Climate Resilience as a Business Opportunity for Nigeria's ICT Sector

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GLOSSARY OF KEY TERMS

Climate Change: A long-term shift in global weather patterns caused by human activity, such as the burning of fossil fuels, deforestation, and land-use changes. Climate change can result in rising temperatures, sea level rise, changes in precipitation, and more frequent and severe weather events.

Climate Mitigation: Actions taken to reduce the greenhouse gas emissions that contribute to climate change, such as promoting renewable energy, improving energy efficiency, and reducing deforestation.

Climate Resilience: The ability of a community or system to adapt and recover from the impacts of climate change. Climate resilience involves reducing vulnerability to climate hazards and strengthening adaptive capacity. Climate Vulnerability: The degree to which a community or system is susceptible to harm from climate change, based on its exposure, sensitivity, and adaptive capacity.

Climate Adaptation: The process of adjusting to the impacts of climate change in order to minimise harm and take advantage of opportunities. Climate adaptation involves implementing strategies to reduce vulnerability and build resilience to climate impacts.

Climate Justice: The concept of fair and equitable distribution of the benefits and burdens of climate change and climate policy. Climate justice recognises that vulnerable populations, particularly low-income communities and communities of colour, are disproportionately impacted by climate change and environmental degradation.

Green Economy: An economic system that promotes sustainable development and addresses environmental challenges, such as climate change and biodiversity loss. The green economy includes sectors that provide environmental goods and services, such as renewable energy, sustainable agriculture, and green infrastructure.

Nationally-Determined Contribution (NDC): A pledge made by each country under the Paris Agreement, which outlines their proposed actions to reduce greenhouse gas emissions and adapt to the impacts of climate change. The NDCs are submitted every five years and are a key component of the global effort to address climate change.

Greenhouse Gas Emissions: These are gases released into the atmosphere that trap heat and contribute to global warming, such as carbon dioxide, methane, and nitrous oxide.

Net Zero: A state where the amount of greenhouse gas emissions produced is equal to the amount removed from the atmosphere, resulting in a balance of zero emissions.

Renewable Energy: Energy that is generated from sources that are replenished naturally and sustainably, such as solar, wind, hydropower, and geothermal.

INTRODUCTION

Climate change is a complex and pressing global issue that threatens the sustainability of ecosystems and human societies. The effects of climate change are evident in extreme weather events, rising sea levels, and increased frequency of natural disasters. In response, there is a growing need for countries, regions, and communities to develop climate resilience strategies to withstand the impacts of climate change while maintaining their economic, social, and environmental systems.

Climate resilience has become an important concept in the climate milieu, encompassing the ability of society to cope with and manage the effects of climate change while also preventing those effects from growing worse. A climate-resilient society would need to be equipped to handle the challenges of a warming world while also maintaining a low-carbon footprint.[1] Climate resilience, therefore, encompasses several concepts ranging from climate vulnerability, climate mitigation, climate adaptation, and climate justice which are key to addressing climate change.

The Intergovernmental Panel on Climate Change (IPCC), the world's global authority on climate science in the Synthesis Report (SYR) of its Sixth Assessment Report identified that there are between 3.3 and 3.6 billion people around the world who are living in areas that are particularly susceptible to the negative impacts of climate change.[2] It further noted that low-emitting countries, like the Least Developed Countries (LDCs) and Small Island Developing States (SIDS), are highly vulnerable to the impacts of climate change, despite contributing very little to global greenhouse gas emissions. Regions such as West, Central, and East Africa, South Asia, Central and South America, SIDS, and the Arctic are especially susceptible to the effects of climate change.[3]

This vulnerability is a result of a range of factors, including their dependence on climate-sensitive sectors such as agriculture and fisheries, their limited capacity to adapt to changing environmental conditions, and their exposure to extreme weather events and other climatic hazards. Hence, the need for these vulnerable countries to build resilience to the impacts of climate change and ensure sustainable development in the face of this global challenge.

Nigeria, like many other African countries, is highly vulnerable to the effects of climate change due to its geographical location, high population density, and heavy reliance on agriculture as a source of income and food security. Nations of the world with similar traits like China, India and Netherlands have leveraged technology, particularly ICT to build climate resilience and even begun the transition to green economies. With Nigeria's update of its Nationally-Determined Contribution (NDC) to the UNFCCC in 2021, the country needs to begin maximising its burgeoning ICT sector to build climate resilience as it strives to fulfil its NDC. This has expectedly opened numerous business opportunities for the ICT sector to take the lead in Nigeria's climate resilience building efforts. The ICT sector already contributes a sizeable 16.51% of the national GDP as of 2022 and through climate resilience business opportunities, it can grow this contribution even further.[4]

This research examines the state of climate resilience in Nigeria and the emergent business opportunities for Nigeria's ICT sector to contribute to the nation's transition to a green economy by providing innovative solutions that will entrench climate resilience in the country.

Climate Resilience in Nigeria

In recent years, Nigeria, the most populous country in Africa, has experienced a range of climate-related disasters, including floods, droughts, and desertification, which have severely impacted the country's economy, social fabric, and environment. Notably, in 2012, the country was hit by severe flooding that affected seven million people and caused economic damages estimated at $500 million or over N79 billion.

1. CLIMATE RESILIENCE IN NIGERIA

In recent years, Nigeria, the most populous country in Africa, has experienced a range of climate-related disasters, including floods, droughts, and desertification, which have severely impacted the country's economy, social fabric, and environment. Notably, in 2012, the country was hit by severe flooding that affected seven million people and caused economic damages estimated at $500 million or over N79 billion. The Post Disaster Needs Assessment (PDNA) report following the 2012 flood indicated that the total damage caused by the disaster amounted to $16.9 billion or N2.6 trillion in 2012, representing 1.4% of real GDP growth that year.

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Additionally, in 2015, another severe flooding event impacted one million people and resulted in damages of approximately $25 million or N4.92 billion.[5] In 2022 over one million people were displaced in the seasonal flooding that affected 33 out of 36 states.[6] As such, it is crucial for Nigeria to develop and implement effective adaptation strategies to mitigate the impacts of climate-related disasters and maintain sustainable economic growth. This involves investing in infrastructure that can withstand climate-related disasters, such as flood-resistant housing and resilient transport systems. It also requires promoting sustainable agriculture practices that can adapt to changing climatic conditions, such as agroforestry and climate-smart agriculture.

1.1 Current State of Climate Resilience in Nigeria

According to the Notre Dame Global Adaptation Initiative Country Index, in 2020, Nigeria was the 53rd most vulnerable country and the 179th most ready country in terms of climate resilience. Thus, underpinning the huge gap that needs to be closed for Nigeria to build strong climate resilience.[7]

Hitherto, efforts to respond to the challenges of climate change occasioned the development of the

The Nigeria Erosion and Watershed Management Project (NEWMAP), launched in 2013, represented a highly significant investment towards building climate resilience, with a commitment amount of $900 million from the World Bank.

