

The Critical Success Factors and Development of Framework for Sustainable Building Projects Delivery in Enugu State, Nigeria

ANTHONY N. EZEMERIHE¹, KEVIN C. OKOLIE², SHEDRACK A. UME³

¹ *Enugu State University of Science and Technology, Enugu, Nigeria*

² *Department of Building, Nnamdi Azikiwe University, Awka, Nigeria*

³ *Everwinners Construction Company Nig. Limited, Enugu, Nigeria*

Abstract- The study established the critical success factors of sustainable building projects delivery in Enugu State and developed a framework for successful sustainable building projects delivery in the state. A study of nine selected local government areas (three each from the three senatorial zones of the state) was sampled based on urbanization and population of inhabitants in the area. A total of four hundred (400) questionnaires were distributed to stakeholders in the built environment while three hundred and forty four (344) representing 86.0% of the respondents were returned and used for the analysis. The data was analyzed using common size percentage analysis, mean score using five point likert rating scale, severity index/ranking, regression and correlation analysis. The result shows that meeting project goal and objective ranked first with mean score of 4.36 and severity index of 87.3%. This was followed by Health and Safety of occupants with mean score of 4.35 and severity index of 86.9%. The least in the ranking was efficiency of project execution and termination with mean score of 3.45 and severity index of 69.1%. The work concluded that the established critical success factors are necessary for development of framework for sustainable building projects development and delivery. The sustainable concepts applied to design, construction, operation and maintenance with whole life assessment of buildings would enhance the economic welfare, environmental health and social well-being of communities in the state. The study recommends that developing a template for sustainable building projects with database; engage in capacity building through education, training, skill acquisition and communities participation to close the knowledge gap; promote product innovation towards sustainable materials for

affordability of occupants; encourage public, private partnership for urban renewal programme and enact legislation to back up all recommended proposals for proper enforcement.

Indexed Terms- Sustainable buildings, Sustainable concepts, Sustainable framework, Critical success factors.

I. INTRODUCTION

The transformation of sustainable construction policy into project level practice, are the non-technological institutional processes, which are dependent upon the industry structure, communication channels and the organization and strategic orientation of its constituent actors (Rohracer, 2001). The uptake and implementation of sustainable construction requires decision processes that are integrated across various project level interfaces demarcated by different phase of the construction life cycle. However, the challenging task may stem from the fragmented nature and complexity of the construction sector (Myers, 2005), the multi-dimensional nature of sustainable construction, the lack of a structured methodology and lack of information at various hierarchical levels (Ugwu and Haupt, 2007).

Building sustainability is fundamentally a process of best practices that leads to sustainable outcomes (Muldavine, 2010). Planning process is typically not conducted very well due to its complexity and extra costs that are always associated with it (Mansur, Chewan Putra, and Mohammed, 2003). The planning process does not encourage sustainability matter clearly and limited interactions between various

disciplines have hindered sustainable building projects from reaching the expected achievement. There are minimal inputs from Operation and maintenance groups, construction managers and trade contractors or outside stakeholders during the design stage and the planning process which make sustainability principles hard to be incorporated in building projects (Construction Industry Development Board (CIDB), 2003).

The development of framework for sustainable development of building projects will seek to establish a path along which such development can progress while enhancing the quality of life of people and ensuring the viability of the natural systems on which that development depends (Udegbunam, Agbazue and Ngang, 2017). The sustainable development concept should encompass the interdependence between economic development, the natural environment and people inhabiting the environment. Sustainability aims at increasing economic efficiency, protecting and restoring ecological systems and improving human well-being with a view to minimizing consumption of matter and energy, re-usability and recyclability of material, human satisfaction, minimum environmental impacts and embodied energy. Embracing green or sustainable concept in design is aimed at reducing energy consumptions, operation and maintenance cost, reduce building related illness, increase the productivity and comfort of building occupants, reduce waste and pollution, increase building and component durability and flexibility. There is the need to integrate these at early stages of building, planning and construction process. However, sustainable development for building project delivery needs time, understanding, acceptance, adjustment and implementation. These can be achieved through awareness/commitment both on the part of individuals, community and professionals (Broman and Roberts, 2017).

