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Impact of Flash Flood Mitigation Approaches on Residential Buildings for Economic Growth and Sustainability in Rivers State.

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Abstract

The study analysed the different approaches used to mitigate the impact of flood on residential buildings for economic growth and sustainability in Rivers State, Nigeria. Three objectives and three research questions guided the study while three null hypotheses were formulated and tested at 0.5 level of significance. The study adopted a survey design and, the population of the study is comprised of all building designers and developers working with the 69 state approved building construction industries in Rivers State. The sampling technique was the stratified random technique, the 4 local government areas in Rivers State were sampled and the one with the highest number of building construction industries (Obio/Akpor) was picked, it has 25 building construction industries with 62 building designers and developers. Structured questionnaire titled 'Impact of Flood Mitigation Approaches on Residential Buildings in Obio/Akpor (IFMARBOA), was used to derive information, the instrument was validated by two experts, and the internal consistency of the research instrument was established by using Cronbach Alpha reliability method to determine internal consistency of the questionnaire items and overall reliability coefficient of 0.85 was obtained. Results revealed that the approaches: Spatial planning approach, Participatory planning and implementation approach and Legal and institutional framework approach had very great impact in mitigating the effect of flood on residential buildings in Rivers State. Based on the findings of the study the following recommendations were made: innovative and cutting edge building material technology is highly required, further research and training of professionals in built environment is highly recommended.

Key words

Mitigation Approaches, Flooding, Residential Buildings, Design and construction,

Introduction

Flooding, according to Gareth cited in Ganiyu and Fadiro (2010) is the over flow of a river or the temporary rise in the level of the sea or lake which results in the overflow of dry land. Zurich insurance group (2022) also affirmed that flooding is an overflowing of water into land that is normally dry, it was further opined that flooding can happen during heavy rain, when waves come on shore or when snows melt quickly or when Dams or levees break. In his assertion on the impact of flooding to the economic growth of a nation, Alcoforado (2018), stated that between 1980 and 2016, 90% of natural disasters were climate-related. In 2016, 31% of global losses were due to storms, 32% attributed to flooding and 10% to extreme temperatures. In addition, this study is justified as there is the prospect that climate change may contribute to increase flooding resulting from rising sea levels and heavy rains in certain regions of the planet. Flooding is caused by the gathering of water on dry land due

to overflow from rivers, and drainages as a result of heavy down pour from rain and unmaintained dams. Also Odume, (2022) stated that, in Nigeria, some of the causes of flooding are urbanization, poor spatial planning and poor solid waste management. In furtherance, he narrated that, flooding is an annual event which in some years the effect is minimal but in some other years, severe. In buttressing this, it was it worthy of note that the flood of 2022 caused massive damage like those experienced in 2012 (ten years ago). The flood affected more than 7.7 million people across 32 out of the 36 states of the nation, while the recent one of 2022 affected 1.4 million people living in 27 out of 36 states (Odume, 2022). There are basically four types of flooding as stated by Elnafaty (2019) and Odume, 2022, they include river flooding (fluvial) – this occurs when the water level in a river lake or stream rises and over flows into neighbouring land, coastal flooding – occurs as a result of overflow of land areas along the coast by sea water due to severe wind storm events resulting from storm surge or tsunami, flash flooding

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(pluvial flood) – this occurs when an stream rainfall event creates flood independent of an overflowing water body, and urban flooding (surface water floods) – this occurs when an urban drainage system is overwhelmed and water flows out into streets and nearby structures. For the purpose of this research, the researcher focused on the flash flooding as its definition suits the type of flooding that occurs in Port Harcourt city of rivers state.

