THEORETICAL FRAMEWORK FOR SUSTAINABLE INTEGRATION IN BUILT ENVIRONMENT CURRICULA IN NIGERIA

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ABSTRACT

The built environment in Nigeria is laggard in its response to incorporating sustainable development ethos in higher education curricula. Though interest in the built environment sector has now expanded, the overall response is largely unstructured thereby making a structured framework imperative. This study determined the theoretical framework for effective integration of sustainable construction modules in built environment curricula. The objective was to investigate the structure and approaches that would adequately embed sustainability learning in the construction industry. The study employed literature synthesis to advance a conceptual theoretical model for sustainability integration. The study revealed that a number of frameworks were available but had not been adopted in the development of built environment curricula. The dominant approach is either disciplinary or multidisciplinary frameworks. The multidisciplinary approach however tends to support sustainability objectives; but lacks adaptation towards experiential learning and the modality for incorporating the segregated theoretic of each discipline is not clear. A re-engineered hybrid trans-disciplinary approach generated using the peculiar challenges inhibiting sustainability learning and integration in Nigeria is presented. The developed model embeds an experiential learning ethos, enables industry stakeholders' participation, and outlines pedagogical methods including modes of delivery and resources.

Keywords: built environment, curriculum, education, sustainable development, and sustainability integration.

Introduction

The drive to improve awareness about sustainable development within academic programmes has grown in recent times (Abdul-Wahab, Abdulraheem & Hutchinson, 2003). Cruz, Macfarlane, Xu, Rodgers and Guensler (2015) emphasize that calls for sustainable development education which started in the last decade have continued to grow. Academic programmes and curricula are now being evaluated for sustainability using developed evaluation matrix (Watson 2013). Jowitt (2004) acknowledged the sustainability paradigm is exerting pressure on existing academic curricula. Numerous studies have also recognized the need for curriculum transformation in schools of built environment (Gelengis & Harris, 2014; Oliveira & O'Flynn, 2015). The need to educate built environment graduates about sustainable construction is well documented. This is because till date, stakeholders' level of knowledge and awareness about sustainability in construction in the built environment is low (Ewuga & Molwus, 2015; Nduka & Ogunsanmi, 2015). Eisenberg & Persram (2009) clearly states that only a few challenges are more difficult to overcome than knowledge barriers in sustainability ethos embedding. In spite of the low awareness, sustainability

learning in the built environment education is less than a sketchpad (Ameh Dania, Zubairu, & Bustani 2010). As a result, promoting and translating sustainability learning to implementation in the industry is difficult.

Consequently, academic communities with support from professional and accreditation bodies have responded significantly to enforce compliance. Tremendous progress towards introducing sustainability is being made (Varga & Lean, 2015). However, the drive tends to be more aggressive in engineering disciplines (Fenner, 2013). Efforts at reforming curricula in the built environment has so far beenless successful (Byrne, Desha, Fitzpatrick, & Hargroves, 2013) for, as Arain (2014) observes, input from the built environment field has not been taken into account. This is alarming, granted that academic institutions are expected to leverage sustainability training in support of the construction industry. Academic institutions across the globe with impetus from their professional bodies have also recognised their focal position in this regard and strategies are being advanced to integrate sustainable development goals in curriculum (Sharma, Steward, Ong & Miguez, 2014).

The situation in Nigeria deserves further investigation to understand ongoing efforts. Ameh, Dania, Zubairu & Bustani (2010) have identified wide gaps in the built environment curriculum of Nigerian institutions. The level of misunderstanding of the basic concepts of sustainability among the academia and young graduates is very low (Ameh, Dania, Zubairu & Bustani, 2010; Allu, 2016). A survey by Saliu & Achimugu (2016) revealed Nigerian design professionals are less involved in climate change preventive practices due to insufficient knowledge.