National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN) in 2011. The NASPA-CCN aimed to enhance the resilience of vulnerable communities to the impacts of climate change, as well as to build capacity for adaptation planning and to mainstream climate change adaptation into sectoral policies.[8]

In 2012, Nigeria launched the Nigeria Climate Change Policy Response and Strategy (NCCPRS) as part of its commitment to mitigating the adverse effects of climate change. The NCCPRS was introduced in response to the rising incidence of extreme weather events, food insecurity, droughts, and floods, amongst other impacts of climate change. The policy aimed to promote low-carbon emissions and encourage sustainable practices in various sectors of the economy.[9] Additionally, the Nigeria Erosion and Watershed Management Project (NEWMAP), launched in 2013, represented a highly significant investment towards building climate resilience, with a commitment amount of $900 million from the World Bank.[10]

A watershed moment for Nigeria's commitment to climate resilience occurred on September 22, 2016, when President Muhammadu Buhari signed the Paris Agreement on the sidelines of the 71st UN General Assembly.[11] This signalled Nigeria's commitment to global climate action and its determination to mitigate the impacts of climate change. This commitment was reiterated in 2021 in Nigeria's Adaptation Communication to the United Nations Framework Convention on Climate Change, which outlines the country's progress and plans for implementing its NDCs. The Communication states that Nigeria is working to implement policies, strategies, and investments tailored towards adaptation for climate resilience to achieve its emissions reduction targets.[12]

In 2021, the Nigerian government's Department of Climate Change, under the auspices of the Ministry of Environment, introduced the National Climate Change Policy (NCCP) for the period spanning 2021 to 2030.

Nigeria submitted its NDCs in 2016, committing to reduce greenhouse gas emissions by 20% unconditionally and up to 45% conditionally by 2030, compared to business-as-usual levels. The conditional target is subject to international support, including finance, technology transfer, and capacity building. In addition to these emissions reduction targets, Nigeria's NDCs also include a range of adaptation measures, such as the promotion of climate-smart agriculture, afforestation and reforestation, and the development of early warning systems for extreme weather events.[13]

The government has since launched several initiatives to promote climate resilience in the country. For example, the Nigerian Climate Innovation Centre (NCIC) was established in 2018 to support the development and commercialisation of innovative climate technologies. The centre provides funding, training, and mentorship to entrepreneurs who are working on climate-related solutions.[14]

Also, in 2021, the Nigerian government's Department of Climate Change, under the auspices of the Ministry of Environment, introduced the National Climate Change Policy (NCCP) for the period spanning 2021 to 2030. The NCCP builds on the foundation laid by the NCCPRS and sets out a comprehensive roadmap for addressing climate change in Nigeria. The policy identifies the conditions necessary for Nigeria to achieve its vision of becoming a climate-resilient economy. It recognises the role of both the government and the private sector in promoting sustainable development and reducing greenhouse gas emissions. The policy also emphasises the importance of building climate resilience in vulnerable communities, including [among] women, youth, and marginalised groups.[15]

Despite these efforts, Nigeria still faces significant challenges in building climate resilience. One of the key challenges is the lack of data and information on the impacts of climate change in the country. This makes it difficult to design effective adaptation strategies and policies. In addition, there is a lack of political will and funding for climate resilience initiatives, which has hindered progress in this area. Another challenge is the limited capacity of communities to adapt to the impacts of climate change. Many communities lack the knowledge and resources to develop and implement effective adaptation strategies. This is particularly true for marginalised communities, such as women and youth, who are more vulnerable to the impacts of climate change. These myriad challenges, however, present landmark opportunities for Nigeria's Information and Communications Technology (ICT) sector to provide solutions that will foster resilience and enhance Nigeria's transition into a green economy.

ICT-Driven Economic Growth

As Africa's largest economy, the ICT sector has been identified as a major contributor to its growth and development, accounting for about 16.51% of Nigeria's Gross Domestic Product (GDP) in 2022.

2. ICT-DRIVEN ECONOMIC GROWTH

The ICT sector has emerged as a key driver of economic growth in Nigeria in recent years. As Africa's largest economy, the ICT sector has been identified as a major contributor to its growth and development, accounting for about 16.51% of Nigeria's Gross Domestic Product (GDP) in 2022.[16]

Nigeria's ICT sector has witnessed significant growth over the past decade, driven by factors such as increased mobile phone penetration, a growing middle class, and government support for ICT infrastructure development. This growth has led to the emergence of a vibrant ICT ecosystem in Nigeria, including start-ups, tech hubs, and a growing pool of skilled ICT professionals.

The importance of the ICT sector in driving economic growth in Nigeria is reflected in its potential to create jobs, promote innovation and entrepreneurship, and enhance productivity and efficiency across all sectors of the economy. For instance, the use of fintech applications and mobile money has expanded financial inclusion in Nigeria, enabling more people to access banking services and participate in the formal economy. The EFInA Access to Financial Services in Nigeria 2018 survey produced noteworthy results on the status of financial inclusion in Nigeria. The survey revealed that a considerable 39.7% of the adult population, or 39.5 million adults, have a deposit money bank account. This

represents a 2.6 million increase from the 36.9 million adults with bank accounts in 2016. Additionally, the formally included segment, which refers to adults with access to formal financial services, increased from 46.9 million in 2016 to 48.4 million in 2018.[17]

Furthermore, the ICT sector has the potential to drive Nigeria's digital transformation, enabling the country to harness the power of technology to solve complex challenges such as poverty, healthcare, education, agriculture, transportation and disaster management. For instance, the use of e-learning platforms and solutions is already improving access to quality education in Nigeria with public and private sector deployment of e-learning and assessment solutions, notably, the transition to computer-based testing by the Joint Admissions and Matriculation Board (JAMB), and emergence of e-learning platforms like uLesson, Utiva and Passnownow that leverage technology to promote learning. Also transportation has been increasingly democratised and with the proliferation of ride hailing applications like Uber, Bolt, Indriver, etc. These ride sharing apps help to limit emissions with fewer vehicles on the road.

Similarly, climate resilience is another virgin frontier awaiting the mass deployment of ICT-driven solutions to drive it.

3. OVERVIEW OF POTENTIAL BUSINESS OPPORTUNITIES IN CLIMATE RESILIENCE FOR THE ICT SECTOR

Nigeria's ICT sector has the potential to drive innovation and build resilience against the impacts of climate change by developing solutions in areas such as weather forecasting, flood monitoring, precision agriculture, and renewable energy; the latter of which is becoming quite popular in the country. For example, studies have estimated concentrated solar thermal power potential in Nigeria at over 427,000 MW.[18] Hence, renewable energy optimised by smart grids could be highly consequential in helping the country transition to a low-carbon economy.

