ASSESSING THE SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF URBAN FLOODING IN RAPIDLY DEVELOPING CITIES: PATHWAYS TO SUSTAINABLE RISK MANAGEMENT AND CLIMATE-RESILIENT URBAN PLANNING

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Abstract

Flooding remains a recurrent and escalating environmental challenge in Nigeria, driven by climate change, rapid urbanization, poor infrastructure, inadequate drainage systems, and weak enforcement of urban planning laws. This study examines the causes, impacts, and implications of flooding in Nigeria, emphasizing its effects on the achievement of the United Nations Sustainable Development Goals (SDGs). Drawing from existing literature, the paper highlights how flooding adversely affects poverty alleviation, food security, health, education, clean water and sanitation, economic growth, urban sustainability, and terrestrial and aquatic ecosystems. The analysis underscores the interlinkages between flooding and socio-economic vulnerability, demonstrating that poor governance, ineffective flood risk management, and anthropogenic activities exacerbate these impacts. The study advocates for integrated urban planning, robust flood risk management strategies, and strengthened policy enforcement to mitigate flooding and support Nigeria's progress toward sustainable development. Findings contribute to the broader discourse on environmental risk management and offer practical insights for policymakers, urban planners, and stakeholders to enhance resilience against flooding in developing contexts.

1. Introduction

Globally, flooding has constituted climate change challenge. Humans are always attracted to flood plain areas for different economic activities, and a massive world population rely on the essential natural resources that is deposited in flood plains. Different global problems, like ecosystem degradation, climate change and variability and continuous rise of population pressure can further escalate the risk of flooding globally. In major part of the world, the problem of floods becomes furthermore complex due to poor management and flood planning practices. But notwithstanding, floods are fundamental natural river regime; management of floods plays a vital role in protecting and securing the life, property and infrastructure from devastating effect of flooding and flooding. Incorporating flood risks into water resources management offers justification to move away from a solitary

centered approach, like control of flood into unified management of flood.

Urban arrangement, supported by appropriate authorized and policy outline, forms the foundation of human habitation. Components like FRM strive at reducing the possibility and/or effect of floods whereas urban planning, also called town planning, city planning, regional planning, rural planning, urban design, and urbanism are different means used by blue chip in interlinkage, location and distribution of land usage (Acheampong 2019;). The poor infrastructure in Nigeria cities which have a direct effect on the living condition and in attaining sustainability. The absence of authorized policies and legal outlines indicates the extend or priority placed on managing and controlling of flooding in Nigeria at large at local government, state and federal level and the approach by the government in solving flooding problem suggest little or nothing has been done /n addressing the issue (Cirella and Iyalomhe 2018; Okoye 2019).

The global pursuit or goal in achieving environmental and human development SDGs before year 2030 (Bebbington and Unerman 2018). The Achilles heel is the continuous or recurrent flooding problem in Nigeria and government role in solving the issue in attaining sustainable development goals by the year 2030. By highlighting the linkages between the phenomena and the specific development goals impacted, such as sustainable agriculture, this article shed light on the unique ways flooding influences Nigeria sustainable development.

The purpose of highlighting these links is to persuade the Nigeria government and pertinent parties to take action and provide the required infrastructure to manage flooding and so enhance the lives of the populace. This essay begins with examining flood in Nigeria, and it causes, followed by discussions of flood risk management and sustainable development, urban planning, and the SGDs then highlights, along with how they affected. The article concludes by listing the effects of flooding in the country and urging coordinated action from all interested parties to control the threat of flooding.

2. Nigeria and Flooding Problem

Communities living downstream of dammed river in parts of northern Nigeria, the Niger delta communities, and the south-western states, encounters flooding recurrently with wide ranging effect on the populace. The high level of rainfall in southern part and Niger delta of the country is mainly cause of the flooding (Agbonkhese et al. 2014; U Nkwunonwo, Malcolm, and Brian 2015). The flooding in Nigeria in 2012 was the most devastating in recent history (Nkeki, Henah, and Ojeh 2013; OCHA 2012; Toure 2014). Approximately three million two thousand people were displaced, sixteen million people were impacted, and a total of 363 died during the flooding which has a negative effect in several ways and years of development gains were inverted (Nwigwe and Emberga 2014; Oladokun and Proverbs 2016). The total losses were estimated to be between US$16.9 billion and above (Security 2013). In true sense, the degree and nature of flooding in Nigeria are such that the exact figures for displacements, fatalities, and losses cannot be accurately determined (Cirella and Iyalomhe 2018; Nkwunonwo,Malcolm, and Brian 2015).

