

Towards Achieving Sustainability in the Built Environment

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Abstract

With an increase in the global population, there is an increasing need for various types of infrastructure. Provision of the infrastructure is a challenge with the limited financial and natural resources. This is exacerbated by the need to provide sustainable infrastructure to ensure that the current resources are accessible to future generations. To add, inactivity of some stakeholders towards the sustainability agenda has contributed to non-sustainability of the built environment. Sustainability economically, environmentally and socially are the main goals. The literature suggests that measures can be taken to achieve viable, bearable and equitable solutions for the sustainability of the built environment. Through a review of the literature a framework for achieving sustainability in the built environment is presented. This is a contribution to knowledge as it serves as a guide of what should be focused on, by whom and on what activities as sustainability is aimed for in the built environment. This has been done through the identification of main players, focus areas and activities. The duty therefore remains with each stakeholder to play their role so that sustainability can be attained in the built environment.

Keywords: built environment, sustainability, processes, stakeholders, framework

INTRODUCTION

As of December 2017 the world population was estimated to have reached 7.6 Billion, a further increase of up to 11.8 Billion is expected by 2100 (Worldmeters, 2018). This increase puts pressure on the built environment to provide housing, health care, roads, energy, water and other types of infrastructure for the growing population. However, the construction is one of the major consumers of natural resources both in renewable and unrenowable form. The consumption of resources currently calls for sustainability if future generations are to benefit. Therefore, this raises the concern of how can the construction industry be sustainable.

DuBose et al (1997) defines, sustainability as a way which offers a way of interacting with our world which reconciles the ubiquitous human desire for a high quality of life with the realities of our global context. While Yilmaz and Bakis (2015) define sustainability as a means of using of natural resources in such an equilibrium condition that they do not reach decay, depletion and unrenowable point and handing them down to the next generations by developing them. Sustainability in the construction industry calls for application of sustainable construction. Sustainable construction refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. Kibert (2005) defines the goal of sustainable construction as one aimed at creating and operating a healthy built environment based on resource efficiency and ecological design

with emphasis on the core principles across the building's life cycle: reducing resource consumption, reusing resources, using recyclable resources, protecting nature, eliminating toxins, applying life cycle costing and focusing on quality. For the built environment to be sustainable, the following questions need to be answered:

- What are the areas of concern in the construction industry?
- Who should be involved in sustainability fight in the construction industry?
- What activities should be focussed on to promote sustainability?
- What mechanism can be formulated to promote sustainability in the built environment?

The answering of these questions provides a platform for building capacity for national sustainable development specifically in the built environment. The built environment is important as it drives many sectors of national development by providing infrastructure for day to day operations.

Dimensions of Sustainability

The dimensions of sustainability are social, economic and environment (UN, 2015; Whang and Kim, 2015) nevertheless, other researchers have more than three dimensions of sustainability as it is believed that the 3 are limited. The dimensions of place, permanence and persons are proposed which could necessitate the distinction of five dimensions with additions to the aforementioned being the human dimension and time

(Seghezze, 2009). The three widely accepted dimensions are shown in Figure 1.



Figure 1: Dimensions of sustainability

The three dimensions of sustainability from Figure 1 interact with each at varying expectations of social and environmental are expected to be bearable, environmental and economic are expected to be viable while economic and social are expected to be equitable for sustainability to be achieved. It has been argued that the construction industry is struggling to maintain a bearable outcome for social and the

environment due to its extensive use of natural resources (Aigbavboa, Ohiomaha, and Zwane 2017). It is unclear to what extent the built environment is viable in maintaining economic and environmental sustainability the same applies to how equitable the social and economic dimensions play out in the sustainability agenda. Nevertheless, effort have been made in deciphering how the construction industry can be more sustainable for instance.

Figure 2 outlines the progression and challenges of a sustainable construction concept in a universal context (Huovila and Koskela 1998). The progress highlights the basic alignments of the golden triangle (cost, time and quality) in the final analysis. The progression however does not highlight the actors needed to get there or the stages in the construction process where the processes shown in Figure 1 in the middle triangle could be achieved. Minimization of depletion of resources, conservation of natural areas and biodiversity and reduction of harmful emissions and maintenance of a healthy environment remain some of the challenges faced by the built environment as it meets the construction needs of today's population.

