INTEGRATING ENVIRONMENTAL PRIORITY CONCERNS IN BUILDING PLANNING AND PRODUCTION IN NIGER DELTA, NIGERIA

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ABSTRACT

This study aims at encouraging and supporting building developers to integrate environmental concerns more centrally in the planning and production management of buildings in Niger Delta, Nigeria. The objectives are to evaluate the integration level of environmental sustainability concerns, the barriers to effective integration of the concerns and design a decision framework for effective integration of the environmental concerns in the production process. A purposive survey of 148 stakeholders with structured questionnaire resulted in 136 valid responses from; Architect (30), Builders(14), Clients(35), Engineers(22), Town Planners(18) and Surveyors (17). Data were analysed using descriptive, mean score, and Kruskal Wallis tests. The study concludes that, the highest level of integration is given to concern for air quality, natural lighting, and landscape & historical sites protection, while only about 50% of the identified concerns attained moderate integration level. The study found that higher final costs, lack of sustainability promotion strategy, lack of demand and lack of building codes and regulation are the most significant barrier to the integration of environmental concerns, with all the stakeholders having common views on the issues. Based on the findings it is recommended that Government and her agencies should provide the building codes and regulation as well as the enlightenment and supports which will enhance integration of environmental concerns in building planning and production. Stakeholders should endeavour to apply the designed decision framework to enhance the integration of the environmental concerns for sustainable development.

Keywords: Building design; Building production; Environmental concerns; Nigeria; Sustainability

INTRODUCTION

The built environment includes all buildings and living spaces that are created, or modified, by people, including the infrastructural elements such as waste management, transportation and utility transmission systems put in place to serve these building spaces. This built environment in many developing countries particularly Nigeria, according to Lanrewaju (2012) is fast degenerating due to rapid urbanization, rural-urban migration, and decades of steady economic downturn, decay of urban infrastructure and poor housing quality. In corroboration Ijigah, Jimoh, Aruleba and Ade (2013) also stated that the quest for housing has tremendously increased urbanization and the built environment resulting in various environmental impacts and environmental degradation which is recently being traced to human activities with construction projects/works taking a lion's share. Saroop and Allopi (2014) also identified climate change as another environmental problem, the impacts of which are also felt in several specific sectors like; water, ecosystems, food, coasts, health, and singular events, all of which effects our urban areas. It further explained that the vulnerability of cities and their residents to climate change is shaped not only by their exposure to particular hazards, but also by the sensitivity of social, economic and environmental systems, and by the capacity of these systems (including urban households and communities) to adapt.

A region in southern Nigeria severely affected by the environmental degeneration is the Niger Delta region as a result of economic activities and oil exploration over the years. According to Kadafa (2012) oil exploration and exploitation which has been on-going for several decades in the Niger Delta, has had disastrous impacts on the environment in the region and has adversely affected people inhabiting that region. The study noted that the region has been rendered one of the five most severely petroleum damaged ecosystems in the world. Similarly, Ite, Ibok, Ite, and Petters (2013) observed that the bulk proven oil reserves of the region has encouraged the influx of visitors and multinational oil corporations whose operations have created serious threats to the livelihood of the coaster communities in the Niger Delta region. Destruction of habitats, loss of biodiversity, ecosystem destruction, destruction of farmland to access onshore sites and marine resource areas, and water pollution all have extensive implications on the people's livelihood in the region. It is about 20,000sq/km being the largest wetland in Africa and among the third largest in the world with 2,370sq/km of the Niger Delta area consists of rivers, creeks and estuaries. It has stagnant swamps covering approximately 8600sq/km, while the Delta mangrove swamp spans about 1900sq/km as the largest mangrove swamp in Africa (Kadafa, 2012). The study further opined that Niger Delta is classified as a tropical rainforest with ecosystems consisting of diverse species of flora and fauna both aquatic and terrestrial species. The region can be classified into four ecological zones; coastal inland zone, freshwater zone, lowland rainforest zone, mangrove swamp zone and this region is considered one of the ten most important wetlands and marine ecosystems in the world. Apart from the environmental degeneration suffered due to oil exploration, the fact that several construction activities have been on to accommodate the activities and growing population, also add to the degeneration. Asad and Khalfan (2007) reported that construction has a significant effect on people's quality of life; construction outputs affect the nature, function and appearance of the towns and countryside in which people live and work. The study also opined that the construction, use, repair, maintenance and demolition of infrastructure consumes resources and energy and generates wastes. Similarly, Suliman and Abdelnaser (2009) observed that construction accounts for an estimated 40% of all resources consumption and produces about 40% of all wastes including greenhouse gas emissions. Ijigah *et al*. (2013) also revealed major environmental impacts of building construction projects to include environmental pollution, resource depletion and habitat destruction causing destruction of ecosystem, desertification, soil erosion and increasing Material Wastage. Similarly, Saroop and Allopi (2014) elucidated that, the construction industry globally, is one of the main contributors to the depletion of natural resources and a major cause of unwanted side effects such as air and water pollution, solid waste, deforestation, health hazards, global warming, and other negative consequences. The awareness of environmental impacts is growing, hence there is increasing concern by many international and national initiatives to protect the environment for future generations by adopting sustainable development principles. Ijigah *et al*. (2013) opined that effective protection of the environment is critical to sustainable development and if we do not conserve the natural environment and its resources, human development and growth will be short lived. Previous studies have established that the life cycle of products that emerge from the built environment processes are typically inter-generational. Meaning that future generations will be influenced by decisions made today in terms of buildings and the supporting infrastructure related to the built environment processes and products. Thus, having a direct relationship to the inter-generational management philosophy associated with sustainability.

