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Revealing Parameters For Sustainable Property Development In Flood Prone Lands: A Case Study Of Yenagoa Metropolis, Bayelsa State, Nigeria

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Abstract: *Flooding is one of the environmental problems that have constituted a major concern in Bayelsa State of Nigeria especially with the attendance risk of disaster to the built environment and socioeconomic activities. The study is an attempt to address the issues of flood disaster in Bayelsa State with particular focus on assessing the parameters for sustainable property development in the study specific area. A case study research design was used for the study. The major instrument of data collection was questionnaire designed in a 5-point Likert scale. A total sample size of 90 respondents was drawn from the professionals in the built industry by using convenience random sampling out of which 63 responses were obtained. The data collected were analysed through descriptive statistics. The findings revealed that the traditional method of direct construction on the site is commonly used in the study area thus, there is need for design re-orientation to inculcate other modern methods/models of sustainable construction in order to achieve sustainable property development in Bayelsa built environment. Furthermore, the sustainability criteria of environmental, economic and social variables indicated that the most important factors are- raising of building elevation higher than the flood water level (0.98), use of sustainable building materials (0.95), avoidance of building on flood plains (0.90), maximization of land and space use 0.90), visual comfort and adequate lighting (0.93)which are all essential for consideration in making property development sustainable in Yenagoa, Bayelsa. Therefore, for an improved environment in Bayelsa State, strict enforcement of building codes and rules is necessary, building on flood plains should be discouraged, use of sustainable and high standard building materials for property development should be maintained. Hence, government should enact relevant laws to enhance the quality of built environment and as well educate the stakeholders in the property development/construction industry.*

Keywords: *Sustainability, Sustainable Property Development, Flooding, Disaster Risk, Built Environment*

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I. Introduction

Reducing disaster risk and increasing resilience to natural hazards in the social, economic and environmental aspects in the different development sectors of nations is increasingly dominating the global issues today. This results from the primary goal of sustainability, which is to reduce humanity's environmental or ecological footprint on the planet (Nwokoro, et. al 2011). Further, this major objective has been linked to all other aspects of the economic development of nations, such as in the real property development sectors. Therefore, the emphasis for sustainable property development is on how to develop our built environment without endangering our natural environment or putting humanity at risk. Flooding is the result of water overtopping its natural and manmade defences and overflowing places not typically submerged as a result of sudden arrival of heavy storms which overwhelms soil infiltration capacity and urban drainage systems (Smith & Ward, 1998 cited in Nkwunonwo (2016). It is therefore one of the environmental problems that affect the sustainability of the living environment with the attendant disaster which are the risks associated with living in hazardous locations such as flood prone land. The disaster risks involved include damage to property and infrastructure, displacement, disease, loss of lives and means of livelihood etc. Bayelsa State is naturally prone to flooding which has become a perennial issue due to its location at the base of Niger Delta region of Nigeria, to make the matter was, most of the buildings/properties in the locality were not developed with the principles and attributes of sustainability which can make them to withstand the damaging effect of flooding.

The spatial distribution of built environment in some parts of the state depicts a situation of poor or lack of urban planning. Most properties were developed without regard for planning rules and building regulations, there is also lack of resilience and adaptive measures for disaster reduction during flooding**.** For this reason, the study was carried out to elucidate on the strategic criteria require for environmental, economic and

social sustainability of property development in the study area, the significance of which include among others - to minimise negative environmental impacts in the built environment, reduce disaster risk and improve the living condition in the local area, maximise the sustainable use of resources, reduction in waste and effective waste disposal, encourage utilisation of recycled materials and enhance recyclability, extend durability and functionality to property, reduce the energy and water intensity in property development by encouraging the use of renewable energy and reduction in water consumption and follow through in land use planning, zoning and building regulations. This will in-turn assist in formulating necessary policy, regulations, ethics and awareness required by government and stakeholders in the building/construction industry.

