

OBSTACLES TO SUSTAINABLE CONSTRUCTION IN DEVELOPING COUNTRIES

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ABSTRACT

Creating a sustainable built environment is a growing concern for the construction industry in developed and developing countries. Enormous efforts are required of stakeholders but they face extrinsic and intrinsic obstacles that prevent a smooth transition to sustainable construction (SC) practices. This paper identifies and discusses major barriers to SC in developing countries. It adopts a systematic review of literature in a structured approach. Some of the main obstacles identified include: poor understanding and awareness, lack of education and training among construction professionals, poor public attitude towards sustainability, poor implementation of sustainability principles and lack of accurate data and integrated research. Based on these findings, we have categorised the obstacles as follows: professionals' judgements, clients' philosophies, government mechanism and structure of the industry. In conclusion, the paper presents a framework of obstacles to sustainable construction in developing countries.

Keywords: Construction industry, developing countries, obstacles, sustainable construction, sustainability

1.0 INTRODUCTION

An obstacle refers to anything that blocks one's way. It prevents movement from one stage to another. Obstacles are part of development and can inhibit the success of projects. In the construction industry, obstacles to successful completion of a project include: limited budget, inclement weather, approvals or permits, workers and force majeure. Delays in completion, increased cost of construction and sustainability issues are some of the effects of these obstacles.

Sustainable development (SD) has been widely discussed and adopted in many facets of life. It is aimed at integrating environmental, social and economic factors to achieve what is ecologically possible (Emmanuel, Ibrahim & Adogbo, 2014). The term has been accepted and used in several sectors, including sustainable built environment, sustainable agriculture, sustainable production, and sustainable health practices. These sectors have proposed different measures to achieve SD. Sustainable construction (SC) is an approach that addresses the needs of the construction industry. Its purpose is to achieve sustainable development (Abidin, 2010).

The industry has been criticised for its contribution to environmental degradation which conflicts with the principles of sustainable development (Pearce, 2005). A review of literature (e.g. Dania et al., 2007; Oko & Emmanuel, 2013; Pearce, 2005) has uncovered the marked impacts imposed on the environment by construction activities. These highlight the need for sustainable construction. Creating a more sustainable built environment is a growing concern for the construction industry in developed and developing countries. Concerted efforts have been and are still being made in developed countries to achieve it. These efforts have resulted in policies, laws and the construction of several sustainable buildings. Although, SC has had an impact in some developed countries, the challenge is now for developing countries to follow suit. SC is all encompassing and may be problematic (Leiserowitz, Kates, & Parris, 2006). It requires huge efforts from all stakeholders but these face extrinsic or intrinsic obstacles. Extrinsic obstacles are external factors such as inclement weather while intrinsic are internal factors such as limited budget. These factors prevent a smooth transition to SC practices. Furthermore, construction professionals are responsible for ensuring that they integrate sustainable development measures into their practices (Cotgrave & Riley, 2012; Mostafavi & Doherty, 2010; Newman, Beatley, & Boyer, 2009; Newton, 2012) to achieve SC.

This study investigates SC, reviews the factors that hinder implementation and explores how they can be overcome. A framework that categorises these hindrances is presented.

2.0 LITERATURE REVIEW

The term 'sustainable construction' (SC) is generally used to describe preconstruction and post construction processes. Dickie and Howard (2000) defined SC as the efforts of the industry to achieve SD. Abidin (2010) agrees, describing it as a medium through which the industry can achieve SD. Hill and Bowen (1997) described it as the management and maintenance of buildings over its lifespan aimed at reducing deconstruction waste. Also, Du Plessis (2002, p. 8) described SC as "*a holistic process aiming to restore and maintain harmony between the natural and built environments, and create settlements that affirm human dignity and encourage economic equity*". This definition suggests a synergy between the SD principles of the economy, environment and society that are complex and challenging to achieve for most developing countries (Serpell, Kort, & Vera, 2013). Although SC has been the subject of extensive research particularly in developed countries, little has been done in most developing countries, particularly in Africa.

The foregoing definitions indicate that SC is challenging to implement. Stakeholders include clients, professionals, material manufacturers, legislatures (government), planning regulatory bodies and builders. They are expected to reduce waste, construction cost and exercise effective maintenance strategies through careful material selection and decision making (Shafii, Arman Ali, & Othman, 2006). When deployed, these activities align the industry with the sustainable development agenda (Murray & Cotgrave, 2007). Adopting SC requires adequate consideration of SD principles in construction projects' lifecycles and sustainable practices by stakeholders (Hill & Bowen, 1997; Matar, Georgy, & Ibrahim, 2008).

