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Environmental Influences on Sustainability Dimensions in the South African Construction Industry

Modupe Cecilia Mewomo¹, Clinton Ohis Aigbavboa², Thobakgale Machela
Esther³

Abstract

The construction industry contributes significantly to the economic growth of developing countries including South Africa. The industry adds value to the quality of life of its citizen through the provision of necessary infrastructures. Notwithstanding its importance and contributions, the industry has been recognised as one of the largest environmental polluters. Its activities have significant impact on the quality of life of people and the environment. As such, sustainable development was recognised as prominent element for the improvement of quality of life through the maximisation and efficient use of natural resources to address issue related to social, economic and environment. Thus, this paper investigates the environmental sustainability dimensions that can influence the promotion of sustainable construction ideas in the South African construction industry. The participants were selected through non-probability convenience sampling techniques. Data were collected through the use of questionnaire design. The targeted respondents were construction professionals in the Gauteng Province of South Africa. A total number of 111 questionnaires were obtained and frequency analysis of the raw data were carried out using the Statistical Package for Social Sciences (SPSS). Mean values was obtained for each of the identified variables and the level at which each factor promotes the idea of sustainability in the SA construction industry was determined. The study reveals seven environmental dimensions that can promotes sustainable ideas in SA construction industry. These factors include reduction in potential environmental pollution, efficient use of water during construction (such as designing project for efficient water use and eliminating water wastage), encouraging the use of renewable building materials, lower energy use, increase in value management practitioners, encourages construction waste management and increased costs associated with disposal of waste. It is very important that various construction stakeholders have good knowledge and adequate awareness of these environment factors. This will not only reveal the benefits associated with sustainable construction practices, but encourage greater procurement of sustainable building and infrastructures.

Keywords: construction industry, environmental factors, sustainability, South Africa

¹Post-doctoral Fellow; Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa; modupemewomo@gmail.com.

²Associate Professor; Department of Construction Management and Quantity Surveying; University of Johannesburg; University of Johannesburg, South Africa; caigbavboa@uj.ac.za.

³Graduate Student; Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa

1. Introduction

Sustainable development has become important subject worldwide. As a result, the concept is receiving an increasing attention in different facet of human activities including construction (Ugwu and Haupt, 2007; Okoye and Okolie, 2013; Saleh and Alalouch, 2015; Elmualim and Alp, 2016). Notwithstanding, the increased attention and importance placed on sustainable development globally, the implementation of its concept remains a challenge in South Africa (Emuze et al., 2015). Over the last few decades, there has been a significant increase in the global environmental awareness (Elmualim and Alp, 2016). The global environmental awareness arises from the emergnence of environmental problems including climate change, water problem, global warming, energy problem, habitats loss, deforestation, degradation, pollution, ozone layer depletion among others. These problems have resulted in the global call for radical shift towards environmental responsiveness (Emuze et al., 2015; Asif, 2016). In order to alleviate the impact of these environmental problems, sustainability was identified as an important concept which should be incorporated in all human activities (Sourani and Sohail, 2005; Asif, 2016).

In line with this call, several countries around the globe have long embraced the concept of sustainability. For instance, the United Kingdom (UK) construction industry promoted the understanding and awareness of sustainable construction. They had strategies in place which support more sustainable development especially sustainable construction (ICE, 2015). In addition, the construction industry is expected to play a very significant role in the mitigation of environmental problems. This is because the building and construction sector accounts for more than 40% of energy and material consumption and also generates a huge amount of waste from its activities (Elmualim and Alp, 2016; Oke et al., 2017). In fact, the built environment industry is found to be mostly responsible for the environmental pollution (OECD, 2013). Unfortunately, the form of construction development in the past ignored the reality of natural resources and environmental issues (Emuze et al., 2015). This neglect results in a lot of consequences inform of environmental degradation, economic downturn, pollution etc and these consequences have significant impact on the environment and the quality of life of people. All these points attention to the urgency of environmental sustainability interventions.

While there have been remarkable advances towards the achievement of sustainable development in South Africa, the reality is that there is still much to be attained (Department of Environmental Affairs and Tourism, 2008). In addition, the implementation of sustainable construction still faces a lot of challenges in South Africa (Emuze et al., 2015). Thus, in line with the urgent need to promote the concepts and implementation of sustainability in South Africa, this study investigates the environmental sustainability dimensions that can influence the promotion of sustainable construction ideas in the South African construction industry.

