Factors Impeding the Integration of Sustainability Elements in Built Environment Academic Curricula

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ABSTRACT

Development within the construction industry shows that higher education is critical in the sector's skills improvement. However, research findings are also explicit about absent and shadow integration of core sustainable construction modules for built environment's curricula. The study aimed to examine issues critical for the integration of sustainability element in the built environment curricula. It outlined two objectives which: (1) to determine the causes for the low integration of sustainability elements in academic curricula and, (2) to identify the principal factors inhibiting the integration of sustainability elements in academic curricula in Nigeria. Data for the study was obtained using a questionnaire survey administered to a random sample of 186 academic stakeholders related to schools of the built environment across Nigeria with factor analysis was subsequently employed to analyze the survey data. The results showed that seven principal factors inhibit and are responsible for the dearth of sustainable construction modules in built environment academic curricula in Nigeria. These are: (1) Skills and knowledge dearth, (2) Lack of empowerment to effect change, (3) Low level of awareness, (4) Lack of green building council, (5) Lack of real-life sustainable projects, (6) Non-prioritization by accreditation bodies and (7) Lack of research and industry collaboration. The findings suggest that strong government policy and viable industry and academic collaboration are imperative to effect curriculum change in support of the integration of sustainability element in the built environment curricula. The findings reported in this paper is significant as a basis to inaugurate the development of academic curricula which integrates the sustainability elements, capable of driving behavioural change to adapt sustainability practices among graduates.

1. Introduction

The sustainability of the built environment hinged on the mitigation of construction impacts on the environment. Achieving this goal is also predicated on acquiring requisite skills in sustainable construction (Hayles and de la Harpe, 2010). However, sustainable construction skills set remains an area where vast deficit in learning is increasingly reported (Nduka and Ogunsami, 2015; Higham and Thomson, 2015). Despite this awareness, learning of related skills is alarming low (Tramontin and Moodley, 2016; Ekung and Odesola, 2018). Sustainability education, therefore, seeks to embed skills imperative to safe environmental practices. At the centre of this education, higher education curriculum has a pivotal role in advanced complex manpower skills development (Ferrer-Balas et al., 2008; Rieh et al., 2017).

Development of sustainability-based curriculum at higher education level began decades ago in many developed nations (Rieh et al., 2017, Mros, et al., 2018). Advocacies to replicate similar efforts in the African context also exist (Ameh et al., 2010; Tramontin and Trois, 2016), but the level of response in the built environment is low. As a result, efforts to combat climate change impact remain voluntary, and without applied consequences (RICS, 2007). Studies attribute this development to less timetable space for sustainability-related modules in schools' curriculum (Edward, 2004; Ameh et al., 2010).

Review of the literature suggested varying contextual descriptions with the term curriculum. This suggests a lack of consensus in the literature to the term though an outline of expected learning requirements, defined under a set of goal, content, objectives and pedagogy are supporting it's basic understanding (Sahlherg, 2011). The context of academic curriculum is therefore complex, and is constantly changing as a response to the dynamics of practice (Levin, 2007; McKernan, 2008). Curricula for disciplines in the built environment are also subject to changes although, the level of response to sustainability concern is laggard. But despite the slow take-off in this sector, sustainability issues have nevertheless reached deep (Abdul-Wahab et al., 2003; Gelengis and Harris, 2014; and Xia et al., 2016); and is on-going (Cruz et al., 2015). Educational programmes in this sector are also being evaluated for sustainability (Watson, 2013). However, the structure of existing curricula is fragmented along with disciplinary silos. The focus is also mainly on specific organisation/region's learning needs (Thomson and Gleeson, 2012), and selected higher education programmes (Xia et al., 2016; Opoku and Egbu, 2017). As a result, the level of students' dissatisfaction with the delivery of sustainability literacy modules is alarmingly high (Opoku and Egbu, 2017).

In Nigeria, studies that focus on curriculum change for the integration of sustainability elements are still lacking (Ameh et al., 2010; Oluwatayo et al., 2014). The consequences of these lapses include low application of sustainable construction techniques (Ali et al., 2010; Bobbo et al., 2015) and less engagement in climate change preventive practices (Saliu and Achimugu, 2016). Against the background, the study reported in this paper aims to examine issues critical for the integration of sustainability element in the built environment curricula. It outlined two objectives which: (1) to determine the causes for the low integration of sustainability elements in academic curricula and, (2) to identify the principal factors inhibiting the integration of sustainability elements in academic curricula in Nigeria. The findings reported in this paper is significant as a basis to inaugurate the development of academic curricula which integrates the sustainability elements, capable of driving behavioural change to adapt sustainability practices among graduates.