This study therefore is aimed at encouraging and supporting building developers to integrate environmental concerns more centrally in the planning and production management of buildings. These concerns according to Dodman *et al*. (2013) are understood as threats to present or future human well-being, resulting from human-induced damage to the physical environment originating in or affecting urban areas. The study observed that environmental goals for cities can therefore include ensuring healthy living and working environments for all inhabitants, the provision of the necessary services that are essential for health and important for a proper economic base, and ecologically sustainable relationships between the demands of the city and the environmental resources, waste sinks, and ecosystems on which they draw – in ways that also contribute to social and economic goals.

OBJECTIVES OF THE STUDY

In order to achieve the aim of this study, the following are the specific objectives:

1. To identify and evaluate the integration level of environmental sustainability concerns in building production process in Niger Delta region.
2. Evaluate the perception of the barriers to effective integration of the environmental sustainability concerns in building production process in the region and,
3. To design a decision framework for effective integration of the environmental concerns in the production process.

The result of this study will contributes to a broader understanding of the potential for the incorporation of environmental concerns in building planning and production management, the barriers to this, and the opportunities to overcome these barriers through the use of the framework.

The result of this study will also speak directly to external organizations that can provide the necessary support and impetus for more integrated environmental activities in urban development. The Framework designed will guide and enable professionals to identify environmental sustainable opportunities that may add value to the project while at the same time improve the financial and social performance of the production.

REVIEW OF RELATED LITERATURE

A number of studies on environmental concerns and barriers in construction sustainability globally were reviewed as a basis for the questionnaire formulation for this study.

ENVIRONMENTAL SUSTAINABILITY CONCERNS

Saroop and Allopi (2014) identified eco-efficient criteria for sustainable green infrastructure as tools which can be used in the conceptualization, implementation, and monitoring of progress in urban infrastructure projects. The Criteria define the essential components by which sustainability may be assessed. Collectively, the criteria provide an implicit, generally agreed-upon global definition for the concept of sustainability. Each criterion relates to a key element of sustainability. Through the measurement and monitoring of these indicators or concerns, the environmental effects of infrastructure solutions, can be assessed and evaluated, to meet stated aims and clients objectives more effectively, these are: efficient layout planning, resources utilization, environmental quality, functional efficiency, future maintenance, economy, safety and social concerns. The study concluded that sustainable design of township infrastructure services can be achieved by enforcing the consideration of resources, environmental impacts of design decisions, ecologically sensitivity, innovation, maintenance and materials at the design stage of a project. Asad and Khalfan (2007) reported ten key indicators for sustainable construction as; design for minimum waste; applying lean construction principles; minimising energy; pollution reduction; preservation and enhancement of biodiversity; conservation of water resources; respect for people and local environment; and setting targets, monitoring and reporting, in order to benchmark performance. Shen *et al*. (2011) also identified 10 environmental aspects of sustainability; these are ecological effect, effect on land pollution, effect on air quality, effect on water quality, noise effect, waste generation, influence on public health, environment protection measures in project design, energy savings and protection to landscape and historical sites.

