Constraint Factors to Sustainable Building Projects Delivery in Enugu State, Nigeria[1]

Anthony N. Ezemerihe[1], Kevin C. Okolie[2], and Dominic A. Obodoh[2]
[1]Enugu State University of Science and Technology, Enugu, Nigeria
[2]Department of Building, Nnamdi Azikiwe University, Awka, Nigeria

ABSTRACT

The study identified the constraint factors to sustainable building projects delivery in Enugu State with a view to mitigate these factors in order to deliver successful sustainable building in the state. 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. 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 results show that incentive factors ranked first with grand mean score of 4.05 and severity index of 81.0% followed by economic factors and project factors. The least in ranking was technical and technological factors. The work concluded that sustainable building would offer a holistic approach by integrating sustainability at the design, execution and whole life assessment maintenance in order to achieve environmental safety and cost-effective buildings over their life cycle. The study recommends that capacity building through education, training, skill and bridging knowledge gap of project participants; product innovation towards sustainable materials; community participation at the design/construction stages would mitigate the constraint factors to achieve sustainable building projects delivery in Enugu State.

Keywords: Sustainability, Sustainable buildings, Constraint factors, Sustainable design and execution.

1.0 INTRODUCTION

Construction activities deplete our natural resources which are major threat to our ecological environment. Sustainable building was sought because of the discomfort like, destroying our natural ecosystem, air, land and water pollution, greenhouse gas emissions, heating up of the ozone

[1] How to cite this work: Ezemerihe, A. N., Okolie, K. C., Obodoh, D. A. (2024). Constraint Factors to Sustainable Building Projects Delivery in Enugu State, Nigeria; *PM World Journal*, Vol. XIII, Issue II, February.

layer, erosion, flooding and associated hazards. Sustainable building design and subsequent construction seeks to reduce negative impact on the environment, improve the health and comfort of building occupants which improves building performance. Construction is one of the largest industries in both developing and developed countries in terms of investment, employment and contribution to Gross Domestic Product (GDP) of any Nation (Spence and Mulligan, 1995 cited in Ametepy, Ansah and Gyadu-Asiedu, 2020). The construction industry accounts directly and indirectly for nearly forty percent (40%) of material flow entering the world economy (Clement, Cheng and Hong, 2018); and in developing countries for around fifty percent (50%) of the total energy consumption (Ametepy *et al.*, 2020; Ibrahim and Price, 2005).

Aluko (2011) stated that, in Nigeria, many laws and regulations were enunciated at Federal, State and Local government levels for proper planning of the environment and building design architecture without integration of sustainability concepts. Most of the building projects are not sustainable which portends danger to the environment by degrading the natural design architecture. Although the principal indicators for sustainable development are not integrated at the planning stage for most building projects, their execution also lack proper monitoring by the policy makers (Udegbunam, Agbazue, and Ngang, 2017). These led to poor implementation during construction which drastically affects our living environment. For a building development project to be sustainable, it must have the ability to be sustained for a definite period without damaging the environment, or without depleting a resource (Hornby, Gatenby and Wakefield, 2000).

Building sustainability is fundamentally a process of best practices that leads to sustainable outcomes (Muldavin, 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 made sustainability principles hard to be incorporated in building projects (Construction Industry Development Board (CIDB), 2003).

The constraints to sustainable building projects delivery in Enugu State, Nigeria is apt in this era where human related activities, burning of fossil fuel, greenhouse gas emissions, and construction activities had led to variability in rainfall, temperature and other climatic conditions. These have resulted to food insecurity, deforestation, erosion induced gullies, unbalancing of ecosystem, pollution of air, land and water, loss of lives and properties in the state. In order to address the constraints to sustainable building projects delivery in Enugu State, there is need to identify the constraint factors that impair sustainable building projects delivery and address them for successful sustainable building delivery in the state.