The increasing inclusion of sustainability within built environment programmes at various levels is recognized (Gelengis & Harris, 2014). However, there is little emphasis on pedagogical practice, and mode of learning on sustainability (Oliveira & O'Flynn, 2015). Scholarly works on sustainability in construction tends to focus more on technologies and management issues; and less on education processes and methods (Oliveira & Flynn, 2015). Adopted integration approaches also tend to conflict; but significant opportunities exist to develop and connect academic programmes to sustainability in construction (Oliveira & O'Flynn, 2015). The research question addressed in this study seeks to scaffold theoretical framework for sustainability integration in Nigeria's built environment curricula.

Sustainability in the Nigerian Built Environment Curriculum

The built environment professionals are generally responsible for the creation of housing and other infrastructures needed to support life-long habitation. However, the activities of the construction sector are significant contributors to the overall environmental degradation. The sector is also associated with inappropriate development practices that create wastes, pollution, green-house gas emissions and the like. The built environment consists of a broad range of professionals supporting these requisite infrastructures including architects, building experts, surveyors, planners, quantity surveyors and engineering experts. Requisite conventions and practices at various levels are on-going both locally and internationally to ensure that sustainable development ethos is embedded in academic curricula that produce the respective professionals in each field. It is therefore often debated that, issues of sustainability are not new but the concern is knowledge and skills dearth. The focus on

academic programmes recognized the curriculum as organized activities directed at giving learning experience to learners under the guide of a school system (Ogunrayewa, Morakinyo, & Adenubi, 2012).

In the research space, there are few studies with interests in establishing the level of sustainability embedding in Nigerian built environment curricula including Oluwatayo, Aderonmu & Ezema (2014) and Ameh, Dania, Zubairu & Bustani (2010). Ameh, Dania, Zubairu & Bustani (2010) evaluated the holistic contents of built environment curricula while Oluwatayo, Aderonmu & Ezema (2014) appraised sustainability in architectural institutions in Nigeria. Both studies concluded that there was a lag in sustainability contents in the Nigerian built environment academic programmes. The overriding conclusion in both studies is the call for the review of the existing curricula. This study is therefore predicated on the established gap in academic curriculum. While awaiting the much campaigned review, this study advances structured framework in developing effective sustainability curriculum. It also provides a leap of response on prior learning activities that can be carried into the preparation for comprehensive sustainability integration.

Sustainability Integration Approaches

Several approaches have seen increased adoption in embedding sustainability education in construction curriculum. A number of these approaches are used across all sectors including engineering disciplines. Vanasupa & Splitt (nd) observed that stakeholders are unable to reach consensus on the dominant approach to be adopted.

a. Build-on or Built-in

One of the most popular integration models is to introduce a new course as an add-on to existing content either as an elective or mandatory course (Arsat, Holgaard & Graaf, 2011; Vargas & Lean, 2015). Another approach involves student incorporating professional specialization in any of the related courses in energy, sustainability and environment. These approaches are referred to as 'build-on' and built-in approaches (Wals, 2013). Built-on approaches involve adding new courses and modules with elements of sustainable construction; whilst built-in approaches involve simply integrating sustainability to existing studies, programmes and researches. Vargas & Lean (2015) explain that the built-on approach is becoming unpopular. However, whether built-in or build-on, the basic principle is that, sustainability must be integrated as part of coursework, service learning, adapting real world problem solving, linking students with future employers and learning from what others are doing. Other methods include creating new courses taught across disciplines; collaborating between institutions and industry experts; and distance learning courses. Service learning requirements involve real-life project initiation which does not only impact on the learners but also the recipient of the benefit. In the next strategy, graduates are connected with employers desiring expertise in sustainability. Learning from best-in-class experience could leverage a hallmark learning pedagogy in Centres for Sustainable Building Design in UK (Kingston, Herriot Watt, Sheffield Hallam and University College, London) (Hayles & de la Harpe, 2010).

b. Vertical or Horizontal Integration

Barrella & Watson (2015) discussed the built-in and add-on approaches using the terms "vertical and horizontal integration". Vertical integration explains the stand-alone model where a specific sustainability course is identified and administered (Ceulemans & De Prins, 2010). Horizontal integration consists of a broad range of sustainable issues identified and introduced into numerous courses (built-in course) (Ceulemans & De Prins, 2010). Barrella & Watson (2015) found that horizontal integration offers wider and deeper understanding of sustainability issues than the vertical (stand-alone) model.