The concept of sustainability otherwise known as sustainable development is the development that meets the needs of humans in the present without limiting the ability of future generations to meet their own needs" (Brundtland, 1987). Sustainable property development is the application of the principles of sustainable development to the comprehensive construction cycle, from the extraction and processing of raw materials through the planning, design, and construction of buildings and infrastructure to their final deconstruction and waste management (PEDRR/CNRD 2000). The purpose of the study is to investigate the sustainable property development parameters that can be adopted as a strategy for disaster risk reduction in the development of real properties in the flood prone areas of Yenagoa, Bayelsa State. The research addressed the following research questions: - (a) what are the sustainable property development models most often utilized in Bayelsa? and (b) what are the criteria for sustainable property development in the flood prone area? Hence, relevant works on sustainability concept, sustainable property development, were reviewed, as well as how sustainability principles and attributes can be aligned to create sustainable property development in a flood prone area. In a more specific focus, sustainable building (green & brown sites) construction models through their attributes and criteria for sustainable property development were also examined in this paper.

II. Literature Review

Environmental awareness is no longer optional, the legal, fiscal and planning policy frameworks as well as the demands of increasingly informed building occupiers and owners make it essential for property professionals to understand the issues affecting sustainable property development today (Keeping, et. al, 2003). Therefore, flooding is one of the environmental problems that affect the sustainability of the living environment with a lot of concerns to government, non-governmental organizations, general public and professionals in the built environment. There are many speculations as to the causes, the damaging or negative effects and the possible strategies or measures to reduce the negative impacts on the society, bio diversities and ecosystem. Flooding is the most common of all environmental hazards (Evans, 1995 as cited in Odubo, 2014). In Nigeria, flood has been reported to affect and displace more people than any other disaster **(**Nkwunonwo, 2016**)**. It also causes more damages to property. Further, Etunonovbe (2011), cited in Odubo (2014) clearly stated that at least 20 percent of the population is at risk from one form of flooding to another. However, the built environment in general and property development in particular, have significant impacts on all the three aspects of social, economic and environmental sustainability. According to Keeping, et al, (2003) 'the development process impacts on resource consumption, energy use, biodiversity, water consumption and water course patterns, waste production and the physical design and on urban spaces'. Similarly, Nwokoro et al, (2011) opined that sustainable construction has emerged as a guiding paradigm to create a new kind of built environment: "one that meets the needs of humans in the present without limiting the ability of future generations to meet their own needs" (Brundtland, 1987, Ofori, 2001, Ihuah and Kakulu, 2016). The creation, operation and disposal of the built environment dominate humanity's impact on the natural world (Kibert et al., 2000). Therefore, the demonstration of what sustainable development concept is may be ambiguous but is briefly discussed in the immediate subsection of the paper

2.1 Concept of Sustainability

According to Goodland (1995) the concept of sustainability is based on three major aspects which are: social sustainability, economic sustainability and environmental sustainability. Sustainable Development (SD) should integrate social, environmental, and economic sustainability goals and use these three pillars to start to make development sustainable. Sustainable development is therefore assumed to be the development that is socially, economically and environmentally sustainable. The Sustainability concept is to ensure that human beings of the present generation carry out developmental activities in a way that it would not leave a negative foot-print on the planet (Nwokoro, et. al, 2011). The concept of sustainability has been adapted to address very different challenges, ranging from the planning of sustainable cities to sustainable livelihoods, sustainable agriculture to sustainable fishing, and efforts to develop common corporate standards in the UN Global Compact and in the World Business Council for Sustainable Development (Roberts, et. al, 2005).

Again, Ehrenfeld (2008) defined sustainability as "the possibility that humans and other life will flourish on Earth forever". While Lee Liu, (2009) defined sustainability as "living within one's own ecological

means". However, these definitions pay attention to regional disparities in bio-capacity and ecological footprint, as they recognised that not all people's present and future needs may be met in all regions of the world.

Irrespective of the differences in opining about the concept of sustainable development, Roberts, et. al., (2005) and Ihuah and Kakulu (2016) posit that the Brundtland Comission's (1987) definition is the most globally acceptable and remain the standard definition today. The commission defined sustainable development as "the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs"

