their faith in me that I could do it. I appreciate Prof. Owa Afolabi who agreed to supervise me at a critical time. He encouraged me so much that many international supports came my way in the course of my study. I finished within the record time of 3 years and many publications from the thesis gave me global visibility. I have enjoyed scientific benevolence from my external examiners at different stages of my studies. To this, I thank Prof. Kayode Oyesiku (for the MURP thesis) and Prof. Adeniyi Gbadegesin (for the Ph.D. thesis) who strongly advised me at different times that I must go beyond thesis writing to real scholarship.

To my university, Lead City University (LCU), Ibadan. I appreciate EduServe Foundation, for the courage with a clear vision of providing tertiary education and investment into human capital development in Nigeria., I thank the Council and the Management of the University for the opportunity to work and grow in this system from Assistant Lecturer to full professor. I thank the Chairman of the Council, Prof. Jide Owoeye who has given me so many challenging roles in the development of the University. He made me to stretch my intellectual elasticity. Instead of breaking, I am becoming a better academic. Thank you, sir, for the trust.

I am grateful to Prof. (Emeritus) Johnson Aladekomo (the first Vice Chancellor of this University) who chaired the interviews that led to my appointment to this university. He saw my potential. He is a scientist, a scholar and a great leader. He helped me with timely advice and referee's letters for international opportunities several times in the early years of my career.

I thank the Vice Chancellor, Prof. Remi Adeyemo for his leadership style. I celebrate the Registrar, Dr. Oyebola Ayeni for providing directions and support. My sincere thanks to the Librarian, Dr Lanre Osaniyi for his sharp skills and the Bursar, Dr. Kubi Taiwo-Taiwo for financial columns. I thank

the Director of Academic Planning, Dr. Adekolarin Adewole for the support during the accreditation of academic programmes. I appreciate Prof. Alaba Ogunsanwo for the fatherly admonition when the journey was very rough. I acknowledge Prof. Allan Femi Lana, for the support I enjoyed under his leadership when I was deployed to the Department of Biological Sciences at the commencement of the Environmental Management and Toxicology Programme. I appreciate Prof. Omolara Campbell, the Faculty of EDM emerged from Management and Social Sciences under her deanship. She constantly provides leadership support for various assignments that have come my way since we met at the Adegoke Campus in 2006. I thank Prof. Donald Odeleye, the Dean Faculty of Arts and Education for the support I have personally enjoyed from him and the friendliness of his team when his faculty and my faculty share common facilities.

I appreciate all other Deans; Directors of Units and Heads of Departments for the common hope we share in building LCU. I count it a privilege that I have worked with all of you in one way or the other. I appreciate the working relationship I had with Prof. S.A. Olateru-Olagbegi, Prof. Adetanwa Odebiyi, Dr Retta Akingbade, Mr. Dapo Adeboyejo and Mrs. Oluwaseun Emmanuel during my time in the Department of Environment, Sociology and Psychology.

With my appointment as the Coordinator for General Research Methods for both Undergraduate and Postgraduate classes and Thesis Compliant Assessor for the Postgraduate (PG) School, I was privileged to work with postgraduate students across many disciplines. To this, I thank Prof. Afolakemi Oredein (the provost, PG College) and all PG these supervisors for the privilege to work with you. The relationship has sharpened my interdisciplinary discourse prowess.

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*Thank you for the sunshine, the substance for all from all blue, green and brown waters
Thank you for the condensation, the gathering of vapours and the cloud formation which gives hope that wetness is coming*

Thank you for the rain and snow, which waters every dryness, gives refreshing to all creatures, bringing hopes of surviving

Thank you for the percolation that enriches the underground water

Thank you for the runoffs that the rivers and refill the oceans

Thank you for the lost hope when the thick cloud disappeared without a drop of rain

Thank you for the rain that came with the element of hazards making our living more risky

Thank you for the rocks which will yet give water to the thirsty

Thank you for all things

*Thank you for the water, the life is given and life support resource
Thank you for the Living Water, Jesus Christ who alone satisfies a thirsty soul.*

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Profile of Professor Grace Olufunmike Oloukoi

Professor Grace Olufunmike Oloukoi was born on the 22nd of June, 1977 to the family of Pa. Micheal Abayomi Ojigbede Adeniji (JP) and Mama Racheal Iyabode Adeniji (Mama Alaro No 1) of Okeho town, Oyo State, Nigeria. She attended Second Baptist Primary School, Ogan, Okeho where she was the Health Prefect Girl (1982-1988). Her secondary education between 1989 and 1994 was at Okeho/Iganna Grammar School, Meseole, Okeho, where she was made the Senior Prefect Girl in her final class. She gained admission to the Polytechnic Ibadan where she studied for a Professional Diploma in Urban and Regional Planning (Formerly known as Full Town Planning), a Five-year Professional Diploma programme between 1996 and 2001 and she graduated with Upper Credit. She had the compulsory National Youth Service Scheme at Urban Model College, Abakaliki, Ebonyi State between January and December, 2002.

