Habitat International 57 (2016) 64–73

Contents lists available at ScienceDirect

Habitat International

journal homepage: www.elsevier.com/locate/habitatint

Enhancing sustainable construction in the building sector in Uganda

Nathan Kibwami*, Apollo Tutesigensi

Institute for Resilient Infrastructure, School of Civil Engineering, University of Leeds, Leeds, LS2 9JT, UK

ARTICLE INFO

Article history:
Received 14 March 2016
Received in revised form
16 May 2016
Accepted 30 June 2016

Keywords:
Carbon accounting
Embodied carbon
Environmental policy
Planning approval
Sustainable construction
Uganda

ABSTRACT

To further the sustainability agenda of the building sector, recent research and practice suggest that integrating embodied carbon (EC) in the sustainability assessment of buildings is necessary. This paper presents an investigation to assess whether the consideration of EC in the development approval process (DAP) could enhance sustainable construction (SC). A recent proposal for integrating the assessment of EC in the DAP of building projects in Uganda was used. Structured interviews were used to collect data from construction professionals. Findings show that construction professionals were highly aware of SC, suggesting that initiatives of enhancing SC could be easily appreciated. However, the concept of SC was found to be largely interpreted in terms of environmental sustainability, implying that measures that highly promote environmental sustainability could be adopted. A hypothesis test confirmed that integrating the assessment of EC in the DAP of building projects in Uganda could enhance SC. This provided new evidence to corroborate the assertion that assessment of carbon emissions associated with buildings can enhance sustainable construction. Having further found that social sustainability could be enhanced the most, this study provides new evidence linking the assessment of EC to promoting social sustainability. Recommendations on introducing the assessment of EC in the DAP of buildings in Uganda are also provided. These include taking necessary steps to increase awareness of SC, implementation of a pilot program in a selected area of Uganda, and further research to capture more opinions from stakeholders, other than construction professionals. Overall, this study shows that transition to sustainable low carbon development in developing countries is possible and a potential way of achieving this could be through implementing measures that bring carbon emissions to bear on the environmental impact assessment of prospective buildings.

1. Introduction

Scientific reports suggest that increased concentration of carbon emissions in the atmosphere causes climate change (Hergerl et al., 2007), which is now recognised as a foremost challenge of the 21st century (de Wilde & Coley, 2012). Annually, the building sector accounts for one-third of the carbon emissions worldwide (UNEP, 2009; WBCSD, 2012). With rapid urbanisation happening in the developing world, concomitant with increased construction activities (Shi, Ye, Lu, & Hu, 2014), carbon emissions from the building sector are envisaged to increase (UNEP, 2009). For the developing countries to follow a low carbon path to development, the case for tackling carbon emissions associated with the construction of buildings becomes persuasive. Moreover, unlike in the developed world where emission reduction opportunities are limited by the fact that most buildings that will be operating in decades to come are already built, in the developing world, such buildings are either being built or yet to be built (UNEP, 2009). If developing countries are to avoid some of the mistakes the developed countries made, integrating the assessment of carbon emissions in the prevailing construction practices is necessary to foster sustainable construction.

Unfortunately, in the developing world, the consideration of carbon emissions in the sustainability assessment of proposed buildings is yet to gain recognition. For instance, in the African continent, where most of the developing countries are found (UNCTAD, 2011), recent reviews (Cabeza, Rincón, Vilariño, Pérez, & Castell, 2014) show that environmental assessment of buildings in terms of their energy consumption and carbon emissions is a rarity. Since enhancement of sustainable construction is increasingly linked with addressing carbon emissions (BSI, 2011; RICS, 2012), it is clear that there is a gap in knowledge about the potential of enhancing sustainable construction in developing countries

* Corresponding author.
E-mail address: cnnk@leeds.ac.uk (N. Kibwami).

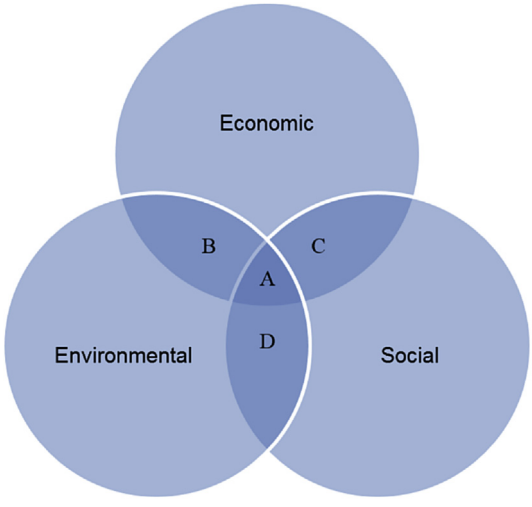
http://dx.doi.org/10.1016/j.habitatint.2016.06.011
0197-3975/

through assessment of carbon emissions. The research presented in this paper contributes to filling this gap by investigating the perceived implications of integrating the assessment of embodied carbon emissions in the development approval process of buildings in Uganda with regard to enhancing sustainable construction.

