Sustainable Improvement Strategy for Existing Office Buildings in developing Nations
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Abstract
This paper reviewed literature on improvement strategy to develop an improvement strategy model to identify and eliminate perceived waste and inefficient facilities in existing office buildings for sustainability in developing countries. Emphasis is placed on the multi-stakeholder/interdisciplinary approach in which each professional in the built environment add discipline-specific data to a single shared model, and “bottom-up” improvement policy formulation and subsequent implementation approach, which would stem from occupants and property managers. Many writers have criticized the ignorance of end-user requirements during the construction briefing, highlighting the communications gap between the end-users, designers and owners.

Keywords: Sustainable development, waste, inefficient facilities, improvement, existing buildings, user’s requirement, property manager.

Preamble
A major reason why many developing nations did not meet the UN target for Sustainable Development (SD) is the neglect of existing old buildings, as Wood (2006) noted that, “sustainability cannot be achieved without addressing the existing building stock. Even if every new building was a ‘sustainable building’, their impact on sustainability as a whole will be minimal for some time.” Another reason is the prevalent “Top to bottom” approach for policy formulations and implementations in developing nations. Jiboye (2011) noted that, “… one peculiar feature of governance in Nigeria is the use of Top-down approach to policy formulation and implementation.” By this, adequate decentralization of control with delegation of power is ignored, thereby ensuring that the chief executive is overburdened with so much detail that he loses the sight of the main lines of policy. This paper seeks the opposite, whereby improvement policy formulation and subsequent implementation would stem from occupants and property managers.

Background
The retrogressive trend witnessed in FESTAC Town, Lagos Nigeria once dubbed ‘Little London’ when it was built 36 years ago because of its state-of-the-art infrastructure had since sent tongues wagging questioning whether infrastructural maintenance is alien to the people. Okojie (2013) wrote: “As a mark of the country’s penchant for lack of maintenance culture, the once beautiful town is now a shadow of itself, given the collapse of virtually all its infrastructure. Rather than finding lasting solution to the rapid decay of infrastructure in the estate, it has been accusations and counter accusations between the residents and management of the Federal Housing Authority (FHA). The Managing Director of FHA… blamed the deterioration of infrastructure in the estate on the residents who he accused of departing from the authorities original design and concept.” The comment of the MD of FHA is thought provoking and it ushered in a vital dimension of sustainability i.e. if occupants depart from original building design (or carried out alteration/modification works, as it would seem in this case), then the accommodation (i.e. spatial arrangement) or other facilities offered were not meeting their needs and must have had elements of waste and inefficiencies.

Waste and Inefficient Facilities
Waste is any material unused and rejected as worthless or unwanted or a trait of wasting resources, while inefficient means not producing desired results, or lacking ability to perform effectively (Advanced English Dictionary, 2013). Adopting this to built assets, ‘waste’ could be seen as those partitions within or without the building(s), which the occupants do not find useful, for example, multiple passageways in a building which could have been more useful to the occupants if converted to store(s). Bootle & Kalyan, (2002), claimed that UK businesses are throwing away £18 billion a year through the inefficient use of space. Bullen & Love (2011) referred to such as “inefficiencies in spatial layout”. Thus, the improvement of spatial quality can eliminate such waste.

‘Inefficiencies’ in built assets can also be seen as a building or its components not having the ability to function efficiently. An example is a building having two-ply sliding window in a humid and hot environment without provision for artificial ventilation; in such situation, the window can only provide a maximum 50% opening as compared to louvres that would provide up to 90% opening. Thus the former has more of aesthetic than functional value, which is the opposite for the latter. Therefore, the sliding window may be regarded as ‘inefficient’ because it does not have the ‘ability’ to provide enough ventilation in the environment without further provision for artificial ventilation, whereas it can be more efficient in temperate regions or in built assets with further provision for artificial ventilation such as air conditioners. This problem is more pronounced in many developing countries where electricity supply is erratic, thus provision of artificial ventilation alone would still not solve the problem of the ‘inefficient’ windows. Architects are often criticized for giving more preference to aesthetics rather than functional value.

There is no doubt that there are a number of other factors and barriers that affect our ability to make our existing building stock more sustainable, however, until we are also able to address these two major issues of ‘waste’, and ‘inefficient facilities’ from occupants’ and property managers’ viewpoints, the pace of SD in the developing nations will remain slow.

Why Improvement and not Maintenance?
This paper re-evaluated existing buildings and their role to sustainability through the improvement (as against maintenance) of their standards and it adopted the definition of ‘Maintenance’ as repair works carried out to restore a building to its original standard at construction, while ‘Improvement’ is any work carried out to upsurge...
the initial standard of the building. Thus, maintenance reinstates the original standard, while in improvement; it is upgraded (see Fig. 1 below).