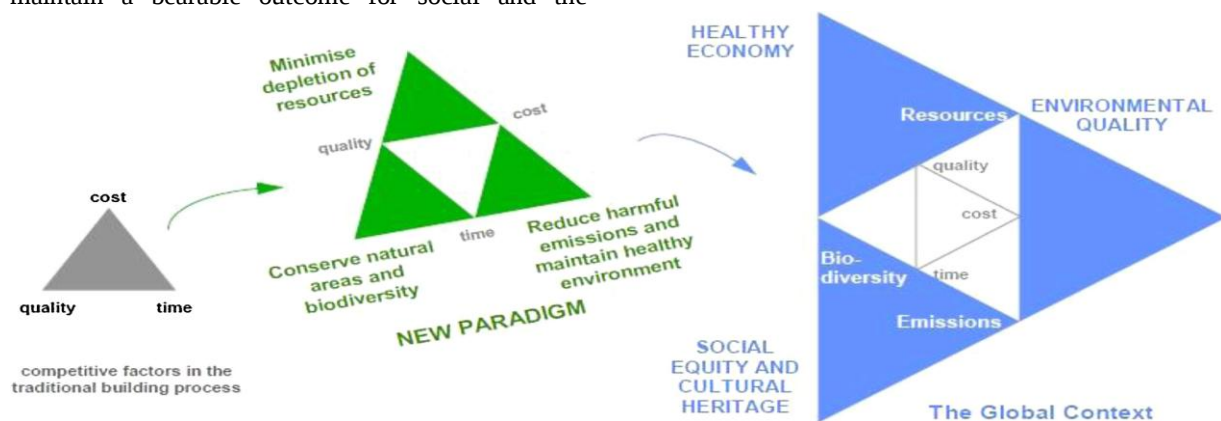


Figure 2: Challenges of sustainable construction in a global context (Huovila and Koskela 1998)

Yilmaz and Bakis (2015) outline the following requirements for attainment of social, environmental and economic sustainability.

Environmental sustainability requires being sensitive in the subjects of;

- Protection of aliveness and diversity on the earth,
- Conservation of life-supports systems,
- Sustainable usage of renewable resources,
- Being saving in using unrenueable resources,
- Minimizing harm to the environment and living things, and
- Protection of cultural and historical environments

A sustainable economic development requires;

- Creation new markets and merchandising opportunities,

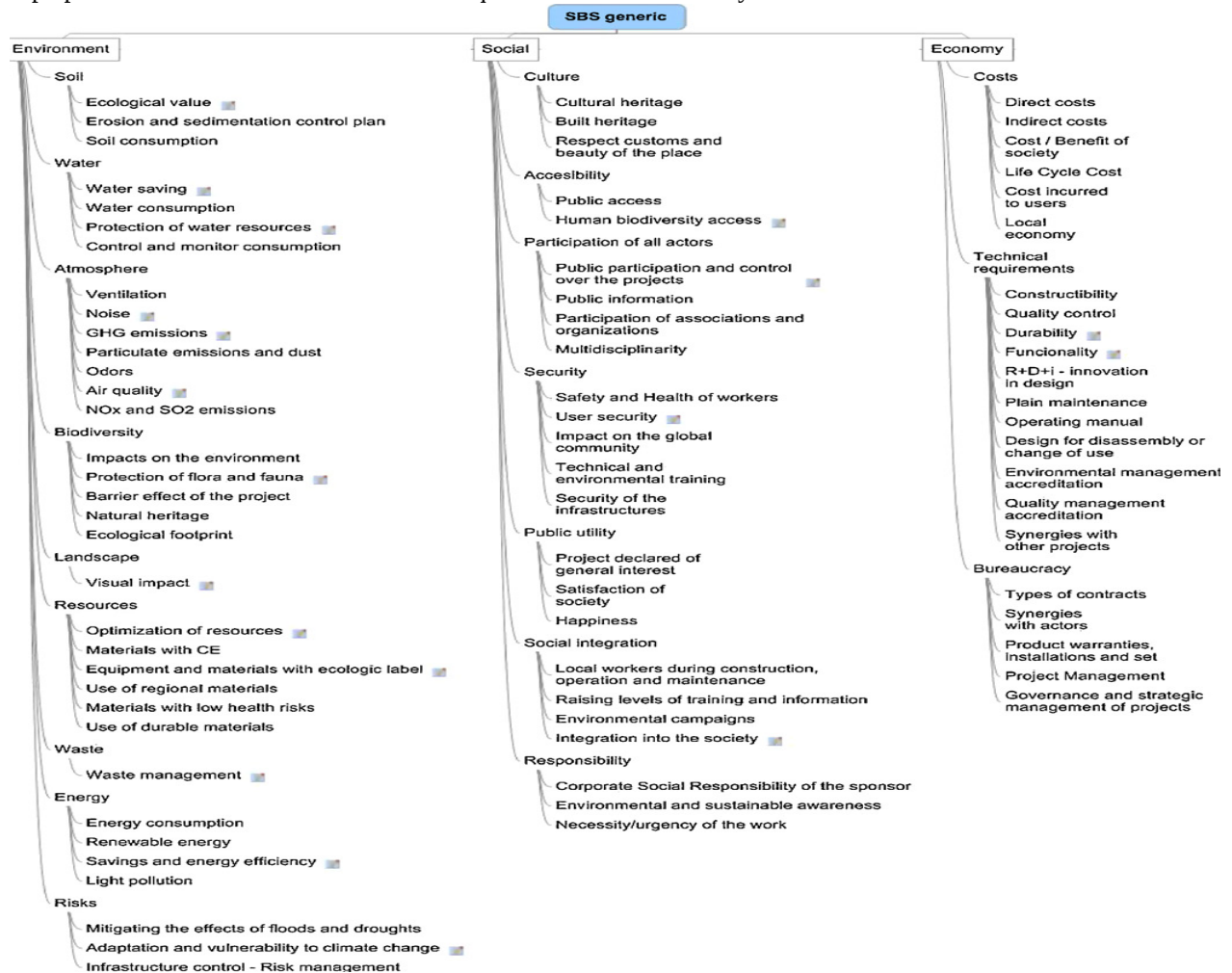
- Decrease in cost via providing efficiency by decreasing energy and resource input in production, and
- Provision added value