c. Stand-alone or Embedded Approach

Salih (2006) used a different but related nomenclature to advance two models which lean towards the built-in and built-on philosophies: stand-alone; and embedded model. The stand-alone model enables learners (students) to cultivate sustainability skills through identified courses that are designed for this purpose. Quist, Rammelt, Overschie, & Werk (2006) assert the model does not influence other modules in the programme and institutions. Erdrogan & Tuncer (2009) highlight their advantages to include enhancing the understanding of sustainability in daily life and work; cognizance of environmental concerns and attainment of social values (Russell, Legge & Petrolito, 2009; Gardiner & Keith, 2010). Hayle & de la Harpe (2010) argue the stand-alone courses cannot support students' awareness of sustainability issues. In contrast, the embedded model aggregates sustainability concerns in the teaching and learning activities across the curriculum. The model does not specify a course for students to take. Rather, the model advocates relating traditional learning in a discipline to sustainability concerns. In this way, the learning outputs are integrated as part of the learning performance in the respective courses (Boks & Diehl, 2006).

d. Disciplinary or Interdisciplinary Approach

Iyer-Raniga & Andamon (2013) reviewed the interdisciplinary and discipline-based approaches for Asian-Pacific countries. Their review first recognized the inability to squeeze sustainability into disciplinary 'silos' (Selby, 2006). The interdisciplinary approach is anchored on the fundamental understanding that sustainability issues cannot be understood in seclusion (Parker, 2010). The approach therefore stipulates curriculum across disciplines in the built environment. Jones, Selby & Sterling (2010) defined 'interdisciplinarity as disciplines working collaboratively, sharing their insights and methods in an attempt to go beyond their own boundaries to address issues or questions'. Lozano (2006) insists interdisciplinary education is not concerned with co-operation across discipline only but also aggregate the theoretical fundamentals of participating disciplines using 'common methods. Interdisciplinary oriented curriculum however consciously aggregates the holistic range of disciplines (Arsat, Holgaard & Graaf, 2011). Interdisciplinary-oriented curriculum demands a cross-discipline application without necessarily altering the curriculum to a particular discipline. In other words, the model depicts compatibility with a broad range of disciplines. This model has seen increasing adoption (Heeney & Foster, 2010). Iyer-Raniga & Andamon (2013) expressed concern about the least adoption of interdisciplinary approach in the literature. The underlying demerits is that the approach can promote cooperative working but without sharing ideas, assumptions and methods (Jones, Selby and Sterling, 2010). It is

also subject to influences by others. However, interdisciplinary education approach aligns more the relevant thinking with the sustainability discourse.

Multidisciplinary education is advocated by Lozano (2006). The approach seeks co-operation across discipline but the theoretical underpinnings of each discipline is kept separate. Thinking in support of interdisciplinary learning is now emerging. MacDonald (2013) contends that collaborative learning is not reflected in current construction education. Individual discipline trains in isolation but are expected to work as integrated team in the field. As a result, there is low level of trust and poor information sharing in the construction industry (MacDonald, 2013).

Disciplinary or discipline-based approaches focus on individual discipline embedding. Jones, Selby & Sterling (2010) acknowledged this approach suits current 'disciplinary compartmentalization' of the built environment curriculum. According to Arsat, Holgaard & Graaf (2011), the disciplinary-oriented design is supplementary to a specific profession with focus only on that discipline. The choice of the sustainability content is decided by the relevant built environment profession. Disciplinary-oriented curriculum emphasizes strict analysis of a discipline with distinct themes with no attempt to integrate them. Arsat, Holgaard & Graaf (2011) delimits the scope of this approach into singular approach (pure economic, social or environmental); and then, the holistic approach. The holistic approach combines social, environmental and economic sustainability education. The economic, social and environmental approach combines each of these objectives with another and is termed singular, dialectic or consensual approach (Arsat, Holgaard & Graaf, 2011). The three approaches offer different levels of inclusiveness in the analysis of sustainability concern.