2.2 Property Development Process

Property as a social institution implies a system of relations between individuals and it involves rights, duties, powers, privileges, forbearance, etc., of certain kinds (Hallowell, (1943) as cited in Ebohon, et. al., 2002). The property in the context of this scholarship means the land and physical development on it. According to Ebohon, et. al., (2002), property development is the process by which buildings are erected for use/occupation or for sale/investment and is a key dimension of both urban capacity and urban quality. The entire property development process can be regarded as a number of different stages of activity which may be carried on consecutively, but some of which are likely to be undertaken simultaneously (Millington, 2000). It is a process that transforms a vacant site into a new land use or one that converts a redundant or obsolete property into a new use (Wyatt, 2014). The property development process envisages a timeline from inception to completion which involves different stages that include: Conception stage which is the initial creative thinking and a very important stage in property development process at which ideas are formulated for realistic development proposals (Millington, 2000); Site identification and detailed survey of locations that are most suitable for the development considering some characteristics such as physical site, economic, legal interest, planning control, cost of acquisition, size, shape, accessibility, soil structure, facilities etc (Millington, 2000); Site acquisition if site/location has been determined as acceptable with the relevant attributes considered for the envisaged development; Provision of outline schemes and appraisal in parallel to working up a development concept/scheme which would win the support of the local planning authority (Isaac et al, 2010); Detailed design and engineering drawings of the development by the architect; Obtaining planning consent through application and detailed permission from the planning authority (Isaac et al, 2010); Finance: This is the stage at which decision and negotiation for finance to fund the development will be appraised either through equity capital of the project owner or loan facility arrangement (Isaac et al, 2010); Invitation for tender documents through various or selected contractors for the execution of construction activities and materials supply as the case may be; Selection and assembly of the professional/construction team for the actualization of the development project. The number of professional requirement varies and will depend on the type and magnitude of the project. Most professions in the team usually include architect, estate surveyor & valuer, land surveyor, quantity surveyor, town planner, engineers from various fields – building, civil, electrical, mechanical and legal adviser etc as the project may require; Environmental Impact Assessment which will depend on the type and category of the development project and may not be necessary in small scale residential development. This is done to ensure that the likely effects of a new development on the environment are fully understood before the development starts with proposed mitigation measures to reduce the negative impact (Wyatt, 2014). Other stages may also be required such as marketing stage if the development is for sale/investment. Appointment of a project manager or site supervisor is also an important process as without good supervision a sound scheme can become a failure. There are various stakeholders involved in the property development process. The number of stakeholders would however depend on the type or magnitude of the development. Millington (2000), categorized those involved into two, namely (i) developers, and (ii) the professionals, or the consultants, who assist and advise developers. Isaac et al, (2010), opined that there are some general patterns of stakeholder involvement which include the Developer, Landowner or Client, Contractor, Local Planning Authority, Funding Institution/Development partner, the Community, and the Developer's professional team

2.3 Sustainability and Property Development

Property development accounts for a considerable large amount of land. The construction industry is the largest destroyer of the natural environment (Woolley, 2000). It is a major consumer of non-renewable resources, produces substantial waste, pollutes air and water, and contributes to land dereliction (Wallbaum and Buerkin (2003) as cited by (Nwokoro et al, 2011)**.** The primary goal of sustainability is to reduce humanity's environmental or ecological foot print on the planet (Nwokoro et al, 2011)**.** The emphasis is therefore, how to develop without endangering our natural environment or putting humanity at risk. The principle of sustainability 'implies using natural resources in a way which does not eliminate or degrade them or otherwise decrease their usefulness to future generations, and implies using non-renewable natural resources at a rate slow enough to ensure a high probability of an orderly societal transition to a new alternatives' (Pearce et al 1989 as cited in Kates et al,(2005).Sustainable property development is the adoption of the concepts of sustainability in the built

environment. Thus sustainable property development has emerged as a guiding paradigm to create a new kind of built environment (Nwokoro et al 2011). "Principles of sustainable property development focus on the attributes such as the physical structure, technical, environmental, economic, social, utility, durability, and comfort**.** Hence, the sustainable property development approach is aimed at the structure and the use of processes that are environmentally responsible and resource efficient throughout a building's life-cycle which starts from identifying a site to design, construction, operation, maintenance, renovation, and demolition in order to reduce the negative environmental impacts and enhance the local area, health of the occupant, extend durability, functionality and economic life and maximize the sustainable use of resources"(GBCA, 2016)**.**