However, there is still a lot of work to be done to build resilience against the impacts of climate change in Nigeria. According to recent projections, achieving a Net Zero status by 2060 would require a substantial financial commitment of $1.9 trillion. This figure includes an additional expenditure of $410 billion above the anticipated usual spending. Translated into an annual cost, this represents an approximate amount of $10 billion.[19] This presents a significant opportunity for the ICT sector to develop climate resilience solutions that can help Nigeria transition to a green economy and build resilience against the impacts of climate change in areas including:

3.1 Early Warning Systems

3.1.1 Weather Forecasting and Early Warning Systems
Nigeria experiences extreme weather events such as floods, droughts, and heatwaves. The development of weather forecasting and early warning systems can help communities prepare for these events and reduce the negative impact on lives and property.

The ICT sector can leverage its expertise in technology and data management to develop these systems and improve their accuracy and effectiveness. This includes innovative technologies such as mobile applications which can provide real-time weather forecasts, storm tracking, and flood alerts. These mobile applications can also be customised to meet the specific needs of vulnerable Nigerian communities.

To ensure the effectiveness and accuracy of weather forecasting and early warning systems, the ICT sector should also seek to collaborate with meteorological agencies and government bodies. These agencies have access to weather data and expertise in meteorology, which can be invaluable in developing reliable and accurate weather forecasting and early warning systems. Collaboration with these agencies will ensure that mobile applications are tailored to the specific needs of Nigerian communities and that they are based on the most up-to-date weather data.

A notable development in this regard that needs to be maximised through collaboration is the deployment of an equatorial low-latitude SuperDARN by Bowen University, Iwo, Nigeria. Christened the 'Virginia Tech - Nigerian Bowen Equatorial Aeronomy Radar (VT-NigerBEAR)', Bowen University's is the 36th Super Dual Auroral Radar Network (SuperDARN) in the world. It is also the first in the low-latitude part of the globe.[20]

The SuperDARN is a network of High Frequency (HF) radars that continuously monitor and study the upper atmosphere of the Earth. These radars operate 24/7 and observe the movement of charged particles, also known as plasma, in the ionosphere. By doing so, they provide scientists with valuable information about Earth's space environment. The information collected by the SuperDARN provides insights into space weather hazards and helps scientists to better understand the behaviour of our planet's atmosphere.[21]

Speaking during the launch of the SuperDARN, Vice-President Yemi Osinbajo noted it "can radically transform communications-infrastructure, space research, equipment design, geo-mapping, forecasting and prediction of atmospheric, climatic and oceanic conditions within Nigeria and the near low latitudes."[22]

3.2 Risk Knowledge & Analysis

3.2.1 Precision Agriculture Solutions
Precision agriculture solutions offer immense potential for Nigeria to increase agricultural productivity and food security while mitigating the impacts of climate change. According to the National Bureau of Statistics (NBS), agriculture accounted for about 24.05% of the country's Gross Domestic Product (GDP) in 2022.[23] However, the sector faces several challenges, including limited access to information, inputs, and finance, as well as poor infrastructure and climate variability.

Precision agriculture solutions can address some of these challenges by providing farmers with real-time data on soil and crop health, enabling them to make informed decisions on crop management. IoT devices, in particular, can collect data from multiple sources, including sensors, satellites and drones, and provide farmers with actionable insights on when to irrigate, fertilise, and apply pesticides. This can help farmers reduce input costs, increase crop yields, and improve the quality of their produce.[24]

Several countries have already implemented precision agriculture solutions to boost their agricultural

productivity. In India, for instance, the government launched the Pradhan Mantri Fasal Bima Yojana scheme, which uses satellite imagery and IoT devices to assess crop damage and provide insurance payouts to farmers.[25]

In Nigeria, precision agriculture solutions are still in their infancy, and there is a need for greater investment in research and development to enable their widespread adoption. The ICT sector can play a crucial role in developing and implementing these solutions by collaborating with farmers, researchers, and policymakers. The sector can also leverage existing technologies, such as mobile phones and drones, to provide farmers with access to real-time data and market information.

IoT devices for precision agriculture can be adapted to the specific needs of Nigerian farmers, considering the diversity of crops and agro-ecological zones. For instance, the deployment of low-cost soil moisture sensors in rice paddies can enable farmers to optimise their water use, thereby reducing water waste and increasing rice yields. Similarly, drones equipped with multispectral cameras can be used to monitor crop health and detect pest infestations, enabling farmers to take timely action to protect their crops.

3.2.2 Risk Assessment Tools

One area of opportunity for the ICT sector is the development of digital risk assessment tools. These tools can utilise data on climate patterns, infrastructure vulnerabilities, and socio-economic factors to assess the potential risks associated with climate change. By leveraging data analytics, machine learning, and modelling techniques, Nigerian ICT companies can create sophisticated risk assessment platforms that provide accurate and actionable insights on ESG factors. These tools can help businesses and communities understand their exposure to climate risks and make informed decisions to enhance their resilience.

For example, the Sustainable Finance Diagnostic Toolkit is a comprehensive online questionnaire comprising 10 steps.[26] Its purpose is to assist in the development of a national sustainable finance status report and guide the formulation of a sustainable finance roadmap. This roadmap serves as an agenda to achieve consensus on key measures and actions required to advance sustainable finance within the country.

The toolkit draws upon extensive research and analysis conducted by the UNEP Inquiry into the Design of a Sustainable Financial System and the International Network of Financial Centres for Sustainability (FC4S). It has been specifically designed and made available online as part of the Aligning Finance Policies project, which is funded by the Global Environment Facility (GEF).[27]

3.3 Preparedness and Response

3.3.1 Flood Monitoring and Management Systems

Flooding is a recurring problem in Nigeria, especially during the rainy season. For example, 600 people died and over 1 million people were displaced in the 2022 seasonal flooding which affected 33 out of Nigeria's 36 states.

Flood monitoring and management systems can be developed using remote sensing and GIS technologies to model and detect floods, provide real-time information to emergency responders, and manage flood risk. These systems can enable authorities to respond more effectively to floods by providing accurate and timely information on the location, severity, and duration of flooding events.

One example of a flood monitoring and management system is the European Flood Awareness System (EFAS), which is operated by the European Commission's Joint Research Centre (JRC). The EFAS uses a combination of meteorological and hydrological data to generate early flood warnings, which are then disseminated to relevant authorities and stakeholders. Drones can also be used to map flood-prone areas and monitor floods in real-time through drone-based flood mapping and monitoring systems. These systems can provide accurate information on flood risk, enable authorities to assess flood damage, and inform post-flood recovery efforts. For example, the Global Facility for Disaster Reduction and Recovery (GFDRR) is providing support to the city of Dar es Salaam in Tanzania through an initiative called Ramani Huria. This initiative aims to improve the resilience of vulnerable neighbourhoods to flooding by using community mapping. Through this project, university students and local community members are trained to use open-source mapping platforms to create maps of areas in the city that are most prone to flooding. They are also taught to use new technologies such as drones to gather information that helps them identify vulnerabilities in their community.