BARRIERS TO EFFECTIVE INTEGRATION OF THE ENVIRONMENTAL SUSTAINABILITY CONCERNS IN BUILDING CONSTRUCTION

Studies have identified some proposed principles for sustainable construction which includes; minimization of resource consumption; maximization of resource reuse; use of renewable and recyclable resources; protection of the natural environment; creation of a healthy and non-toxic environment; and pursuing quality in creating the built environment (Zhang *et al.*, 2011; Samari *et al*., 2013 and Djokoto *et al*., 2014). It has also been opined that factors that inhibit the realization of the principles are considered as barriers to sustainability. Djokoto *et al*., 2014 thus identified twenty barriers to sustainable construction from Ahn *et al*., (2013), Samari *et al*., 2013, Hakkinen and Belloni (2011), Williams and Dair (2007) and Nelms *et al*., (2005) as; lack of building codes and regulation, lack of incentives higher investment cost, risk of investment, higher final cost, lack of public awareness, lack of demand, lack of strategy to promote sustainable construction, lack of design and construction team, lack of expertise, lack of professional knowledge, lack of database and information, lack of technology, lack of government support, lack of a measurement tool, increased documentation, extensive pre-contract planning, change resistance, lack of training and lack of cooperation. Pennell *et al*. (2013) in a critical review of the barriers to the integration of sustainability practices into Uk construction projects at site level identified: problems of supply chain management, problems of adaptation to innovation, lack of top management commitment, lack of knowledge of sustainability among stakeholders, undue focus on cost as barometer of success, and the fragmented nature of construction industry. Levin (2000) in an earlier study of design and construction of healthy and sustainable buildings, identified barriers to the realization of sustainability to include: short term economic analysis, absence of realistic target for carbon emission, lack of use of lighting standards in building, limited acceptable indoor condition, building size, absence of reliable health effect-based guidance, lack of life cycle assessment of building materials, value differences among stakeholders and lack of building ecology and location of building. Others are difficulty of ascertaining ventilation rate, types of users, types of resources required, use of building, quality of outdoor air and indoor air requirement and types of emission from building materials. The constituted the sources of barrier variables used in this study.

METHODOLOGY

This study adopted the exploratory, descriptive and inductive approach with the aid of structured questionnaire which was piloted by a survey of experts who are conversant with the region. This was to determine whether the questions were unambiguous and have substantially captured the environmental concerns and factors perceived to be barrier to their integration in building production. The study population comprises six groups of stakeholders involved in the planning and production of buildings and their facilities. Based on the comments received from the experts, 148 stakeholders were purposively sampled resulting in 136 valid responses from; 30 Architects, 14 Builders, 35 Clients, 22 Engineers, 18 Town Planners and 17 Surveyors.

Through the guidance of the group discussion during the pilot study, sixteen environmental concerns and thirty barriers to effective integration of the environmental concerns were identified from literature as variables for the basis of formulation of questions administered. Data on the perception of the integration level of environmental sustainability concerns in building production process and influences of barriers to effective integration of the environmental sustainability concerns in building production process were collected from the stakeholders using structured questionnaires. The measurements were on a five point Likert-scale namely: nil=1, low=2, moderate=3, high=4 and very high=5 to assess integration level of environmental sustainability concerns and the influence of barriers to effective integration of the environmental sustainability concerns in building production process. The cut-off score of mean score (MS) computed is determined by summing the nominal values and dividing by the total number of scaling items: (1+2+3+4+5)/5 = 3. Thus, events that have means that are higher than 3.0 are defined as significant, those with mean equal to 3 are moderate, while those less than 3 are insignificant. This approach adapted from Mojekeh and Eze (2011) and Imonikebe (2013) is with the expectation that the use of 3.0 as reference value will effectively cover only important variables in terms of their level of integration and barrier. The respondents' agreement in the perceptions of integration level of environmental sustainability concerns and the influence of barriers to effective integration of the environmental sustainability concerns were analysed with Kruskal Wallis tests since the data were obtained on ordinal scale. Based on the priority of the environmental concerns identified a decision framework for their integration into building production was then designed to guide and enable professionals to identify and integrate environmental sustainable opportunities that may add value to the project.

PRESENTATION AND DISCUSSION OF RESULTS

Characteristics of Respondents used for the Study:

The respondents that supplied the data used for the study were analysed for an understanding of the characteristics the people whose perceptions were investigated. For this purpose; affiliation, sex, age, qualification, experience and professional registration were all evaluated and result presented in Table 1.

Table 1 show that the proportion of male respondents used for the study is 72.4%, while that of female respondents is 27.6%. The result indicates that majority of the respondents used for the study were males. The result shows that about 64% of the respondents have experience over eleven years. This indicates that majority of the respondents have reasonable experience to give reliable information on the subject matter. The result also shows that majority of the professionals have adequate educational qualification with about 60% having B.Sc degree and above.