2.   Literature Review

There were reports which attempted to explore the constraints to embed sustainability elements in academic curricula (Lozano, 2006; Lozano-Garcia et al. 2008). These studies adopted both linear process and smooth cumulative approach, the result

obtained, therefore, focused on a single outcome. The single-outcome result was characterised by variations between undergraduate and postgraduate programmes, and between institutions. This trend is widespread and cut across studies conducted at regional level (Sherren, 2005; Iyer-Raniga and Andamon, 2013). However, the importance to integrate sustainability elements in a curriculum to improve the awareness and perception of students about sustainability issues in construction was equally reported. There were also studies which portrayed a clear lack of attention for sustainability-related issues in the academic curriculum (Amaratunga, et al. 2014). Based on the survey of Russian, Ukrainian and Byelorussian Universities; Amaratunga et al. (2014) noted that sustainability issues were considered non-essential. In a study of one Nigerian university, Allu (2016) revealed that only half of the population of graduate architecture students are knowledgeable in sustainable construction. The fundamental values, concepts, and methodologies of sustainability is therefore not widespread hence, the low level of knowledge currently bedevilling practices in the built environment sector in Nigeria and globally (Nduka and Ogunsami, 2015; Higham and Thomson, 2015). This study proposes there are fundamental constraints critical to the integration of sustainability elements in academic curricula. This baseline study, therefore, seeks to identify possible impediments to low integration with a view to direct relevant mitigation actions that will improve schools' curricula in the higher education sector.

2.1   Critical Issues in the Integration of Sustainability Elements in Built Environment Curricula

Factors influencing sustainability integration have been conceived differently, and various scholars' view is either organisational practice or context-dependent. This varying contextualisation, have led to poor communication between higher institutions and the labour market, including lack of compliance with environmental laws and regulations (Amaratunga, et al., 2014). However, key issues raised in extant literature seems to be a common denominator across all studies impliedly.

2.1.1   Designed Learning

Sterling (2004) pinpointed that designed learning that is, learning by curricula and structured pedagogy inhibits formal and informal learning. Designed learning is counterproductive to attendant learning, that is, learning with an extended community of stakeholders including senior management, academics and industry actors. Designed learning is also learners focus with limited attention to teachers' education (Altomonte, 2012; Iyer-Raniga and Andamon, 2013). Teacher continuous education is necessary because, new attitudes and skills are required to effectively understand and embed sustainability learning (Sterling and Thomas, 2006). Issues related to the inability to develop learning and lack of adaptation towards practice as focal curriculum development barriers are also common-place (Finlow, 2008). This is driven by the academic doctrine, which tends to advance research over teaching. Although teaching in higher institution underlines both responsibilities, Harvey and Kamvounias (2008) however maintained that the problem

portends a strong conflict that must be clearly resolved to improve teacher's performance.

2.1.2   Multi-disciplinary Structure of Sustainability Learning

Sustainability skills and knowledge are generic and multidisciplinary. This philosophy contradicts the disciplinary-based focus of existing built environment curricula (Jones, 2009; Badcock et al., 2010). The present disciplinary curriculum lacks innovation, and the persistent alignment to a rigid curriculum structure poses a severe challenge to sustainability-based curriculum development in higher education (Tilbury, 2004). Tilbury (2004) contested the increasing emphasis on integration and suggested that curriculum change for sustainability actually requires innovation and not integration. MacDonald (2013) is concerned about the isolated training within disciplines in the built environment. MacDonald's study noted that the level of update and capacity of educators, and the problems of interdisciplinary rivalry remains imminent threats to integration targeted in sustainability education (MacDonald, 2013).