United nations SDGs, which Nigeria is signatory to, and the impact of flooding on various SDGs. The threat of flooding on sustainability because of its adverse effect on the environment, social life, health, and economy (Ludwig et al. 2007). The impacts of flooding and it devastating effects are not peculiar to a particular geographic location and has the potential of delaying the progress toward achieving the SDGs. Nevertheless, in developing country like Nigeria the adverse

effect of flooding is felt more as a result level of development in the country. Presently the lack of solid legal framework or policy for management of flood to tackle this recurrent problem (Adekola and Lamond 2018;Akinloye 2018). The government have demonstrated lack of interest in finding a lasting solution to the persistent flooding problem and can be associated to disconnected relationship and misinformation or interpretation of flooding effect on the SDGs Nigeria is aiming to achieve (Akinloye 2018), this paper fills that gap.

3. Flooding in Nigeria and Causes

An increase in rainfall due to climate change than what it used to be in the past has amplified the occurrence of flooding, human- nature relation has aggravated flooding problem and frequently cause by human activities (Aderogba 2012). The interactions between human and nature that intensified flooding in Nigeria form the groundwork for this article but are not constraint to

a. **Inadequate waste management practices**: The management of waste is a contributing factor to the already deteriorating flooding situation and it negative effect on the populace in Nigeria. Nigerians approach to waste disposal and it consequence has been extensively discussed in numerous studies. Blockages of drainage can be directly associated to poor sanitation observation or practices in Nigeria's densely populated urban cities. Canal dumping, dumping in rains, and roadside dumping, is a common practice seen in densely populated urban city in Nigeria. This indiscriminate dumping of refuse causes drainage blockage and brings about flooding during the wet season (Onwuemele 2012; Eneji et al. 2016; Ojo and Adejugbagbe 2017; Ojo and Adejugbagbe 2017).

b. **Unchecked urbanization**: The direct relationship between Flooding and urbanization cannot be over emphasize in developed and developing countries. The population of Nigerians living in urban areas today exceeds 50% (Farrell 2018). Nigeria is experiencing high rate rural urban without corresponding provision of basic amenities (Aderogba2012). The massive conversion Agricultural lands into residential areas to cater for housing needs and development is been undertaken out without appropriate infrastructure and management in place, in turn increased the problem of flooding (Dan-Jumbo, Metzger, and Clark 2018). The approach to city planning in Nigeria is at its lowest level and this is complicated by several compliance complications; this low-level planning standard is a principal cause of flooding challenge being experienced today in Nigeria. Poor urban or city development practices is directly linked to continuous flooding problems being experience in Nigeria (Omoboye and Festus 2014).

c. **Non-existent or poorly designed drainage systems**: This situation is majorly human-induced that aggravate flooding experienced in Nigeria (Ogundele and Jegede 2011). There is lack of drainage system in most inhabited area in Nigeria and the populace rely on drainages which nature offers (Nabegu 2014). Over the years, Nigeria has experienced an exponential growth in urbanization which is not commensurate to the available infrastructures in urban area and absence of purification of water and drains to cater for the ever-increasing numbers population (Adeloye and Rustum 2011). Absence of good drainage system is one of the major causes of flooding in Nigeria. There is call for an urgent need drainage systems

construction to handle the flooding problem (Etuonovbe 2011).

d. **Corruption and planning laws implementation**: Nigeria has a concrete planning law currently but implementation of these laws is poorly executed or enforced (Nnaemeka Okeke 2 A. J. ECHENDU 2016). Political meddling and interest in planning activities, shortage of working tools, less staff are features effecting the effectiveness and discharge of duties by the urban planners (Nnaemeka-Okeke 2016; Oluwaseyi 2019). The interpretation of planning laws is most time carelessly implemented those results in building projects on unauthorize area i.e storm water paths and natural floodplains are approved, which has negative effect on sustainability and aggravates the flooding challenge in Nigeria. The continuous corruption among urban planning administrators in accepting bribes and turning a blind eye to critical issues such as, adjusted approved construction design in zones that impede natural water paths and drain, illegal usage of land, and substandard social amenities on the long run collapse during the wet season (Oladokun and Proverbs 2016). Refuse reducing the flow of water in the drain channel resulting to flooding and aggravating the issue being addressed.