Table shows that the ages of all the professionals are more than 17 years, with majority of the respondents being working adults (18-60yrs). The result also shows that majority of the respondents are true professionals as only 13.24% of the respondents were not registered with their regulatory bodies. The result also indicates that some of the clients sampled are also professionals. The results generally indicate that the respondents chosen for the study are appropriate and dependable.

Characteristics of Respondents	Sub characteristics	No	%	characteristics of Respondents	sub characteristics	No	%
Respondents affiliation	Architects	30	22.06	Respondents Professionals Registration	ARCON	28	20.59
	Builders	14	10.29		CORBON	13	9.56
	Clients	35	25.74		COREN	30	22.06
	Engineers	22	16.18		TOPREC	15	11.03
	Planners	18	13.24		ESVARBON	12	8.83
	Surveyors	17	12.50		OTHERS	20	14.71
					UNREGISTERED	18	13.24
	Total	136	100		Total	136	100
Sex of Respondents	Male	98	72.4	Age of Respondents	1-17yrs	0	0
	Female	38	27.6		18-60yrs	117	86.03
					>60yrs	19	13.97
	Total	136	100		Total	136	100
Experience of Respondents	1-5yrs	21	15.4	Qualification of Respondents	O/L & Trade Tests	34	25.0
	6-10yrs	28	20.6		OND/HND	20	14.7
	11-15yrs	40	29.4		B.Sc	41	30.2
	16-20yrs	28	20.6		M.Sc	29	21.3
	>20yrs	19	14.0		PhD	12	8.8
	Total	136	100		Total	136	100

Table 1: Descriptive results of Respondents' characteristics

Level of integration of Environmental sustainability concerns

For the purpose of evaluating the level of integration of environmental sustainability concerns into the planning and production of buildings, sixteen environmental concerns were identified from literature, and then presented to respondents for subjective assessment with the scales provided as earlier described. The results are presented on Table 2.

In view of the observed similarity in the views of the respondents, it became necessary to combine all the views of the stakeholders for harmony. The results on Table 2 shows that the stakeholders perceive that the highest level of integration is given to concern for air quality, followed by concern for natural lighting, while concern for landscape & historical sites protection, concern for biodiversity/ecology conservation and concern for maintainability ranked third, fourth and fifth respectively. The results also show that only about 50% of the identified concerns attained moderate Integration level, with 50% below the cut off value of 3.0. This is an indication that the level of integration of environmental concern in the planning and construction of building. This may be attributable to the higher final cost, lack of sustainability promotion strategy, lack of demand and lack of building codes and regulation which were found to be the most significant barrier to the integration of environmental concerns in building production.

Environmental sustainability concerns	Architects (N=30)			Builders (N=14)			Clients (N=35)			Engineers (N=22)			Planners (N=18)			Surveyors (N=17)			Combined (N=136)		
	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank
Concern for air quality	113	3.77	1	51	3.64	2	132	3.77	1	81	3.68	2	75	4.17	1	72	4.24	1	524	3.85	1
Concern for natural lighting	104	3.47	2	58	4.14	1	124	3.54	2	88	4.00	1	66	3.67	3	55	3.24	7	495	3.64	2
Landscape & historical sites protection	102	3.40	3	51	3.64	2	117	3.34	4	75	3.41	5	66	3.67	3	62	3.65	2	473	3.48	3
Biodiversity/ecology conservation	100	3.33	4	47	3.36	5	118	3.37	3	78	3.55	4	67	3.72	2	61	3.59	3	471	3.46	4
Concern for maintainability	98	3.27	6	44	3.14	8	117	3.34	4	79	3.59	3	64	3.56	5	60	3.53	4	462	3.40	5
Concern for waste generation control	99	3.30	5	50	3.57	4	110	3.14	6	69	3.14	9	64	3.56	5	55	3.24	7	447	3.29	6
Concern for pollution reduction	98	3.27	6	46	3.29	7	106	3.03	8	73	3.32	6	64	3.56	5	58	3.41	5	445	3.27	7
Enhancing environmental aesthetics	90	3.00	9	42	3.00	10	109	3.11	7	68	3.09	10	58	3.22	8	53	3.12	9	420	3.09	8
Discouraging importations	91	3.03	8	41	2.93	12	94	2.69	12	70	3.18	7	57	3.17	9	50	2.94	10	403	2.96	9
Concern for energy savings	85	2.83	10	39	2.79	14	99	2.83	10	62	2.82	12	57	3.17	9	56	3.29	6	398	2.93	10
Concern for water quality	80	2.67	12	43	3.07	9	106	3.03	8	67	3.05	11	50	2.78	12	49	2.88	11	395	2.90	11
Concern for Noise control	82	2.73	11	47	3.36	5	99	2.83	10	70	3.18	7	50	2.78	12	41	2.41	14	389	2.86	12
Concern for public health	78	2.60	13	42	3.00	10	93	2.66	13	62	2.82	12	54	3.00	11	49	2.88	11	378	2.78	13
Environment friendly innovation	77	2.57	14	41	2.93	12	92	2.63	14	62	2.82	12	49	2.72	14	47	2.76	13	368	2.71	14
Applying lean construction principles	69	2.30	15	37	2.64	15	82	2.34	15	58	2.64	16	44	2.44	15	40	2.35	15	330	2.43	15
Respect for people & local environment	58	1.93	16	37	2.64	15	71	2.03	16	59	2.68	15	34	1.89	16	35	2.06	16	294	2.16	16