2.4 Sustainable Property Development Models

Sustainable property development (construction) model looks into the design and management of buildings, materials and building performance, energy and resource consumption through efficient energy use and environment friendly materials (Shahriar et al 2009). Sustainable property development models are in two forms – the greenfield sites and the brownfield sites. Sites previously developed for any purpose are generally known as 'brownfield' sites while sites which have no previous development are known as 'greenfield' sites (Wilkinson, et al, 2016)

- ***Green Construction Methods/Models***

Sustainable development has given rise to green construction. The concept is used as a basis for enhancing understanding of sustainable construction and property development (Nwokoro et al 2011). Green construction is a sustainable design and construction method that use our resources more efficiently while creating healthier and more efficient homes with the aim to leave lighter footprint on the environment through conservation of resources, while balancing energy efficient, cost effectiveness and low-maintenance products (Ekong, 2015). It is a construction model or method that involves finding the delicate balance between construction and sustainable environment. Most green building practices fall into basic categories of energy saving, land saving, storm water runoff-reducing, cost reduction, material conservation and pollution reduction (ECO Northwest, (2001) cited in Nwokoro et al (2011). On the aesthetic side of green architecture or sustainable design is the philosophy of designing a building that is in harmony with the natural features and resources surrounding the site(GBCA, 2005). The various methods of green construction models include:"Lean Construction Model (LCM) - (Reduce Resource Use strategy) which is concerned with the alignment and holistic pursuit of concurrent and continuous improvements in all dimensions of the built and natural environment design, construction, activation, maintenance, salvaging and recycling (Abdelhamid et al, 2008); De-Construction model is designing a building in such a way that the components can be easily removed or dismantled for re-use or recycle. De-construction model in property design minimize waste, saves time, and eases maintenance; Recycle and Re-Use Materials model", the Re-use materials method is using of already used materials in another part of the same building or new development. Recycling is re-processing of materials and using them for other purpose; Pre-Fabrication (Off–Site) Method of Construction - building components can be fabricated off sight and brought to the building site to be assembled. It is similar to de-construction strategy but are not the same; In–Situ Construction Method is the method of executing building construction work directly on the site, the method encourages waste of materials since every activity is carried out on the site (GBCA, 2016).

- ***Brownfield Construction Methods/Models***

Using a 'brown field' site in preference to a 'green field' site is written into planning policy in some countries (Wilkinson, et al, 2016). The various brownfield development models are: Re-use of land - previously developed land can be re-used for new development, this often reduce dependence on transport and promote more compact settlements, it could also be seen as protection of important habitats. However, the development must be balanced against the other environmental arguments against dense development, including propensity to flood due to increased hard surfacing (Wilkinson, et al, 2016); Re-use of building – is the promotion of retrofit and refurbishment of buildings. Such solutions can help to maintain a sense of place whilst reducing the creation of waste and reduction in carbon emission (Wilkinson, et al, 2016). "Repair and maintenance of existing infrastructure instead of embarking on new development which can further impact the environment is encouraged as another way of sustainable property development. This is based on the premise that one can refuse to build where alternative exists. Since construction activity almost always degrades a building site, not building at all is preferable to green building, in terms of reducing environmental impact" (GBCA, 2016). Successful projects built on brownfield sites can improve water quality, remodel eyesores or restore community character(Wilkinson, et al, 2016).

2.5 Strategies and Criteria for Sustainable Property Development

Green building construction methods bring together a vast array of practices, techniques, and skills to reduce and ultimately eliminate the impacts of buildings on the environment and human health.(GBCA, 2005). While the practices and strategies or technologies employed in green building are constantly evolving and may differ from region to region, fundamental principles/strategies persist from which the method is derived: sitting and structure design efficiency, energy efficiency, water efficiency, materials efficiency, indoor environmental quality enhancement, operations and maintenance optimization and waste and toxics reduction. Thus, the essence of green building is an optimization of one or more of these principles as a strategy for sustainable (building) property development. Based on the principles/strategies for sustainable (green) construction Isaac et al (2010) opined some sustainable development criteria that can be applied to property development as follows:

a) Environmental dimension: Use of sustainable building materials such as softwood; renewable energy sources such as onsite micro-generation, energy efficient building services and reduced reliance on air conditioning plant; use of brownfield sites and avoidance of building on flood plains; ensure building components are lifecycle costed so that they require less maintenance and repair.
b) Economic dimension: Ensure that heating and other equipments can easily convert to cheaper energy sources; adoption of high insulation standards to reduce heat loss; ensuring internal space is adaptable to meet a variety of user needs.
c) Social dimension: Ensure development is close to social infrastructure so that building users/residents have convenient access to schools, healthcare facilities, shops, leisure and recreational opportunities; improved security by incorporating crime reduction device.