Flash flooding according to Weather.gov (2022) can be caused by a number of things, but most often, due to serious and consistent rain fall of within 3 – 6 hours. It can also occur due to Dam or levee breaks and or debris flow. Other causes of flash flooding according to Weather.gov are the intensity of rain fall, topography, distribution of rain fall, soil type, vegetation types, soil water content and growth density. Also, Flash flooding according to (Elnafaty 2019), can be caused by a number of factors, but most often, due to serious and consistent rain fall of within 3 – 6 hours. It can also occur due to Dam or levee breaks and or debris flow (Djimesah, Okine & Mireku 2018). Other causes of flash flooding according to Nwigwe, and Emberga, (2014) are the intensity of rain fall, topography, distribution of rain fall, soil type, vegetation types, soil water content and growth density. Port Harcourt being an urban city is characterised with most of all the features listed above, this makes it prone to flash flooding. Port Harcourt is the largest city and capital of rivers state, and by its nature, it is an urban city inhabited by people from all walks of life, as at 2016 it had an estimated population of 1,865,000 inhabitants as against 1,382, 592 of 2006. It is comprised of four local government areas namely: Obio/Akpo, Port Harcourt, Ikwerre and Emohua local government areas, their major language is Ikwerre. There are several means of livelihood ranging from industries and business places, these have attracted people from all walks of life to settle in Port Harcourt which in turn is supposed to foster growth and development in the area. Due to influx of humans seeking livelihood, buildings have become a necessity to house both the inhabitants and their source of livelihood. There are different types of buildings namely; industrial (housing all industrials activities), commercial (housing activities involving exchange of goods and services) and residential buildings (housing humans and their properties). This research is on approaches to mitigate impact of flash flooding on residential buildings.

Residential buildings as earlier described refers to the kind of building that shelters man and his properties, (International Building Code IBC, 2018). They are of different types namely: bungalows, semi-detached bungalows, terrace buildings and so on. Buildings are constructed to ensure satisfaction of the users, safety from invaders and weather conditions, but where the function becomes otherwise, it then calls for maintenance and renovation. Several reasons may be attributed to the dilapidated state of these buildings thereby causing discomfort to inhabitants, among them are depreciation in paint colour, roof and roof members' dilapidation, wall deformation and so on. Furthermore, Ganiyu and Fadairo (2010) opined that flooding does not only damage property and endangers human and animal lives, it also have some other devastating effects on the environment as well. Some

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of which he listed as sewer outfalls, bridge abutment, bank lines and other structures within floodway Some of the these problems most a time are as a result of weather conditions such as flooding.

Flooding is a natural occurrence that can even have far reaching effects on people and the environment; put simply as too much water in the wrong place. Also, flooding is a large quality of water covering a dry land as a result of flow from storm water (rain) and other sources such as river overflow due to the volume of water within a water body exceeding the total capacity of the body (Ceylon, 2014). Flooding is a common occurrence in many parts of the entire mangrove belt of Nigeria and fresh water especially at the high tide or during rainy season. Flooding also occurs in floodplains of large rivers and many areas and town especially those located on flat or low-ling terrain where adequate provisions have not been made for surface drainage or drainages have been blocked by municipal wastes and eroded soil sediments. Cities like Port Harcourt, Lagos, Warri, and Bayelsa are within the mangrove and fresh water belt. They experience annual flooding. Flooding occurs when the amount of water on the land (from rainfall, snow melt, surface flow, and flow in water) courses inundation or when the sea exceeds the capacity of the land to be discharged by infiltration, surface flow, piped drainage or surface water courses. Flooding also occur if water accumulates across an impermeable surface and cannot rapidly dissipate it. There are various factors that enhance flooding, these include; the degree of urbanization, lack of vegetation cover due to deforestation, land development; presence of impermeable soils and existence of low-lands. Flooding poses disastrous effect to our buildings and to our health, to avoid this, there is need for mitigation.

Mitigation from the office of strategic initiatives (2022) is the effort to reduce loss of life and property by lessening the impact of disasters, it mean; taking action now before the next disaster. Flood mitigation involves the management and control of flood water movement such as redirecting flood run-off through the use of flood walls and floodgates. It involves the management of people, through measures such as evacuation and dry/wet proofing properties. The prevention and mitigation of flooding can be carried out on three levels which are on; individual properties, small communities and whole town/ cities. However, this study focuses on the approaches to mitigate flash flood in residential building designs and during construction, some of these approaches include: Spatial planning approach, Participatory planning and Implementation approach and Legal and Institutional framework approach Spatial planning is a future oriented activity, it influences future allocation of activities in spaces. Spatially Integrated Policy Infrastructure (SIPI) is conceptualized to encompass data and information, decision support and analysis tools, and access tools and protocols (Elsevier 2016). It has both regulatory and development functions and through spatial planning individuals and collective agents exercise discretion and make choices or choices about future courses of action related to future investment and development. Key issues such as Disaster Risk Reduction are considered when analyzing spatial planning problems. Programs to improve

quality and durability of existing infrastructure can also be established. New building codes with disaster risk reduction (DRR) provisions and standard can be implemented and enforced.