MS- Mean Score

Table 2: Results of integration level of environmental sustainability concerns into the planning and production of buildings

Evaluation of Barriers to integration of environmental concerns in buildings

Thirty barriers to integration of environmental sustainability concerns were identified from literature in order to evaluate stakeholders' perception of them. Respondents were asked to indicate their perception of level of impediment posed by the identified barriers to the integration of the environmental concerns during planning and production of buildings with the scales provided. The results are presented on Table 3.

The results on Table 3 show that higher final costs, lack of sustainability promotion strategy, lack of demand and lack of building codes and regulation are the most significant barriers to the integration of environmental concerns to building planning/production in Niger Delta. This result is similar to the findings by Djokoto *et al. (*2014) which identified lack of demand, lack of strategy to promote sustainable construction, higher final cost and lack of public awareness as most significant barriers to sustainable construction in the Ghanaian construction industry, and the findings by Samari *et al*. (2013) which identified lack of credit resources to cover up front cost, risk of investment and lack of demand as most significant barriers to developing green building in Malaysia. The results also show that 63.33% of the identified barriers attained 3.0 cut off for moderate effect. These results are indication that most developing countries have common problems of poor sustainable development caused by several barriers which need to be tackled for comfortable human accommodation on earth. The result also indicate that government and her agencies have significant role to play by providing the building codes and regulation as well as the enlightenment and supports which will enhance integration of environmental concerns for sustainable development.

