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INNOVATIVE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN MITIGATION OF FLOODING IN NIGERIA

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ABSTRACT

Climate change is a global challenge with its effects being felt in Nigeria in a profound way. The impacts of climate change include flooding, erosion, drought and environmental degradation which are prevalent at some communities in Nigeria. Thus, there is a great need for adaptation and mitigation strategies to be effectively used to stem the negative tides. Through literature review and participation observation, this study identifies how information and communication technology (ICT) can be used innovatively in mitigation of flooding in Nigeria. In an era marked by the escalating implications of climate change, the importance of Information and Communication Technology (ICT) cannot be over-emphasized. This paper elucidates the multifaceted roles of ICT in the mitigation and adaptation to climate change. It recommends informed policy-making, integration with traditional ecological knowledge, and interdisciplinary collaboration to leverage ICT effectively in the mitigation of flooding in Nigeria. It concludes with a clarion call for deeper research on the role of ICT in mitigating flooding in Nigeria.

KEYWORDS: Adaptation, Communication, Flooding, Information Technology, Mitigation.

INTRODUCTION

Flooding which is one of the impacts of climate change in Nigeria with devastating effects both in health, education and socio-economic sectors can be mitigated through the Information and Communication Technology (ICT). Information and Communication Technology (ICT) refers to communication technologies, including the internet, wireless networks, cell phones, computers, software, video-conferencing, social networking and other media applications and services enabling users to access, retrieve, store, transmit, and disseminate information in a digital form (FAO,2024). Information and Communication Technology (ICT) involves the use of computing and telecommunication technologies, systems and tools to facilitate the way information is created, collected, processed, transmitted and stored. It includes computing technologies like servers, laptop computers and software applications, as well as the wired and wireless communication technologies that support telephones, the Internet, the Internet of Things (IoT) and the metaverse (Rouse,2023). In our 21st Century, the role of ICT in mitigating the negative effects of flooding for sustainable economic growth in Nigeria cannot be over-emphasized. Information and Communication Technology (ICT) plays major roles in climate change mitigation and adaptation locally, nationally and globally. This is increasingly being recognized within the climate change technology transfer negotiations according to the World Development Report 2010 (Lawal, 2011). In 2016, the FAO and International Telecommunication Union (ITU) published the 'E-Agriculture Strategy Guide: Piloted in Asia-Pacific Countries'. This toolkit provides countries with a framework to develop their national e-agriculture strategies, which should help mitigate the impacts of flooding and other climatic challenges, as well as address ICT opportunities for the agricultural sector in a more efficient manner(FAO, 2024). This study vividly identifies the innovative use of ICT in mitigation of flooding thereby achieving sustainable economic growth in Nigeria.

METHODOLOGY

Generally, this paper aimed to examine the innovative use of information and communication technology (ICT) in mitigating flooding in Nigeria through existing literature review and participant observation. The literature review includes journal articles, magazines, book chapters and encyclopedia available online and in libraries. This paper examined current progress with the innovative use of ICT in climate change adaptation and mitigation strategy for sustainable development in Nigeria through existing literature review. It also identified the role of ICT in mitigating flooding which is one of the major impacts of climate change in Nigeria.

ICT AND CLIMATE CHANGE: AN IMPORTANT LINKAGE

Beyond climate change adaptation and mitigation, ICT has an important role to play in Nigeria in enhancing a diversified, sustainable and competitive economy that harnesses the energies and talents of its people and guarantees high standard of living and quality of life for its citizens(Lawal,2011). Flooding which is one of the impacts of climate change requires appropriate and urgent actions to be taken both by individuals, institutions and the government to mitigate its negative effects for sustainable economic growth in Nigeria (Anabaraonye, Okafor & Eriobu,2019). Flooding also exerts a negative effect on biodiversity and innovative solutions through the use of ICT can be implored for promoting sustainable development, as well as for addressing climate change in Nigeria (Anabaraonye, Amaechi, Okolo, Adeniyi & Nwobu, 2022). It is good to know that ICT has a great

role to play in enhancing sustainable economic growth and this must be recognized by policy makers in Nigeria. Due to harvest failures such as damage of crops, storage facilities and physical injuries brought on by the impacts of flooding in Nigeria, farmers suffer huge economic losses(Anabaraonye, Okafor and Hope, 2020). Environmental education which can be advanced through ICT will go a long way in mitigating flooding and enhancing climate resilience in Nigeria (Onnoghen, Ojong, Omang, Obibessong & Asor, 2020). As the impacts of climate change is felt in a profound way in Nigeria's economic sector (Onnoghen, Orji, Olisah & Anabaraonye,2024), green entrepreneurship education which can also be advanced through ICT will go a long way in mitigating flooding and enhancing climate resilience in Nigeria (Onnoghen, Onwuzurike & Anabaraonye, 2024). ICT can be used efficiently and effectively for environmental modeling, environmental monitoring such as monitoring of weather and climate change and deforestation using satellite imagery.