2.1.3   Awareness, Funding, Limited Resources and Lack of Empowerment to Effect Change

Factors such as inadequate funding, poor planning, limited expertise in sustainability issues, inadequate human resources, lack of case studies, low level of awareness, and lack of technical courses that support sustainability were prominent issues to the integration of sustainability elements (Adegbile, 2012). Although Adegbile (2012) discuss obstacles to sustainable architectural education, emergent factors are can issue critical to the overall integration of sustainability in the built environment's curricula. Sinnott and Thomas (2012) also found that limited resources, low enrollment rate, and academic diversity are peculiar to

curriculum changes in the built environment. Low awareness about sustainable construction issues among stakeholders in the built environment is equally a significant barrier to integration (Higham and Thomson, 2015; Nduka and Ogunsami, 2015).

2.1.4   Non-Prioritisation of Sustainability Education

Absent of motivation and non-prioritisation of sustainability content by programmes accrediting bodies also significantly inhibit sustainability integration into the academic curriculum (Altomonte et al., 2014).

2.1.5   The Barrier To Change

Lozano (2006) explored barriers to incorporation and institutionalisation of sustainability in universities. According to Lozano (2006), barriers to change exist at three levels namely: 'resistance to the notion of sustainability itself'; 'resistance involving deeper issues'; and 'deeply embedded resistance to change'. Lozano's study was not curricula focused, but the curriculum was recognised as part of the five universities' systems aligned to sustainability by the study (Lozano, 2006).

Shari and Jaafar (n.d) on the other hand surveyed educators in Malaysia and identified 109 barriers to sustainability integration grouped into eight categories. The grouping variables include educators; resource, government, students, public, subject, curriculum and monetary factors. Table 1 provides an overview of critical issues extracted from the literature. The factors are collectively and individually organised and filtered based on the sources under discussion of result as a general practice, regulatory, academic, and industry.

Table 1 Summary of Factors Influencing Sustainability Integration in Built Environment Curricula

Authors	Challenges
Shari and Jaafar (nd)	Low knowledge and exposure; non-prioritization by policy bodies; lack of practical skills at the right level; poor dialogue and coordination; lack of training & education in sustainability; restrictive structure towards innovating; crowded curriculum; lack of agencies to promote sustainability issue; lack of resources (books and the likes); lack of exemplar projects; and ignorance and negative attitude towards sustainability.
Yang and Giard (2001) & Metropolis (2002)	Complex and added skill requirements; and lack of adequate trained academic staff
Shaffi and Othman (2005)	Lack of awareness; lack of research and professional network, and skills and knowledge dearth.
Bobbo, Garba, Ali and Salisu (2015)	Incompatible teaching methods; and lack of training and theory-based curriculum
Majumdar (2009)	Inability to define sustainability skills and knowledge; inability to integrate sustainability in subject domain; and inability to define learning and teaching methodology
Lozano (2006)	Lack of information, disagreement with the idea, individual and organizational resistant to change, lack of facilities, lack of empowerment, rigid curricula, lack of interdisciplinary training in learning

The study, therefore, proposed that factors influencing sustainability integration in the built environment curricula are regulatory, industry, and academia related. The rationale is to contest whether the task of curriculum change could be more effective using 'community' of efforts. This is important to interpret learning into practice using the essentials of active engagement across organisations (Treleaven et al., 2012; Southwell et al., 2005). Lack of active engagement of stakeholders in curriculum development provides imperative to advance knowledge beyond mere information transmission towards ensuring curriculum changes.

3.   Research Methodology

The study employed a cross sectional design using survey as the instrument to collect data. The study covered the six geo-political zones of Nigeria and Abuja. The study area was extended to Abuja based on the need to sample academic stakeholders in professional bodies, and universities' regulatory organisations. The sample frame comprised lecturers in twelve schools of built environment (two universities were selected from each zone), and stakeholders from the respective profession's regulatory bodies, and universities' commission.

The population of the study covers six disciplines namely: Architecture, Building Technology, Estate Management, Geo-informatics, Quantity Surveying and Urban and Regional Planning. A preliminary investigation conducted revealed the total population of 346. The population was subjected to sample size determination using Taro Yamane formula, where the sample size of 186 was obtained. However, 250 questionnaires were administered to curb non-response bias. The administration of the questionnaire involved largely face-to-face administration and email. The data from the survey was developed into a database management system using Statistical Package for Social Science (SPSS) and analysed using the relative important index, and factor analysis. The reliability of the measurement constructs (factors), was also determined using Cronbach Alpha. The value (0.86) was obtained for the 28 factors generated from the literature. This value indicates a high level of consistency and is within the acceptable threshold of 'good' reliability (Meyers et al., 2006).