Barriers of Environmental integration in building production	Architects (N=30)			Builders (N=14)			Clients (N=35)			Engineers (N=22)			Planners (N=18)			Surveyors (N=17)			Combined (N=136)		
	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank	Sum	MS	Rank
Higher final cost	126	4.20	2	55	3.93	2	144	4.11	1	88	4.00	1	69	3.83	3	65	3.82	4	547	4.02	1
Lack of sustainability promotion strategy	127	4.23	1	58	4.14	1	142	4.06	2	75	3.41	7	76	4.22	1	64	3.76	5	542	3.99	2
Lack of demand	119	3.97	3	53	3.79	5	141	4.03	3	76	3.45	6	70	3.89	2	68	4.00	1	527	3.88	3
Lack of building codes and regulation	116	3.87	4	47	3.36	8	127	3.63	5	85	3.86	2	62	3.44	7	67	3.94	2	504	3.71	4
Lack of extensive pre-contract planning	104	3.47	7	54	3.86	3	125	3.57	8	77	3.50	5	68	3.78	4	66	3.88	3	494	3.63	5
Lack of government support	112	3.73	6	41	2.93	22	126	3.60	6	83	3.77	3	66	3.67	5	64	3.76	5	492	3.62	6
Value differences amid stakeholders/poor	104	3.47	7	50	3.57	6	126	3.60	6	80	3.64	4	63	3.50	6	64	3.76	5	487	3.58	7
Poor stakeholders knowledge of sustainability	113	3.77	5	47	3.36	8	128	3.66	4	75	3.41	7	61	3.39	10	56	3.29	14	480	3.53	8
Lack of professional knowledge & expertise	102	3.40	11	54	3.86	3	117	3.34	13	74	3.36	10	57	3.17	17	62	3.65	8	466	3.43	9
Risk of investment	100	3.33	12	47	3.36	8	123	3.51	9	71	3.23	12	58	3.22	15	61	3.59	10	460	3.38	10
Undue focus on cost as barometer of success	97	3.23	15	50	3.57	6	117	3.34	13	71	3.23	12	62	3.44	7	61	3.59	10	458	3.37	11
Higher investment cost of sustainability	103	3.43	9	46	3.29	13	118	3.37	12	73	3.32	11	61	3.39	10	55	3.24	15	456	3.35	12
Lack of database and information	103	3.43	9	47	3.36	8	122	3.49	10	66	3.00	16	61	3.39	10	55	3.24	15	454	3.34	13
Lack of top management commitment	100	3.33	12	45	3.21	15	120	3.43	11	75	3.41	7	57	3.17	17	57	3.35	13	454	3.34	13
Lack of a measurement tools	92	3.07	18	45	3.21	15	108	3.09	18	70	3.18	14	60	3.33	13	58	3.41	12	433	3.18	15
Limited acceptable in/outdoor conditions	87	2.90	20	47	3.36	8	110	3.14	16	64	2.91	18	62	3.44	7	55	3.24	15	425	3.13	16
Problems of adaptation to innovation/change	90	3.00	19	43	3.07	20	113	3.23	15	58	2.64	25	57	3.17	17	62	3.65	8	423	3.11	17
Lack of materials life cycle assessment	93	3.10	17	41	2.93	22	107	3.06	19	61	2.77	22	56	3.11	20	53	3.12	19	411	3.02	18
Lack of use of design and construction team	94	3.13	16	43	3.07	20	106	3.03	20	63	2.86	19	55	3.06	22	49	2.88	22	410	3.01	19
Short term economic analysis	85	2.83	21	45	3.21	15	102	2.91	21	60	2.73	23	56	3.11	20	54	3.18	18	402	2.96	20
Fragmented nature of construction industry	98	3.27	14	37	2.64	27	110	3.14	16	63	2.86	19	43	2.39	29	44	2.59	25	395	2.90	21
Lack of adequate technology	72	2.40	24	46	3.29	13	89	2.54	24	62	2.82	21	60	3.33	13	52	3.06	21	381	2.80	22
Lack of building ecology	73	2.43	23	39	2.79	24	93	2.66	22	66	3.00	16	51	2.83	25	53	3.12	19	375	2.76	23
Challenges of building location	70	2.33	26	45	3.21	15	90	2.57	23	68	3.09	15	58	3.22	15	41	2.41	28	372	2.74	24
Problems of supply chain management	76	2.53	22	45	3.21	15	86	2.46	26	55	2.50	26	55	3.06	22	47	2.76	23	364	2.68	25
Problems of ascertaining materials emission	72	2.40	24	38	2.71	25	88	2.51	25	54	2.45	27	52	2.89	24	46	2.71	24	350	2.57	26
Difficulty of ascertaining ventilation rate	69	2.30	27	38	2.71	25	85	2.43	27	59	2.68	24	47	2.61	26	42	2.47	27	340	2.50	27
Problems of ascertaining required resources	67	2.23	28	36	2.57	28	77	2.20	29	51	2.32	28	47	2.61	26	43	2.53	26	321	2.36	28
Difficulty of ascertaining types of users	67	2.23	28	32	2.29	29	79	2.26	28	49	2.23	29	43	2.39	29	37	2.18	29	307	2.26	29
Building size and type	64	2.13	30	32	2.29	29	75	2.14	30	48	2.18	30	44	2.44	28	37	2.18	29	300	2.21	30

Table 3: Result of evaluation of barriers to integration of environmental concerns in buildings

Evaluation of agreement in the perceptions of stakeholders

For the purpose of evaluating the respondents' agreement in the perceptions of integration level of environmental sustainability concerns and the influence of barriers to effective integration of the environmental sustainability concerns, two hypotheses were postulated. The first states that there is no significant variation in the perceptions of integration level of environmental sustainability concerns among the stake holders, while the second states that the perceptions of influence of barriers to effective integration of the environmental sustainability concerns do not significantly vary among the stakeholders. The results of the hypotheses which were tested with Kruskal Wallis test at $p \leq 0.05$ were meant to provide confidence of views in the integration and provision of solution to barriers to environmental sustainability concerns. The decision rule is that if p-value > 0.05, the hypothesis is accepted, but if p-value ≤ 0.05 the hypothesis is rejected. The results are presented on Table 4.