The Use Of ICT In Climate Change Education In Nigeria

Education is an essential element of the global response to climate change. Climate change education is therefore vital in every community, city, campus and company in Nigeria in order to prepare us for climate change impacts and to learn how to adapt and mitigate effectively (Anabaraonye, Nji & Hope,2018; Anabaraonye, Okafor & Hope, 2020). Climate change education will go a long way to help scale up climate resilience in Nigeria and this is presently being achieved through the use of ICT. ICT is therefore a vital tool in enhancing climate change education across communities, cities, campuses and companies in Nigeria. It appears that integration of ICT into teaching and learning issues of climate change adaptation, mitigation and resilience might possibly enhance the pedagogy of climate change education in primary, secondary and tertiary institutions in Nigeria. The teaching and learning of climate change education require concrete application as advocated in the study by Down (2012). As such, the use of ICT becomes very vital. The study by Ojedokun and Gbadamosi (2014) had suggested scheme of work to teach undergraduate students climate change education(CCE) in Nigeria. Based on unpredicted and changing nature of climate change, the incorporation of ICT into the existing teaching method suggested by Ojedokun and Gbadamosi (2014) will be added advantage. Take for example, the use of remote sensing and geography information system (GIS) might be better resources to explore the rapid changing nature of climate in our locality(ITU, 2008; Olaniyi, Adetumbi, & Adereti, 2013; Shafiq, Ahsan, AdnanNadeem, Shaikh, & Siddiq, 2014). In addition, the use of social media networks might enhance students learning by discussing climate change issues among their peers(Stevenson et al., 2017). Anabaraonye, Okafor and Hope (2020) identified that climate change education is a vital tool for adaptation and mitigation to the climatic challenges including flooding in Nigeria thereby enhancing sustainable economic growth. ICT plays four main roles of mitigation, monitoring, adaptation and strategy to

reduce impact of climate change globally(ITU, 2008; Ospina & Heeks, 2010). Using ICT for studying the changing weather of a given location, wireless sensor network application could be used in environmental monitoring (Arampatzis, Lygeros, & Manesis, 2005) and digital video is useful to monitor wetland ecosystems (Shafiq et al., 2014). According to the report of International Telecommunication Union (ITU, 2008),though ICT is contributing about 2.5 per cent to greenhouse gas GHG emission but ICT solutions reduce GHG emission by 97.5 per cent. Additionally, software applications geographical information system (GIS), wireless sensor networks (WSN), mobile technology (MT), web based applications, satellite technology, remote sensing (RS) (Kalas & Finlay, 2009; Shafiq et al., 2014) have the possibility of enhancing teaching and learning about climate change. In addition, web-based agro-climatic application(Churi, Mlozi, Mahoo, Tumbo, & Casmir, 2013) could be developed for climate change education in Nigerian schools. To develop the web based application, stakeholders like teachers, students, traditional farmers, computer experts, etc. should be involved in the design. This is to reflect local concepts of climate change in the application for this will positively influence the use of the system by learners and teachers (Bano & Zowghi, 2013; Buchan, Bano, Zowghi, MacDonell, & Shinde, 2017).

The Use of ICT in Mitigating Flooding in Nigeria

According to Ikani (2016), Flooding is the overflowing of water either as a result of torrential rainfall, a broken dam,a high rise in the volume of water in rivers, oceans or seas as a result of melting ice caps or prolonged rainfall. Flooding was found to have influenced food insecurity in a research conducted a few years ago (Akukwe and Ogbodo, 2015). Floods as noted by Odufuwa et al (2012) are the most frequent disaster and widespread natural hazards of the world. It is also noted that floods have caused 84% disaster deaths in the world with an average of 20,000 deaths per year (Odufuwa et al,2012). Floods can be very dangerous depending on the nature and level of water volume involved. It is noted to have caused massive destruction of farmlands which resulted to food insecurity at various parts of the country including the south eastern region that produce the three main tuber food crops in Nigeria (namely yam, cassava and sweet potato). Many farmers lost their sources of livelihood as a result of the flood and were pushed into extreme poverty thereby negatively affecting sustainable economic growth in Nigeria (Akukwe and Ogbodo, 2015; Odufuwa et al, 2012). Flooding which is one of the impacts of climate change has been discovered to play a great part in destroying people's sources of livelihood, wreaking properties and valuable belongings, inflicting water-borne sicknesses and diseases thereby leading to poverty in Nigeria (Anabaraonye, Ewa &