Furthermore, spatial analysis approach to flood mitigation is functional in two aspects, they are: mitigation at the structural point, and mitigation at site development. The mitigation at the structural point is carried out to ascertain the following: source of flood, flood depth, flood velocity, flood duration, rate of rise and fall, wave effects, flood borne debris, erosion, while at site development level, mitigation includes; detached garages, fences, filling in-site, ground elevation at or above design elevation level, flood proofing which could be active or passive, wet proofing or dry proofing which makes the building resistant to flood damage either by taking the building out of contact with flood waters or by making the building resistant to any potential damage resulting from contact with flood waters. Use of flood resistant building materials such as concrete, concrete tiles, precast concrete, bituminous, ceramic, terrazzo, rubber sheet and tile, pressure treated or decay resistant lumber, brick, glass block, stone, clay tile, reinforced concrete, flood elevation elements, foundation bracing, grade beams, flood openings, use of sealants. Flood shields and valves, are all spatial mitigation approach Participatory planning and implementation approach involves soliciting ideas from participants or users of the residential buildings, local communities to discover solutions to problems through participatory techniques. The motivation for participation by local people is that, beneficiary involvement makes the residential building project more likely to succeed in meeting their objectives. Legal and institutional framework approach involves the use of formal organization structures, rules and formal norms for service provision. It is essential for establishing the roles and responsibilities of the different actors involved in designing, administering, delivering and enforcing social protection systems. The most applicable legislation for the construction industry in Nigeria today is the Building act 1984 and its associated regulations, the act is the primary legislation and its stated purpose is to secure health, safety, welfare and convenience of persons in and about buildings and others who may be affected by building matters or matters connected to buildings. These standards are regulated by Council of Registered Builders of Nigeria CORBON in Nigeria and other related regulatory bodies.

Reasons for the study

The enlightenment of flood mitigation to professionals of the built environment, developers, land owners and Government reduces the overall risk of structures experiencing flood damage and also reduces the severity of flood damage when it occurs. It also reduces physical, financial and emotional strain on the users of the buildings that could be affected by flood. The effects of flooding on structures include direct damage during a flood from inundation, high velocity flow, waves, erosion, sedimentation and or flood-borne debris, degradation of building materials either during flood or sometime after flood, contamination of the building due to flood borne substances or mold. These and other vices of flood in a society results to exodus of dwellers, and in other

words is capable of crumbling growth and development of such environment where it occurs.

Statement of the Problem

Port Harcourt city, like most urban areas of the third world, has in most times experienced accelerated population growth which has led to changes in the land use activities. Depth of flood water in affected areas has escalated significantly in the past ten years due to combined effect of uncoordinated, uncontrolled rapid urbanization, development of swamps, flood plains and natural drainage channels, (Akpokodje, 2007). Elenwo (2015) affirmed that, flood has affected real property value in Port Harcourt as flood prone properties remained in the market longer without a buyer due to the intensive cost of developing and maintaining them. More so, he stated that a survey on house hold losses on flood from 2003, 2006 and 2007 in Port Harcourt revealed a whopping loss of about five million naira every year. The overflow of Ntawogba creek in 2002, 2004, and the Obio/Akpor flood of 2016, caused untold hardship to inhabitants living of Port Harcourt municipal. Disposal of refuse into the creek is another contributing factor and it is common in Port Harcourt municipal which is bound to result to risk of sea-level over flow and flooding because of its low elevation over extensive areas. The flood risk in Port Harcourt is bound to increase in future with increasing urbanization, hence the need to explore the approaches to mitigate the impact of flashfloods in residential buildings' design and construction in Rivers State.

Aim/Objectives of the Study

The aim of the study is to explore the impact of flood mitigation approaches on residential buildings for economic growth and sustainability in Rivers State.

Specifically the study will explore the extent of the impact of flood mitigation with;

1. Spatial planning approach on residential buildings for economic growth and sustainability in Rivers State.
2. Participatory planning and implementation approach on residential buildings for economic growth and sustainability in Rivers State.
3. Legal and institutional framework approach on residential buildings for economic growth and sustainability in Rivers State.