While for a sustainable social environment the following are needed

- Provided basic requirements such as work, house, health conditions, education and cultural activities for each individual as long-term (strategically),
- Increased life quality,
- Reintegrated disabled groups into society, and at the same time
- Protected right to life of future generation

Figure 3 gives a detailed classification of activities as developed by Fernández-Sánchez and Rodríguez-López, (2010). The breakdown structure is helpful as

it pinpoints the various areas of focus in the quest for sustainability.



Fernández-Sánchez and . Rodríguez-López (2010)

Stakeholders in the Fight for Sustainability

The built environment is a multifaceted industry in terms of interaction with other sectors of a nation. It is therefore unsurprising that the stakeholders in the fight for sustainability are vast. Abidin (2010) identifies government, developers, clients,

buyers/end-users, contractors, manufacturers and other stakeholder (regulators, enforcers or activists) and consultants. As can be seen the various stakeholders may play various roles in the quest for sustainability. Table 1 below shows the various roles which the various stakeholders could play.

Table 1 roles played by various stakeholders

Stakeholder	Role in sustainability fight	Possible area of project involvement
Government	Formulation of policy for sustainability and implementation	Planning, design, construction,
Developer	Uphold sustainable provisions	Planning, design, construction
Client	Decides and approves materials and design	Planning, design, construction operation
Buyer/ end-user	maintenance	Operation and maintenance
Contractor	Material purchase and installation	Design and construction, maintenance
Consultant	Design, advise on materials	Design and construction, maintenance and demolition
Manufacturer/ supplier	Use of sustainable material processing and manufacturing	Construction and demolition

As can be seen from Table 1 various stages have various stakeholders involved at various stages of the project. Additionally various roles could be played by the various stakeholders. For sustainability to be achieved all stakeholders should play their role. In some industries designers, manufacturers and

governments have been fast in adoption of practices yet the adoption of sustainability related practices by owners is generally poor (Gan , Zuo, Ye, Skitmore and Xiong , 2015). The next section briefly discusses the various activities that can be of focus to promote sustainability in the built environment.

Areas and Activities of Focus to Promote Sustainability

The construction cycle involves various activities such as design, construction, operation maintenance and dismantling. The various activities have various unsustainable practices as shown in Table 2. The unsustainable practices have possible solutions and participants. Therefore the curtailing of the unsustainable practices could lead to a more sustainable built environment.