Wala, 2020). Floods threaten food production, food prices as well as both nutritive and microbial quality of harvested food materials, and drives food insecurity and malnutrition (Anabaraonye, Ewa & Wala, 2020). Some researchers recently highlighted the impacts of flooding on Nigeria's educational sector and the need to mitigate for sustainable development (Anabaraonye, Otti, Anukwonke, Ewa & Eslamian, 2022). Nwafor (2021) further identified the influence of flood risk information on the adaptive behavior of residents in flood prone areas in Southeast Nigeria. The use of ICT plays a great role in awareness creation, advocacy and education towards the mitigation of flooding in Nigeria. As ICT continue to advance and becomes a necessary utility, individuals, organizations and governments need to recognize both the benefits and challenges of ICT in mitigating the impacts of flooding in Nigeria.

Best practices for enhancing the innovative use of ICT in mitigating the impacts of flooding in Nigeria include:

- Supporting ESG (environmental, social and governance) initiatives.
- Prioritizing the development of affordable, repairable digital technologies.
- Investing in infrastructure and connectivity solutions that provide remote and underserved areas with access to ICT services.
- Encouraging the development and adoption of open standards and robust data protection regulations.
- Facilitating international cooperation and partnerships between governments and businesses.
- Developing new ways to educate people about ICT.
- Promoting the creation and dissemination of local content that reflects the values of ICT users worldwide.

The innovative use of ICT in mitigating the impact of flooding is multifaceted and crucial. Here are some ways ICT can make a positive impact:

1. Data collection and analysis: It helps collect and analyze vast amounts of environmental data, enabling scientists to better understand climate patterns and predict future changes.

2. Renewable energy management: It optimizes the performance and distribution of renewable energy sources like solar and wind power, promoting a cleaner energy mix.

3. Energy efficiency: It enables smart buildings and homes to reduce energy consumption through automation, sensors, and advanced building management systems.

4. Sustainable transportation: It supports the development of electric and hybrid vehicles, as well as optimizes traffic flow and public transportation systems to reduce emissions.

5. Climate modeling and simulation: It powers complex climate models, helping researchers understand the consequences of different scenarios and develop effective flood mitigation strategies.

6. Environmental monitoring: It enables real-time monitoring of air and water quality, tracking the impact of flooding on ecosystems and human health.

7. Green ICT: ICT companies are adopting sustainable practices, reducing e-waste, and developing energy-efficient technologies to minimize their own carbon footprint.

8. Disaster response and recovery: It facilitates rapid response and communication during natural disasters such as flooding, supporting relief efforts and minimizing the impact of climate-related events.

9. Education and awareness: It helps to spread climate change awareness through digital platforms, promoting education and community engagement in climate action.

10. Collaboration and policy-making: It enables global collaboration among scientists, policymakers, and stakeholders, facilitating the development of effective climate policies and international agreements.

RECOMMENDATIONS

By harnessing the power of ICT, we can mitigate the effects of flooding, create a more sustainable future, and protect our lands for generations to come. Rouse (2023) identifies that the innovative use of information technology and communication technology has a beautiful impact on society. As technology and collaboration tools continue to advance, organizations are finding it necessary to continually reevaluate their best practices for sharing digital information and governments are continually looking for ways to reduce the digital divide. Digital literacy has become a necessary skill for everyone. The environmental effects of ICT have also been profound. Data centers and electronic devices require significant amounts of power to operate, and the rapid growth and constant evolution of technology has led to a surge in e-waste as obsolete devices are discarded. This waste often contains hazardous materials that pollute the environment and can harm human health. Thus, the benefits and challenges of ICT need to be taken into consideration towards mitigating flooding in Nigeria.

CONCLUSION

Public awareness campaigns and climate change education through ICT are necessary to ensure the people are conversant with the new adaptation and mitigation measures such as use of renewable energy, waste recycling, strategic tree planting activities, etc. thereby mitigating the negative effects of flooding for sustainable economic growth in Nigeria. The multifaceted roles of ICT in the mitigation and adaptation to climate change especially flooding cannot be overemphasized. On the mitigation front, ICT offers tools for monitoring and modeling greenhouse gas emissions, optimizing energy consumption, and facilitating the transition to renewable energy sources. In terms of adaptation, ICT enhances the prediction and management of climate-induced risks, supports real-time communication during extreme weather events, and aids in the planning and implementation of resilient infrastructure. Moreover, ICT bolsters the communication of climate science to diverse audiences, fostering education and advocacy. There is need for deeper research by scholars, researchers and lecturers in the higher education institutions on the innovative use of ICT in mitigation of flooding for sustainable development in Nigeria.

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