Research Questions

The following research questions were formulated to guide the study:

1. To what extent is the impact of spatial planning approach in flood mitigating on residential buildings in Rivers State?
2. To what extent is the impact of participatory planning and implementation approach in flood mitigating on residential buildings in Rivers State?
3. To what extent is the impact of legal and institutional framework approach in flood mitigating on residential buildings in Rivers State?

Hypotheses

The following hypotheses were formulated and tested at .05 level of significance

H₀₁: There is no significant difference in the mean response of building designers and developers on the extent of the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State.

H₀₂: There is no significant difference in the mean response of building designers and developers on the extent of the impact of participatory planning and implementation approaches in flood mitigation on residential buildings in Rivers State.

H₀₃: There is no significant difference in the mean response of building designers and developers on the extent of the impact of legal and institutional framework approaches in flood mitigation on residential buildings in Rivers State?

Methodology

The survey research design was carried out with a questionnaire instrument titled ‘Impact of Flood Mitigation Approaches on Residential Buildings (IFMARB), to elicit appropriate responses the population was 138 building designers and developers in 69 registered building Data Analysis and Presentation

Research Question 1: To what extent is the impact of spatial planning approach in flood mitigating on residential buildings in Rivers State?

Table 1: Mean and Standard Deviation on the extent of the impact of spatial planning approach to mitigate the impact of flood on residential buildings’ in Rivers State.

S/NO	Spatial Planning Approach	Designers			Developers		
		X	SD	RMK	X	SD	RMK
1	Disaster risk reduction	3.57	.692	SA	3.81	1.039	A
2	Elevate above the flood level	3.56	.732	SA	4.11	.859	A
3	Apply coating, sealants and water proof veneer.	4.28	.750	A	4.35	.719	A
4	Raise or flood proof HVAC equipment.	4.93	1.004	A	3.95	.932	A
5	Install foundation vents	4.16	.941	A	4.42	.844	A
6	Construct permanent barriers	4.95	.875	A	4.09	.860	A
7	Install Sewer backflow pipes	4.25	.931	A	4.32	.736	A
8	Grade lawn away from the building	4.99	1.088	A	4.31	.790	A
9		4.05	.990	A	4.42	.625	A
	Grand Mean	4.31	0.88	A	4.19	0.83	A

Source: Field Survey 2022

Data in Table 1 revealed that designers had a mean range of 3.56-4.99 and standard deviation range of 0.69- 1.08. While the developers had a mean range of 3.81-4.42 and standard deviation range of 0.71-1.04. The mean shows that the respondents agreed to a high extent the spatial planning approach to mitigate the impact of floods on residential

construction industries in Rivers State (Rivers State Yellow Page, 2006). Only 25 designers and 40 developers were randomly sampled from the building construction industries in Obio/Akpor Local Government Area making a total of 65 respondents. The instrument (IFMARBOA) was subjected to face and content validity by two experts in Building technology option at the Ignatius Ajuru University of Education, Rumuolomeni, Port- Harcourt. The internal consistency of the research instrument was established by using Cronbach Alpha reliability method. Five likert scale of Strongly Agree (SA) - 5, Agree (A) - 4, Undecided (U) - 3, Disagree (D) - 2, Strongly Disagree (SD) - 1. Data collected from the respondents were analysed using mean and standard deviation to answer the 3 research questions, a decision rule based on real limit of numbers was used. Decision was taken as follows: Agree an item if mean calculated is greater than the real limit of 3.50 but disagree item if mean calculated is less than the real limit 3.50. Standard deviation and z-test statistical table was used to test the null hypotheses and the decision for hypotheses was, if the calculated value of z (z-cal) is greater than p value of (0.05), accept the null hypothesis, otherwise reject null hypothesis. The computation was done with Stastical Package for Social Science (SPSS).

buildings’ in Rivers State. The standard deviation shows the homogeneity of the respondents. Research Question 2: To what extent is the impact of participatory planning and implementation approach in flood mitigating on residential buildings in Rivers State?