The construction cycle has associated with it areas of focus where possible issues arise. The areas of focus are material extraction, material processing, manufacturing, retail, use and disposal & recycling. Though going strictly by the construction cycle the design and construction phase is the bulk of were much of the sustainability might be practiced (Abidin, 2010).

Abidin (2010) outlines the following activities to promote sustainability: awareness, knowledge, demand, implementation and improvement. For the built environment to be sustainable the players need to be ware of practices that promote sustainability

(Yin, Laing, Leon and Mabon, 2018). They should also possess the knowledge on how to realise the awareness. Consultants should make clients knowledgeable as well as other stakeholders on sustainability issues concerning the built environment (Aigbavboa, Ohiomaha, and Zwane, 2017). Awareness and knowledge could be improved by effective information flow and adoption of new technologies. Aside from the knowledge and awareness, a demand for sustainable practices should be created. The fastest way to create demand for sustainable practices is through regulation. Laws and regulations could be put in place to ensure sustainability is practiced. Enactment of such laws and regulations could be through integrated planning. Once the demand is created there is need for the practices to be improved upon. Improvements could be made from intermediary activities by shared learning through interest, acceptance, commitment, experiences and lesson learnt. All the aforementioned activities have to be continuous if sustainability is to be achieved and future generations need to be equipped with sustainable practices.

Table 2 Activities and their associated practices and stakeholders

Activities	Unsustainable practices	Solutions	Possible stakeholders or participants
Design	Unsustainable designs, choosing unsustainable materials	Use of sustainable materials, integrated design, use of sustainable water, lighting and HVAC systems, fitting specifications	Architect, engineer, client/developer, contractor
Construction	Loss of agricultural land, forests and wild land ,Material depletion	Waste reduction targets, site recycling, ecological conservation, performance reporting, material waste audits	Project manager, contractor, planning authorities
Operation	Pollution of air, land, soils, water, extensive use of natural resources and energy	Recycling facilities, building log books,	Environmental protection agencies, manufacturers, occupants,
Maintenance, rehabilitation and modernisation	Use of unsustainable materials	Effective maintenance systems	maintenance personnel, occupants
Dismantling	Waste	Safe disposal of waste, recycling	Contractor, client, waste management managers

Framework for Achieving Sustainability in the Built Environment Industry

From the literature analysed so far Figure 4 shows a framework that can be formulated from the review in order achieve sustainability in the built environment. What has been cardinal is to identify the players, areas of focus, activities of focus and the sustainability dimensions to be achieved. Activities and players were identified by Abidin (2010) while the sustainability parameters for the built environment were put forward by Huovila and Koskela (1998). Building on the work of the researchers a framework for achieving sustainability is developed as shown in Figure 4.

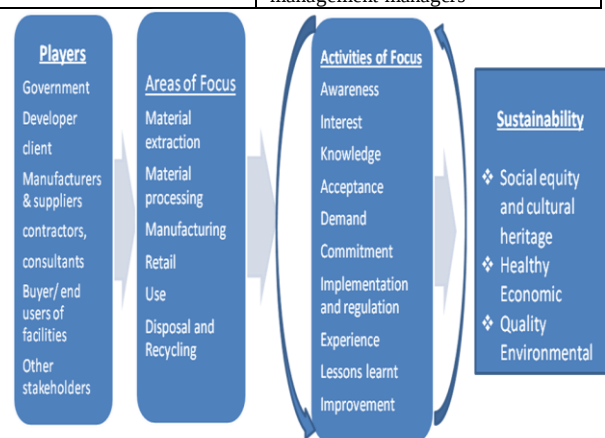


Figure 4: Framework for achieving sustainability in the built environment industry

CONCLUSION

From the review it is clear that for the built environment to achieve sustainability various players, activities and areas of focus need to be considered. It appears it would be the specific contributions that each stakeholder makes that would result in the attainment of a sustainable built environment. This starts from material extraction to disposal and recycling of the material used in a given infrastructure project. The framework developed is a contribution as it provides a basis for sustainability in the built Environment. However, this paper was not empirical in nature as it was developed using existing literature. It is also limited as it investigated sustainability as a holistic concept not broken down into its various dimensions. Therefore, future research could focus on how the individual parameters of social equity and cultural heritage, healthy economic and quality environment could be achieved using empirical research. Additionally, future research could focus on testing the framework empirically.

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