Wood (2006) pointed out that, “A shortcoming of existing buildings is that they were constructed to the standards of the past, while standards, as measured by building regulations, have tended to increase over time in as far as they improve sustainability, both in quality and quantity. There is no requirement generally to bring existing buildings up to the standards applicable to new buildings; thus most existing buildings are some way below the standard of new buildings.” Bullen & Love (2011) stated that, “Improvements carried out during adaptive reuse were considered to provide the opportunity to link the performance of a building directly to the objectives of sustainability.”

Concept of Sustainable Development
The concept of SD came into general usage following publication of the 1987 report of the Brundland Commission - formally, World Commission on Environment and Development (WCED). It is this Commission that coined the most often-quoted definition of SD which is “development that meets the needs of the present generation without compromising future generations to meet their own needs” (WCED, 1987).

However, over 60 definitions of SD have emerged over the years (Pezzy, 1989; Hartshorn et al., 2005). While authors have not been able to agree on its precise meaning, they have agreed that although it is a universal problem, the same approach cannot be used universally but that practical responses should be defined nationally and locally (e.g. Rana, 2009; Strzelecka, 2008). This paper therefore suggests addressing the issue of SD from the perspective of occupants in public offices in the local context along the triple bottom line approach.

Literature Review on Improvement of Existing Buildings
Wood & Muncaster (2012) observed that, “The rate and scale of improvements needed to existing buildings to “save the planet” are immense and extensive programmes are seen as necessary... The “developed world” as a whole has huge numbers of buildings designed and constructed to standards that were barely adequate in their day and inadequate for today and tomorrow; and those in the developing world are even poorer.”

According to Wood (2006), “Sustainability cannot be achieved without addressing the existing building stock. Even if every new building was a “sustainable building”, their impact on sustainability as a whole will be minimal for some time.” Teo & Lin (2011) also wrote that “the level of adaptation a building shall receive always seems puzzling to property portfolio managers”, which this paper also addressed, mainly from occupants’ viewpoint.

A benefit of improvement as observed by many researchers is that it will appreciably lower maintenance cost (e.g. Kincaid, 2002; Suzuki, et al., 2010).

Again, improvement is seen as far cheaper than demolition and rebuilding (Shrestha al., 2012; Ma et al., 2012; Bullen, 2007; Shipley et al., 2006).

Improvement strategy is also perceived as environmental friendliness, it generates less waste, uses fewer materials and probably uses less energy than demolition and rebuilding (Iyard & Klunder; 2007, Power, 2008).

Notwithstanding the evidences clearly supporting improvement, the decision-making process associated with whether to improve or demolish assets can be exacerbated by an array of interacting variables that converge around financial issues (Gohardani & Bjork, 2012.).

Despite contribution to the existing body of knowledge, these writers (and studies alike) fail to provide property managers with an ideal approach that can determine the desired improvement strategy in existing buildings, especially in the developing world with particular reference to waste and inefficiencies. This paper therefore developed such a model. With this tool, property managers are able to resolve the puzzle of which level of improvement they shall consider for a specific building; as a result, they can achieve near-optimal allocation of limited resources spent on building improvement, rather than giving in to different pressures due to intra-organizational politics.

Elimination of Waste and Inefficient Facilities Models
Four models that deal mainly with the issues of elimination of waste were examined during the literature review and they include (1) Lean Thinking, (2) Green Building, (3) Zero Emission, and (4) Building Information Modeling (BIM). The Integrated Whole Building Design (IWBD) model was not considered, because it was designed for new builds, whereas this paper focuses on already existing buildings.

a. Concept of Lean Thinking
Lean thinking is an improvement model that emphasizes the identification and elimination of muda (Japanese word for waste) wherever it exists in a system, while value is defined by the customer (end-user). According to Nicholas & Soni (2006), the two overarching philosophy of Lean Principles for sustainability is “elimination of waste” and “continuous improvement” (or kaizen in
Japanese). Wang (2011) explained that Kaizen is a system of continuous improvement in quality, technology, and safety among other things. Ohno (1988) classified waste into seven types as shown in Table 1 (Nos. 1-7); however the eighth - “unused human talent” had been added (e.g. Womack & Jones, 1996).