The UN Habitat/UNEP (2008) identified the issue of (i) inconsistent government policies on sustainable development of building projects to incorporate critical issues of environmental management and sustainability. (ii) bureaucratic bottleneck during the approval of building design process. (iii) lack of adherence to planning rules and regulations (iv) multiple agencies involved in the approval and

monitoring the execution of building projects (v) high cost of land acquisition and processing of certificate of occupancy (vi) distortion in land use management from the original master plan, and future planning not in accordance with the needs and aspiration of the increasing population (vii) indiscriminate felling of trees without replanting, building on water and drainage channels, erosion induced gullies as a result of poor environmental management. (viii) poor road network and infrastructural facilities to existing and new development areas, and (ix) lack of integrity on the part of project participants and individuals entrusted with the monitoring and implementation of the stipulated rules and regulations in Enugu State.

The study established the critical success factors to sustainable building projects delivery and developed a framework for sustainable development of building projects delivery in Enugu state, South East of Nigeria.

II. LITERATURE REVIEW

2.1 Critical Success Factors to Sustainable Building Project Delivery

In order to determine project success and sustainability criteria, there is no currently available specific criteria model and framework for sustainability in building projects. The available Frameworks have shortcomings of taking into full account all of the project's life cycle and rarely align the sustainability concept with both short- and long-term goals of project (Labuschagne, Brent and Classen, 2005). The Project Management Body of Knowledge (PMBOK) which is the most popular model of project management was also criticized to be predominantly skewed towards managing the execution functions (Morris, 2011). Many omissions have been made by the model such as strategy, value and benefits, people uses, technology management, estimating and various matters relating to procurement (Morris, 2011).

BCA (2007) and Hayles (2004) emphasized that Sustainability in Construction project would improve the project performance. It is competent to assess sustainable project's success on criteria of cost, time, quality and stakeholders' satisfaction but should also accomplish the criteria of meeting sustainability project goal and objectives. The design and finance of projects ab-initio should encompass sustainability

high on agenda because at this stage plans can be formulated holistically and the greatest cost benefits are derived (CIOB, 2010).

Although, the sustainability principles and successful project performance are related and parallel, a successful sustainable building project can be achieved by accomplishment of the sustainability principles requirements of the project through integration strategies at planning and construction stages. There is need for cost within budget, time within schedule, quality, meeting project goal and objective, technical performance, benefit to the technological infrastructure, value and profit, or business benefit, functionality, efficiency of execution and project termination.

In Project Management, Sustainability involves both individual and corporate responsibility to ensure the outputs, outcomes and benefits are not only sustainable over their life cycles, but also sustainable during their creation (APM, 2012). The use of natural and human resources to achieve growth and financial support, without regard to achieve growth and financial support, without regard to environmental or social cost is no longer acceptable. Lower costs and increase value is achieved in thinking sustainably (CIOB, 2010). Sustainability should be considered in many different core areas of project, programme and portfolio management to meet sustainable objectives. Sustainable development should be considered as need in every profession involved in building projects for successful project performance.

2.2 Framework for Sustainable Building Project Delivery

A framework for sustainable development of building projects will address all associated issues holistically by applying a Scandinavian proverb that “many creeks make a big river” suggesting that all small contribution will make a difference. The reality is like “if everybody does a little bit little is done”. There is need in climate change for a reduction in greenhouse gas emissions of more than 90 % within 2100 in order to a 2-degree increase in average global temperature (IPCC, 2014) which sustainable development aim to achieve.

There is need for a schematic way of assessing the project performance and success criteria with regards

to achieving a sustainable building project. The OECD (2006) developed an integrated model of five success criteria of Efficiency, Effectiveness, Impact, Relevance and Sustainability.

- (a).Efficiency: A measure of how economically resources and inputs (funds, expertise, time, etc.) are converted to results.
- (b).Effectiveness: The extent to which the development intervention’s objectives were achieved, or are expected to be achieved, taking into account their relative importance.
- (c).Impact: Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.
- (d).Relevance: The extent to which the objectives of a development intervention are consistent with the beneficiaries requirements, needs, priorities and the policies of partners and donors.
- (e).Sustainability: The continuation of benefits from a development intervention’ after major development assistance has been completed.