e. Trans-Disciplinary Approach

Trans-disciplinary education derives its merits from the increasing recommendation from academia and industry participants to provide interlinked learning. In the trans-disciplinary approach, there is an extended co-operation across academia and industry (Lozano, 2006). The industry dimension includes but is not limited to internal and external stakeholders.

f. Others

Rusinko (2010) extended the theoretical framework of Sterling (2004) and developed a 'generic matrix of options' for integrating sustainability in higher education (SHE). Rusinko's matrix presents multiple options in which stakeholders can adapt including integration into existing courses (minor, major and/or programs). Others are creating new stand-alone sustainability course(s); integration into common core requirements; and creating new cross disciplinary sustainability course(s). Rusinko's models are either built-on or built-in as earlier expatiated and disciplinary and interdisciplinary.

The modular approach (Table 1) involves any of the narrated approaches (a-e). Intra-disciplinary framework involves project work across disciplines. In inter-disciplinary framework, common subjects are shared across disciplines including integrated project teams. Exploring course culture advocates orientation activities, handbooks, student

associations, professional codes etc. Professional practice establishes links with appropriate professional associations in developing and integrating fresh graduate characteristics. Experiential learning includes site visits and field trips, and developing project topics in sustainability materials. Flexible resources are used by lecturers integrating varying entry points as they deem fit. Thomas & Nacita's (2002) addition, incorporation and engagement model is similar to the built-on and built-in approaches. Altomonte (2012) further identified five models of programme structures based on higher academic curricula review for incorporating sustainability in architecture education. These include linear/parallel, partially integrated, fully integrated, iterative and elective/minor. In the linear/parallel model, courses in individual disciplines are delivered in parallel independently with 'ex-cathedra lectures'. Partially integrated models co-opt environmentally sensitive modules with other subjects; but can however, be delivered as a stand-alone module. Fully integrated courses conceive project work as 'working spaces' where context of varying areas converge. Elective/minor is defined by series of electives from different discipline and programmes for the students include in their programmes.

Table 1: Summary of Other Sustainability Integrating Approaches

Authors	**Sustainability Integrating Approaches**
Thomas, Kyle & Alvarez (1999)	Modular approach; Intra-disciplinary framework; Inter-disciplinary framework, Exploring course culture, professional practice, Experiential learning, and Flexible learning resource
Thomas & Nacita (2002)	Addition, incorporation and engagement
Altomonte (2012)	linear/parallel, partially integrated, fully integrated, iterative and elective/minor
MacDonald (2012)	IMAC framework
Rusinko (2010)	Integration into existing courses (minor, major and or programs; creating new stand-alone sustainability course(s); integration into common core requirements; and create new cross disciplinary sustainability course(s).

MacDonald (2012) developed IMAC (illustration, manipulation, application and collaboration) Framework to integrate collaborative design to academic curricula. The Framework consists of two key processes namely benchmarking and a separate guide to implementation (MacDonald, 2013). The IMAC Framework characteristically does not stipulate which level of education to introduce new modules but can be adapted to suit individual learning protocols. The attributes of these models are synthesized to generate the trans-disciplinary integration approach.

Research Methodology

The study adopted literature synthesis to advance a conceptual theoretical framework for sustainability integration in the academic curricula of built environment programmes in Nigeria. Forty seven (47) published texts, comprising journal articles, conference papers, textbooks and institutional reports were synthesized to model a conceptual theoretical sustainability integration framework based on the peculiarity of the Nigerian system. Systemic challenges are however excluded in the literature presented in this study, but resultant challenges domains were relevant to contextualizing the developed framework. Out of the 47 texts, 95% evaluated research interests in sustainability integration in the global

perspective including Europe, UK and America. The preliminary findings of the on-going literature review are presented in this paper.