4. Sustainable Development and SDGs

The wildly accepted definition of sustainable development is; "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. "the adoption of this definition is from the UN *Report of the World Commission on Environment and Development: Our Common Future* and was named after the chairperson Gro Harlem Brundtland (Brundtland Report, 1987: 37). This milestone description offers foundation and agreement that mantle the idea of sustainable development for all nations, irrespective of the country's advancement status (developing or developed), and it understanding development as a constant revolution to society with aim to deliver the psychological needs of mankind – housing, food and clothing and fulfilling humanity's psychological needs while preserving earth for both current and forthcoming generations. The Millennium Development Goals (MDGs) was replaced with The Sustainable Development Goals (SDGs) in 2015.

Regardless of the developmental status, in international partnership, an urgent need to attain the set-out goals by changing the globe through addressing several issue confronting mankind to guarantee it well-being, environmental protection for developing or developed nations, and economics riches or prosperity by 2030. The inseparable and mutually bond goals of SDGs, harmonizing the three-fundamental dimension of sustainable development namely; the environmental, social, and economics. This view contradicts the traditional or conventional development goals which laid emphasis on a prearranged measure, the all-inclusive and multi layered proffer by SDGs on development (Pradhan et al., 2017). The impact of flooding on the world population varies from nation to nation due to variation in developmental advancement and are not confronted with similar challenges (Reckien et al. 2017).

a. No Poverty: Goal1 and Flooding: Poverty eradication by 2030. Poverty is the greatest challenge in attaining sustainable development, therefore elimination of poverty is elementary in achieving success of the SDGs (Roy et al. 2018, 450). There is a connection between poverty and flooding because they complement each other; the flooding effect

strengthens poverty, and poverty, increases the level vulnerability. Poverty and flooding has a negative effect on standard of living of people that are affected and obstruct progress of development, particularly the most affected members of the society (Dube, Mtapuri, and Matunhu 2018). Nigeria can't be classified as a poor nation, ironically it has surpassed India estimated to have a population of 1.4 billion people as the country with high poverty index. Nigeria with population of 200 million and 87 million out of the 200 million persons live in extreme poverty (Homi Kharas and Hofer 2018).

The yearly occurrence of floods, as helped further intensify poverty. Nigeria been the most populous Africa nation there is no doubt ecological issue like floods aggravates the level of poverty and threatens UN sustainable development goals. The frequent occurrence of floods, complicates the effect on the population. The destructive nature of floods has ability to obstruct the social structure of the populace, the finance of poor households and the environment at large inflict suffering on the people. The continuous rise in poverty rate, flooding is main contributory element (Egbinola, Olaniran, and Amanambu 2017). The aftermath effect of flooding on the poor is devastating on the long run and imposes threat on SDGs. The vulnerability of the poor becomes more evident when disasters happens, automatically placing them on the receiving end poor. The effect is felt more by the poor when flooding calamity ensue urban centers. low-earners are typically the residents of informal settlements which describe urban environment Nigeria (Wahab 2017).

b. Zero Hunger: SDG 2 and Flooding: Ending hunger by 2030 is the main target of SDG goal 2 (Gil et al. 2019). In achieving this goal, agricultural industry and food sector plays a vital role but unfortunately this essential sector is seriously affected by continuous yearly flooding in Nigeria (Osabohien, Osabuohien, and Urhie 2018). Eradicating huger there must be food security a critical component in ensuring the demand and supply chain is functional and easy to access particularly essential foods. In spite of fertile land, Nigeria continues importation of food the main importer of food in African continent (Matemilola and Elegbede 2017; Osabohien, Osabuohien, and Urhie 2018). Psychologically food is an essential need of man and that can be made available through agriculture, but the negative effect of flooding on agriculture is threating food security (Akukwe, Krhoda, and Oluoko-Odingo 2018).