There are also six cross cutting issues which should be considered for each of the five criteria which include; Economic and financial aspects, Institutional aspects, Social aspects, Technological aspects, Environmental aspects and Policy support measures (Samset, 2010). These models and more will help in articulating a framework for successful sustainable development of building projects in Enugu State.

III. METHODOLOGY

The research study adopted a descriptive survey design approach. This is to prevent ambiguity and inconsistency in responses. The descriptive survey approach describes the characteristics of existing situation and provides insight into the research problems by describing the variables of interest in order to achieve the aim and objectives of this research study (Mugenda and Mugenda, 2003). The population of Enugu State was projected to be 5,441,900 as at 2023 based on the last census of 2006. The sample study was carried out from Nine local government areas which comprise Awgu, Enugu East, Enugu North, Enugu South, Igbo Etititi, Igboeze North, Nsukka, Oji River, and Udi of the state with a total projection population of 3,672,971 as at 2023 (NBS

2023). The study adopted the stratified random sampling techniques. This is because different disciplines of registered professionals were sampled who had varied knowledge, experience, exposure and interest based on their occupation. Sixty percent (60 %) of the sample was randomly selected using a sample frame while forty percent (40 %) will be randomly selected from each of the professional disciplines in the built environment.

Nine local government areas (three each from the three senatorial zones of the state) were sampled based on urbanization and population of inhabitants in the area. A total of four hundred (400) questionnaires were distributed to stakeholders in the built environment while three hundred and forty-four (344) representing 86.0% of the respondents were returned and used for

the analysis (See table 1). The primary data was collected through questionnaires while secondary data was obtained from journals, textbooks, seminar papers and occasional publications. The data was analyzed using common size percentage analysis, mean score using five-point likert rating scale, severity index/ranking, regression and correlation analysis. The sample population for the study comprised prospective estate developers, stakeholders in the built environment in both public and private sectors.

IV. RESULTS AND DISCUSSION

Results:

4.1. Analysis of Questionnaire Distributed and Category of Respondents

Table 1: Questionnaire Distributed and Retrieved

S/N	Senatorial Zone	Number distributed		Number Retrieved		Number not returned	Percentage not returned (%)
			%		%		
A	Enugu East Senatorial Zone						
(i).	Enugu North LGA	54	13.5	49	90.7	5	9.3
(ii).	Enugu East LGA	53	13.25	43	81.1	10	18.9
(iii).	Enugu South LGA	53	13.25	45	84.9	8	15.1
B	Enugu West Senatorial Zone						
(i).	Oji River LGA	40	10	32	80.0	8	20.0
(ii).	Udi Local Government Area	40	10	35	87.5	5	12.5
(iii).	Awgu LGA	40	10	33	82.5	7	17.5
C	Enugu North Senatorial Zone						
(i).	Nsukka LGA	40	10	36	90.0	4	10.0
(ii).	Igbo-Eze North LGA	40	10	34	85.0	6	15.0
(iii).	Igbo-Etiti LGA	40	10	37	92.5	3	7.5
Total		400	100	344	86.0	56	14.0

Source: Researcher Field Survey Report (2022)

From Table 1, a total of four hundred questionnaires were distributed to the respondents in the area of study. The selected local government areas and senatorial zones were shown in Table 1 indicated the questionnaires distributed and their percentages according to the various local governments in the

sample survey. The total number retrieved/not retrieved and their respective percentages were also shown in Table 1. A total number of three hundred and forty-four (344) questionnaires were retrieved representing eighty six percent (86%) of the total number administered to respondents.