Factor analysis (FA) has been recognised as a successful tool for dimensional reduction and classification by detecting relationships among variables, and can also integrate a large number of observed variables into a few common latent factors (Babatunde and Perera, 2017). The use of FA in this study is consistently based on the spread of these factors across literature, and the need to compress them into principal components. The spread of the adopted measurement variables (factors) in the literature was captured in Table 1.

4.   Data Analysis and Findings

4.1   Response Rate and Profile

The study retrieved 206 questionnaires but only 106 valid responses were analysed, and this is equivalent to a 43% response rate. The Sample consists of Senior Lecturers (45%), Readers and Professors (15%) and Lecturers (40%). The quantity surveying profession constitutes about 22% of the study population, estate management (20%), Architecture (15%), Geo-informatics (10%), Building (15%) and Urban and Regional Planning (18%). The average years of experience of respondents are twelve years. Thirty-six percent have participated in curriculum review and programme accreditation in the last five years. Ninety percent of the respective programmes of the respondent disciplines have been reviewed in the last five years. However, the focus of the review was not on sustainability, but mainly to integrate disciplinary modules based on professional/universities' commission requirements, industry demand/changing dynamics of practice, and for general courses. The distribution of respondents shows a fair representation of programmes in the School of Built Environment.

4.2   Descriptive Importance of Factors Critical to Sustainability Integration

Figure 2 presents the descriptive perception of the respondents about the Twenty-Eight factors explored in the survey. Based on the disconnect between respondents' perception and actual practice (Leireiger, 2015); the study further validated the dimension of the actual implication of each factors using group survey. The overall Relative Important Index (RII) weaned towards zero and none of the factors was rated above average. The only factor that achieved an approximated average rating (0.50) is non-prioritisation of sustainability by accreditation bodies. Based on the developing characteristics, the study explores using data reduction tool, the principal components.

4.3   Internal   Validity   and   Significance   of Correlation

The preliminary factor analysis evaluated the extent and pattern of relationships. To achieve this, Field (2005) significance of the correlation matrix for values greater than 0.05, and the correlation coefficient for values greater than 0.9 was used. However, due to the complexity of the correlation matrix, the determinant of the matrix was used (Field, 2005; Ledesma and Valero-Mora, 2007; Hayes & Lamb, 2012). The Determinant is 1.441E-016 (0.0001441). This value is significantly greater than the necessary value of 0.00001 (Field, 2005). The result, therefore, means absent of multicollinearity in the data set. Multicollinearity explains the presence of a highly correlated factor (R > 0.8) (Field, 2005); and data without this threat reflects that data collection instrument was appropriate. This analysis further provides the second reliability to Cronbach tests earlier presented above. The relevant factors influencing sustainability integration are related and correlates fairly well.

The study also evaluated sampling adequacy using Kaiser-Mayer-Olkin (KMO) and Bartlett's test of sphericity. The appropriate sample has KMO value greater than 0.5 (Field, 2005), but the study yielded KMO value (0.791 > 0.50) and this is close to One. KMO value close to One indicates that the order of correlations is relatively compact, and dimension reduction will generate reliable factors. Field (2005) considered KMO values between 0.7 and

0.8, fairly good. Bartlett's test, on the other hand, indicates that the samples are related.