Items compared among Professionals	Integration level of Environmental concerns	Barriers to integration of Environmental concerns
No of variables (N)	16	30
Mean Rank of Architects	41.25	85.95
Mean Rank of Builders	52.28	93.72
Mean Rank of Clients	41.72	90.00
Mean Rank of Engineers	52.50	80.78
Mean Rank of Planners	54.59	95.43
Mean Rank of Surveyors	48.66	97.12
Chi-Square	3.424	2.142
P-value	0.635	0.829
Significance level	0.05	0.05
Decision	Accept	Accept

Table 4: Results of Kruskal-Wallis test for Comparison of respondents' perception

The results in Table 4 show that the p-values for hypotheses one and two tested are 0.635 and 0.829 respectively. Since the *p*-values are greater than assumed significance level of 0.05, the null hypotheses fail rejection, and it is concluded that there is no evidence in the data to suggest that the perceptions of the stakeholders are different. The results indicate that the building production stakeholders have a common opinion about environmental concerns, which may be attributable to the general low level of development, awareness and technology of developing countries. The results in Table 4 also authenticate the necessity for combining the views as earlier done during the evaluation of level of integration and barriers to environmental concerns.

Development of Decision Support Framework for Integrating Environmental Concerns

In order to develop a decision support framework for integrating environmental concerns, six criteria for concerns and sixteen environmental concerns were identified from literature. These were then integrated into the flow diagram which was then presented to experts made up of stakeholders in the study for assessment and criticism before the final framework was designed, as presented in Figure 1.

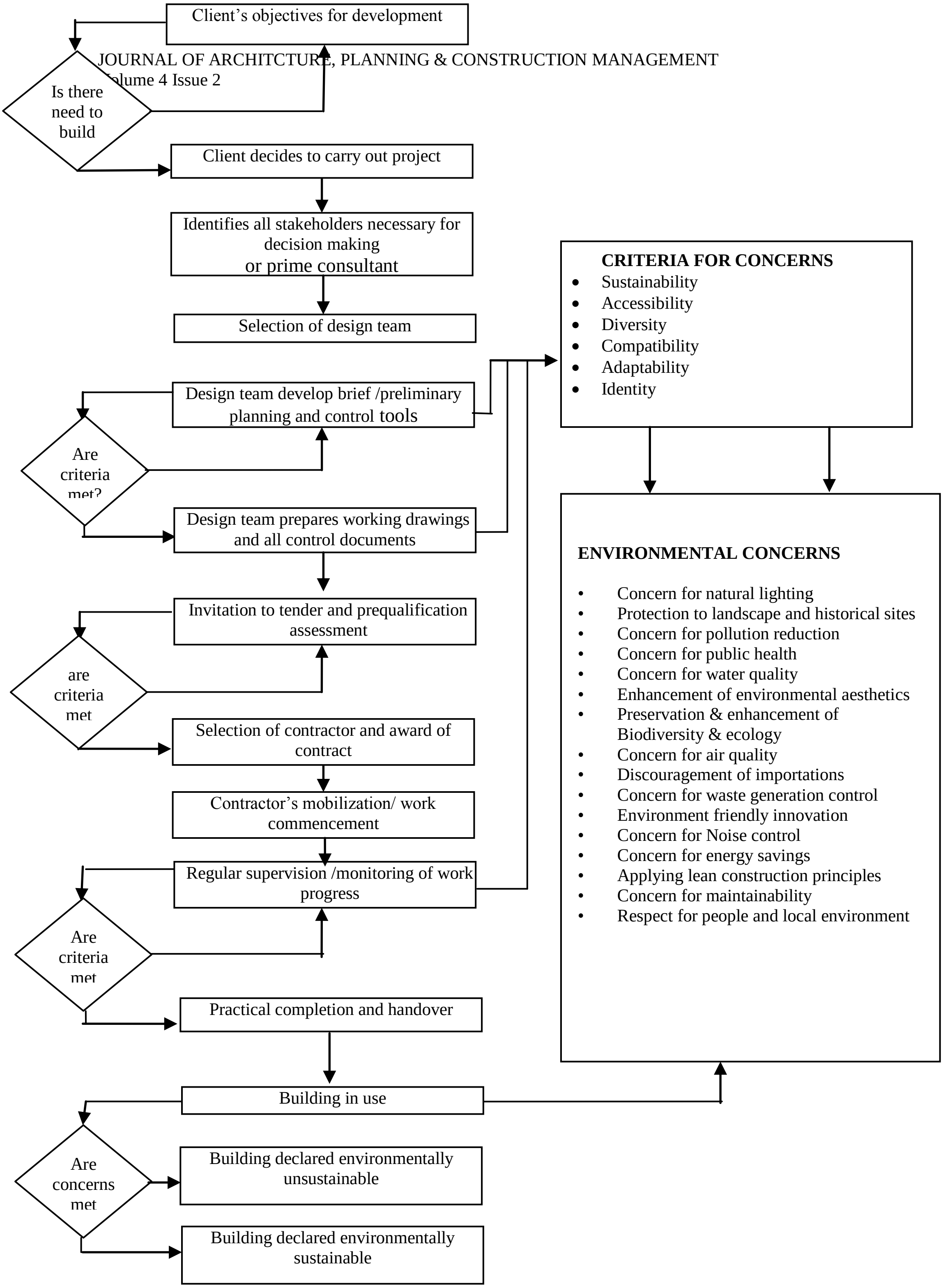
Client's objectives for development
Is there need to build
Client decides to carry out project
Identifies all stakeholders necessary for decision making or prime consultant
Selection of design team
Design team develop brief /preliminary planning and control tools
Are criteria met?
Design team prepares working drawings and all control documents
Invitation to tender and prequalification assessment
are criteria met
Selection of contractor and award of contract
Contractor's mobilization/ work commencement
Regular supervision /monitoring of work progress
Are criteria met
Practical completion and handover
Building in use
Are concerns met
Building declared environmentally unsustainable
Building declared environmentally sustainable
CRITERIA FOR CONCERNS
Sustainability
Accessibility
Diversity
Compatibility
Adaptability
Identity
ENVIRONMENTAL CONCERNS
Concern for natural lighting
Protection to landscape and historical sites
Concern for pollution reduction
Concern for public health
Concern for water quality
Enhancement of environmental aesthetics
Preservation & enhancement of Biodiversity & ecology
Concern for air quality
Discouragement of importations
Concern for waste generation control
Environment friendly innovation
Concern for Noise control
Concern for energy savings
Applying lean construction principles
Concern for maintainability
Respect for people and local environment