The effect of flooding affects food security and food uncertainty causes hunger (Azubuike and Nnubia 2015). Floods directly affects agricultural sector in Nigeria and increases challenge on food security because of the devastating effect on production, demand, and supply of food (Armah et al. 2010). The destruction of crops, seedling stores and livestock, diminishes yield and influences the subsequent planting season, causing shortage of food supply, therefore flooding affects food security agricultural supply more than anticipated (Chapagain and Raizada 2017).

c. Healthy Lives and Well-being: SDG 3 and Flooding: This goal is under siege with the continuous flooding yearly in Nigeria. There is negative impact on health by flooding and the long-term effect comes in different (Aliyu 2015; Olanrewaju et al. 2019). The aim and objective of Sustainable Development Goals interwoven with each other and are inseparable, the effect of flooding on health also link to the rest SDGs for example; zero hunger and no poverty. The inability of sick people to work can give rise to hunger and poverty. The direct effect of flooding on poverty and hunger increases outbreak of communicable disease due to low immune.

Health is indirectly or directly affected by flooding, additional injury and death are direct impact of flooding, 90% of these impacts befall

developing nations like Nigeria (Zorn 2018). The largely unequipped Nigeria health sector is faced with setback from continuous yearly flooding. An outbreak of life threatening and infectious disease for instance: Dysentery, Typhoid, and Cholera are widespread during flooding (Rieckmann et al. 2018). Children and woman are most helpless and immensely suffers from malaria due to flooding provides perfect breeding condition that gives rise to mosquitos which might result to more death. In developed nations post-floods power outages drivers, the populace to the use of gasoline powered generators (Prevention 2017).

Deposit of human feces, dead animals, fertilizer, sewage, pesticide, insecticide, and refuse by humans into floodwater eventually contaminates the floodwater and are also carriers of microorganisms (Oriji 2015). Consumption of contaminated water by human and animal or usage the this said water on food items and agricultural crops is dangerous. Storage of foods are immensely affected due to irregular power supply and this can lead to a serious health challenge (DFTE 2017). Nigeria sources of water during flooding are polluted, individually septic tanks and boreholes are commonly found in Nigeria eventually submerge by overflow contaminated floodwater and becomes home for infectious diseases.

d. Quality Education: SDG 4 and Flooding: Sustainable Development Goals 4 aims to guarantee unbiased and all-encompassing quality education and encourage unending learning opportunities for all (UN 2016). The role education plays in attaining the sustainable development goal cannot be over emphasized (Oghenekohwo and Frank-Oputu 2017). More attention should be given to education in developing nations because when comparing the literacy level of developed nation to developing nation the gap is worrisome (Winthrop and McGivney 2015). There has been effort made to promote and encourage basic education for all, most importantly for children (Mudavanhu 2014). Children displaced due to flooding in disaster zones, automatically becomes educationally deprived at the critical school age and place them on opportunity and economic difficulty in the future (Erica, Jessie, and Stephanie 2018).

Flooding disaster interrupts the learning of children in school and administration of education in several ways; the severity of the flooding does not matter. Parents are uncertain if rainfall or storm will multiple the severity of floods when kids are in school and based on the uncertainty parents prefer to keep their children at home during flooding. The teachers are not psychologically stable to teach and handle the condition if flooding increases or the need for evacuation arises. preparation of lesson notes is definitely out the question. The teachers individually have issue of flooding to tackle, their flooded houses damaged belongings. Little or nothing can be done by parents to their children education during the flooding period or assist with schooling at home. Even after the floods have subsided or dried up, learning instrument have been destroyed. Replacing damaged educational material or instrument in developing nation like Nigeria are most times in doubt. Areas prone to yearly flooding might experience setbacks due to accessibility or government approach in delivering educational material destroyed my floods.

e. Clean water and Sanitation: SDG 6 and Flooding: The 6th goal objective of SDG is to guarantee the accessibility, maintainable management of water and hygiene for all (UN2016). Flood negatively affect these rights to clean water and sanitation by triggering various kind of water pollution and destroys sanitation facilities which have an adverse effect on populace that is hit by flood. It is estimated that 100 million people in Nigeria don't have access to basic hygiene facilities and 63 million Nigeria's are need of potable water. About 80% of diseases globally can be traced

to poor hygiene practice and unhealthy water (Raimi et al. 2018). The increasing number of people are still being affected my flooding. Flooding brings about water contamination and decreases the level of accessibility to clean/potable water (Olanrewaju et al. 2019).