There has been a marked and recent upsurge of urbanisation and infrastructure developments in most developing countries. This is evident in Asia and Africa. Countries like China, Malaysia, Hong Kong, South Africa, Nigeria and Tanzania are experiencing significant growth in their construction industries. Alongside these developments are the negative environmental impacts of construction. Most developing countries struggle with the rapid rate of urbanisation, poverty, low skill levels, weak governance, institutional incapacity, social inequality and environmental development. All these make development very challenging (Du Plessis, 2007; Ofori, 1998).

Studies from developed countries have identified obstacles in implementing SC. Williams and Dair (2007) reveal stakeholders' aloofness to sustainability as the most commonly recorded barrier. In the same vein, Häkkinen and Belloni (2011) identified steering mechanisms, economics, client understanding, process (procurement and tendering, timing, cooperation

and networking) and underpinning knowledge (knowledge and common language, availability of methods and tools, innovation) as barriers to sustainable building. Wilson and Rezgui (2013) explored barriers to construction industry stakeholders' engagement with sustainability. They grouped the barriers into three categories. The first relates to individually perceived barriers and include lack of knowledge about sustainable construction, uncertainty and scepticism, distrust in information sources, reliance on technology and resistance to lifestyle change. The second relates to barriers organisations perceive, including lack of enabling initiatives, lack of training, work overload and prioritising current tasks and activities, lack of time for reflective actions and capitalising on lessons learnt, lack of information and knowledge sharing. The third relates to the barriers as perceived by industry in general, including lack of government action and government focus on regulation.

Several drivers of sustainable construction have also been identified. Häkkinen and Belloni (2011) recognised the development of clients' awareness of the benefits of sustainable buildings, development and adoption of methods for sustainable building requirements management, mobilisation of sustainable building tools, development of designers' competence and team-working and development of concepts and services as drivers of sustainable construction. Pitt, Tucker, Riley, & Longden (2009) identified the drivers to include; client awareness, building regulations, client demand, financial incentives, investment, labelling/measurement, planning policy and taxes/levies.

The aforementioned literature has identified that sustainable construction is challenging and requires the joint efforts of stakeholders for successful implementation, particularly in developing countries. It has shown that construction activities contribute negatively to the environment. It identified several obstacles of SC, some of which have been alleviated in some developed countries but may remain in developing countries. It is important to identify the obstacles confronting developing countries and identify how they can be mitigated to enable a smooth transition to SC practices. This is the overall research gap that this study contributes to.

3.0 METHODOLOGY

This study systematically reviewed relevant academic literature to identify the obstacles of SC (Häkkinen & Belloni, 2011; Pitt, Tucker, Riley, & Longden, 2009; Williams & Dair, 2007; Wilson & Rezgui, 2013). Searches for relevant articles were conducted using the university online databases and Google Scholar. The keywords used include: sustainability, obstacles, sustainable construction, sustainable development, construction industry and developing countries. Searches on *obstacles to sustainable* construction and *sustainable construction in developing countries* were also conducted. As expected, these searches resulted in an extremely large numbers of results.

The search was limited to peer reviewed journals in English. The advanced search feature in Google Scholar was used to set specific criteria. The time period was limited from 2000 to 2015. The abstracts of potentially relevant papers were then examined to determine if the original research included data about obstacles to SC. Afterwards, the full text version of relevant articles were selected. To obtain additional studies, the bibliographies of the articles consulted were reviewed for articles with different terminologies. Overall, 21 articles were obtained, reviewed and analysed. Similar articles relating to sustainability in different fields were also included.

4.0 FINDINGS AND DISCUSSION

This section analyses the 21 articles identified above. The methodologies adopted in these studies are shown in Table 1 and discussed below.

Methodology	Frequency	Percentage (%)
Survey (Questionnaire)	8	38.10
Report	2	9.52
Focus Group Discussion	1	4.76
Literature Review	5	23.81
Case study	1	4.76
Multi Case Study	1	4.76
Mixed Methods	3	14.29
Total	21	100

Table 1: Methodology adopted in the studies

Table 1 shows that the majority (38.10%) are based on questionnaire surveys administered to stakeholders in the construction industry. Literature reviews (23.81%) and mixed methods (14.29%) were also employed. Some researchers used case studies, surveys, focus group discussions and interviews.

These studies indicate that the construction industry impacts negatively on the environment (Abidin, 2010; Dania et al., 2007; Emmanuel, Ibrahim, & Adogbo, 2014) and that most construction projects in developing countries are not sustainable. According to Emmanuel et al. (2014), the sustainability of infrastructure is between moderate and high. Some factors fell below moderate. These include protection of the ozone layer, grid or standardised planning and release of water (Emmanuel et al., 2014). The implication is that the less sustainable infrastructure becomes, the more the environment becomes uninhabitable.

Table 2 lists the obstacles to SC and these are categorised in Figure 1. The categorisation is based on stakeholders' perspectives. Each category is subdivided into groups reflecting literature by number and highlighted in bold text below.