Kaiser-Mayer-Olkin (KMO) was conducted to determine whether the correlation matrix is not an identity matrix. Based on data in Table 2, the null hypothesis (that is, the correlation matrix is not an identity matrix) is rejected (0.000 < p = 0.05); and the inference is that the correlation matrix (R-matrix) is not an identity matrix but have some relationship between variables. The Bartlett test is therefore highly significant.
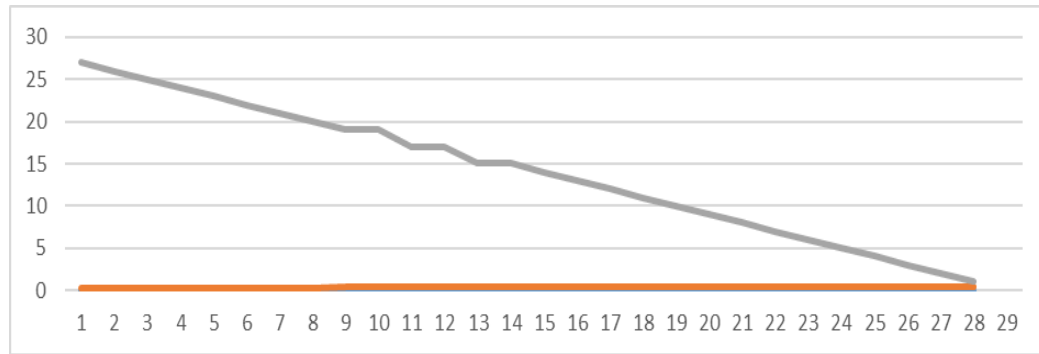
Designed learning (learning by rigid curricula and pedagogy)	14	Skills and knowledge dearth.	28
Lack of adequately trained capacity academic staff	13	Inadequate resources and planning	27
Lack of adaptation towards practice	12	Limited expertise in sustainability issues	26
Emphasis on research over teaching	11	Lack of case studies and exemplar projects	25
Isolated training among discipline	10	Low level of awareness	24
Inadequate skilled human resources	9	Poor dialogue and coordination	23
Academic diversity (culture, economic; language)	8	Lack of training & education in sustainability	22
Crowded and theory-based curriculum	7	Lack of agencies to promote sustainability issue	21
Incompatible teaching methods	6	Lack of innovation	20
Inability to integrate sustainability in subject domain	5	Lack of information lack of facilities	19
Inability to define learning and teaching methodology	4	Individual and organizational resistant to change,	18
Lack of empowerment	3	Lack of compliance to environmental laws and regulations	17
Inability to developed learning	2	lack of research and professional network,	16
Non-prioritization of sustainability by accreditation bodies	1	Bridge in communication between higher institutions and labour market	15

Figure 1 Relative Important Index of Factors

Table 2 KMO and Bartlett's Test of Identity Matrix

Tests		Values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.791
Bartlett's Test of Sphericity	Approx. Chi-Square	1562.381
	Df	378
	Sig.	0.000

4.4   *Exploratory Factor Analysis*

The exploratory factor analysis generated seven principal components. The initial exploratory extraction created 28 factors with Eigen values greater than 1, but with significant variance explained by only seven factors. Only seven factors, therefore, yielded Eigen value greater than 1.00 benchmark used in the analysis (12.702; 3.131, 1.885; 1.507; 1.314;

1.189; and 1.060 – see Table 3). Twenty-One (75%) extracted factors, therefore, explained only an insignificant proportion of the issues critical to the integration of sustainability in built environment curricula. The 21 factors are also responsible for an insignificant 18.62% variation in the sample, while 7 (25%) factors account for 81.38% of the variation in the entire sample.

Table 3 Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	12.702	45.363	45.363
2	3.131	11.181	56.544
3	1.885	6.732	63.276
4	1.507	5.381	68.657
5	1.314	4.694	73.350
6	1.189	4.247	77.597
7	1.06	3.787	81.384

Extraction Method: Principal Component Analysis

The study further analysed the commonality test. Communality was carried-out to measure commonness in the spread of the factors. This result is important to direct the number of factors to be extracted and in this case seven (7). The seven factors are valid since the number of variables are less than 30, and the averaged of the commonalities total significance – column two Table 3 (22.788/28 = 0.81) is greater than 0.70 (Field, 2005). Related to the result in Table 3 is the scree plot shown in Figure 2. The plot actually tailed significantly after the eighth factor