III. Methodology

The research work employed both quantitative and qualitative methods of data collection through questionnaire, photograph and observation of the phenomenon. The sample frame was drawn from the practicing professionals in the built industry in Yenagoa Local Government, Bayelsa State through random sampling technique. Out of the total number of 90 respondents selected for the study, 63 feedbacks were retrieved i.e. a response rate of 70%. A 5 point modified Likert scale was used to assess their judgments on the proffered indicators. The data collected were analysed and presented in simple descriptive statistical method in tables of frequency, percentage and relative importance index (RII) to quantitatively evaluate the importance of each factor and for easy communication of results. Section 1 addresses questions on the demographic characteristics of the respondents for which percentage was used to determine. Section 2 was to determine the sustainable property development method being utilized in the study area for which frequency/percentage was also used to analyse. Section 3 comprises the sustainable property development criteria for which relative importance index was used to determine. Physical observation of the built environment and property development activities were carried out with photographs to corroborate the primary information on the questionnaire feedback.

IV. Data Analysis, Findings And Discussion

Table 1 Characteristic of the Study Respondents from Section A of the research instrument

S/N	Demographic Variable	Category	Frequency (N = 63)	Percentage
1	Educational Status	Tertiary	51	80.95
		Technical	12	19.05
2	Age	21 – 30 Yrs	13	20.63
		31 – 40 Yrs	22	34.92
		41 Yrs & above	28	44.44
3	Years of Experience	1 – 5 Yrs	18	28.57
		6 – 10 Yrs	22	34.92
		Above 10 Yrs	23	36.51

The analysis of the data collected on the characteristics of the respondents revealed that on the educational status 80.95% of the respondents' attained tertiary educational level while 19.05% is of technical education background. The age of the respondents revealed that 20.63% are within the age bracket of 21 – 30 yrs, 34.92% are within 31 – 40 yrs while 44.44% are above 41 years of age. Respondents' years of experience in the built industry shows that 28.57% have experience of 1 – 5 yrs, 34.92% have experience of 6 – 10 yrs while 36.51% have experience above 10 years. The implication of this result is that most of the respondents have the required technical or professional background and experience to make useful contribution to this research.

Table 2 Sustainable Property Development Approaches

S/N	Methods	VO		O		U		R		N	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
1	In-situ construction (traditional method)	63	100	0	0.0	0	0.0	0	0.0	0	0.0
2	Pre-fabrication(off-site construction)	0	0.0	0	0.0	0	0.0	15	23.8	48	76.2
3	Lean construction	23	36.5	40	63.5	0	0.0	0	0.0	0	0.0
4	De-construction	0	0.0	0	0.0	0	0.0	10	15.9	53	84.1
5	Re-use or recycle construction	25	39.7	20	31.7	0	0.0	18	28.6	0	0.0
6	Repair existing infrastructure instead of new construction	0	0.0	18	28.6	0	0.0	20	31.7	25	39.7

Source: Field Data, 2017 VO (Very Often) = 5, O (Often) = 4, U (Undecided) = 3, R (Rarely) = 2, N (Never) = 1

Table 2 seeks to analyse the result of sustainable property development (i.e. design & construction) method being utilized in the study area. The analysis and result on the methods/approaches for design of sustainable property development strategies in Yenagoa, Bayelsa State showed that all the 63 respondents to the study i.e.100% affirmed that the use of traditional approach of construction method on the site is used very often as a strategy for design and construction of properties in Yenagoa, Bayelsa. 48 respondents out of 63 representing 76.2% and 15 representing 23.8% agreed that Pre-fabrication i.e. off-site construction is never and rarely in use in the study area. 23 and 43 respondents signifying 36.5% and 63.5% respectively agreed that Lean construction strategy is Very Often and Often used during construction. 84.1% i.e. 53 respondents and 10 representing 15.9% agreed that De-construction strategy is never/ rarely used as a method of construction. Re-use or recycle strategy has 39.7% of the respondents on Very Often and 31.7% as Often while 28.6% is rarely. On Repair of existing infrastructure as a strategy instead of new construction, 39.7% of the respondents responded to Never, 31.7% responded to Rarely while only 28.6% responded to Often. Finally the study revealed and confirmed that the traditional method of on-site construction is mainly being used in Bayelsa while prefabrication and deconstruction methods are not in use. The study also revealed that other methods are often incorporated.