2.0 LITERATURE REVIEW

2.1 Concept of Sustainable Development

WCED (1987) referred to sustainable development as development that meets the needs of the present without compromising the ability of the future generation to meet their own needs and aspirations. United Nations (2011) referred to sustainable development as development that seeks to eradicate poverty which is a global challenge and the requirement to achieve sustainable requirement requires enhancement of global resources base by gradually changing the ways in which we develop and use technologies. Hornby and Wehmeier (2000) said that sustainable development is the process of developing; growth, directed change or application of new ideas to practical problems in formulating a course of action with the ability to be sustained for a definite period without damaging the environment or without depleting a resource, renewable. Munasinghe (1993) defined sustainable development as the interdependence between economic development, the natural environment and the people. Schumann (2010) said that sustainable development includes the integration of ecological, socio-cultural, economic, technical, process and location aspects in the planning and construction of building projects. UNCHS (Habitat) (1992) opined that sustainable development deals with improving the quality of human life, economically by minimizing nonrenewable energy sources etc., socially by reducing population pressure on resources like food and water etc. and politically through good governance. The researcher refers to sustainable development of building projects as an integrated and systematic approach of solving human shelter needs by taking into consideration the ecological, economic, socio-cultural, technical process and aspects of location in the planning and execution of building projects to minimize nonrenewable energy sources, sustain the biosphere with its diversity, preserve our natural resources for the present and future generations of the inhabitants on earth.

CIOB (2010) stated that sustainable developments of building projects are inconsistent with conventional projects because of use of special materials, building practices and management commitment to sustainability of buildings. These required additional considerations whose implementations form major barriers as a result of knowledge gaps, communication shortfall, ownership structure, operating cost responsibility, family issues, risks, and other technical and process issues. The chances of delivering the projects successfully can be enhanced if there are modifications to the traditional planning and execution process through proper integration of sustainability concepts in the project delivery. Yudelson (2009) surmise that the process of planning for a sustainable building project is different from the traditional planning process due to its complexity and holistic approach. The process has the responsibility to deliver sustainable development goals throughout the project. This process requires decisions to be made in order to achieve sustainability standards so that maximum capital and whole life costs can be achieved (CIOB, 2010).

2.2 Constraints to Sustainable Building Projects Development

Sustainable construction has to take place by understanding the political, economic social and developmental issues of a place, and that sustainable construction then becomes an integral part of sustainable development. Sustainable construction has not received sufficient attention in Nigeria even though it is an important aspect of sustainable development. The critical issue surrounding our construction activities is that construction systems have long been modeled on the experience of the developed world (Adindu, Musa, Nwajagu, Yusuf and Yisa, 2020). They contend that it has been assumed historically that norms and systems arising from a particular set of experiences in the developed world can be readily adopted by developing countries. The implication is that this type of thinking typified the stage of economic growth, whereby the economic emergencies of nations were hypothesized to be consistently and universally similar, thus ignoring national circumstances, value systems or current priorities. This is inappropriate where principles of the developed world have been applied without modification in our construction environment with its diversity of problems. The issues of conflicts and wars, and pandemics that have implication for sustainable construction have become another perspective of the debate around sustainability in our development setting (Adebayo, 2000).

The government policies in areas of housing, economics, environment and spatial planning affect sustainable development and construction and have direct implications on the construction industry and related development issues. These policies are concerned with alleviation of poverty, employment creation, capacity building, quality of environment etc. but most of these policies do not enhance the objective of sustainability. The situation is compounded by the lending policies of the International Monetary Fund (IMF) and the World Bank with structural adjustment which have had considerable impact on our construction industry. The policies advocate for reduction in public spending and restructuring of the public sector and privatization of assets. This process has created unemployment in certain sectors, and some of these labour forces are absorbed by the construction sector (Adebayo and Adebayo, 2000). Most construction activities impact on the built environment and these projects focus on the economics angle, and negate the aspects of quality of environment, preservation of green architecture, water and sanitations etc. There are other pertinent issues such as infrastructure and services provision, energy and water as constant requirements for the success of the construction sector. The intensive consumption of these by the construction industry and their perpetual shortage result to waste disposal on construction sites disposal of byproducts of construction materials as well as unused building materials which become an environmental concern.

3.0 RESEARCH 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 Etiti, 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.

4.0 RESULTS AND DISCUSSION

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 with the questionnaires distributed and their percentages according to the various local governments in the sample survey. 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 professionals 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%.

This study identified the constraint factors to sustainable building projects delivery in the study area. These include the Economic factors; Education, training, skills and knowledge gap; Project

factors; Design related factors; Technical and Technological Factors; Construction factors; Site Related Factors; Criteria Cost Risk Factors; Perception Factors; Process and Regulatory Factors; and Incentive Factors. The constraints were identified and discussed in table 3 from the responses of respondents as stated in the questionnaires.

Table 3: Summary of Perception of Respondents on identified constraint factors, mean score rating and severity index to sustainable building project delivery in Enugu State.