before attaining relative plateau. It is safe to retain 8 factors against 7 suggested by SPSS. Since the factors are less than 30, and commonalities after extraction are greater than 0.70 (0.81), the seven factors (Table 3) are accordingly retained. Seven principal factors can be grouped from 28 factors identified from the literature as issues critical to the integration of sustainability in the academic curriculum.
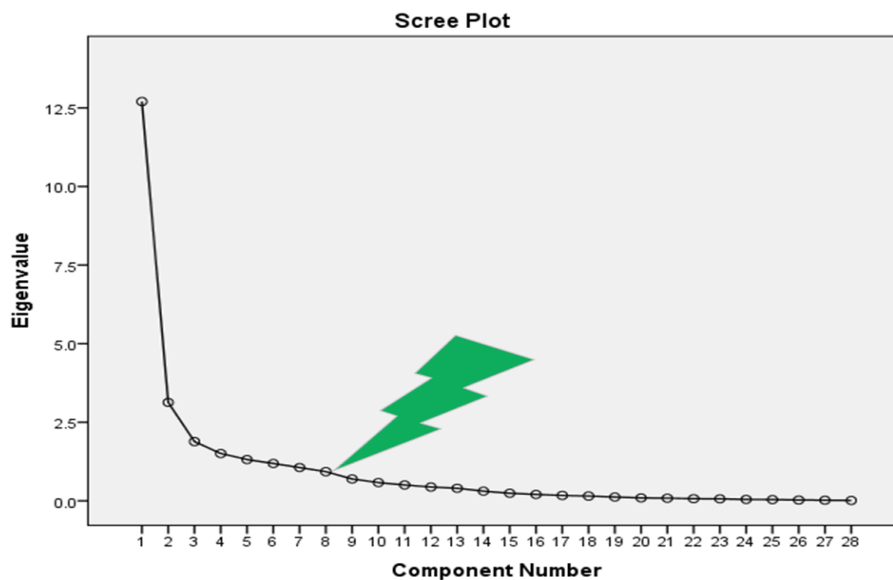

Figure 2 Screen Plot of Principal Factors

4.5　　Principal Factor Analysis

Factor rotation was further conducted to suppress loading less than 0.40 to make interpretation easier. Using oblique rotation, seven factors are therefore loaded unto component matrix, and a scan through the various factors loading indicates the most significant loading in factor one has the score 0.804, this component relates to lack of agencies to promote sustainability (Table 4). The study, therefore, selected the framing 'lack of green building council' for this factor. Under the second factor, the most significant loading has the value 0.815, this component relates to a low level of awareness, the frame 'lack of awareness' is selected for factor 2. The most critical issue under the third factor relates to lack of empowerment (0.883), the framing

'lack of empowerment to effect change' is adopted. The fourth factor relates to the 'non-prioritisation of sustainability by accreditation bodies (0.730). The frame non-prioritisation by accreditation bodies' is retained for the fourth component. Under the fifth component, lack of case studies and exemplar project is most significant (0.856), the frame 'lack of real-life sustainable projects' is adequate. The sixth factor relates to the lack of research and professional network (0.723), the frame for this component is 'lack of research and industry collaboration'. The most significant challenge under the seventh factor relates to skills and knowledge dearth problem (0.938). The seventh issue is, however, the most critical, and the frame 'skills and knowledge dearth' is appropriate.

Table 4 Rotated Principal Component Matrix

	Component						
Challenges	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Skills and knowledge dearth							0.938
Low level of awareness		0.815					
Lack of green building council	0.804						
Lack of empowerment to effect change			0.883				
Lack of real-life sustainable projects					0.777		
Non-prioritization by accreditation bodies				0.730			
Lack of research and industry collaboration						0.723	

5.　　Discussion Of Findings

The findings are discussed in the context of policy issues, academic institution's neglect, and industry's inactions. However, issues related to collaboration and lack of regulatory agencies which is central to the overall groupings are discussed separately. The contexts which the findings are discussed are fitted with the result in Table 4 to obtain the representation of the findings which is depicted in Figure 3. The figure shows that each sector's actions and inactions collectively contribute to the interface problems inherently responsible for foot-dragging in integrating sustainability in the built environment curricula. The critical issues in the general domain, therefore, affect all spheres of the industry, academia and regulatory bodies and will be discussed in the following sections.
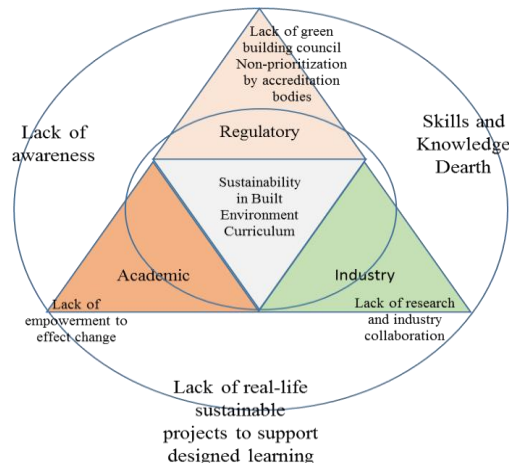