Table 2: Category of Respondents

S/N	Characteristics	Frequency	Percentage (%)
(a).	Construction Professionals		
(i).	Builders	22	6.4
(ii).	Architects	36	10.5
(iii).	Quantity Surveyors	18	5.2
(iv).	Land Surveyor	9	2.6
(v).	Estate Surveyor	16	4.7
(vi).	Town Planners	27	7.8
(vii).	Geography and Meteorologists	14	4.1
(viii).	Environmental Engineers/Managers	12	3.5
(ix).	Engineers		
	Civil/Structural Engineers	25	7.3
	Electrical Engineers	12	3.5
	Mechanical Engineers	10	2.9
	Geotechnical Engineers	6	1.7
Total		207	60.2
(b).	Building and Civil Engineering Contractors	21	6.7
(c).	Manufacturers and suppliers of Building Materials/Products	62	18.0
(d).	Others	54	15.7
Total		344	100

Source: Researcher Field Survey Report (2022)

In Table 2, the Category of Respondents includes all professional in the built environment in order to benefit from their expertise on perspective of sustainable building projects delivery in Enugu State. A total of two hundred and seven (207) professional in the built environment responses were retrieved which represents 60.2% of the respondents. The Building and Civil Engineering Contractors were twenty-one (21) representing 6.7% of the respondents. The total number of respondents for Manufactures and Suppliers of Building Materials/Products were sixty-two (62) representing 18.0% of the respondents and others which include Policy Makers, interest groups, developers etc. have a total number of fifty-four (54) respondents representing 15.7%.

4.2 Analysis of Critical Success Factors that affect Sustainable Building Projects Delivery in Enugu State

The responses from the respondents on the established critical success factors that affect sustainable building

projects delivery in the Enugu State were as stated in Table 3.

The information in Table 3 indicates that, the highest mean score value of 4.36 and severity index of 87.3% was on “Meeting project goal and objectives” followed by mean score value of 4.35 and severity index of 86.9% on “Health and safety of occupants”. The “participants’ satisfaction” has a mean score value of 4.33 and severity index of 86.7% while “satisfaction” of interpersonal relations with project team members has a mean score value of 4.32 and severity index of 86.3%. The least mean score value of 3.45 and severity index of 69.1% was on the “Efficiency of project execution and termination”. All the factor variables mean are all above 3.25 and severity index of 65.0% which indicates that they are critical success factors to sustainable building projects delivery in Enugu State. The grand mean score value of 4.15 and severity index of 82.9% which shows that the established critical success factors certainly affect the sustainable building projects delivery in Enugu State.

Table 3: Perception of Respondents on Critical Success Factors to Sustainable Building Projects Delivery in Enugu State

S/N	Item	SD	DA	UD	A	SA	$\sum Fx$	Mean	S. I	Rank
1.	Cost within the stipulated budget	–	6	64	126	148	1448	4.21	84.2	9 th
2.	Time within the scheduled delivery period	–	13	70	134	127	1407	4.09	81.8	12 th
3.	Building to stipulated quality standard specifications.	–	–	55	137	152	1473	4.28	85.6	5 th
4.	Satisfaction of interpersonal relations with project team members	–	–	37	161	146	1485	4.32	86.3	4 th
5.	Participants’ satisfaction	–	–	28	173	143	1491	4.33	86.7	3 rd
6.	Efficiency of project execution and termination	–	–	67	178	55	1188	3.45	69.1	17 th
7.	User satisfaction on the project performance.	–	–	52	147	145	1469	4.27	85.4	6 th
8.	Meeting project goal and objective	–	–	29	161	154	1501	4.36	87.3	1 st
9.	Technical performance achievement	–	–	36	182	126	1466	4.26	85.2	8 th
10.	Health and safety of occupants	–	–	47	131	166	1495	4.35	86.9	2 nd
11.	Environmental performance and user friendly	–	–	69	142	133	1440	4.19	83.7	11 th
12.	Functionality of the designed and constructed projects		15	78	142	109	1377	4.00	80.1	13 th
13.	Benefits to the end user	–	26	43	117	158	1439	4.18	83.7	12 th
14.	Benefits to the end stakeholders	–	–	63	154	127	1440	4.19	83.7	11 th
15.	Benefits to the end developing organization	–	–	55	165	124	1445	4.20	84.0	10 th
16.	Benefits to the technological infrastructure	–	–	74	128	142	1444	4.20	84.0	10 th
17.	Value and profit or business benefit	–	32	49	157	106	1369	3.98	79.6	15 th
18.	Improved market value (or share) of the project facility	–	22	10	167	145	1467	4.26	85.3	7 th
19.	Comparative advantage and reputations of the beneficiaries	–	41	52	122	129	1371	3.99	79.7	14 th
20.	Personal growth and actualization of the stakeholders’ vision.		65	37	134	108	1317	3.83	76.6	16 th
Grand Mean								4.15	82.9	