Professionals' judgements are based on their attitudes, awareness, education and training. Their attitudes to SC stem from their resistance to change and inappropriate priorities (Wong & Yip, 2004). This is when professionals feel reluctant to adopt new technologies, systems and methods of construction because they fear it could waste time and incur additional costs. Professionals' attitudes to SC are very important if SC is to be achieved. Limited exposure, lack of knowledge, understanding and awareness of SC were also identified and grouped under awareness. Some are unaware of SC and its concepts. A study by Dania et al. (2013) found that practicing Nigerian construction professionals are lax in incorporating sustainable concepts. This could be attributed to their lack of exposure to the concept (Nwokoro & Onukwube, 2015).

	Obstacle	Author(s) and year	
1.	Resistance to change	Wong and Yip (2004)	
2.	Financial incentives	Wong and Yip (2004)	
3.	Culture of the industry	Wong and Yip (2004)	
4.	Lack of training and education	Abidin (2010); Ebohon and Rwelamila (2001);	
		Gan, Zuo, Ye, Skitmore, and Xiong (2015);	
		Nwokoro and Unukwube (2015); Shafii et al.	
F	Look of conscitut of the inductor	(2006); wong and Yip (2004)	
<u></u> .	Lack of capacity of the industry	Du Du Plessis (2001)	
6.	Uncertain economic environment	(2001) (2001); Ebonon and Rwelamila	
7.	Poverty and low urban investment	Du Du Plessis (2001)	
8.	Lack of accurate data	Du Du Plessis (2001)	
9.	Lack of interest in SC issues	Du Du Plessis (2001)	
10.	Lack of proven alternative	Du Du Plessis (2001); Pitt et al. (2009); Ebohon	
	technology	and Rwelamila (2001)	
11.	Lack of integrated research	Du Du Plessis (2001); Babawale and Oyalowo (2011)	
12.	Lack of knowledge, understanding	Shafii et al. (2006); Abidin (2010); A. A. Dania et	
	and awareness of SC	al. (2013); Jailani, Reed, and James (2015); Pitt et	
		al. (2009); Dania et al. (2007)	
13.	Higher cost of SC	Shafii et al. (2006); Pitt et al. (2009)	
14.	Procurement issues	Shafii et al. (2006); Ebohon and Rwelamila (2001)	
15.	Building regulatory barriers	Shafii et al. (2006); Pitt et al. (2009)	
16.	Limited exposure of professionals	Shafii et al. (2006); Babawale and Oyalowo (2011)	
17.	Lack of domestic materials production	Shafii et al. (2006); Ebohon and Rwelamila (2001)	
18.	Lack of demonstration examples	Shafii et al. (2006)	
19.	Lack of measurement standard	Hill and Bowen (1997); Emmanuel et al. (2014);	
		Pitt et al. (2009); Shen, Tam, Tam, and Ji (2010)	
20.	Lack of business case	Pitt et al. (2009)	
	understanding		
21.	Lack of client demand	Pitt et al. (2009); Gan et al. (2015); Abidin (2010)	
22.	Vagueness of SC definition	A. A. Dania et al. (2013); Lai and Yik (2006); Du	
23.	Lack of planning policy	Pitt et al. (2009)	
24.	Clients' requirement	Gan et al. (2015)	
25.	Lack of enforcement and	Abidin (2010): Nwokoro and Onukwube (2015):	
	monitoring of law and legislation	Ebohon and Rwelamila (2001)	
26.	Inappropriate priority	Babawale and Oyalowo (2011); Shen et al. (2010);	
		Gan et al. (2015); Shafii et al. (2006)	
27.	Poor public attitude	Nwokoro and Onukwube (2015); Mansaray,	
		Ajiboye, and Audu (1998)	
28.	No common basis for information	Emmanuel et al. (2014)	
29.	Lack of co-ordination	Ebohon and Rwelamila (2001)	
30.	Huge political instability	Ebohon and Rwelamila (2001)	

Table 2: Obstacles of sustainable construction



Figure 1: Framework of obstacles to sustainable construction

Lack of training and education; lack of accurate data; lack of integrated research and vagueness of a definition of SC were grouped under education/training. Construction professionals in developing countries lack SD adequate training. Although formal education has informed younger generations about SC techniques and equipped them for the tasks ahead, their theoretical skills have not been tested (Abidin, 2010). The lack of education and training was reported in most articles studied. Wong and Yip (2004) reveal that education and training in SC is rare due to heavy work commitments and lack of sponsorship from employers. Jailani et al. (2015) posit that the knowledge required to enhance sustainable performance has not been fully disseminated through the construction industry and that it is compounded by a lack of critical knowledge of building design and operation.