S/N	Identified constraint factors	Grand mean score	Severity index (%)	Rank
A	Economic factors	4.02	80.4	2nd
B	Education training skills and knowledge gap	3.92	78.4	4th
C	Project factors	4.00	80.0	3rd
D	Design related factors	3.46	69.2	12th
E	Technical and Technological Factors	3.25	65.0	13th
F	Construction factors	3.70	73.9	7th
G	Project management factors	3.62	72.4	8th
H	Procurement factors	3.73	74.6	5th
I	Site Related Factors	3.50	70.0	11th
J	Criteria Cost Risk Factors	3.71	74.2	6th
K	Perception Factors	3.52	70.4	10th
L	Process and Regulatory Factors	3.58	71.6	9th
M	Incentive Factors	4.05	81.0	1st
	Overall Grand Mean Score	**3.70**	**73.9**	

Source: Researcher Field Survey Report (2022)

The information in table 3 indicates that among the identified constraint factors, incentive factors ranked first with grand mean score of 4.05 and severity index of 81.0%, this is followed by economic factors with grand mean of 4.02 and severity index of 80.4%. The third in the ranking is project factors with grand mean of 4.00 and severity index of 80.0%. The least is the technical and technological factors constraints with grand mean of 3.25 and severity index of 65.0%. In all the identified constraint factors, none was below the mean value of 3.25 and severity index of 65.0%. Therefore, all these identified factors are constraints to sustainable building project delivery in Enugu State. The identified constraint factor variables of incentive factors ranked first and observation is that for a sustainable building delivery to be achieved incentive will play a pioneering roles since the concept of sustainability is alien to the construction workers in the area. Lack of incentive will discourage project workers, which is a major constraint. Economic factors that ranked second shows that major constraints like affordability, high cost of sustainable products, inflation and interest charges on loan facilities will hinder sustainable building projects delivery. Technical and technological factors variables may not be major constraints because accessible technology, experience workforce and others cannot impede sustainable building

projects delivery. There is a need for the policy makers and stakeholders to be orientated on the need to achieve sustainable building dream goals in the study area.

The above information in Table 3 was plotted on a graph of Grand Mean Score against the identified constraint factors from items (a) to (m) in figure 1.