She proceeded to the Nigerian Premier University, the University of Ibadan for a Master of Urban and Regional Planning (MURP) between 2003 and 2005. She was the best graduating student and her dissertation was the best in her set. She obtained a Doctor of Philosophy in Geography and Planning Science from the University of Ado-Ekiti in 2010. She later went to Joseph Ayo Babalola University (JABU) to bag B.Sc. Geography in 2015. She has a Certificate in Advanced Institute on Global Environmental Change and Vulnerability of Water Resources from UNESCO-IHE in 2007 and a Certificate from AffiAlliance and Open Water Education on Water and Climate Change in Africa in the Netherlands in 2019. She also has a certificate in Social Science Methods for Urban Research, from the Institute for Housing and Urban Development Studies (IHS), Erasmus University Rotterdam, in 2020.

Her area of research includes Environmental Resources Management, Urban planning and Climate Adaptation with a special interest in water issues within environmental systems.

She is a Registered Member of the Town Planners Registration Council of Nigeria (TOPREC) in October 2006 with the registration Number (RTP 1550). She became a registered Member of the Nigerian Institute of Town Planners (NITP) in October 2005 with the Full membership number (MNITP 1841) and a Fellow of NITP in October 2022 (FNITP 421). She is also a member of the Gender and Water Alliance (GWA), the Netherlands, a Fellow of the African Climate Change Fellowship Programme (ACCFP), USA, and a Research Fellow of the Earth System Governance (ESG) Project, Faculty of Geo-Sciences, Utrecht University, The Netherlands.

Oloukoi started her teaching career in 2001 as a Volunteer Community Teacher handling Biology and Geography at Awoyemi Commercial High School, Okeho, Oyo State. She taught Geography and Mathematics at Urban Model High School,

Abakaliki, Ebonyi State as a National Youth Service Corps (NYSC) member in 2002. She was an Adjunct Staff in the Department of Urban and Regional Planning, The Polytechnic, Ibadan between 2003 and 2005. Immediately after her MURP study, she served as a Research Assistant with the Institute for Human Settlement and Environment (IHSE), Ibadan between June and December, 2005. She joined the service of Lead City University, Ibadan first as an Adjunct Staff in December 2005. She was given a Full-Time Appointment in April 2006 as Assistant Lecturer. She was regraded to Lecturer II in April 2007 after she had a professional license with the Town Planners Registration Council of Nigeria (TOPREC). She was promoted to Lecturer 1 in April 2009, Senior Lecturer in December 2012, Reader in July 2017 and Full Professor in November 2020 which made her the first Professorial Chair of Urban Planning and Environmental Management, Lead City University, Ibadan.

Professor Oloukoi has received several recognitions for her research career, including special trainings, fellowship awards and international collaborations. These include the first set of Young Africans to be trained under the Advanced Institute on Global Environmental Change and Vulnerability of Water Resources in UNESCO-IHE, Delft, The Netherlands with funding from the International Science Foundation (IFS) and START International in 2007. She has special training on Global Environmental Change and Urban Health at the School of Environmental Studies (SES), Jawaharlal Nehru University, New Delhi, India in 2008 with support from the International Dimension Programme (Germany). She was a Visiting Scholar at the University of KwaZulu Natal, Durban South Africa under the African Climate Change Fellowship Programme in 2009. She was also awarded the Visiting Scholarship by the MIT-UTM Malaysia Sustainable Cities Program, Department of Urban Studies and Planning, Massachusetts Institute of Technology (MIT) (Boston) in 2017.

Professor Oloukoi is a recipient of some research grants. These include a study on 'Women and Water in the Oke-Ogun region, Oyo State, Nigeria, under the African Climate Change Doctoral Research Grant founded by the International Development Research Center IDRC (Canada) and Department for International Developments (DFID, UK) and START International (USA) (2009).

- Community and natural resources for the improvement of livelihoods and food security in the Nigerian Savanna funded by the International START Secretariat through the grant for the Global Environmental Change (GEC) Africa Project, Climate Knowledge Development Network (CDKN) and the United States Global Change Research Program from 2011 to 2013.
- Comparative study on Land use pattern in the climatic transition zone of Benin and Nigeria which was Funded by the Council for Development of Social Science Research in Africa (CODESRIA) from 2013 to 2015.
- Nigerian Urban Water Stewardship Project which was founded by the United Nations Industrial Development Organization (UNIDO) from 2016 to 2018.

Currently, Prof. Grace Oloukoi leads the Nigeria Team on a project called, 'A Pan African and Transdisciplinary Lens on the Margins: Tackling the Risks of Extreme Events (PALM-TREES) which is funded by the Canadian International Development Research Centre (IDRC) Climate Adaptation and resilience (CLARE) Scheme.