Source: Researcher Field Survey Report (2022)

4.3 Analysis of the Regression Function of the Information in Table 3

The mean score rating values were plotted against the established critical success factors in Table 3 to determine the regression function in a graph as shown in Figure 1

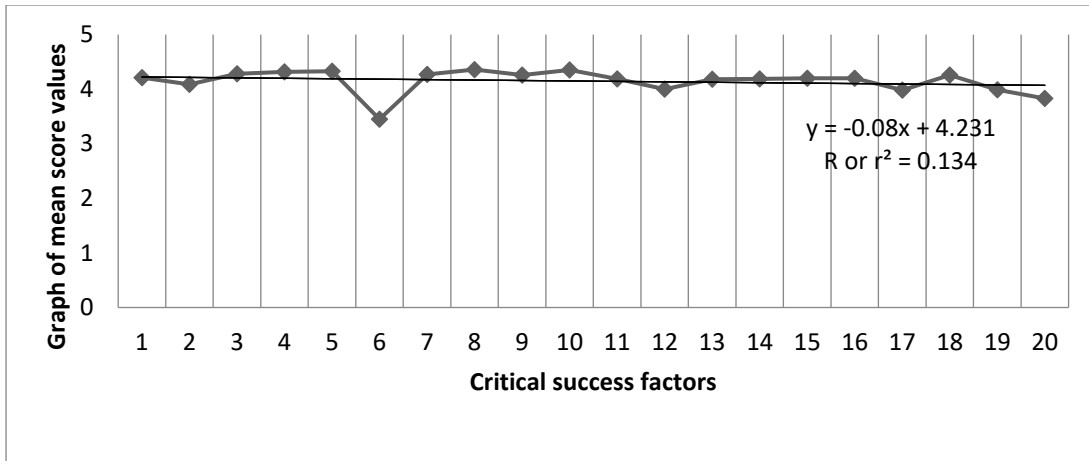


Figure 1: Mean score values against Critical success factors

In Figure 1, the graph of the regression function of grand mean score values against critical success factors to sustainable building project delivery is a linear relationship with the line of best fit at $y = -0.08x + 4.231$. The estimation of the graphical function for the coefficient of determination (R or r^2) = 0.134. The coefficient of correlation (r) which is the positive square root of the coefficient of determination is calculated as $= \sqrt{r^2 \text{ or } R} = \sqrt{0.134} = 0.3661$. The results show that of the total variation in the values of mean score ratings is explained by the variation on critical success factors. The result shows that since critical value of the coefficient of correlation (r) = 0.2070 at 0.1 level of significance and degree of freedom (d_f) = 38 is less than the computed value of $r = 0.3661$, from the regression function, the critical success factor variables are necessary for sustainable building projects delivery in Enugu State.

4.4. Development of Framework for Sustainable Building Projects Delivery in Enugu State.

The analysis of the critical success factors on item No. 1 to item No. 5 are based on project management success criteria, and item No. 6 to item No. 16 are based on product success criteria while item No. 17 to item No. 20 are based on market success criteria (CIOB, 2010). The analysis shows that the most critical success factors for sustainable building projects delivery is meeting project goal and objective, followed by Health and Safety of occupants which are under product success criteria while participants' satisfaction, followed by satisfaction of interpersonal relation with the project team members, and building

to stipulated quality standard specification were under project management success criteria. Improved market value (or share) of the project facility under market success criteria ranked 7th on critical success factors. The framework to be adopted to sustainable building projects delivery in Enugu State also need the integration of execution, monitoring and implementation process in order to consider the use of supervisory and monitoring group to ensure that all the information during the integration of the design process are actually implemented as stated.