The Framework

It seems that disciplinary and interdisciplinary approaches cannot work in exclusion. Both are needed to align the "theoretic' of individual disciplines and to foster collaboration and integrated practice across domains. Built-on, built-in, stand-alone and embedded approaches can be used at disciplinary and interdisciplinary levels. Separate courses can be created or embedded within existing disciplinary modules. They can also be used across interdisciplinary levels either as separated or embedded. There is a need to seek a hybrid approach intertwining disciplinary and interdisciplinary models. This is needed to strengthen individual professional alignment and contribution to sustainable development objectives. The role of a professional is characteristically distinct from the role of another in the project interface. Such hybridization must therefore allow for full development of the respective disciplines so that the specific skills and knowledge needed to fulfill professional duties can be buttressed.

Three distinct layers are identified in Figure 1. The upper section depicts the fusion of inherent integration approach to form the trans-disciplinary approach. At the domain of the new integration approach, certain activities are needed to ensure smooth transition and embedding. The set of activities required may include existing curriculum review, public support and awareness among others. The second domain is actors' domain and the resources and delivery mechanisms required to implement. Trans-disciplinary approach canvasses industry-academia collaboration and each actor's specific responsibilities and the overall methods and resources deployable is seen in the last section. Industry-academia collaboration is could kick-start with research collaboration with possible industry work experience.

In fulfilling the research goal, the developed framework for embedding the development of trans-disciplinary sustainability competence, a systematic model is envisioned. The projected approach is strictly dissociated from stand-alone and integrative approaches to developing trans-disciplinary affiliation. However, in advancing the developing approach, the integration process must be perceived from vibrant, developing and clarifying positions. Based on this understanding, a framework based on three generic and overlapping domains in higher education is presented (Figure 1).

These include first, communities of practice (industry); second, academic structured learning; and third, resources, tools and methods. Stakeholders in the third domain are situated to promote and embed experiential and action learning thereby bridging current gap between industry and the academia. The second domain advances the requisite sustainability learning needs and skills. The first scaffolds students' awareness, developing understanding and promoting disciplinary "theoretic" in the integrated project interface. Tripartite actions

are required at the first domain since there is significant practice experience and case studies to stimulate interests and benefits. For instance, the industry actors may be required to sponsor students and advance demonstration projects. The framework advocates strong academic and industry interfacing. Disciplinary and interdisciplinary hybrid approach can be adopted at the academic domain but strong industry practice experience is advantageous.

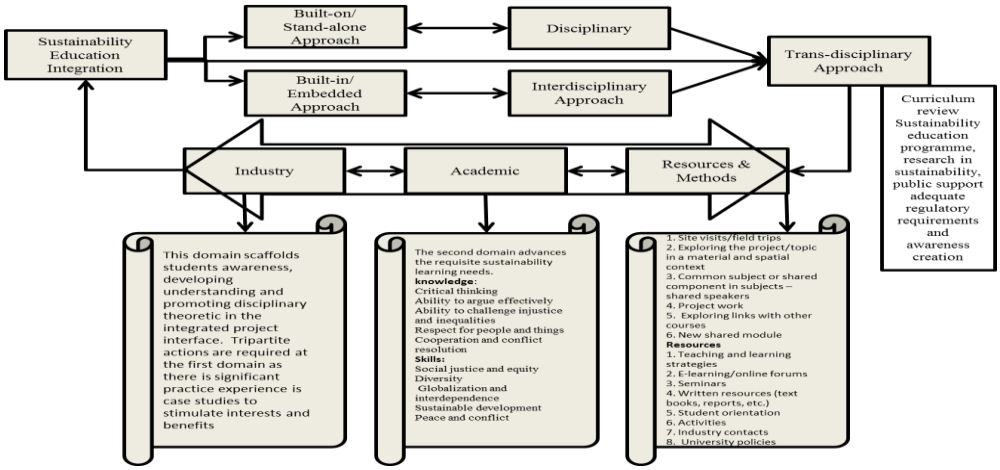


Figure 1: Conceptual Theoretical Sustainability Integration Framework for Built Environment Curricula in Nigeria