The effectiveness of natural water cleansing can also be decreased as a result of floods which increases groundwater level, further upsurge infectious disease rate and to harmful compounds (Nations 2010). In most developing nations, when floods occur, and absent of proper sanitary amenities tremendously increases the probability of widespread of diseases such as cholera and diarrhea. Mostly woman and girls are highly vulnerable in developing nations, because washing and collection of water is primarily their duties. Substance that contaminates water during flooding period like commercial waste, refuse, industrial chemical, bacteria, sewage and micro-organism that cause disease and lead to (Sun et al. 2016). It is estimated that communities prone to flood, about 80% of illnesses have been connected to poor access to water and hygiene during this period (Chanda Shimi et al. 2010; Islam 2017).

f. Decent Work and Economic Growth: SDG 8 and Flooding: The objective of Sustainable Development Goal 8 is targeted to improve sustained, all-encompassing, and maintainable economic growth, full and creative employment and conducive work for all (UN 2016). This is threatened by yearly flooding that damages the means of livelihood of the people. There is well documented effect of flooding on economic development (Chapagain and Raizada 2017; Mwape 2009; Olanrewaju et al. 2019). Illness occurrence connected with flooding also decreases the supply or availability of manpower, and the level of productivity of sick person will be little or nothing.

The impact of flood study undertaken by Mwape (2009) suggests that 94% of the respondents majorly farmers lost their farms to floods, indicating farming families' vulnerability. Similar study in Port Harcourt, Nigeria, by (Ikechukwu 2015) suggests that 29.4% respondents buildings were destroyed by floods while 30% income was negatively affected which occurs yearly during the wet season. A substantial amount of properties is lost during floods which includes farming equipment, furniture, electronics, and clothing. There is a negative effect of flood on the income of flood victims, their means of livelihood that provides household income is loss to floods. (Kwari, Paul, and Shekarau 2015; Mwape 2009).

Relocation of funds to rebuilding and rehabilitation project impend the rate of economic growth. The aftermath of flooding on economic growth exceeds short term and spans beyond floods affected area (Jongman 2018). Nigeria spent 10Billion US dollars on floods in 2012 (Olalekan, 2018). Diseases triggered by flooding similarly effects the economy, method of Cost-of-illness (COI) is frequently use to determine the effect on the economy. The Cost-of-illness approach focus on direct and indirect influence of ailment on the economy, which include medical care cost (out-patient and inpatient care, medication, diagnosis, procedures), and transportation for care and treatment, cost for nonpersonal like education, communication, loss of income due to sickness, research and information which are indirect (Kwari, Paul, and Shekarau 2015).

g. Sustainable Cities and Communities: SDG 11 and Flooding: Currently, it is estimated that the world's population has more than half of its populace living in metropolises. One out of four urban inhabitants reside in slums as at 2020. This interprets, above 1 billion people and 85% of this 1 billion resides in three regions – sub-Saharan Africa (230 million people), Southern & Central Asia (359 million people), and Eastern & South-Eastern Asia (306 million people). SDG 11 aims at

making cities and human settlements all-encompassing, harmless, buoyant, and sustainable (UN 2016). Reducing significantly the death toll and also reduce the number people affected by disasters by 2030 is a major concern of the SDG 11. Its main concern is focused on providing the needs of most vulnerable and the poorest members of the public, that are mostly children and women, and maintaining the security and integrity of human dweller among the existing challenge coming with the climate change (UNDP. 2016). Increase in urbanization, inadequate waste disposal management, change in climate, poor drainage system, and lack of water infrastructure maintenance are factors contributing to flooding in urban settlements (Koop and Van Leeuwen 2017). Nigeria is experiencing an increase in population and alongside rapid increase in urbanization. Currently, over 50 per cent of Nigeria population is inhabiting in urban areas and there is high likelihood of this number to increase to above 75 per cent in the years to come (Aliyu and Amadu 2017; Farrell 2018; Reed and Mberu 2014).