Table 2: Mean and Standard Deviation on the extent of the impact of participatory planning and implementation approaches to mitigate the impact of floods residential buildings’ in Rivers State

S/NO	participatory planning and implementation approaches	Designers			Developers		
		X	SD	RMK	X	SD	RMK
1	Architects participation	4.23	.881	A	4.34	.797	A
2	Builders participation	4.44	.926	A	4.16	.902	A
3	Engineers participation	4.11	.858	A	3.70	1.059	A
4	Developers participation	4.26	.897	A	3.86	1.025	A
5	Community representative participation	4.09	.989	A	4.17	.891	A
6	NGOs participation	4.18	.889	A	4.25	.830	A
7	Focal groups participation	3.97	.954	A	4.26	.809	A
8	Users of school buildings participation	4.04	1.017	A	4.32	.827	A
9		3.88	.880	A	4.02	.979	A
10		3.61	0.99	A	4.02	1.06	A
	Grand Mean	4.08	0.93	A	4.11	0.92	A

Source: Field Survey 2022

Data in Table 2 revealed that building designers had a mean range of 3.61-4.44 and standard deviation range of 0.88 - 1.02. While the building developers had a mean range of 3.70-4.34 and standard deviation range of 0.79 - 1.06. The mean shows that the respondents agreed to high a extent that the participatory planning and implementation approaches to mitigate the impact of floods on residential buildings’ in Rivers State.

The standard deviation shows the homogeneity of the respondents.

Research Question 3: To what extent is the impact of legal and institutional framework approach in flood mitigating on residential buildings in Rivers State?

Table 3: Mean and Standard Deviation on the extent of the impact of legal and institutional framework approaches to mitigate the impact of floods on residential buildings’ in Rivers State.

S/NO	Legal and Institutional framework approaches	Designers			Developers		
		X	SD	RMK	X	SD	RMK
1	Formal organization structures	4.22	.856	A	4.03	.929	A
2	Rules/laws	3.58	.706	SA	4.02	.876	A
3	Informal norms	4.09	.785	A	4.22	.932	A
4	Establishment of roles of key actors	3.98	.719	A	4.39	.840	A
5	Enforcing social protection system	4.17	.921	A	4.03	.982	A
6	Use of building codes and regulations	4.11	.994	A	3.98	.744	A
7	Building standards	4.27	.877	A	3.88	.982	A
8	Functions of regulatory bodies	3.93	.863	A	4.07	.923	A
9	Compliance and enforcement agencies	4.34	0.86	A	3.63	0.59	A
10		3.55	0.67	A	3.86	0.49	A
	Grand Mean	4.02	0.83	A	4.01	0.83	A

Source: Field Survey 2022

Data in Table 3 revealed that building designers had a mean range of 3.55-4.34 and standard deviation range of 0.67 - 0.99. While the building developers had a mean range of 3.63-4.39 and standard deviation range of 0.49 - 0.98. The mean shows that the respondents agreed to a high extent that the legal and institutional framework approaches to mitigate the impact of floods on residential buildings' in Rivers State.

Table 4: Independent sample t-test between the mean responses of building designers and developers on the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State.

Respondents	NO	\bar{x}	SD	DF	T-Calc	T-crit	P	Decision
Designers	25	4.31	.88	63	.19	1.68	.05	Accept
Developers	40	4.19	.83					

Source: Field Survey 2022

Table 4 is the result of an independent sample t-test between the mean responses of building designers and developers on the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State. The table revealed that mean and standard deviation of designers 4.31 and .88 respectively. The mean and standard of developers is 4.19 and .83. The calculated t-value is .19 and is less than the

Ho₂: There is no significant difference in the mean response of building designers and developers on the extent of the impact of participatory planning and implementation approaches in flood mitigation on residential buildings in Rivers State.

The standard deviation shows the homogeneity of the respondents.

Ho₁: There is no significant difference in the mean response of building designers and developers on the extent of the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State.

critical table value of 1.68 hence the null hypotheses was accepted. This shows there is no significant difference in the mean response of building designers and developers on the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State.

Table 5: Independent sample t-test between the mean responses of building designers and developers on the extent of participatory planning and implementation approaches in flood mitigation on residential buildings in Rivers State.

Respondents	NO	\bar{x}	SD	DF	T-Cacl	T-crit	P	Decision
Designers	25	4.08	.93	63	.12	1.68	.05	Accept
Developers	40	4.11	.92					

Source: Field Survey 2022

Table 5 is the result of an independent sample t-test between the mean responses of building designers and developers on the impact of participatory planning and implementation approaches in flood mitigation on residential buildings in Rivers State. The table revealed that mean and standard deviation of designers 4.08 and .93 respectively. The mean and standard of developers is 4.11 and .92. The calculated t-value is .12 and is less than the critical table value of 1.68 hence the null hypotheses was accepted. This shows there is no significant difference in the mean response of building designers and developers on the impact of participatory planning and implementation approaches in flood mitigation on residential buildings in Rivers State.