The framework in figure 2 consists of three levels to include conceptual, strategic and operations. The conceptual level entails identifying the sustainability principles used to be integrated including whole life of building consideration. The strategic level entails integrating in the project planning process; sustainable project integration, integrated project team, integrated design process with regulation and code compliances to deliver a sustainable project plan of guidance for whole project life. The operations level involve the practical application of construction, monitoring and implementation to sustainable building project plan of ideal concepts, sustainable project definition, development, hand over and accruing benefits by using a template for sustainable building projects delivery in Enugu State.

The project success criteria for successful project performance can be feed front to conceptual level for continuous improvement. The established Bureau for Sustainable Building Development (BSBD) which

consist of selected built environment professionals educated on sustainability integration to building projects delivery, policy makers, and manufacturers' representatives will continuously monitor

performance and improve on the sustainability template for building project delivery in the state.

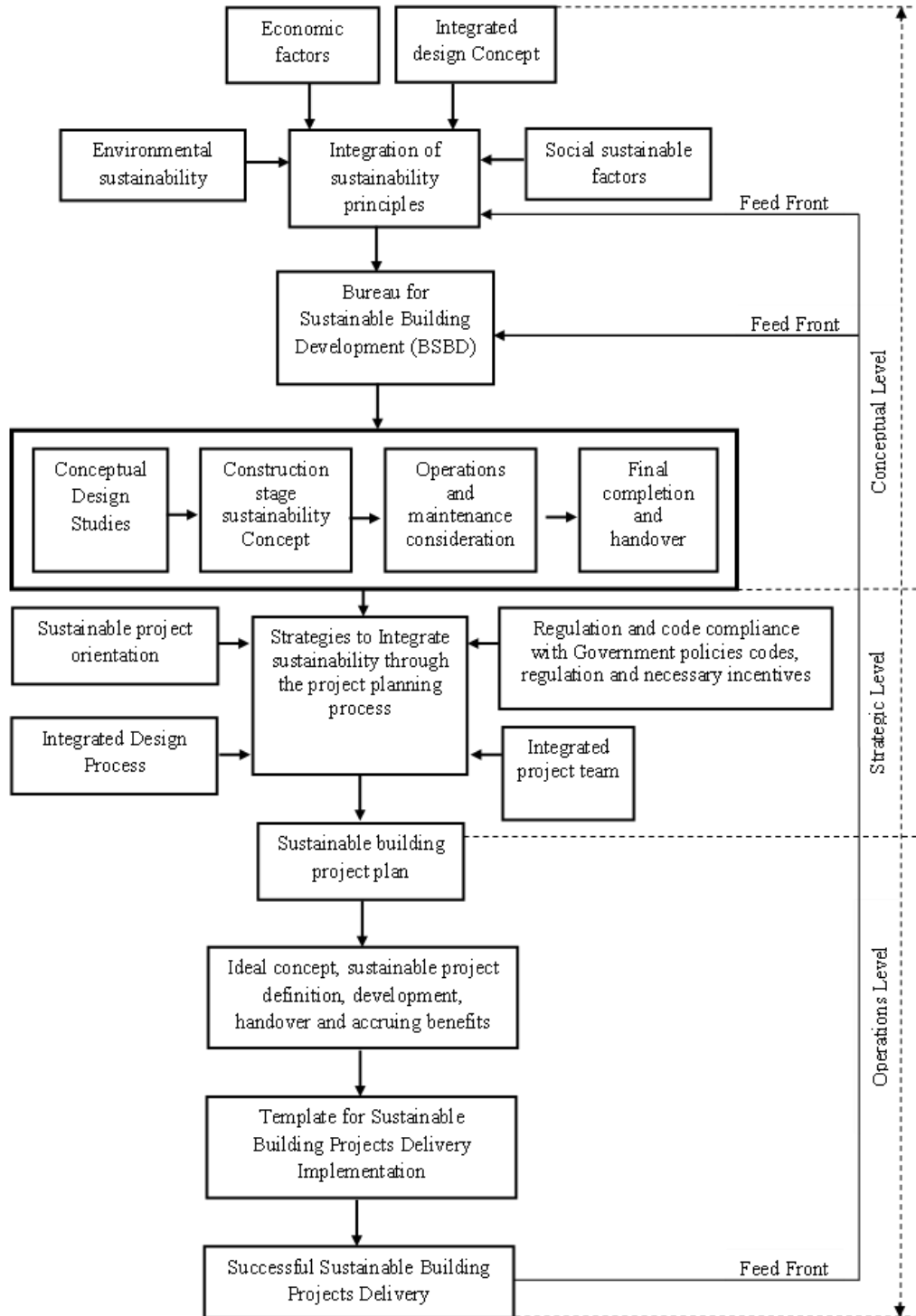


Figure 2: Framework for successful Sustainable Building Projects Delivery in Enugu State

V. CONCLUSION AND RECOMMENDATION

- i. Sustainable building projects development and delivery entails challenge of meeting growing human needs for natural resources, industrial products, embodied energy savings, food, transportation and effective waste management while conserving and protecting environmental quality and natural resource base essential for present, and future life with well-articulated development policy and strategy.
- ii. The sustainable development concepts applied to design, construction, operation and maintenance with whole life assessment of buildings would enhance both the economic welfare, environmental health and social well-being of communities in Enugu State.
- iii. The critical success factors are essential as good performance indicators to successful sustainable building projects delivery in Enugu State.
- iv. The development of framework for successful sustainable building projects delivery will benefit the construction stakeholders in the built environment, academia, students and building products manufacturers, and enhance market value of the sustainable buildings.

5.4 Recommendations

Based on the findings, the study made the following recommendations:

- 1. Enugu State government should establish Bureau for Sustainable Building Development (BSBD) charged with the responsibility of;
 - (a) Developing a template for sustainable building projects delivery to incorporate mitigation measures for the constraints to sustainable building projects at pre-contract and post-contract stages by making it obligatory to use the framework developed for sustainable building projects delivery in the state.