Grace Oloukoi is a recipient of many Travel Grants which enabled her to present scientific papers in many international conferences. Some of these are:

- Gender and STEM in Africa, held in Rwanda, 2018.
- Pan-Africa Union Education Forum, Ethiopia (2017)
- Africa Climate Conference held in Arusha, Tanzania (2013).
- 2nd Scientific Conference of the UNCCD on Economic Assessment of Desertification in the Arid Region held in Bonn, Germany (2013).
- Writeshop organized by Global Change Systems Analysis for Research and Training, Virginia, USA (2012).
- International Conference on Sustainable Development of Natural Resources in Africa at the United Nations University-Institute for Natural Resources Assessment (UNU-INRA), Ghana (2011).
- International Colloquium on Climate Change Adaptation Organised by the Centre for Environmental Monitoring (CSE) and the National Committee InfoClim, Dakar, Senegal (2010).
- Forum on Education, Capacity Building, and Climate Change: A Strategy for Collective Action in Africa. in Dar es Salaam, Tanzania (2010).
- The World Bank's 5th Urban Symposium on "Cities and Climate Change, held in Marseille, France (2009).
- Open Science Conference on "Biodiversity and Society held at Cape Town, South Africa (2009).
- International Conference on Empowerment of Civil Society in Urban Policies organized by the UNESCO Chair on Urban Policies, Porquerolles Island, France (2009).
- 6th IHDP International Human Dimension Workshop at New Delhi, India (2008).
- Prof. Oloukoi is a well-travelled scientist who has shared her scientific outputs in many other meetings across global spaces: Germany, Canada, Nepal, Benin Republic and UAE.

Professor Oloukoi is prolific and her works are evident in refereed journals and book chapters in both national and international journals and conference proceedings. She has 81 scientific outputs to her credit. These include 3 books, 18 chapters in books, 29 articles in journals, 5 Technical Reports, 25 papers in conference proceedings and 1 documentary on Urban Waste. One of her scientific publications, '**Households' coping strategies for climate variability related water shortages in Oke-Ogun region, Nigeria**' was the most popular article in 2013 by Elsevier, *Environmental Development*, 5(2013): 23-38. She has

also presented many papers in scientific and public meetings where she served as Guest Lecturer, Keynote Speaker, Discussant, Chair, Co-chair and Convener.

Oloukoi has immensely contributed to academic training and mentorship. She has supervised 8 BSc. Dissertations, 12 PGD Dissertations, 26 M.Sc. Theses, 1 MPhil thesis and 1 PhD Thesis. She is currently supervising 6 Ph.D. students in Built Environment, Tourism and Hospitality Management, 3 of which are ready for their theses VIVA in a matter of days.

She has served in many capacities within Lead City University Community. These include Programme Coordinator for Environmental Management (2014-2016), Coordinator for Tourism and Hospitality Management Programme, Pioneer Head of the Department of Environmental Management and Toxicology (2019), Pioneer Head of Department of Architecture and Estate Management (2017-2018), Head, Department of Estate Management (2018-2022), Acting Dean (2019-2020) and Pioneer Dean, Faculty of Environmental Design and Management (2020-Date). She is a member of the Senate (2017 – Date). As the Team Leader for the University's General Research Methods Class, she developed training modules for the course for both Undergraduate and Postgraduate levels and championed and coordinated the teaching with three other scientists. She was Appointed as a Compliance Officer for Postgraduate Theses in 2020.

These positions have provided her with opportunities to initiate new academic programmes, and work on Curriculum Development and Programme Accreditation in which her team have received tremendous success for both the National University Commission (NUC's) and Professional Bodies. She has initiated and developed training modules for some interdisciplinary programmes: Graduate studies in Environmental Management, MPhil/Ph.D. in Built Environment, MPhil/Ph.D. in Land Administration and Development, Environmental Governance and Sustainable Development. These programmes are Oloukoi's intellectual contribution to the education curriculum in Lead City University and a foremost to be reckoned with in the Nigerian University system. Presently, the programmes have more than 50 candidates, 7 of which are ready for the VIVA of their PhD theses.

Outside the University, Professor Oloukoi has served as External Examiner and PhD Thesis Arbitrator to the University of KwaZulu-Natal, South Africa and Nelson Mandela University, South Africa. She has also consulted for government and development agencies such as the UNIDO project on Water Stewardship, Water and Sanitation Issues, Campus Master Plan, City-Based Master Plan, Urban water infrastructure and Climate Adaptation. She has also collaborated with Industries such as Guinness Nigeria and Lagos Business School on water-related issues. She participated in the review of Ibadan Master Plan Document Water Stewardship projects of Oyo State. Grace Oloukoi has also been privileged to serve in Leadership with: Baptist Student Fellowship (Campus and church-

based), The Vineyard Assembly Incorporated, Ibadan and All Souls Chapel, O.A.U Campus, Ile-Ife, Nigeria.

Prof. Oloukoi has a Certificate in Leadership Training from the Twelve Institute of Leadership, Nigeria where she has also served as a co-coach for some training streams. She is the Founder and Executive Director of Water for Life Support Foundation, a Non-Governmental Organization (NGO) that focuses on advocacy, research and adaptation actions towards improved water accessibility for marginalized communities.

Grace is married to Joseph Oloukoi, a Professor of Geospatial Information Science, and the marriage is blessed.