2. Environmental Challenges and Need for Environmental Sustainability Dimensions in South Africa

Globally, the construction industry carries out a vast number of construction activities yearly. The industry uses a lot of natural resources including energy, raw materials, land and water in the operation of its activities (Elmualim and Alp, 2016). The industry similarly consumes a huge volume of natural and non-renewable resources which engender wastes that are potentially hazardous and cause environmental pollution (Asif, 2016; Nwokoro and Onukwube, 2011). Thus, the construction industry has been unarguably recognised as the largest pollutants, most hazardous industry and destroyer of

natural environment (Okoye, Okolie, 2013; Wallbaum and Buerkin, 2003; Wooley, 2000). Literature reveals, that both the building and the construction sector contribute significantly to global warming which happen to be one of the major challenges facing the entire world today (Asif, 2016). Moreover, there are carbon emissions from the construction activities. This carbon emission further added to the rapidly increasing global warming and weather variations (Kolev, 2009). All these pose serious threats to the global ecosystem and also it also has serious impacts on human life, the environment and socio-economic development (Oke et al., 2017; Muneer et al., 2008). These negative impacts have become an issue of serious challenge to the global environment. Unfortunately, the traditional procurement practices are observed to be deficient in providing the needed solution to these serious challenges. As a result, several researchers have stressed the need for grave attention being given to resources consumption through radical shift in human practices (Asif, 2016). Thus, the call for sustainable development in construction has been loud and clear worldwide (Hussin et al., 2013). Ofori (2007) emphasised the need for the global construction sector to be familiar with sustainable development and transforming its traditional structures into modern sustainable construction. For this to be achieved, there is need to first identify the prevailing situation within a particular community and best approach to providing a sustainable building environment. At the 2002 World Summit on Sustainable Development (WSSD), it was agreed that the greatest challenge facing South Africa was dealing with poverty. As such, social equity, intergenerational equity, efficient use of resources, human welfare and sustainable living were the core of the implementation plan during the summit. In order to promote the sustainability thinking in South Africa, this study investigates the environmental factors that can promote the sustainability ideas in the South African construction industry.

3. Environmental Sustainability Elements

According to Yilmaz and Bakis (2015), environmental sustainability signifies handling of natural resources to future generation without destruction. It involves protecting ecological balance and saving in consumption of unrenewable resources. For this to be achieved, some researchers have emphasised the need to start utilising sustainable building practices on construction projects procurement (Koranteng, 2010; Asif, 2016). Ashiboe-Mensah *et al.* (2011) as well as Koranteng (2010) point out the need for the adoption of energy efficiency and sustainable materials. In line with these, Yilmaz and Bakis (2015) likewise noted that environmental sustainability requires sensitivity and should focus on subjects which include: (i) protection of aliveness and diversity on the earth; (ii) conservation of live-support system; (iii) sustainable usage of renewable resources; (iv) being saving in using unrenewable resources; (v) minimising harm to the environment and living things; and (vi) protection of cultural and historical environment. The importance of environmental sustainability cannot be over emphasised as such, several tools to promote sustainable building practice, in the area of design and construction, have been developed throughout the world. In South Africa, government has made effort to establish policy in support of environmental sustainability. A notable one is the establishment of SANS 204 which sets out the general requirements for achieving energy efficiency in all types of new buildings, both for naturally ventilated buildings and for artificially ventilated buildings. Several researchers have examined different elements\dimensions which environmental sustainability should cover. Sourani and Sohail (2005) provided an extensive review of the criteria underpinning the environmental dimensions of sustainable construction through a synthesis of the relevant literature. According to them, environmental sustainability cut across different dimensions including: energy, water, land and material conservation; resource utilisation; minimisation of water, land and air pollution; encouraging renewable energy; preserving and enhancing bio-diversity; creating a healthy, non-toxic environment – including

high indoor air quality; protecting and enhancing sensitive landscapes including scenic, cultural, historical and architectural, re- use existing built assets; waste minimisation and management; environmental impact; visual impact and transport – including provision of public transport. In order to give the world to future generation without destruction, adequate attention needed to be given to all these environmental elements. It is on this basis that this study focus on investigating the environmental sustainability dimensions that can actually influence the promotion of sustainable construction ideas in SA.