In Nigeria, the use of flood monitoring and management systems can significantly reduce the impact of flooding on communities. The Federal Government has already taken some steps in this regard, such as the installation of hydrological stations across the country to monitor water levels and flow. However, there is still much room for improvement, particularly in the use of ICT to enhance flood monitoring and management.

3.3.2 Renewable Energy Solutions

Nigeria's power sector is characterised by poor distribution infrastructure, high transmission and distribution losses, and low levels of access to electricity. Renewable energy solutions have the potential to play a significant role in Nigeria's transition towards an energy efficient and low-carbon economy. According to the International Renewable Energy Agency (IRENA), Nigeria has abundant renewable energy resources, including solar, wind, hydro, and biomass. However, renewable energy only accounts for a small fraction of the country's electricity generation, with the majority of electricity still coming from fossil fuels.[28]

Nonetheless, with the signing of the 2023 Electricity Bill into law, which provides a more robust and democratic framework to guide the post-privatisation phase of the Nigerian Electricity Supply Industry, Nigeria is set to witness a boost in private sector investments into the power sector, notably in the area of renewable energy.[29] The new law permits states to issue licences to private investors who have the capacity to operate mini-grids and power plants.

Furthermore, under the Nigeria Electricity Act, electricity generation licensees have a responsibility to fulfil renewable generation obligations as prescribed by NERC. In order to foster a thriving market for renewable energy and encourage investments in the sector, electricity generating companies will be required to engage in one of the following activities: generating power from renewable energy sources, purchasing power generated from renewable energy, or acquiring any instrument that represents renewable energy generation.[30] These developments have therefore increased the scope of business opportunities available to the ICT sector in the area of renewable energy.

The sector can leverage the following renewable energy sources to enhance Nigeria's transition to a green economy and boost climate resilience:

Solar Energy

Nigeria benefits from an average solar radiation of approximately 3.5 - 7 kWh/m² per day, making it conducive for solar energy generation. This remains the most popular renewable energy source in Nigeria and has witnessed an upsurge in use by businesses and households in light of rising fossil fuel and electricity prices.

To further broaden access, the Nigerian government has introduced initiatives like the Solar Power Naija Programme. This programme has set a target to provide 5 million off-grid solar connections to rural households, aiming to improve energy access and affordability in remote areas.[31] Additionally, private sector solar companies, such as Lumos, have played a vital role in democratising access to solar power. Through their subscription-based solar power generation kits, customers can obtain the kits on credit and repay over time, making solar energy more accessible to a broader population.[32]

Other innovative ICT-driven solar companies like Arnergy Solar have embraced advanced technologies to capitalise on this growing sector. By employing IoT-enabled solar power systems and cloud-based monitoring platforms, they offer reliable and affordable solar energy solutions for both homes and businesses. These technological advancements enable efficient energy generation, real-time monitoring, and optimisation of solar power systems, ensuring consistent and cost-effective energy supply.[33]

By investing in digital infrastructure, data analytics, and IoT integration, the ICT sector can contribute to the development of smart solar energy solutions. These solutions can include remote monitoring, energy management systems, and predictive maintenance, improving the overall efficiency and performance of solar energy generation.

Wind Energy

Notably in the northern and coastal regions, Nigeria boasts substantial wind resources, with wind speeds ranging from 2 to 8 m/s on average.[34] While this is a relatively unexplored renewable energy source in Nigeria, Vergnet, a French wind turbine manufacturing company is helping Nigeria blaze the trail with the setup of the Katsina Wind Farm on the initiative of the Federal Ministry of Power and co-funded by Japan International Cooperation Agency (JICA). The Katsina Wind Farm is projected to generate 10MW. This groundbreaking initiative has however suffered setbacks with its commissioning date being continually moved.[35]

Though the Nigerian government has set a target to achieve 30% of its electricity generation from renewable sources by 2030, including a significant contribution from wind power, the success of this goal can be positively influenced by the inclusion of the ICT Sector. The sector can help to employ advanced wind resource assessment techniques and remote monitoring systems to optimise wind farm performance, much like what General Electric has done with its Digital Wind Farm product.[36]

GE's Digital Wind Farm product offers a cohesive solution consisting of a 2MW wind turbine and advanced wind power software. This integrated system enables continuous monitoring and optimisation of the

turbine's performance during energy generation. By combining hardware and software, the integration can potentially increase energy production by up to 20%. This enhanced efficiency translates to approximately $100 million in additional revenue generated over the lifespan of the wind turbine. The Digital Wind Farm product exemplifies the substantial financial benefits and operational advantages that arise from leveraging wind energy software to maximise the output and profitability of wind turbines.[37]

Biomass Energy

Nigeria possesses abundant biomass resources, including agricultural residues, municipal solid waste, and biomass from the forestry and livestock sectors. Nigeria faces significant waste management challenges, making waste-to-energy an attractive solution for both waste disposal and renewable energy generation.

The utilisation of biomass for energy production can help address waste management challenges and provide clean energy solutions by converting organic waste into renewable energy. Biomass has the potential to provide an affordable and sustainable source of energy, while at the same time help in curbing the green house effect. In India for example, the total biomass generation capacity is 10205.61 MW according to its Ministry of New and Renewable Energy.[38]

While this is a relatively underutilized form of renewable energy in Nigeria, the government can partner the ICT sector to fast-track its growth through the development of platforms and apps to connect biomass suppliers to buyers and improve overall waste collection and supply chain efficiency.

The European Union did this through the ICT-BIOCHAIN project which brought together leading experts and support networks to establish Digital Innovation Hubs in well-established bioeconomy regions. These hubs acted as pre-prepared test beds for investigating the potential of information and communication technology (ICT), Internet of Things (IoT), and Industry 4.0 solutions. The project's objective was to utilise these technologies to enhance resource utilisation and overall supply chain performance of the biomass supply chains.[39] The Pakam App for example does this in Nigeria by offering a platform for waste recycling, waste collection management and environmental reporting to enhance the waste collection ecosystem.[40]

Hydropower

The ICT sector in Nigeria also has a multitude of potential business opportunities within the hydropower renewables industry. Nigeria boasts significant hydropower potential, thanks to its major rivers and water bodies, making it an ideal location for the development of small to medium-scale hydropower projects. Hydropower is also the oldest and most established form of renewable energy in Nigeria. Furthermore the Nigerian government has often emphasized the importance of tapping into this hydropower potential to enhance electricity generation and decrease reliance on fossil fuels which has been furthered by the privatisation of the power generation sector. This expectedly has allowed for private investments which prioritise incorporating technology in order to maximise returns on investment. One such example is Mainstream Energy Solutions Limited, which operates the Jebba and Kainji hydropower plants, boasting a combined capacity of 1,338.4 MW. To maximise power generation, improve plant efficiency, and ensure the safety of dam operations, Mainstream Energy Solutions Limited employs satellite technology to optimise operations like remote monitoring, weather forecasting, vegetation management etc.