**Table 1: Types of Waste (Source: Adeyemi, 2013)**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Type of Waste</th>
<th>Description as modified for this paper</th>
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<tbody>
<tr>
<td>1</td>
<td>Transportation</td>
<td>Distant location of complimentary offices causing unnecessary movements for users.</td>
</tr>
<tr>
<td>2</td>
<td>Inventory</td>
<td>Materials kept for maintenance that are not necessary or have short life spans e.g. cement.</td>
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<tr>
<td>3</td>
<td>Motion</td>
<td>Poor ergonomic design affecting productivity, quality &amp; safety e.g. walking, reaching, twisting.</td>
</tr>
<tr>
<td>4</td>
<td>Waiting</td>
<td>Delay, due to inadequate provisions for access to carry out maintenance activities, etc.</td>
</tr>
<tr>
<td>5</td>
<td>Over-processing</td>
<td>Adding design features not needed by users, e.g. bath tubs in general convenience; irregular office spaces thereby reducing functionality; etc.</td>
</tr>
<tr>
<td>6</td>
<td>Over-production</td>
<td>Large accommodation space, too many corridors, etc. not needed or appreciated by users.</td>
</tr>
<tr>
<td>7</td>
<td>Defects</td>
<td>Defect in design &amp; construction: including inflexibility; wrong specifications; inadequacies (e.g. conveniences, ventilation, lightening), etc.</td>
</tr>
<tr>
<td>8</td>
<td>Human talent</td>
<td>Non-inclusion of end-users’ inputs &amp; requirements in design, maintenance or improvement.</td>
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The concept of lean production had since been applied to a vast range of operations and processes in widely differing industries with tweaking of details, including the construction industry from where terms such as “lean construction” and “lean design” emerged. Lean design and construction are fashioned after Lean principles in production had since been modified for this context (e.g. Womack & Jones, 1996). The need for this model stemmed from the fact that much of what have been written about lean design is mainly for new build. According to Huthwaite (2007), the universal lean design equation is “How to create value and reduce waste”, he also mentioned that one of the five laws of lean design is “Law of waste prevention”; however they were applied to new builds only.

**Table 2: Motorola’s Quality Improvement Process “Six Steps to Six Sigma”**

<table>
<thead>
<tr>
<th>Steps</th>
<th>Motorola Lean Production Strategies</th>
<th>Proposed Lean Improvement Strategy</th>
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<tbody>
<tr>
<td>1</td>
<td>Identify the product you create or the service you provide to external or internal customers.</td>
<td>Recognize &amp; define your service: Sustainable building standard.</td>
</tr>
<tr>
<td>2</td>
<td>Identify the customer for your product or service, &amp; determine what he or she considers important.</td>
<td>Identify end-users’ requirements &amp; property manager’s observations thru POE.</td>
</tr>
<tr>
<td>3</td>
<td>Identify your needs to provide product or service so that it satisfies the customer.</td>
<td>Identify inherent waste &amp; inefficiencies (muda): Analysis of data from Step 2 above.</td>
</tr>
<tr>
<td>4</td>
<td>Define the process for doing the work.</td>
<td>Determine the improvement strategy.</td>
</tr>
<tr>
<td>5</td>
<td>Mistake-proof the process &amp; eliminate wasted effort &amp; delays.</td>
<td>Eliminate inherent waste and inefficiencies (muda) from the process.</td>
</tr>
<tr>
<td>6</td>
<td>Ensure continuous improvements by measuring, analyzing, &amp; controlling the improved process.</td>
<td>Measure your results for continuous improvement (kaizen): Feedback &amp; flexibility of improvement design.</td>
</tr>
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Source: Dahlgaard & Dahlgaard-Park, 2006 (modified)

b. Concept of Zero Emission and Existing Buildings

The Zero Emission concept postulated by Pauli Gunter in 1994 advocates for “complete elimination of waste” (Gunter, 1998). The three main objectives of zero emission could be summarized as: (a) No waste; (b) all inputs are used in production; and (c) when waste occurs, it is used to create value elsewhere (www.zeri.org, 2013). In essence, the concept is fashioned after nature in which nothing is wasted in the ecosystem, rather wastes are converted into other uses. It uses mainly the input-output and output-input tables respectively to achieve this. The principle behind input-output table (or model) is “doing more with less”, thus prior to searching for a use for waste materials, there is need to verify that the existing system cannot be improved. The output-input table
c. Concept of Green Building and Existing Buildings
According to Nwokoro & Onukwube (2011), SD gave rise to green buildings, because a primary goal of sustainability is to reduce humanity’s environmental or ecological footprint on the planet. The concept of green building is also an improvement strategy just like lean thinking: Averill (2011) observed that, “There is a natural connection and synergy between lean production and energy conservation programs: both disciplines are dedicated to limiting waste and increasing process efficiency.” Green Building mainly represents climate-friendly buildings that consume lower energy and with low CO₂ emission (Miller & Buys, 2008).