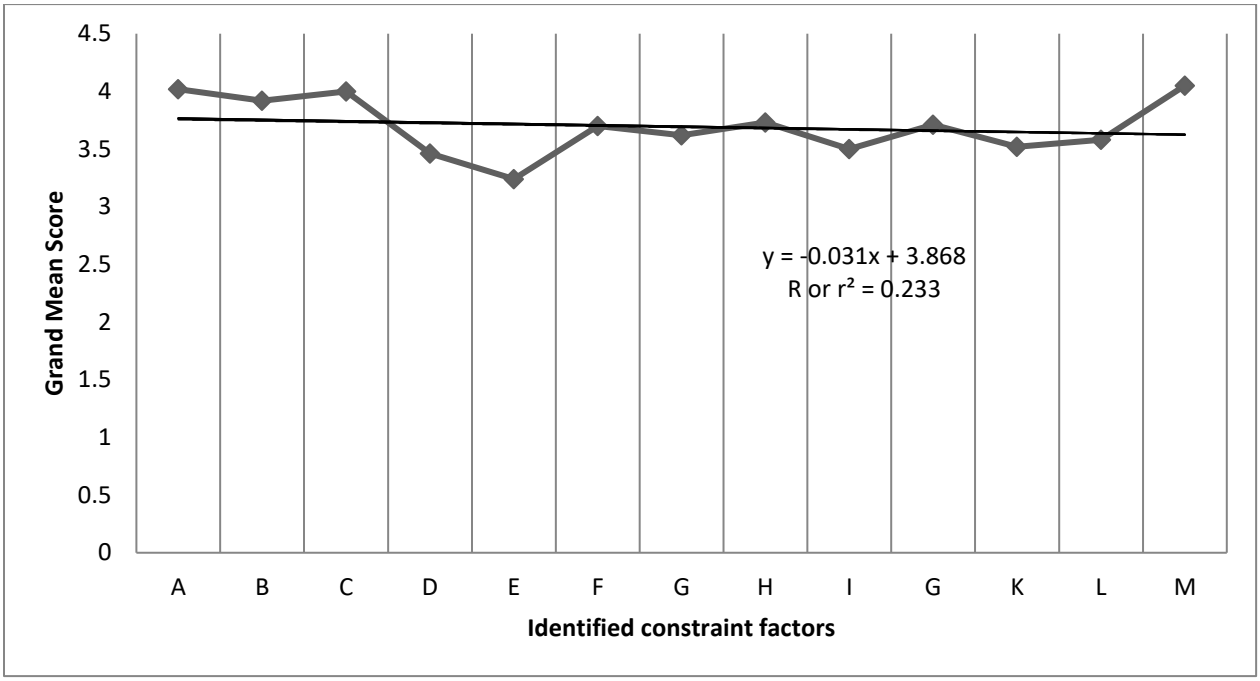

Figure 1: Grand Mean Score against the identified constraint factors

In Figure 1, the graph of the regression function of Grand Mean Score against the identified constraint factors to sustainable building projects delivery is a linear relationship which showed that the line of best fit at Y= 0.031x + 3.868.The estimation of the graphical function for the coefficient of determination (R or r^2) = 0.233.The coefficient of correlation (r) = $\sqrt{R} = \sqrt{0.233}$ = 0.4827. The results show that of the total variation in the values of mean score ratings is explained by the variation in the identified constraint factors variables. The critical value of r at 0.1 level of significance and degree of freedom (d_f) = 24 is 0. 2598.The result shows that since critical value of the coefficient of correlation (r) = 0.2598 is less than the computed value of r = 0.4827, all the identified constraint factors affect sustainable building projects delivery in Enugu State.

The perception of respondents on identified constraint factors to sustainable building project delivery as stated in table 3 shows that incentive factors ranked first followed by economic factors; project factors; and education, training, skills and knowledge gap. The least in the ranking is technical and technological factors. This shows that for sustainable building projects to be

successful, incentives to project participants is paramount. Technical and technological factors are prioritized least because they can always be applied to all types of projects.

5.0 CONCLUSION AND RECOMMENDATION

Based on the findings, the following conclusion and recommendations were drawn:

i. Conserving the earth's natural, physical and chemical system with integration of meeting current and long-term human needs will be difficult without proper articulated development strategy.

ii. The absence of professional builders' input in most construction sites in Enugu State, lack of integrity and unethical practices on the part of some stakeholders involved in approval and monitoring the implementation of building development projects should be properly addressed for sustainable building projects delivery.

iii. There is need for synergy with the policy makers, political administrators, the built environment professionals and consultants both in public and private sectors, estate developers, manufacturers and importers of building materials, building owners, building users/occupants and associated interest groups to mitigate the identified constraint factors.

iv. The government should develop 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.

v. There is need for capacity building through education, training, skill and knowledge gap for sustainability integration of the identified constraints factors.

REFERENCES

Adebayo, A. A. (2000). Architecture and Cities for Tourism' Paper presented in Conference for Tourism for Architecture Mauritius.

Adebayo, A. A. and Adebayo, P. (2000). Sustainable Housing Policy and Practice-reducing constraints and expanding horizons within delivery. Paper presented in 2nd South African Conference on sustainable development in the built Environment 23-25 August Pretoria South Africa.

Adindu C., Musa, A., Nwajagu, U., Yusuf, S. and Yisa, S. (2020). Applicability of sustainable construction in Nigeria Infrastructure Projects. Empirical Study of the Six Geopolitical Zones. Journal of Infrastructure Development 3(2) 129 – 141 (2020).

Aluko, O. (2000). Development control and Nigeria's New Civil Rule Programme NITP Journal, vol. xii.79-88.

Ametepy S. O., Ansah, S. and Gyadu-Asiedu W. (2020). Journal of Building Construction and Planning Research. Vol. 8 No.3 Sept. 2020.

CIDB (Construction Industry Development Board), (2003). IBS Roadmap 2003-2010, CIDB, Malaysia.

CIOB (The Chartered Institute of Building), (2010). Code of Practice for Project Management for Construction and Development, Wiley-Blackwell, United Kingdom.

Clement F. D., Cheng, Y. and Hong, Z. (2018). World Journal of Engineering and Technology Vol. 6 No. 2B May. 22.

Hornby, A.S. and Wehmeier, S. (2000). Oxford Advanced Learners Dictionary of Current English 6th Edition. Oxford University Press.Jan. https://en.wikipedia.org /w/ index. php? title = Enugu &oldid=903961749.

Hornby, A.S., GatenBy, E.V. and Wakefield, H. (2000) Oxford Advanced Learners Dictionary of Current English, Oxford University Press.