Discussions

The above mechanics supports Miller, Munoz-Erickson, & Redman (2011) transformative change adaptive cycle framework adopted in Iyer-Raniga & Andamon (2013). The framework seeks to drive the requisite change through two key players: educators and industry. The strategies for each stakeholder were forthwith identified (Iyer-Raniga & Andamon, 2013): thirteen change strategies for continuous professional education and nine for educators. The performance of actors' strategies must constantly be evaluated for compliance. In a build-up to universal sustainability integration model for Asian-Pacific countries, Iyer-Raniga & Andamon (2013) measured deliverables of each actor's performance at three levels using Thomas, Kyle & Alvarez's (1999) metrics. These include lower; transitional, and higher outcomes for students and professionals (see Figure 2). The learning outcome must attract certain responses attributed to the academics and the industry as indicated by the arrow head in Figure 2 (Iyer-Raniga & Andamon, 2013). The learning is based on the understanding that learning is procedural and adapting learning is similarly gradual. It is equally expected that performance outcomes will improve over time from lower expectations to transitional level expectations and higher outcomes respectively. Transition from lower level to other stages must also witness sophistication both in understanding and application of sustainability knowledge. The overall outcome is

measurable using indicators based on the sector the learner is situated (whether academic or industry).

The above learning performance requires certain dimensions of capability required to realize sustainability education. Iyer-Raniga & Andamon (2013) mapped three dimensions including knowledge and understanding, skills in and values and attitudes (Figure 3). Three critical attributes define whether inputs in the model are successful or a failure. Certain dimensions of knowledge and understanding must be inculcated prior to full integration. The dimensions of social justice, equity, diversity and interdependency of man, society and nature are seminal. Basic skills to advanced critical thinking, logical argument and above all cooperation and conflict resolution are similarly important. Values/ethos such as commitment to social justice, concern for environment and belief in societal ability to make a difference are also needed.

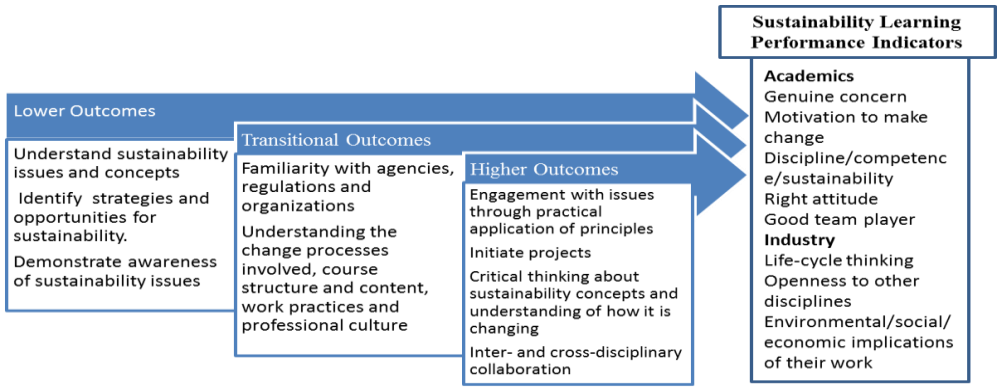
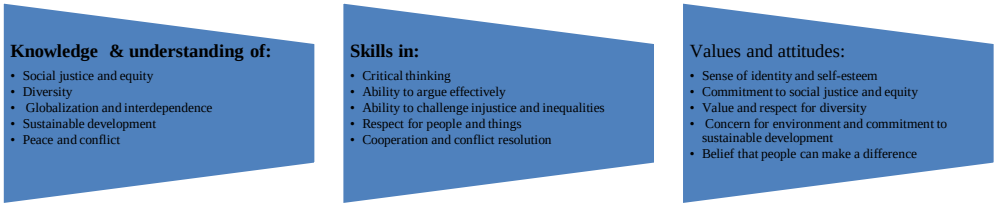


Figure 2: Expected Sustainability Learning Outcomes and Performance Indicators (Iyer-Raniga & Andamon, 2013).