The Role of the Property Manager (PM) in SD
According to Johnson, Davis, & Shapiro (2005), immediately after the architect had produced his proposal, the in-house PM should normally be asked to comment and in doing so, he will first satisfy himself that the proposals contain no hidden danger: which include high windows openable by young children; wide stairwells with climbable balusters; blind corners on roads where children might play; and other menaces to safety. Secondly, he will look at the plans to ensure that they are not likely to give rise to expensive maintenance or difficulties in supervision and control. Thirdly, he will be conscious of cost and try to ensure that the building project will be suited for its intended use.

However, in Nigeria as in many other developing countries, the PM is usually excluded in the development process. However, this paper suggests that he can still find a role in SD; in the improvement of existing building stock.

Occupants’ Satisfaction
Kaya (2004) observed that many writers have criticized the ignorance of end-user requirements during the construction briefing, highlighting the communications gap between the end-users, designers and owners, and that little had since improved. This paper intends to bridge this communication gap by also highlighting the importance of interaction with end-users in order to identify their requirements in public offices. Black (2008) observed that world class companies have intense customer focus in which the customer is an indispensable part of the process. He gave the example of Boeing who involves customers’ views in its production process in what is termed “aggressive listening”. The construction industry should also focus on end-users satisfaction to create world class facilities. Shika et al. (2012) observed that “To achieve sustainability objectives in buildings, a coherent strategy and action plan is needed to address occupants’ expectations and needs in existing buildings.”

Post-Occupancy Evaluation (POE)
According to Shika et al. (2012), to achieve sustainability objectives in buildings, a coherent strategy and action plan is needed to address occupants’ expectations and needs in existing buildings, thus this paper suggests the use of POE. Watson (2003) defined POE as “a systematic evaluation of opinion about buildings in use, from the perspective of the people who use them.” It assesses how well buildings match users’ needs, and identifies ways to improve building design, performance and fitness for purpose. Once occupants’ satisfaction and expectancies are known and analyzed, areas to change and those to improve can be identified and subsequently resolved. The three phases in a typical POE include: Preparation; Interviews; and Analysis and Reporting.

Proposed Lean Improvement Strategy for Existing Office Buildings
The proposed model (Fig. 3 below) took in information from the varied literature review in the following steps:

Step 1: The problem as recognized is “Sustainability of Existing Office Buildings” with respect to users’ facility requirements in terms of a gap between what is and what should be.

Step 2: Determination of recognized users’ requirement, using POE tool. Users include employees, patrons and visitors alike. Major steps include identification and selection of participants for questionnaires and interviews, however, the estate surveyor add his observation to data collected. Design data collection instruments; collect the data and summarize what you have learned about the variable’s effects on the problem; determine what additional information would be helpful at this stage through observation by the property manager.

Step 3: The data collected in step 2 and the experience of the end-users is analyzed, documented, and used to identify perceived inherent waste and inefficiencies. Determine whether more data are needed: if so, repeat step 2. It would afterwards be fed into the
BIM and to other members of the design team to consider. The building team will equally incorporate the principles of SD, Green Building and Zero Emission into their designs which are also fed into the BIM.

Step 4: Through the BIM, an improvement strategy is produced that would be used to satisfy users’ requirements among other things. From a list of possible strategies, a decision will be taken on which solutions to use. Careful assessment of the feasibility of each strategy and potential adverse consequences will be considered also. Reason(s) should be advanced for choosing a particular strategy. Will there be a pilot project?

Step 5: The implementation of the preferred strategy through the activities of the construction team will eliminate perceived waste and inefficient facilities from the building structure for sustainability.

Step 6: Control, to ensure that goal is achieved and sustained (kaizen). The flexible improvement strategy would be used to accommodate feedback through regular POE in step 2.

It is necessary that the use is retained for this model to be valid. It was designed to highlight the roles of the end-users and the property managers in the sustainability of existing office buildings through improvement strategy; these two groups of stakeholders have been neglected in the quest for SD. It can be adopted for other types of property with little tweaking.

**Conclusion**

The views of end-users and property managers is emphasized to policy making and implementation for the sustainability of existing built assets as it promotes the “Bottom-up” policy formulation approach and the multi-stakeholder/interdisciplinary approach in which professionals add discipline-specific data as against far narrower definition of success by different individual participants. An improved office would have a major impact on productivity. The lean improvement strategy will be cheaper financial-wise than to demolish and rebuild; environmental friendly; and bring about an appreciably reduced maintenance cost. However, despite the exemplified disadvantages of building demolition, avoidance of demolition within the existing building stock is uniformly impractical in certain cases.

**References**