 - (b) Engage in capacity building through education, training, skill and knowledge gap for sustainability integration of the identified constraints, impact on constraints factors with the critical success factors to achieve sustainable building projects in the state.
 - (c) Encourage product innovation towards sustainable materials for construction.
 - (d) Re-orientation of building type concept to tend more to solving the housing needs of low- and

medium-income group by introducing condominium with sustainable design innovations in some building estates in the state.

- (e) Encourage active community participation by making the host communities to own the projects in their location and environment in order to close the gap among the clients, building occupants, construction professionals, contractors, and building materials manufacturers for sustainable building project delivery.
 - (f) Create data base for sustainable building projects delivery.
 - (g) Liaise with existing agencies on building projects development for articulation of strategies for successful sustainable building projects in the state.
 - (h) The government should devise strategies to subsidize the sustainable building projects so that they can be affordable to medium and low-income group.
- 2. The Enugu state government should encourage public private partnership to fast-track urban renewal programme for sustainable building projects delivery in the state.
 - 3. The government should have a legislation to back up all the proposals recommended for proper enforcement.

5.5 Contribution to Knowledge

The research x-rayed the constraint factors to sustainable building projects delivery in Enugu State which are threats to present and future generation of the inhabitants in the study area. The contributions to knowledge include the following:

- a) The study generated qualitative and quantitative assessment of constraint factors to sustainable building projects delivery in the study area.
- b) The study provided a solution to integration of key sustainability principles into the planning, execution and successful sustainable building project performance in the study area.
- c) The research work also developed a framework for successful sustainable building project delivery in Enugu State, Nigeria.

5.6 Suggestions for Further Research

The study has addressed mainly the proposals for development of building projects and associated challenges and how to integrate sustainability

principles in the course of their planning and execution. The areas recommended for further studies are;

- i. Integration of sustainability on Existing Building Infrastructure for Urban Renewal Programme in Enugu State.
- ii. Sustainability Integration to Building Estates and its effects on climate change in Enugu State.
- iii. Sustainable Maintenance of Existing Building Infrastructure for Sustainable Development in Enugu State.
- iv. Integration of As Built Drawings and Building Maintenance Manual as veritable tool for sustainable building projects delivery.

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