4. Research Methodology

This study employed a quantitative research method. The research was conducted in the Gauteng Province of South Africa (SA). The Gauteng province was selected because it is widely recognised for its dynamic economic and social circumstances. For example, it is the only province which contributes (34%) more than one third of total Gross Domestic Product (GDP) of South Africa in 2014. Thus, the province has long been recognised as the fastest growing and richest province of SA (The Real Economic Bulletin, 2016). The targeted respondents were the construction professionals within the Gauteng province and they were selected through convenience sampling techniques. These respondents as shown in Table 1 are construction professionals including quantity surveyors, construction/project managers, architects and engineers that are usually involved in construction projects within Gauteng province. Table 1 indicates the demographic analysis of the respondents. The analysis revealed that the respondents have considerable experience within the construction industry and are involved at both private and public construction sectors. They also worked in consulting firms, contracting firms as well as in government establishment. Within the past three years, 39.6% of the respondents were involved in 1-4 projects, 22.5% were involved in 5-6 projects, while 17.1% were involved in 7-8 projects and 20.7% were involved in more than 8 projects. The objectives of this study were achieved using questionnaire survey which attracted one hundred and eleven (111) responses. A thorough review of the relevant literature was carried out to identify the environmental factors that have great potential of influencing the sustainability ideas in the construction industry. A total of seven factors were highlighted and documented in Tables 2. These factors were presented in questionnaire form which attracted (111) one hundred and eleven responses. There are two main parts within the questionnaires. The first part was the introductory section while the second section deals with the ranking of the identified environmental factors. The professionals were requested to rank their perception of the factors on a 5 point Likert scale comprising effect level of strongly disagree =1, disagree = 2, neutral = 3, agree = 4 and strongly agree 5. The mean score (MS) for each variable was established and ranked from highest to the lowest as shown in Table 2. An hypothesised mean of 3.0 was used as relevant level determinant as used in some earlier studies (Coakes and Steed, 2001). This was determined by adopting the mid-point value of the index $(1+2+3+4+5/5=3)$. This implies that all scores above 3 are significant while scores below 3 are insignificant Thus, a factor is considered relevant if it has a mean item score of 3.0 or more.

Table 4: Demographic data of the respondent

	Frequency	Percentage %
Profession of the respondents		
Engineers	24	21.60
Quantity surveyors	29	26.10
Construction/project managers	36	32.40
Architects	22	19.90
Working experiences		
1-5 years	30	27.10
6-15 years	45	40.50
Above 16 years	36	32.40
Construction Industry Sector		
Private	23	19.82
Public	14	11.71
Consultants	34	29.79
Contractors	24	21.62
Government	19	17.12

5. Results and Discussion

Sustainability is a multi-dimensional concept (Sourani and Sohail, 2005). Due to its complex nature it has been viewed in different dimensions as revealed under the literature review section (Sourani and Sohail, 2005; Nwokoro and Onulwube, 2011). This paper as aforementioned mainly focused on the environmental dimension. Seven environmental dimensional factors that can influence the promotion of sustainable construction thinking in the South Africa construction Industry were extracted from literature as depicted in Table 2. Based on factors identified from the review of literature, the respondents were asked to rank these potential environmental sustainability dimension factors. The mean item score technique was adopted in this study. The ratings given by each of the respondents were calculated to arrive at a mean score for each of the listed factors. The mean scores were ranked from highest to the lowest and was used to determine whether the respondents considered a particular factor to be potential sustainability influencing factor or otherwise. In order to provide a clearer picture of the respondents' perceptions, the mean ranking of each factor is also shown in tabular form in Tables 2.

Table 2: Environmental dimension impacting sustainable construction practices in construction project execution

ENVIRONMENTAL DIMENSIONS	MIS	SD	RANK
Reduction of potential pollution	4.24	0.834	1
Efficient use of water during construction	4.23	0.774	2
Encouraging the use of renewable building materials	4.23	0.735	2
Lower energy use	4.22	0.756	3
Increase in value management practitioners	4.20	0.724	4
Encourages construction waste management	4.18	0.777	5
Increased costs associated with disposal	4.12	0.806	6

From findings as shown in Table 2, all the identified factors have great potential to influence the sustainability ideas in SA as all the factors have mean score above the hypothesised mean score of 3.0.