In a survey by Nwokoro and Onukwube (2015), education and training of professionals was ranked second out of ten social factors required for SC. Dania et al. (2007) discovered that construction professionals' understanding of waste management was deficient. They recommended that educational institutions should include SC in professional construction curricula and that professional bodies should use conferences and workshops to educate practicing professionals. Likewise, Lai and Yik (2006) conducted a survey to investigate the "knowledge and perception of serving and prospective operation and maintenance practitioners in Hong Kong about sustainable buildings". They uncovered a lack of understanding about sustainable building, indicating a clear disparity between experience, education and training. Shafii et al. (2006) also identified lack of training and education in sustainable design and construction, lack of awareness of sustainable building, lack of professionals/designers capabilities and several other factors as barriers to SC in Southeast Asia.

Clients, as initiators of construction projects, also play important roles in the successful implementation of SC. **Clients' philosophies** depend on their awareness and attitudes to SC. Their requirements, lack of demand, lack of business case understanding, and the higher cost of SC and procurement issues were grouped under clients' awareness. Literature reveals that most clients in developing countries do not require SC for projects. They tend to see SC as an expensive venture. This is evident from the requirements they articulate to their consultants which, in turn, contributes to the aforementioned procurement issues.

The structure of the construction industry also hinders the successful implementation of SC. Factors such as; culture of the industry; lack of demonstration examples; unreliable information and lack of co-ordination were grouped under culture. These hinder professionals who rely on practical examples. Similarly, a lack of capacity; lack of proven alternative technologies; inappropriate priorities; lack of domestic materials; lack of measurement standards and higher costs of SC were identified. These have a marked impact on SC. For example, the lack of a measurement standard implies that there is no accurate measurement for actions considered to be either sustainable or not (Hill & Bowen, 1997). Pitt et al. (2009) note that measurements of sustainability remain unknown. The industry relies heavily on imported materials as local sustainable materials may be scarce and / or unavailable. This in turn makes SC expensive in developing countries.

The role of government in achieving SD is very important. Government plays important roles through its **mechanisms** (policies and regulations). In addition, a favourable economic climate also helps the implementation of SC. Pitt et al. (2009) and Shafii et al. (2006) identified building regulatory barriers as one of the factors hindering SC. A lack of enforcement and monitoring of law and legislation; lack of planning and misplaced priorities were identified and grouped under policies. Gan et al., (2015) and Shafii et al., (2006) identified poverty reduction and infrastructural developments in developing countries as government priorities in achieving SD. Lack of enforcement and monitoring of law and legislation have also been identified as obstructing SC in developing countries. Abidin (2010) posits that in situations where awareness is high or moderate, implementation problems exist. Lack of institutional infrastructure promoting green buildings and professionals' capacity to incorporate green issues were also identified by Nwokoro and Onukwube (2015). Abidin (2010) identified factors that impede wider the implementation of SC as: financial constraints, lack of knowledge, passive culture, and education versus experience. In the same vein, financial incentives; uncertain economic environment; poverty and low urban investment and political instability were grouped under economy. These factors affect the economy which then distorts a smooth transition to SC.

Having identified these obstacles, the most significant challenge industry faces is "*finding a holistic approach to making sure that its contribution to the physical, economic and human development of these countries meets the requirements of sustainable development*" (Du Plessis, 2007). This results from different challenges facing different countries (Dania et al., 2013). Compared to developed countries, the construction industry in developing countries faces enormous challenges. Evidence (Du Plessis, 2002; Ofori, 2003, 2012; Plessis, 2001) identifies environmental issues and climate change, safety and health of construction workers, population issues, poverty alleviation, international construction, globalisation, technology, quality and productivity and disaster prevention and reconstruction to be some of the differences between developed and developing countries. There is thus a significant and serious gap between what is currently being done in terms of SC and what needs to be accomplished in the future.

5.0 CONCLUSION

This study reviewed literature on SC, revealing that it has become dominant in developed countries while very little has been done in developing countries. It also revealed that SC is challenging and requires the joint efforts of stakeholders for successful implementation. The research developed a framework of thirty obstacles relevant to SC in developing countries. Four categories of obstacles were identified namely: professionals' judgements, clients' philosophies, government mechanisms and structure of the industry. Professionals' judgments were further categorised pertaining to their attitude, awareness, education and training. Clients' philosophies were categorised based on their attitudes and awareness. Industry structure was peculiar to culture and capacity of the industry while government mechanisms were categorised based on regulations, policies and economy. These obstacles are dependent on each other which means that overcoming them requires robust holistic approaches. It is recommended that professionals are educated, trained and become aware of the potential of SC. This will influence their attitudes and position them to educate clients who may not be aware of the benefits of SC. The perceptions of construction professionals about sustainability and how sustainability can be measured could be a springboard for further investigation.

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