4.3. Criteria/Strategies for Sustainable Property Development

Table 3.1: Environmental Criteria/Strategies for Sustainable Property Development

S/N	Environment Criteria	SA 5	A 4	U 3	D 2	SD 1	RII Values	Ranking
1	Raising of building elevation higher than the flood water level	290	20	0	0	0	0.98	1st
2	Use of sustainable building materials	240	60	0	0	0	0.95	2nd
3	Avoidance of building on flood plains	165	120	0	0	0	0.90	3rd
4	Use of renewable energy source	150	100	24	0	0	0.87	4th
5	Use of brown field sites for development	185	72	15	0	0	0.86	5th
6	Adoption of high standard material to avoid water ingress	265	40	0	0	0	0.85	6th
7	Site suitability to ensure legally permitted development	115	80	60	0	0	0.81	7th
8	Energy efficient products and building service	100	80	45	16	0	0.77	8th

Table 3.2: Economic Criteria/Strategies on Sustainable Property Development

S/N	Economic Criteria	SA 5	A 4	U 3	D 2	SD 1	RII Values	Ranking
1	Maximization of land and space use	165	120	0	0	0	0.90	1st
2	Adoption of high standard material to reduce heat loss	165	60	45	0	0	0.85	2nd
3	Ensure that the life circle of building components are costed to require less maintenance/repair	115	120	30	0	0	0.84	3rd
4	Internal space adapted to meet a variety of user needs	115	100	45	0	0	0.83	4th
5	Insurance against risk	115	80	60	0	0	0.81	5th

Table 3.3: Social Criteria/Strategies for Sustainable Property Development

S/N	Social Criteria	SA 5	A 4	U 3	D 2	SD 1	RII Values	Ranking
1	Visual comfort and adequate lighting	215	80	0	0	0	0.93	1st
2	Improved security by incorporating devices	165	120	0	0	0	0.90	2nd
3	Improved accessibility	190	92	0	0	0	0.89	3rd
4	Indoor air quality and adequate ventilation	100	132	30	0	0	0.83	4th
5	Development is close to social infrastructural and facilities	100	112	45	0	0	0.81	5th

Tables 3.1, 3.2 and 3.3 respectively seek to analyse the environmental, economic and social criteria used as strategies for sustainable property. Table 3.1 shows 8 environmental criteria/strategies that were tested and the analysis of the results revealed that raising of building elevation higher than the flood water level with RII value of 0.98, signifying that 98% of the respondents strongly agreed to this environmental criterion as the most important criterion for sustainable property development in Bayelsa. Hence, it was ranked 1st. Also, the use of sustainable building materials was revealed by the analysis as the next most important criteria with RII value of 0.95 indicating 95%. The other environmental criteria for sustainable property development are as listed in the table with their respective RII Values and ranking. The lowest RII value is 0.77 signifying 77% for energy efficient products and building services criterion on environmental factor. Thus, the study revealed that all the listed environmental criteria are critical to sustainable property development.

The findings on economic criteria in table 3.2 revealed that land and space use maximization as a strategy for sustainable property development in the study area has RII Value of 0.90 signifying that 90% concurred to the criterion as very important hence, ranked 1st. The adoption of high standard materials to reduce air and heat loss was shown by the analysis to be 2nd with RII value of 0.85 indicating 85%. The other economic criteria for sustainable property development which are - ensuring that life circle of building components are costed to require less maintenance/repairs, internal space is adaptable to meet a variety of users needs and insurance against risk are with RII Values of 0.85, 0.84 and 0.83 respectively indicating 85%, 84% and 83% with respective ranking as 3rd, 4th and 5th. This confirmed that all the listed economic criteria for sustainable property development are important criteria for sustainable property development.