The ICT sector can further explore opportunities in:

Smart Grid Solutions

The development of smart grids can help manage renewable energy generation and distribution, ensuring that electricity is available when and where it is needed. Smart grids use IoT devices, data analytics, and machine learning algorithms to optimise the use of renewable energy sources and improve energy efficiency. For instance, smart grids can store excess energy from renewable sources during off-peak hours and distribute it during peak demand periods.[41]

Several countries have already implemented smart grid solutions to increase the share of renewable energy in their energy mix. Notably, the United States Department of Energy has launched the Grid Resilience and Innovation Partnerships (GRIP) Programme, which aims to enhance the flexibility of the grid and improve the resilience of the power system in response to extreme weather and climate change threats. The programme was created due to the growing challenges that energy grids face as a result of climate change, including more frequent and severe weather events that can damage power infrastructure and disrupt electricity supply.[42] Similarly, the European Parliament and Council have recently agreed on a provisional agreement to increase their binding renewable energy target to a minimum of 42.5% by 2030.[43] The agreement reached on 30 March 2023 is expected to play a crucial role in accelerating the transition towards a low-carbon economy and achieving the EU's climate goals and smart grids and smart metering are seen as a crucial component in achieving this goal. Notably, a report titled 'Benchmarking Smart Metering

Deployment in the EU-28' revealed in 2019 that by 2024, the EU plans to install close to 225 million smart meters for electricity and 51 million for gas, representing an investment of €47 billion. It is estimated that 77% of European consumers will have a smart meter for electricity and 44% for gas by 2024. While the installation cost averages between €180 and €200 per meter, smart meters can save an average of €270 for electricity and €230 for gas per metering point, with energy savings ranging from at least 2% to as high as 10%, based on pilot project data.[44]

A similar development is the introduction of prepaid meters in Nigeria aimed at improving the efficiency of the power sector and reducing electricity theft. The meters are designed to prevent overbilling and underbilling and promote energy efficiency by enabling consumers to monitor their energy usage and manage their electricity consumption. In 2012, the National Electricity Regulatory Commission (NERC) introduced the Credited Advance Payment for Metering Implementation (CAPMI) to help customers gain access to prepaid meters. This was succeeded by the Meter Asset Providers (MAP) policy to address the metering gap in the country's electricity supply. Under this scheme, third-party investors were authorised to supply meters to electricity consumers that had been enumerated by the Distribution Companies (DisCos). Prepayment meters with the capability of remote credit top-up were also introduced in 2019 to eliminate the need to physically access an electricity vending machine.[45]

There is however more ground to be covered as essentially, to prioritise energy efficiency and sustainability, it is crucial to focus on systems and technologies that incorporate conservation practices, real-time pricing models, self-monitoring and self-healing capabilities, extensive customer interaction, and automated power flow control. These are solutions that the ICT sector can potentially offer.

3.4 Dissemination and Communication

3.4.1 Progress Monitoring & Reporting
Progress monitoring & reporting in the context of climate resilience presents a significant business opportunity for the ICT sector in Nigeria. Effective monitoring and reporting systems are essential for evaluating the effectiveness of climate resilience strategies and initiatives, hence, businesses in the ICT sector can capitalise on this opportunity by developing software applications, data analytics tools, and reporting systems that enable organisations and stakeholders to track, measure and communicate their progress in implementing climate resilience measures. Greenly, a French start-up, serves as a notable example in this field. It has developed a software-as-a-service platform that offers small and medium-sized enterprises (SMEs) a comprehensive solution for managing their carbon emissions. This platform allows companies to calculate, store, and track their carbon emissions in a centralised location. Moreover, it enables them to generate certified reports of their carbon footprint and gain valuable insights into strategies for emission reduction.

One of Greenly's key strengths lies in its ability to provide instructions that enhance the business reporting process and yield more detailed data. Additionally, the platform adheres to the Greenhouse Gas Protocol, ensuring the generated carbon reports meet industry standards. This SME-focused approach has garnered significant attention and investment for the start-up, as evidenced by its successful £23 million Series A funding round in 2022.[46]

Also, Diligent, an American software giant offers SaaS solutions across various ESG areas, with a focus on risks and compliance. Their technology tools aim to promote equity and sustainability within businesses by providing the necessary tools to calculate and consolidate customer data. Diligent generates accurate solutions for sustainability and assists in reducing greenhouse gas emissions. In May 2023, the company introduced Board Reporting for ESG, an innovative dashboard that combines performance data with market intelligence. This pioneering feature offers a comprehensive overview of an organisation's ESG position and can be customised to suit the unique circumstances of each client.[47]

The Nigerian ICT sector is well-positioned to contribute to the global sustainability software development boom by offering customised and scalable solutions. These solutions can aim to strengthen climate resilience and facilitate evidence-based decision-making and climate impact disclosure, aligning with national regulatory frameworks and various international reporting standards such as the Global Reporting Initiative (GRI), International Sustainability Standards Board (ISSB) etc.

The sector's distinct advantage lies in its ability to address Nigeria's specific socio-economic and governance landscape while remaining adaptable for the broader continent.