Based on the ranking, reduction of potential pollution with a mean score (MS) of 4.24, efficient use the use of water during construction with a mean score of 4.23 and encouraging the use of renewable building materials with a mean score of 4.23 ranked the three most important environmental factors that can promote the sustainability idea in South Africa. This finding is very interesting and it is agreement with some previous work on sustainability environmental dimensions. For instance, the construction industry is considered the major user of natural resources (Oke et al., 2017). Its activities have significant consequences on the environment. These consequences come in the form of environment degradation, air and environmental pollution, energy problem, habitats loss, deforestation, ozone layer depletion just to name a few. Regrettably, the traditional procurement practices are noted to be deficient in providing the needed solution to these environmental challenges (Asif, 2016). Moreover, most people are not serious about environmental protection on construction site (Chan, 2000). Thus, several of the construction activities result in serious air pollution. As such the industry becomes the main source of an urban air pollutants (Chan, 2000). Recognising, the fact that sustainable development can enhance better environment and lead to reduction in the environmental pollutions is actually capable of promoting sustainable construction ideas within SA. Hussin et al. (2013) noted that developing a new building involve quarrying to provide aggregates, extensive use of water in the production process and the wide use of toxic and chemical materials. All these accumulate and disrupt our environment, thus it is very important to reduce material intensive through the substitution technology and this is main purpose of environmental sustainability. Examining further into the findings in this study, maximizing the sustainable use of renewable resources was found to be of great import because it will lead to material efficiency. Material efficiency could be achieved by reducing the material demand for non-renewable goods and embracing the principles of 3R which are reduce, reuse and recycle. Other factors which are considered important to promote sustainability dimension in SA include lower energy use, increase in value management practitioners, encourages construction waste management, and increased costs associated with disposal. Emuze et al. (2015) has noted that the initial cost of procurement associated with sustainable construction is a significant barrier to its implementation in South Africa. Notwithstanding, the knowledge that the sustainable construction has a lot of benefits including, reduction in the cost of waste management and also the reduction in the increased cost which is associated with waste disposal can make some construction stakeholders to rethink and embrace sustainable construction.

It is essential to recognise that, although the order in which the seven identified environmental dimension factors are evaluated by the respondents indicate priorities on the level at which they promote sustainable ideas, the mean score of each of the factors shows that all the identified factors are significant. This is because all the identified factors have very high mean scores and the mean scores are close to each other. This implies that environmental dimensions that can influence and promote sustainability ideas in the SA construction industry is a combination of all these identified factors. Thus, all the seven environmental factors identified in this paper are perceived by the professionals to be very important in promoting sustainable construction in South Africa. It is necessary to note that for any country to implement sustainable construction successfully, awareness creation is very important. This awareness must be thorough and adequate. The importance and benefits of sustainable construction must be made known to all construction stakeholders as well as the general public. The concept must be clearly stated and adequate explanation should be provided for proper understanding by the public. Thus, interactions with all the construction industry professionals to discuss the need to adopt more sustainable approaches within the industry practices need to be stressed. Taking into consideration all the key sustainability dimensions that influence the promotion of sustainable construction thinking and

how it affects quality of lives of people and environment. Professionals should be made aware of consequences of continuing in the traditional way of procurement and how not practicing sustainable construction could affect the national and economic development of a country.

6. Conclusion

The concept of sustainable development has become vitally important subject worldwide and is gaining wider attention in the built environment. Notwithstanding, the implementation and application of its concept is still a challenge in South Africa. Thus, this paper investigated the important environmental factors that can influence the promotion of sustainable construction ideas in the South African construction industry. Seven factors were identified from the literature and were investigated. From the obtained results, all the identified factors were found to be important. These factors include, reduction of potential pollution, efficient use of water during construction, encouraging the use of renewable building materials, lower energy use, increase in value management practitioners, encourages construction waste management, and increased costs associated with disposal. It is very important that various construction stakeholders have good knowledge and adequate awareness of these environment factors. This will not only reveal the benefits associated with sustainable construction practices, but encourage greater procurement of sustainable building and infrastructures. Thus, there is need for the construction industry, policy makers and all other relevant stakeholders to take note of all the identified environment factors that can impact sustainability ideas and embrace them in order to advance the concept of sustainability and sustainable development in SA.

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