Ibrahim, A. D. and Price A.D.F. (2005). "Impact of Social and Environmental Factors in the Procurement of Healthcare Infrastructure".Journal of Project Management and Innovation.

Mansur, S.A., Che Wan Putra, C.W.F. and Mohammed, A.H. (2003) Productivity Assessment and Schedule Compression Index (PASCI) for Project Planning.5th Asia Pacific Structural Engineering and Construction Conference (ASPEC, 2003) Johor Bahru, Malaysia.

Mugeda, O.M. and Mugeda, A.G. (2003). Research methods: Quantitative and Qualitative Approaches. Narobi, Kenya: ACTS.

Muldavin, S.R. (2010). Value beyond cost savings, how to underwrite sustainable properties,

Munasinghe, M. (1993). Towards Sustainable Development: An Implementing Framework Springer Link Journal.

National Bureau of Statistics (2023). Enugu State of Nigeria.Retrieved from https://city population.de/Php/Nigeria-admin.

Schumann, B. (2010). Impact of Sustainability on Property Value.Unpublished Master's Thesis, University of Regenburg, Regenburg.

Spence, R. and Mulligan, H. (1995). Sustainable development and the construction industry.*Habitat International*, **19**(3): 279-292.

Udegbunam, D. O., Agbazue, V. E. and Ngang, B.U. (2017). Environment Impact Assessment: A Veritable Tool for sustainable Development in Nigeria. IOSR *Journal of Applied Chemistry* (IOSR-YAC) e-ISSN2278-5736 10(9) Ver. III September .38.43

UNCHS (Habitat) (1992). Global Shelter Strategy to the Year 2000, Nairobi UNCHS (Habitat).

United Nations, (2009). Millennium Development Goals Report, New York: United Nations Report E09.I.12.

WCED (1987).Our Common Future.Oxford University Press Oxford.

Yudelson, J. (2009). The Green Building Revolution.IslandPress.Springer, New York.

About the Authors

Anthony Nnamdi Ezemerihe

Enugu, Nigeria

Ezemerihe, Anthony Nnamdi holds a bachelor's degree in Building from Enugu State University of Science and Technology Enugu, Nigeria, Higher National Diploma in Building Technology and Quantity Surveying from Institute of Management and Technology (IMT) Enugu, Nigeria. Postgraduate Diploma (PGD) and Master of Business Administration (MBA) in Banking and Finance from Anambra State University of Technology (ASUTECH) Enugu. A master of Science (M.Sc) degree in Construction Management from Nnamdi Azikiwe University (NAU) Awka, Nigeria and he is presently rounding up his Doctorate degree in Construction Management at NAU, Awka. He is a registered Builder and Corporate member Nigerian Institute of Building (MNIOB), Nigerian Institute of Quantity Surveyors, Nigerian Institute of Management (MNIM), Nigerian Environmental Society (MNES) and passed with overall result A in Public Service Examination (PSE) from the Administrative Staff college of Nigeria (ASCON). He also obtained Doctor of philosophy (Critical and Creative Thinking) Ph.D. (CACT) (Honouris Causa) from Montclair State University, Upper Montclair New Jersey, United States of America (USA). Ezemerihe Anthony Nnamdi can be contacted at ecatonia2008@yahoo.com.

Prof. Kevin Chuks Okolie

Anambra State, Nigeria

Prof. Kevin Chuks Okolie holds a Doctor of Philosophy Degree in Construction Management from Nelson Mandela Metropolitan University, Port Elizabeth South Africa. His research interest lies in the development of Building Performance Evaluation Methodology, Health and Safety Management and Built Asset Management Systems. His published papers and articles on Construction and Facilities Management have appeared in many international conferences and peer reviewed journals. Prof Okolie can be contacted at kc.okolie@unizik.edu.ng

Dr Dominic Anosike Obodoh

Anambra State, Nigeria

Dr Dominic Anosike Obodoh is a Senior Lecturer in the Department of Building, Nnamdi Azikiwe University, Awka Nigeria. He holds PhD in Project Management Technology, M.Eng Civil Engineering (Structural Engineering), M.Sc Construction Management and B.Sc Building. He is a Registered Builder and a Project Management Consultant. Dr D.A. Obodoh has published many articles in reputable journals in and outside Nigeria. He has supervised many students' projects in both undergraduate and postgraduate levels. He hails from Eke in Udi Local Government Area of Enugu State, Nigeria and is happily married with children. Dr. Obodoh can be contacted at da.obodoh@unizik.edu.ng