h. Life on Water: SDG 14 and Flooding: Conservation and sustainable utilization of seas, oceans and aquatic resources for sustainable development (UN 2016) is the objective of sustainable development goal 14. Water plays a major role in attaining sustainable development therefore cannot be overstressed knowing that water occupy about 70% of the earth and the livelihood of 3 billion persons depend on water (Chukwu, Wekpe, and Ikebude 2018). The world 5% Gross Domestic Product is made-up of recourses gotten from water. Flooding affects the effective exploitation of water resources in achieving sustainable development. It hinders and affects water ecosystems and the services rendering by aquatic ecosystem. Flooding impacts on aquatic ecosystem regularly goes unnoticed because the evidences are not obvious as compared to land or urban city areas that are highly populated therefore imposes difficulty in estimating the degree or effect of damage to aquatic ecosystem (Talbot et al. 2018).

The production and distribution of aquatic life are aided by the chemical and physical components of water which are vital (Khatri and Tyagi 2015). The negative change in water quality of seas, oceans or rivers induces during flooding as a result of fertilizer from farmlands, contaminated residues washing into seas (Bariweni, Tawari, and Abowei 2012). This brings about pollution to aquatic ecosystem and thereafter causes deaths of marine creatures. The reproductive life circle of the remaining deep-sea life is affected. Reproduction is a vital process to enable continuity of marine life and if this process is threatened, many aquatic species will go into extinction. nutrients and pollution, which decreases the quality of water, contaminate marine food resources and damage the water ecosystem.

i. Life on Land: SDG 15 and Flooding: Sustainable use of land and preserving land ecosystems is at forefront of Sustainable Development Goal 15. Flooding has the potentials to terminate human and animal lives, it can also affect the natural wildlife and vegetation of an ecosystem. Flood waters causes land destruction by eroding coastlines, natural plant life, human and animal lives (Smith 2017). The harmful situations that come with flooding imposes threat to both living and nonliving things.

Species of weed scattering is another form of flooding effect. Proliferation of hostile species and decreases competition of indigenous plants as a result of consistent flooding is common in locations prone to flood yearly. Floods encourage hostile species while obstructing sustainability of inherent species by distressing them (Čuda et al. 2017). Aggressive alien species prevention is a core mandate of the 15th Sustainable Development Goal, plant seeds of hostile alien species are transported to

other areas during floods that are not indigenous or native to them.

Wildlife's are not left out during flooding tragedies they become displaced due to loss of natural territories or sometimes killed during disaster (Tawari-Fufeyin, Paul, and Godleads 2015). It is regular occurrence to lose human life, livestock, and farmlands during flood period. There has been an exponential growth of internally displaced persons and environmental refugees caused flooding-related issues in Nigeria in recent years (Adeniji 2018). Melioidosis that causes fatality a Soilborne diseases is been associated to flooding. Swift overflow from flooding induce erosion that brings about land degradation which increases deforestation. Deforestation increases the severity of flooding. Strengthening connection of land degradation caused by flood and degradation increases danger to flooding (De la Paix et al. 2013; Konrad 2003; Mahabaleshwara and Nagabhushan 2014; Mullan et al. 2019).

5. Conclusion

This study has enumerated the various ways flooding in Nigeria affects the nation accomplishing Sustainable Development Goals by computing the specific factors obstructing SDGs and how they are affected. The pattern of rainfall over the last three decades suggests that flooding disaster will continuing rising with consequent penaltie. The study evidently illuminates the effect of flooding on Nigeria to accomplishing the SDGs. It proposes urban planning as an appropriate flood Risk Management (FRM) strategy and an all-encompassing intensified action by government to reduce flooding and it impact in Nigeria. This paper will definitely add positively to flooding literature and open door for further studies on flooding disaster and it also established a holistic connection between flooding and sustainable development in Nigeria (Cirella and Iyalomhe 2018). To ensure advancement and guaranty sustainable development, the concerned parties must address the anthropogenic causes of flooding and it necessitate revisiting urban planning and environment management laws. More infrastructures should be built and the existing ones be improved and maintained in order to arrest the menace of flooding in Nigeria.

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