Table 3.3 shows the analysis of social criteria/strategies. The analysis revealed that the Visual comfort and adequate lighting is very significant as ranked 1st with RII value of 0.93, signifying 93% that strongly agreed to criterion. Improved security by incorporating security devices was shown by the findings to be the 2nd with RII value of 0.90 indicating 90%. Improved accessibility has RII Value of 0.89 which is 89% and ranked 3rd. The other social criteria of indoor air quality/adequate ventilation and making development close to social infrastructure and facilities were ranked 4th and 5th with their respective RII Values as 0.83 and 0.81 signifying 83% and 81% respectively. Finally, the results revealed and confirmed that all the listed environmental, economic and social criteria for sustainable property development are significantly important and are therefore considered as critical strategies to make property development sustainable in flood prone lands.

Plate 1: Section of Residential Property Development on Water front without Flood Preventive measure in Igbogene, Yenegoa, Bayelsa State

Source: Researcher's Field Survey, 2017

Plate 2: Section of a Residential Property within Commissioners Quarters, Ekeki – Yenagoa town, Bayelsa State during raining season (the settlement lacks drainage facility)

Source: Researcher's Field Survey, 2017

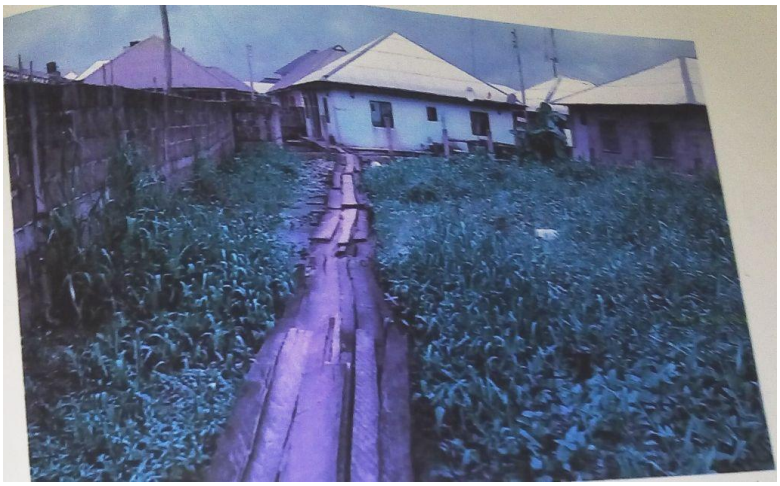

Plate 3: Developed Properties in Wetland area of an Unplanned residential neighbourhood of Amarata in Yenagoa town being accessed through Plank Footpath known as 'Monkey Bridge' in the local parlance
Source: Researcher's Field Survey, 2017

Plate 4: An On-going residential property development in a Floodplain area within Okaka residential neighbourhood of Yenagoa, Bayelsa State. The site is being accessed through Plank Footpath locally called 'Monkey Bridge'
Source: Researcher's Field Survey, 2017

The photographs and the physical observation of the built environment and property development activities in the study area revealed a situation of poor or lack of urban planning control and building construction regulation which depicts poor buildings and building in dangerous and hazardous zones.

V. Conclusion And Recommendation

The study revealed that the typical strategy for property design and construction in the green sites of the community is the in-situ (traditional) method where everything is done on the site. The lean construction approach is also being utilized to minimise waste of resources while the findings showed that other green sustainable property development/construction approaches such as prefabrication (off-site construction) and de-construction are rarely used in the study area. On the brown fields, the re-use of lands/buildings and recycle of construction materials are common while the repair of existing infrastructure is not done very often.

The following recommendations are therefore being proffered to reduce the risk and hazards mostly caused by flooding in the State: The other models of sustainable property development (design & construction methods)such as off-site (prefabrication), and deconstruction approaches should be incorporated and imbibed in the Bayelsa State in order to reduce waste and minimize degradation of the environment which can further compound the issue of flooding. Repair and refurbishment of existing buildings should be encouraged since construction activity always degrades a building site and not building at all is preferable to green building, in terms of reducing environmental impact. Where a green site is to be used there should be avoidance of buildings

on flood plains and water course, building elevation should be raised well above the natural flood level, use of sustainable and high standard building materials for property development, use of renewable energy source, indoor air quality/adequate ventilation and energy efficient products and building service should be maintained to achieve a sustainable property development environment.

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