The theoretical framework also creates the need for certain prior activities involving both the academic and industry actors before fully enforcing integration. These are events intended to create requisite awareness about the subject of sustainable development and sustainable construction practices. Vanasupa & Splitt (n. d.) advocates orientating students on social responsibility towards human welfare, the impact of construction on the ecosystem and integrated project development and the current political, economic, social, environmental, regulatory and other drivers of sustainability across all sectors. Social responsibility to human welfare can be inculcated using the respective profession Code of Ethics (Vanasupa & Splitt, n. d.). Students must be made to understand the competing merits of sustainable design solutions, materials and components. The knowledge context may require deep understanding of sustainability assessment tools, energy simulation and certification. Students need teachings on sustainable technologies and practices within the context of the Nigerian construction industry. UKCES (2013) emphasized training skill sets must embrace the general overview of the construction environment before tending towards specialization. This is needed to fast track transition without necessarily re-training.



Capability Requirements for Sustainability Education (Iyer-Raniga and Andamon, 2013)

Lozano (2006) proposed a step-by-step guide to innovation adoption ('sustainability') including awareness, interest, evaluation, trial and adoption. Lozano (2006) buttressed that individuals must first get exposed to the idea of innovation; stimulated towards the idea; be positioned to evaluate the idea; put to trials and consequently adopt the innovation. Luthans (2002) acknowledged that resistance to change may affect current objectives; and further proposed an approach to overcoming the resistance to adopt sustainability in built environment education. According to Luthans (2002), it is exigent to provide new information, use fear, resolve discrepancies, and optimize peer influence to curb resistance to change. All approaches present differing dimensions but collectively support influencing decision. Lozano (2006) therefore suggested a hybrid application of one or two methods for optimal results.

Quinn, Spreitzer & Brown (2000) discussed three additional strategies in the perspectives of 'empirical-rational (making logical arguments for change); power-coercive (using forms of leverage to force change); and normative-re-educative (using participation and pursuing win-win strategies (Lozano, 2006). The first strategy is based on people's perception being guided by reason to go with the trend. Lozano (2006) maintained the drivers are reinforced by anticipated self-gains. Resistance therefore emanates from ignorance and inability to demonstrate benefits. Empirical-rationality therefore believes awareness and education about potential benefits of actions could generate change to adoption. The power-coercive strategy implies that people must be forced to adopt certain innovative practices using political and economic powers. Lozano (2006) is of the opinion that the dimension of power-coercive thought is invaluable when people are not committed to adapt change. This is understood to the extent that strong political will or commitment to sustainable development goals is needed under this strategy.

The normative-re-educative strategy is persuasive and collaborative in nature. Normative theory canvasses understanding why certain things must be done. Although, rationality still play a critical role in this strategy, the boundary extends beyond just advancing reasons (self-interest) for action to include norms and the underlying policies. Quinn, Spreitzer & Brown (2000) recap the strategies with emphasis that merely providing information cannot generate change (empirical-rational). But seeking interpretation and stakeholders' value re-construction is more important. Respondents in Shari & Jaafar (n. d.) recommended six critical concerns that must be addressed in order for sustainability to be entrenched. There is need for curriculum review, sustainable development education programme, research in sustainability, public support, adequate regulatory requirements, and awareness creation.

Conclusion

The study presents a conceptual theoretical framework for sustainability integration within built environment curriculum. The framework is predicated on a trans-disciplinary approach. Both disciplinary and interdisciplinary inetgration models can be used in this domain. The model optimises industry and academic participation using appropriate resources and methods. To ensure effectiveness, the study recommends normative-re-educative strategy rather than rigid power-coercive approaches adopted by current political and professional interventions in implementing sustainable development objectives. This strategy is persuasive and collaborative, canvassing the need to understand why certain actions must be taken. Academic institutions should not be in haste to foster integration of sustainability into built environment curriculum; rather a number of prior activities must be rigorously pursued. This is to foster awareness, stimulate interest, and position students to evaluate outcome before integration. Related events are similarly highlighted including orientation on social responsibility issues and impact of construction on the environment. There is a need to understand appropriate development practices canvassed by sustainable development. The need to understand the current context of academic practice in the Nigerian built environment is important. Literature has already highlighted the gap in this area; it is therefore imperative to carry out curriculum review, conduct sustainability education review in programmes, pursue research in sustainability, galvanise public support and regulatory requirements framing and awareness creation. However, the established framework requires further emperical validation to understand the extent to which it can be implemented. Further work is therefore required to explicate this.

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