Benefits of Investing in Climate Resilience by the ICT Sector

As Africa's largest economy, the ICT sector has been identified as a major contributor to its growth and development, accounting for about 16.51% of Nigeria's Gross Domestic Product (GDP) in 2022.
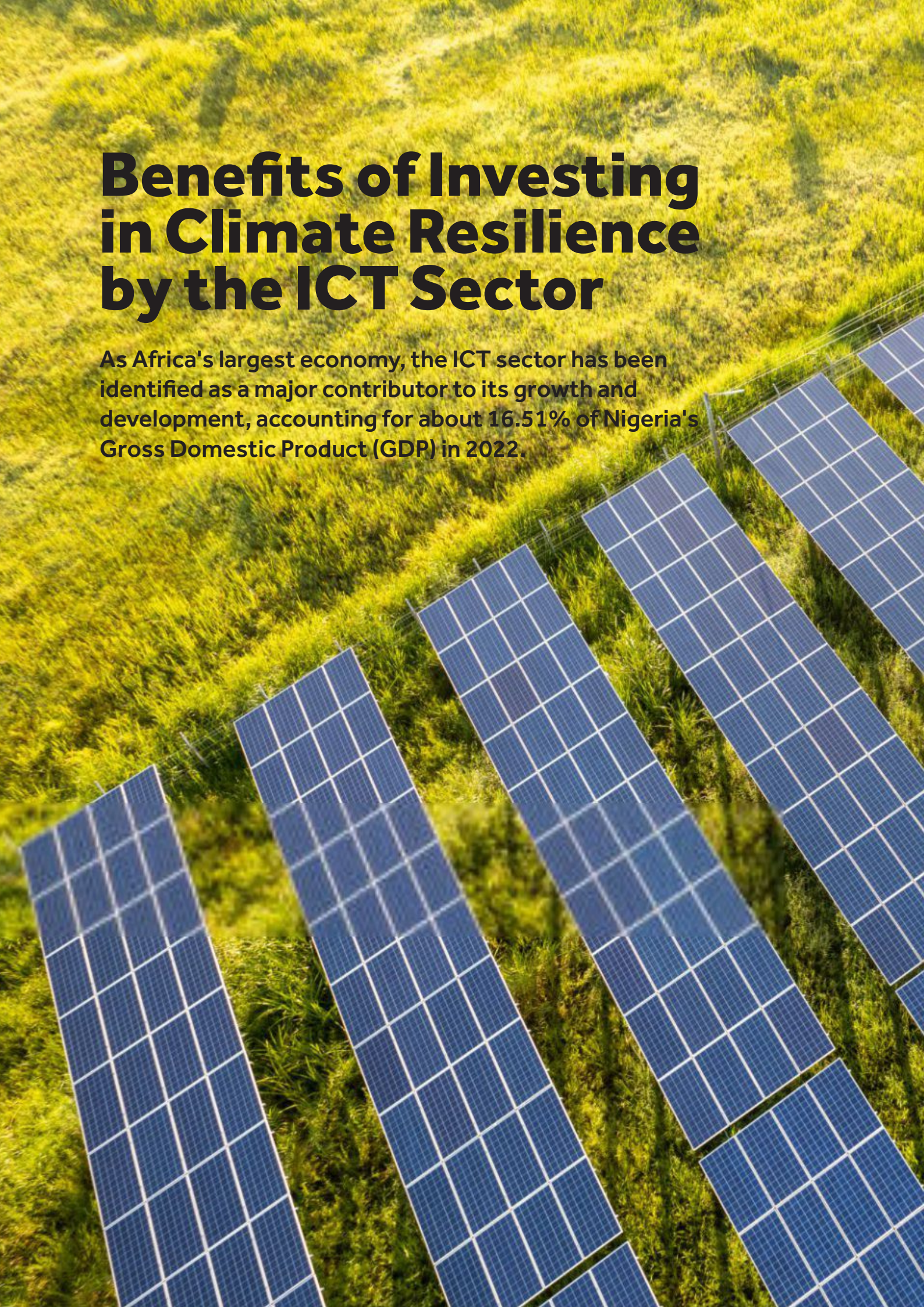
4. BENEFITS OF INVESTING IN CLIMATE RESILIENCE BY THE ICT SECTOR

4.1 Economic Benefits

The development of climate resilience solutions in Nigeria by the ICT sector presents significant economic benefits. For one, the development of these solutions can create job opportunities and promote economic growth. In the agriculture sector for example, which the World Bank estimated employs 35% of the working population as at 2019, the implementation of climate-smart agriculture practices can lead to an increase in crop yields and reduce the impact of droughts on farming communities.[48] Ultimately, Nigeria's pursuit of a net-zero pathway has the potential to generate a significant number of jobs, according to recent studies. By 2030, up to 340,000 jobs may be created, and by 2060, that number could increase to as much as 840,000. These job opportunities are primarily expected to emerge from the power, food [cooking], and transport industries and will cater to the teeming numbers of young people who are unemployed in the country.[49]

Additionally, investing in climate resilience solutions can create new revenue streams for ICT companies. The country's vulnerability to the impact of climate change creates an opportunity for development of innovative climate-resilient solutions as earlier highlighted that can generate revenue for ICT companies. According to estimates by Research Nester, the global climate resilient technologies market is projected to grow significantly from 2023 to 2035. It is estimated that by the end of 2035, the market will generate a revenue of USD 128,025.8 million, indicating a compound annual growth rate (CAGR) of 18.5%. In 2022 alone, the market generated a revenue of USD 14,487.4 million.[50] This translates into vast business opportunities in climate resilience for Nigeria's ICT sector if it positions to provide its solutions not only to Nigeria but the wider African continent.

4.2 Environmental Benefits

The development of climate resilience solutions in Nigeria can also lead to significant environmental benefits. The solutions can reduce greenhouse gas emissions, promote sustainable use of natural resources, and contribute to the preservation of biodiversity. In Lagos for example, the implementation of renewable energy solutions will reduce the economic hub's reliance on fossil fuels and aid the proliferation of electronic-powered public transport which will significantly tackle the challenge of perennial traffic jams in Lagos. Such solutions implemented for transport, cooking, industry and power which is responsible for 65% of Nigeria's emissions will not only address the issue of climate resilience but also improve the nation's standard of life.[51]

Furthermore, development of climate-resilient solutions such as water-efficient irrigation systems can reduce water wastage and ensure the sustainable use of water resources.

4.3 Social Benefits

The social benefits of developing climate-resilient solutions are far-reaching. To begin with, the solutions earlier discussed will prove decisive in addressing social issues like displacement, resource shortage and conflict. For example, precision agriculture could help remedy the rapid climatic deterioration of the Sahel region that has placed immense strain on herder-farmer relationships across the country. With a teeming population of over 200 million citizens, according to the U.S International Trade Administration, Nigeria relies on $10 billion worth of imports to address its food and agricultural production gaps, primarily for wheat, rice, poultry, fish, food services, and consumer-oriented foods. Major agricultural imports originate from various regions, including Europe, Asia, the United States, South America, and South Africa.[52] Bridging this huge gap through ICT-driven climate resilience solutions will have a ripple effect on food security, health and general well-being of the populace.

5. CHALLENGES TO DEVELOPING CLIMATE RESILIENCE SOLUTIONS

5.1 Lack of Adequate Infrastructure and Funding

The development of climate resilience solutions in Nigeria by the ICT sector faces significant challenges, one of which is a lack of adequate infrastructure and funding. Without access to reliable and affordable electricity and internet connectivity, the sector may face difficulties in developing and implementing innovative climate-resilient solutions. Inadequate infrastructure can also limit the reach and effectiveness of these solutions, particularly in rural areas where access to technology is limited.

In addition to infrastructure challenges, the ICT sector faces funding challenges. Limited access to funding for research and development hampers the development of innovative climate resilience solutions. The Nigerian government and international organisations can play a vital role in addressing this challenge by providing funding opportunities for research and development. The Nigerian government has launched several initiatives to support technology start-ups and entrepreneurs, like the Nigerian Youth Investment Fund.[53] Also, in March 2023, a $618 million fund, the Investment in Digital and Creative Enterprises Programme (iDICE) was launched by the Federal Government in partnership with the African Development Bank and other development institutions.[54] These initiatives can provide funding for research and development and help build the capacity of the ICT sector to develop climate resilience solutions.