2. Sustainable construction

Sustainable construction can be interpreted as the application of the principles of sustainable development to construction. Acknowledgment of sustainable construction manifested in 1994 during the first international conference on sustainable construction which was held in Tampa, Florida, United States of America (Kibert, 1994). In that conference, sustainable construction was defined as "… creating and operating a healthy built environment based on resource efficiency and ecological design" (Hill & Bowen, 1997). Other commentators suggest that sustainable construction should be viewed as the responsibility of the construction industry towards sustainability (Bourdeau, 1999; Hill & Bowen, 1997). However, Kibert further suggested that sustainable construction should be construed as a subset of sustainable development (Kibert, 2008). This concurs with the assertion that sustainable construction is the means through which the construction industry contributes to achieving sustainable development (CIB, 1999).

Since sustainable construction is related to sustainable development, sustainable construction practices should therefore address the three pillars of sustainable development. According to a widely quoted definition, sustainable development is development "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland et al., 1987). Achieving sustainable development requires balancing economic, social, and environmental pillars of sustainability (Edum-Fotwe & Price, 2009; Parkin, Sommer & Uren, 2003). It is argued in Edum-Fotwe and Price (2009) that consideration of one pillar only, two pillars only, and all the three pillars relates to first order, second order, and third order states of sustainability, respectively (see Fig. 1). Therefore, sustainable construction can be interpreted to manifest in first, second, and third order states of sustainability.



'A' stands for sustainable development (3rd order sustainability); 'B', 'C' and 'D' stand for 2nd orders of sustainability. Adapted from Edum-Fotwe and Price (2009)

Fig. 1. Pillars of sustainable development.

Literature suggests that the drivers for sustainable construction can be structured into environmental, economic, and social drivers (see Table 1). As such, strategies that aim to enhance sustainable construction should facilitate at least one of such drivers of sustainable construction. However, for a given project, optimising all the possible available drivers of sustainable construction is often impossible; compromises are inevitable (Hill & Bowen, 1997). Therefore, a strategy that facilitates the largest number of the drivers for sustainable construction would greatly contribute to enhancing sustainable construction practices. In the building sector, a bulk of strategies (e.g. EU's *European Performance of Buildings Directive* (CA EPBD, 2014)) hitherto focus on energy efficiency, which relates to driver number 2 in Table 1. However, the increasing focus on energy efficiency in the operational phases of buildings has made embodied energy, and consequently embodied carbon (EC) emissions, prominent in the lifecycle of buildings (Ibn-Mohammed, Greenough, Taylor, Ozawa-Meida & Acquaye, 2013). Therefore, for holistic enhancement of sustainable construction, strategies that focus on energy efficiency need to consider EC emissions as well.

EC are emissions that are largely attributed to activities like material manufacture, transportation, and on-site construction, during the creation of buildings (Cole, 1998; Hacker, De Saulles, Minson, & Holmes, 2008; Hammond & Jones, 2008). Recent research suggests that EC should be integrated in the environmental assessment of buildings, so as to enhance sustainable construction (Häkkinen, Kuittinen, Ruuska, & Jung, 2015; Kibwami & Tutesigensi, 2016; Knight & Addis, 2011; Teh, Wiedmann, Schinabeck, Rowley, & Moore, 2015; Yuan & Ng, 2015). For some recent practices like in the UK, local planning authorities started requiring infrastructure developers to demonstrate how they use "materials that are sustainable and have low embodied carbon" (see Brighton and Hove, 2013, p.162). In addition, there is also an increasing number of guidelines that include assessment of EC in environmental assessment of buildings (BSI, 2011; Franklin & Andrews, 2013; RICS, 2012). Therefore, it is plausible to hypothesise that integrating the assessment of EC emissions in existing construction practices can enhance sustainable construction.

3. Brief overview of the situation in Uganda

As a developing country, Uganda grapples with a challenge of addressing environmental problems without undermining economic development. Most of the technologies used are highly energy-intensive, inefficient, and associated with high levels of pollution (Okello, Pindozzi, Faugno, & Boccia, 2013). The prevalent low level of industrialization in Uganda implies that construction activities are highly labour intensive, largely involve unskilled labour, and use primitive construction methods (Alinaitwe, Mwakali, & Hansson, 2007). A recent study found that the average embodied energy consumed in small-scale brick manufacturing in Uganda is over 5 times higher than that in developed countries (Hashemi, Cruickshank, & Cheshmehzangi, 2015). Moreover, the prevailing environmental impact assessment practices do not consider assessment of energy or EC associated with constructing buildings (Kibwami & Tutesigensi, 2016). Although some initiatives began "to assist national and local governments in reviewing and updating building laws and regulations, with a view of promoting low carbon practices" (UN-HABITAT, 2013, p.6), there is limited knowledge on how such initiatives will enhance sustainable construction. This limited knowledge, coupled with the lack of studies on the extent of awareness and interpretation of sustainable construction amongst various stakeholders in the building sector, makes it difficult to understand whether the assessment of EC is appreciated as a