Figure 3 Principal Constraints Influencing Sustainability Integration in Curricula

5.1   Lack   of   Collaboration   among Stakeholders

The results of the study reinforce the role of critical stakeholders' involvement/collaboration to effect curriculum change to benefit sustainability. Moreover, a greater proportion of validated factors in Figure 1 could be resolved through stakeholders' collaboration. Therefore, critical issues to sustainability integration are seen as the failure of relevant stakeholders' to take appropriate actions toward addressing extant gaps. This means that factors responsible for the current state of affairs are mirrored to relevant stakeholders' institutional roles and responsibilities. Three factors are directly linked with this collaborative actions namely: isolated training among disciplines, lack of research and professional network, and poor dialogue and coordination.

The importance of collaboration in curriculum change to benefit sustainability elements is not however new. A study by Tramontin and Trois (2016) showed that sustainability issues have multiple linkages. The result also conforms to the findings of De Coninck (2008) which indicated that effective curriculum development is a duty of the entire society. Moreover, the nexus between human, society and sustainability discourse is not also in doubt, hence respondents' view about the interrelatedness of stakeholder's collaboration for effective curriculum change towards sustainability is consistent with the literature (Barr and Tagg, 1995; Tramontin and Trois, 2016; and El-Feki and Kenawy, 2018). Tramontin and Trois (2016) obtained that blended interdisciplinary competencies are required to implement sustainable construction strategies in project delivery. Also, El-Feki and Kenawy (2018) found that multi-sectorial nesting of sustainability issues will enhance international experience sharing between industry and academia. Similarly, Barr and Tagg (1995) also found that sustainability integration requires an integrative framework and not isolated 'nesting' as currently obtained in the built environment curricula. Lack of stakeholders' collaboration is therefore imperative issues critical to the integration of sustainability in schools' curriculum in the built environment.

5.2   General Factors

Thirty-eight (38) percent of the principal issues in the integration of sustainability in academic curricula are generic to all sectors. Factors in this category include lack of awareness; skills and knowledge dearth, and lack of real-life exemplar projects to support designed learning. The term designed learning was earlier defined to mean curriculum-based teaching. Two of these factors (skills and knowledge dearth and low awareness) are first and second most critical issue in sustainability integration, while the third-factor lack of real-life (exemplar) sustainable project

is the fourth most critical issue in sustainability integration. These set of factors form the base of the sustainability integration interface (Figure 3). Sustainability skills and knowledge dearth in the construction industry is seminal in the local and global perspectives (UKCES, 2013; Nduka and Ogunsami, 2015). Therefore, factors relating knowledge gap and lack of awareness are also imperative issues critical to the integration of sustainability in schools' curriculum in the built environment

5.3   Regulatory/Governmental Factors

At the top of the integration, interface is factors associated with actions and inactions of regulatory/government bodies. Twenty-five percent of the principal components validated in Table 4 are in this domain. Factors in this category include lack of established green building council and non-prioritisation of sustainability by accreditation bodies. Lack of green building council was rated the third most significant constraint, while non-prioritisation of sustainability by accreditation bodies was rated sixth. The Green Building Council is responsible for setting a framework for sustainable construction practices learning across sectors. This result differs from the finding in the Egyptian survey undertaken by El-Feki and Kenawy (2018), which study showed that discharge of the isolated roles of Green Building Council, was not enough to address the dearth of sustainability integration in architecture's curriculum. This paper attributes the deviant view to the lack of an established Green Building Council in Nigeria, a position which also influences stakeholders' conception of their roles in sustainability curriculum development.

On the other hand, although, sustainability issues are not limited to the building sector, the role of Green Building Council is central to achieving sustainable construction in the built environment sector. The impact of Green Building Councils in countries where they are established is undisputable. This result is consistent with the findings of Shari and Jaafar (n.d) which study also found this factor critical to sustainability integration.