Ho₃ There is no significant difference in the mean response of building designers and developers on the legal and institutional framework approaches in flood mitigation on residential buildings in Rivers State?

Table 6: Independent sample t-test between the mean responses of building designers and developers on the legal and institutional frameworks approaches in flood mitigation on residential buildings in Rivers State.

Respondents	NO	\bar{x}	SD	DF	T-Cacl	T-crit	P	Decision
Designers	25	4.02	.83	63	.04	1.68	.05	Accept
Developers	40	4.01	.83					

Source: Field Survey 2022

Table 6 is the result of an independent sample t-test between the mean responses of building designers and developers on the impact of legal and institutional framework approaches in flood mitigation on residential buildings in Rivers State. The table revealed that mean of and standard deviation of designers 4.04 and .88 respectively. The mean and standard

of developers is 4.01 and .83. The calculated t-value is .04 and is less than the critical table value of 1.68 hence the null hypotheses was accepted. This shows there is no significant difference in the mean response of building designers and developers on the impact of legal and institutional

framework approaches in flood mitigation on residential buildings in Rivers State.

Discussion

Research question one examined the impact of spatial planning approach in flood mitigating on residential buildings in Rivers State. The respondents agreed on all the items in the instrument as the spatial planning approach in mitigating the impact of flood on residential buildings in Rivers State. The null hypothesis guiding the study was accepted indicating that there is no significant difference in the mean response of building designers and developers on the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State. The findings of the study is harmony with Casper, Wim, and Jos (2022) who maintained that the spatial analysis approach to flood mitigation is functional in two aspects namely the mitigation at the structural point and mitigation at site development.

Research question two determined the impact of participatory planning and implementation approach in flood mitigating on residential buildings in Rivers State. The respondents agreed on all the items in the instrument as the of participatory planning and implementation approach in mitigating the impact of flood on residential buildings in Rivers State. The study also revealed that there is no significant difference in the mean response of building designers and developers on the impact of spatial planning approach in flood mitigation on residential buildings in Rivers State. The findings of the study is in harmony with Nugraheni and Suyatna, (2020) and Hendra, and Zakariah (2018) whose studies also revealed that the participation of the community in the maintenance determines the quality of the environment and life of the existing community, because the community is the main actor who plays an important role in the good condition of the environment around the community thereby mitigating flood.

Research question three deals with the legal and institutional framework approach in flood mitigating on residential buildings in Rivers State. The respondents agreed on all the items in the instrument as the of legal and institutional framework approach in mitigating the impact of flood on residential buildings in Rivers State. The study also revealed that there is no significant difference in the mean response of building designers and developers on the impact of legal and institutional framework approach in flood mitigation on residential buildings in Rivers State. The findings of the study is in agreement with Amadi and Azubuike (2017) who maintained that for effective flood mitigation it is vital to develop land use policies that can steer potential developers to alternative locations outside the flood-prone areas, outlaw or reduce the rate of floodplain invasion, compel governments to invest in flood mitigation measures on a sustainable basis and prohibit deforestation and other unwise land use practices in threatened areas. They further asserted that the absence of up to date flood control Acts 5 and inadequate number of sustainable flood control strategies especially in low lying coastal and southern urban areas of the country have been some of the contributing factors that leads to floods.

Conclusion

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The study explored some of the approaches to mitigate flooding on residential building designs and during construction, these include spatial planning, flash flood forecasting and Warning Participatory planning and Implementation, legal and Institutional framework and how they impact on residential buildings and every other kind of buildings. It further emphasized that if the approaches are adhered to, flood which is a natural occurrence, will not be diverting dwellers and stopping them from running around their businesses. This in turn will aid in environmental and societal growth and sustainability.

Recommendations

Spatial planning approach in flood mitigating involving Innovative and cutting edge building material technology is highly required.; Participatory planning and implementation approach should be effective and functional to enhance mitigation of flood and Legislation on a comprehensive national policy on flood control should be prepared and implemented across the control.

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