Figure 1: Decision support framework for integrating environmental concerns to building production

The decision support framework begins with the client who evaluates his developmental objectives for feasibility and viability. Upon his conviction to build, whatever the particular case, recognises that the participation of a range of stakeholders and political commitment are important; ensuring that all activities are harmonized and integrated in all levels of production. At the design stage the design team uses the six criteria for concern as guide to incorporating the environmental concerns in building production planning. The management in itself requires an integrated approach that recognizes the multiple dimensions and scales of environmental problems and opportunities. This approach is required to prioritise statutory arrangements, which can then provide a basis on which specific tools for integrating the environmental concerns in building production can be utilised. The planning and development of building face different issues and require appropriately tailored responses depending on the size, type, complexity, use, location and others. The approach is further enforced during the regular supervision and monitoring of work progress to ensure that all criteria are met as to declare a building environmentally sustainable.

The framework in line with the observation by Abdalla *et al*. (2009) is an indication that integration of environmental concerns requires the full cooperation from all project team members, and this should be communicated timely and effectively as the project team's common goal. This has to take place along with the client. If there is the lack of participation by clients in promoting the integration of environmental concerns, there will be no effective implementation of environmental measures along the whole construction chain from designers, consultants, contractors, subcontractors, and suppliers.

CONCLUSIONS

The perceptions of integration level of environmental sustainability concerns and the barriers to effective integration of the concerns were evaluated in the study. A decision framework was also designed to encourage and support building developers to integrate environmental concerns more centrally in the planning and production management of buildings in Niger Delta, Nigeria. Based on these evaluations, it is advocated that the need to integrate environmental considerations in the design, construction of building for sustainable development in Niger Delta and Nigeria in general is appropriate. The study concludes that, the most significant level of integration are given to concern for air quality, natural lighting, landscape & historical sites protection, concern for biodiversity/ecology conservation and concern for maintainability while only about 50% of the identified concerns attained moderate integration level.

It is also concluded that majority of the identified barriers have significant inhibitive influence on the concerns with higher final costs, lack of sustainability promotion strategy, lack of demand and lack of building codes and regulation being the most significant barriers to the integration of environmental concerns to building planning/production in Niger Delta. This is because government and her agencies have not played their regulatory roles as well as the enlightenment and supports of all stakeholders for enhanced integration of environmental concerns for sustainable development. It is also concluded that the view of all the stakeholders are relatively the same which gives some level on consensus on the issue.

RECOMMENDATIONS

In view of the findings in the study the following recommendations are made:

i. Stakeholders should endeavour to integrate all the concerns as much as applicable throughout the planning and production of building projects bearing in mind the level of environmental degeneration.
ii. It is recommended that Clients and all stakeholders should collaborate at the design, supervision, and monitoring stages of building projects guided by the decision framework for effective integration of environmental concerns
iii. Government and her agencies should provide the building codes and regulation as well as the enlightenment and

supports which will enhance integration of environmental concerns in building planning and production.

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