Accreditation bodies are agencies of government saddled with the responsibility of maintaining standards of academic programmes in higher institutions. The criticality of the issue related to non-prioritisation of sustainability by accreditation bodies shows that the government retains the most important role in integrating sustainability in academic curricula. This viewpoint is consistent with the position reported in El-Feki and Kenawy (2018). El-Feki and Kenawy (2018) recommended that when the government mandates sustainability integration through enabling legislation, and the provision of requisite resources, uptake will flourish. The position of the government and its regulatory bodies to the overall integration of sustainability is significant not just in the built environment but also in other fields. These bodies are

largely responsible for the review of the curriculum, and schools are sometimes restricted to remove from the basic requirements of each regulatory body. Based on this reason, schools' curriculum is therefore christened rigid. Altomonte et al. (2014) in the study of sustainability integration in European countries universities obtained that sustainability is fused between legislative issues, professional regulatory criteria and accreditation structures. The role of coordination bodies, exemplary projects and access to funding are therefore significant to achieving progress in integration (Ferrer-Balas, 2008).

5.4   *Academic Factor*

The left side of the sustainability integration interface has academic related factors. The principal component underlying this frame from Table 4 is lack of empowerment to effect curriculum change. Lozano (2006) linked empowerment to effect curriculum change to self-actualisation needs. According to Lozano (2006), empowerment at this level refers to motivation to transform accumulated self and system's beneficial actions into reality. The built environment system is stiffened by the curriculum, research, campus operations, community outreach, and assessment and reporting (Cortese, 2003). The curriculum is also fixed and rigid, inclined to research than teaching, and campus teaching methods are regulated. There is limited empowerment for the individual professional staff to influence and add or modify existing modules. The case for overcrowded modules is seminal in the relevant literature (Arsat et al., 2011).

5.5   *Industry Factor*

The right side of the sustainability integration interface has academic related factors. The principal component underlying this frame from Table 4 is lack of research and industry collaboration. The role of industry/academia collaboration is critical to the integration of sustainability in structured learning, the principal framing relating to industry factor is therefore consistent with extant literature. Du Plessis (2007) found that dearth of research collaborations between industry and academic in the African context stiffens progress toward diffused learning of sustainable construction. Lack of research collaboration inhibits transformative action and experiential learning needed to adapt sustainability skills and learning. Characteristically, sustainability learning requires interdisciplinary and trans-disciplinary learning approach, (Ekung and Odesola, 2017). This view agrees to the integrated project delivery practised as a life-long learning mechanism in developed countries.

It is important for stakeholders to moderate the respective sectorial problems towards effective sustainability integration in the curriculum. RICS (2007) responded to this problem and advanced the responsibility of its related professions in the sustainability agenda. But current and on-going efforts seem to generate additional challenges. For instance, insistent on integrated project practice seeks to compel respective professions to learn generic skills external to individual discipline knowledge and skill areas. There is also limited content for sustainable thinking, and the problem of where to fit the sustainability modules in an already crowded curriculum is yet unresolved. Effective curriculum design must be positioned to address these emerging concerns to benefit the graduate professionals, since learning at the industry level is itself bedevilled with challenges.

6.   Conclusion

Years after the 'Decade for Sustainability Education', low awareness, low skills and knowledge gap in requisite sustainability issues applied to construction poses critical problems to the industry. The developed countries may have achieved significant progress with sustainability integration, as many degree and post-graduate programmes are now available with designed modules for sustainable construction. Developing countries are however, laggard in their response including Nigeria. This study explored issues critical to the integration of sustainability element in built environment curricula using data reduction tool (Factor Analysis).

The study showed that seven principal factors categorised into five groups namely: collaborative issues, general factors, academic, regulatory, and industry factors inhibits the integration of sustainability element in academic curricula in Nigeria. The distribution of these factors shows that effective curriculum design for sustainability requires relevant stakeholders' collaboration at various levels. This includes prescription of appropriate modules and pedagogies and facilitation of implementation. Therefore, knowledge dearth, low awareness, lack of green building council, lack of empowerment to effect change, and lack of real-life sustainable projects are issues critical to the integration of sustainability element into built environment curriculum. Sustainability integration could be facilitated by directing inferred stakeholders' actions towards moderating the effects of the principal factors headlined in this paper. These results portray vast benefits to sustainable built environment curricula development in Nigeria in verifying that the bane of curriculum change to suit sustainability elements lies with Government (accreditation/regulatory) bodies. This means that upscaling sustainability integration in academic curriculum could be best achieved through the effects of regulatory

arms such as accreditation bodies; and sustainability promoting council such as the Green Building Council.

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