Moreover, Nigeria can leverage international partnerships and funding opportunities to build its climate resilience capacity. The Green Climate Fund for example is a financial mechanism under the United Nations Framework Convention on Climate Change (UNFCCC) that provides financial support to developing countries to help them mitigate and adapt to climate change. The fund has over 13 projects in Nigeria with available funding to the tune of $181 million.[55] By collaborating with the Green Climate Fund, the Nigerian government and ICT sector can access financial support to develop and implement climate resilience solutions.

Similarly, the African Development Bank's Climate Change Action Plan provides funding for climate-resilient projects in Africa. The bank aims to mobilise $25 billion in climate finance by 2025 to support climate-resilient development in Africa.[56] Nigeria can leverage this funding opportunity to support the development of climate-resilient solutions by the ICT sector.

5.2 Limited Awareness of the Potential of ICT Sector-driven Climate Resilience Solutions

In Nigeria, the ICT sector is facing a challenge of limited awareness of the potential of climate resilience solutions, which can lead to limited investment in their development. Statista estimated that 37.3% of the Nigerian population accessed the internet via mobile device. While this is a very substantial number, the difference in terms of those left behind underpins the need for greater awareness of these solutions.[57] The need for awareness can be addressed through outreach and advocacy efforts to raise awareness among policymakers, investors, and end-users.

In addition, it is crucial to note that the development of climate resilience solutions in Nigeria by the ICT sector requires a set of specialised knowledge and skills. However, the current education system in Nigeria is yet to incorporate these specific skills into its curriculum. Nigeria's education system has been facing endemic challenges in meeting the demands of the labour market. This limitation, in turn, has indirectly impacted the development of innovative climate resilience solutions.

To overcome the challenge of limited awareness of climate resilience solutions, the Nigerian government and private sector should adopt outreach and advocacy efforts, along with education and training programmes for those interested in developing such solutions. Workshops and training programmes can equip the workforce with the knowledge and skills required for developing and implementing climate-resilient solutions, which can support the growth of the ICT sector and help Nigeria achieve its climate goals. Such initiatives can also raise awareness among policymakers, investors, and end-users about the potential of climate resilience solutions.

Additionally, partnerships with international organisations can provide opportunities for concerted capacity building. For example, the World Bank in partnership with the Nigerian government and other stakeholders, has launched initiatives to build capacity and raise awareness about climate resilience solutions in the country. One such initiative is the Nigeria Climate Innovation Centre which provides training, mentorship and funding opportunities for young entrepreneurs to develop innovative solutions to climate challenges.

CONCLUSION

Nigeria remains one of the most vulnerable countries to the impacts of climate change. It has experienced an increase in temperature, erratic rainfall, and extreme weather events, which have affected its agricultural sector, infrastructure, and human health. However, these challenges have created an opportunity for the ICT sector to develop innovative solutions that can help mitigate the effects of climate change and build resilience in the country. In this research, we have explored various business opportunities available to the sector and highlighted the benefits that can be derived from developing climate resilience solutions in the country.

Summarily, the development of climate resilience solutions in Nigeria's ICT sector calls for increased investment and awareness. The government and private sector should collaborate to provide funding for research and development of innovative solutions. Also, awareness efforts should be intensified to orientate policymakers, investors, and end-users on the potential of these solutions.

REFERENCES

[1]Union of Concerned Scientists (2022). What is Climate Resilience? Available at
https://www.ucsusa.org/resources/what-climate-resilience

[2]Lee et al. 2023: Synthesis Report of the IPCC Sixth Assessment Report (AR6): Longer Report.
Intergovernmental Panel on Climate Change (IPCC). Available at
https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_LongerReport.pdf

[3]Ibid.

[4]National Bureau of Statistics (2023). Nigerian Gross Domestic Q4 2022 Report. Available at
https://nigerianstat.gov.ng/elibrary/read/1241288

[5]Climate Risk Profile: Nigeria (2021): The World Bank Group. p.13

[6]https://www.aljazeera.com/news/2022/10/17/nigeria-flood-death-toll-rises-as-thousands-evacuated

[7]Notre Dame Global Adaptation Initiative - Country Index (2020). Available at https://gain
new.crc.nd.edu/country/nigeria

[8]BNRCC (Building Nigeria's Response to Climate Change). (2011). National adaptation strategy and plan of
action on climate change for Nigeria (NASPA-CCN). Prepared for the Federal Ministry of Environment
Special Climate Change Unit

[9]Mojeed, Abdulkareem (Feb 13, 2023), Climate Change: FG to unveil carbon tax system for Nigeria, Premium
Times. https://www.premiumtimesng.com/news/more-news/581752-climate-change-fg-to-unveil-carbon-
tax-system-for-nigeria.html. Retrieved 05/05/2023

[10]World Bank (2023). Nigeria Erosion and Watershed Management Project. Available at
https://projects.worldbank.org/en/projects-operations/project-detail/P124905?lang=en.

[11]Premium Times (2016), Buhari signs Paris Agreement, pledges to help tackle climate change. Available at
https://www.premiumtimesng.com/news/top-news/211034-buhari-signs-paris-agreement-pledges-
help-tackle-climate-change.html. Retrieved 05/05/2023

[12]Department of Climate Change (2021), Nigeria's Adaptation Communication to the United Nations
Framework Convention on Climate Change. Available at
https://unfccc.int/sites/default/files/resource/Nigeria%20Final%20ADCOM%20Report.pdf

[13]Department of Climate Change (2021), National Climate Change Policy For Nigeria 2021 – 2030. p.11.
Available at https://climatechange.gov.ng/wp-
content/uploads/2021/08/NCCP_NIGERIA_REVISED_2-JUNE-2021.pdf

[14]Nigeria Climate Innovation Centre (2023). Available at https://nigeriacic.org/about-us/

[15]Department of Climate Change (2021), National Climate Change Policy For Nigeria 2021 – 2030. Available at
https://climatechange.gov.ng/wp-content/uploads/2021/08/NCCP_NIGERIA_REVISED_2-JUNE-
2021.pdf

[16]National Bureau of Statistics (2023). Nigerian Gross Domestic Q4 2022 Report. Available at
https://nigerianstat.gov.ng/elibrary/read/1241288

[17]Enhancing Financial Innovation & Access (EFInA) (2018), EFInA Access to Financial Services in Nigeria 2018
Survey. Available at: https://efina.org.ng/wp-content/uploads/2021/10/A2F-2018-Final-Report.pdf

[18]Newsome, C (2012). Renewable Energy Potential in Nigeria, Published by the International
Institute for Environment and Development, pp. 1-36.

[19]Nigeria Energy Transition Plan (2022). Available at https://energytransition.gov.ng/

[20]Anthony Ailemen (2022) Bowen University receives praise for deploying high frequency radars. Business Day. Available at https://businessday.ng/news/article/bowen-university-receives-praise-for-deploying-high-frequency-radars/

[21]Center for Space Science and Engineering Research. Virginia Tech. SuperDARN. Available at: http://vt.superdarn.org/tiki-index.php. Retrieved 05/05/2023

[22]Ibid.

[23]National Bureau of Statistics (2023). Nigerian Gross Domestic Q4 2022 Report. Available at https://nigerianstat.gov.ng/elibrary/read/1241288

[24]EOS Data Analytics (2022). Precision Agriculture: Technology To Boost Crop Farming. Available at https://eos.com/blog/precision-agriculture/

[25]Transforming India. Pradhan Mantri Fasal Bima Yojana. Available at https://transformingindia.mygov.in/scheme/pradhan-mantri-fasal-bima-yojana/

[26]Green Finance Platform. Welcome to the Sustainable Finance Diagnostic Toolkit. https://www.greenfinanceplatform.org/diagnostic-toolkit

[27]Ibid.

[28]IRENA (2023), Renewable Energy Roadmap: Nigeria, International Renewable Energy Agency, Abu Dhabi.

[29]Izeaka, Mary (2023). Tinubu signs 2023 Electricity bill into law. Premium Times. Available at: https://www.premiumtimesng.com/news/more-news/603599-tinubu-signs-2023-electricity-bill-into-law.html

[30]Ibid.

[31]https://nep.rea.gov.ng/federal-governments-5milion-solar-connections-program/

[32]https://www.lumos-global.com/

[33]Important Questions That People Usually Ask About Solar Systems And Direct Answers To Them. Available at: https://arnergy.com/faqs/

[34]Audu, M.O., Terwase, A.S. & Isikwue, B.C (2019). Investigation of wind speed characteristics and its energy potential in Makurdi, north central, Nigeria. SN Appl. Sci. 1, 178 (2019). https://doi.org/10.1007/s42452-019-0189-x

[35]ECOWAS Observatory and for Renewable Energy and Energy Efficiency. Katsina Wind Farm Projec. Available at: http://www.ecowrex.org/project/katsina-wind-farm-project

[36]GE Renewable Energy. Meet the Digital Wind FAR. Available at: https://www.ge.com/renewableenergy/stories/meet-the-digital-wind-farm

[37]Ibid.

[38]https://mnre.gov.in/bio-energy/current-status

[39]CORDIS. ICT-BIOCHAIN - ICT Tools in Efficient Biomass Supply Chains for Sustainable Chemical Production. Available at: https://cordis.europa.eu/article/id/425625-information-technology-is-key-for-biomass-success

[40]https://www.pakam.ng/

[41]IRENA (2023), Renewable Energy Roadmap: Nigeria, International Renewable Energy Agency, Abu Dhabi. p.95

[42]U.S Department of Energy. Grid Resilience and Innovation Partnerships (GRIP) Program. https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program

[43]European Commission. Renewable energy targets. Available at https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-targets_en#:~:text=EU%20wants%20to%20accelerate%20the,at%20least%2055%25%20by%202030.

[44]Alaton, C., Tounquet, F (2020). European Commission, Directorate-General for Energy., Benchmarking smart metering deployment in the EU-28 : final report, Publications Office. Available at https://data.europa.eu/doi/10.2833/492070

[45]Dahunsi F.M et.al. Nigerian Journal of Technological Development, Vol. 18, No.2, June 2021. Evolution of Electricity Metering Technologies in Nigeria. pp 152-165

[46]Dillet, Romain (2022). Greenly helps you measure your carbon emissions from a modern dashboard. Tech Crunch. https://techcrunch.com/2022/04/21/greenly-helps-you-measure-your-carbon-emissions-from-a-modern-dashboard/

[47]Diligent (2023). Diligent Launches Board Reporting for ESG, Providing Directors with Clear and Consistent Insight into Climate Performance amid CSRD and Upcoming SEC Climate Disclosure Requirements. Available at: https://www.diligent.com/en-gb/news/diligent-launches-board-reporting-esg/

[48]The World Bank. Employment in agriculture (% of total employment) (modeled ILO estimate) – Nigeria. https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?end=2019&locations=NG&start=1991

[49]Nigeria Energy Transition Plan (2022). Available at https://energytransition.gov.ng/

[50]Research Nester 2023. Climate Resilient Technologies Market Analysis by Solution {Resilience Solutions, and Services (Integration & Implementation, Consulting Services, and Support & Maintenance)}; by Enterprise Size (SMEs, and Large Enterprises); and by Application (Agriculture, Research, Energy & Utilities, Ecosystem Monitoring/Health, and Others) – Global Supply & Demand Analysis & Opportunity Outlook 2022-2035. https://www.researchnester.com/reports/climate-resilient-technologies-market/4001#:~:text=The%20global%20climate%20resilient%20technologies,million%20in%20the%20year%202022.

[51]Nigeria Energy Transition Plan (2022). Available at https://energytransition.gov.ng/

[52]Nigeria – Country Commercial Guide (2023). International Trade Administration. Available at: https://www.trade.gov/country-commercial-guides/nigeria-agriculture-sector#:~:text=Nigeria%20relies%20on%20%2410%20billion,major%20sources%20for%20agricultural%20imports.

[53]CBN Update. CBN Launch Nigeria Youth Investment Fund (NYIF) ISSN No: 2695-2394 Vol. 2 No. 10 October 2020. FG. pp. 1-2. Available at https://www.cbn.gov.ng/out/2021/ccd/cbn%20update%20(october%202020).pdf

[54]Innovation – A Pathway To Economic Growth For Africa – Speech By His Excellency, Prof. Yemi Osinbajo, SAN, GCON, Vice President Of The Federal Republic Of Nigeria At The Launch Of The African Development Bank, AFDB, Supported Investment In Digital And Creative Enterprises Programme (iDICE) At The State House Conference Centre On The 14th Of March, 2023. Available at https://www.yemiosinbajo.ng/presidential-launch-of-the-investment-in-digital-and-creative-enterprises-programme-idice/

[55] Green Climate Fund. https://www.greenclimate.fund/countries/nigeria

[56] AFDB Group (2023). African Development Bank Climate Change and Green Growth Strategic Framework: Operationalising Africa's Voice Action Plan 2021–2025. Available at https://www.afdb.org/en/documents/climate-change-and-green-growth-strategic-framework-operationalising-africas-voice-action-plan-2021-2025

[57] Doris Dokua Sasu(2022) Mobile internet user penetration in Nigeria from 2018 to 2027 [Infographic]. Statista. https://www.statista.com/statistics/972900/internet-user-reach-nigeria/

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