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Sustainable Construction Implementation In Ghana: Focusing On Awareness And Challenges

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Abstract

The quest for sustainable construction everywhere is mainly to achieve the dual end of ensuring a balance in infrastructural development and the ecosystem both for the present and future generations. This is due the growing realization among leading scientists and researchers that the rate at which the earth's resources are being used exceeds its long-term capacity and undermines the vital life support system of the earth. The extent to which this all-important agenda is being pursued varies from one country to the other despite the global nature of the threat. This research assesses the level of awareness and challenges of implementing sustainable construction in Ghana. The study adopted a quantitative study design where questionnaire survey was used to elicit data from respondents. Structured questionnaire was used to obtain data from 100 randomly sampled construction practitioners (architects, quantity surveyors and structural engineers). For the data analysis, descriptive statistics and severity index were mainly used. The results of the survey demonstrated that there is low level of awareness and practical application of the concept of sustainable construction amongst stakeholders in the construction industry in Ghana. The research findings further indicate cultural change resistance, lack of commitment from government, fear of higher investment costs, lack of professional knowledge, and lack of legislation as the most severe challenges of implementing sustainable construction in Ghana.

Keywords: Awareness, Challenges, Construction Industry, Ghana, Sustainable Construction

1.0 Introduction

Sustainability is a serious subject across the world, incessantly being discussed by vast numbers of interest groups, summits and nations. There is increasing awareness among leading scientists, researchers and the public that the rate at which the earth's resources are being used exceeds its long-term capacity and undermines the vital life support system of the earth. The construction industry is no exception to this menace, since it is a major consumer of non- renewable resources and also destroys the natural environment due to its activities. Sustainable construction (SC) has emerged as a guiding paradigm to create a new kind of built environment: "one that meets the needs of humans in the present without limiting the ability of future generations to meet their own needs" (Ofori, 2001). The primary goal of SC is to reduce construction industry's environmental or ecological footprint on the planet.

The role construction play is fundamental to the realisation of sustainable development. As a result of the huge impacts of construction activities on the environment, most countries are striving to adopt SC practices in their various construction industries. As worldwide interest on sustainability is increasingly thriving, the industry should not unwind in its stance on SC. Construction is a major and primary sector of the Ghanaian economy and its consideration of the issues of sustainability covers a huge spectrum of the sector. Nevertheless, the construction industry in Ghana is yet to fully assert itself in ensuring SC due to a myriad of challenges such as

lack of institutional structures promoting SC. It is not common to find sustainable construction as a major agenda for most seminars, conferences and even academic curricular in the Built environment (academic and industry). In order to adopt and implement this concept in the construction industry in Ghana, there is the need for all stakeholders in the construction industry to be conscious and to also have some knowledge about the concept and to also identify the inherent challenges associated with its implementation. This paper, thus, seeks to assess the awareness and challenges of implementing SC in the Ghanaian construction industry

2.0 The Theory of Sustainable Construction

SC is a cross-cutting issue which has dominated academic discussions globally. The review of related works shows a variety of definitions exist for the concept (e.g. Kibert 1994; Wyatt, 1994; DETR, 2000; Langston & Ding, 2001) and there is inconsistency in terms of scope and context. For straightforwardness, SC is best described as the subdivision of sustainable development and its application to the construction industry. The construction industry involves all who plan, develop, produce, design, modify or maintain the built environment and includes manufacturers and suppliers of construction materials, clients, contractors, consultants and end users of facilities (CRISP, 2000). Therefore, SC could best be described as a subset of sustainable development, which encloses matters such as tendering, site planning and organization, material selection, recycling, and waste minimization (Langston & Ding, 2001). SC is defined by some researchers as a construction process which integrates the fundamental themes of sustainable development (Parkin, 2000; Chaharbaghi & Willis, 1999; Sage, 1998). Such construction processes would thence bring benefits such as environmental responsibility, social awareness, and economic profitability to society at large (Langston & Ding, 2001; Miyatake, 1996).

In most literature, a common definition of SC is: ‘the creation and responsible management of a healthy built environment based on prudent use of resources and ecological principles’ (Kibert 1994) and a myriad of other definitions(e.g. Roodman & Lenssen, 1994, 1995) focused more on the environmental aspect of sustainability. Others, for example Wyatt (1994) stated that ‘sustainable construction philosophy requires a 'cradle to grave’ appraisal of project, which involves managing the serviceability of project during its life- time and eventual deconstruction’ focus on the economic aspect of sustainability. Osaily (2010) posited that SC is ‘the design, development, construction, and management of real estate such that the negative environmental effects of the construction, restructuring, and management of the built environment are reduced as far as possible. Only a few of the existing definitions are comprehensive and capture the entirety of the concept. A good example of this is, ‘sustainable construction comprises several processes through which a profitable and competitive industry delivers built assets to improve quality of life and stakeholder satisfaction’ (DETR, 2000). United Kingdom Government’s strategy for comprehensive sustainable construction (DETR, 2000) suggests key factors for action by the construction industry by widening the basic themes. These include design for minimum waste; lean construction; minimize energy in construction and use; do not pollute; preserve and enhance biodiversity; conserve water resources; respect people and local environment; and set targets, monitor and report, in order to benchmark performance (Langston & Ding, 2001; Miyatake, 1996; Ofori et al., 2000; Cole, 2000). Construction activities have momentous impact on quality of life: its outputs change the nature, function and appearance of the communities and countryside in which people live and work. However, Osaily (2010) is of the view that the future of SC has its roots in past and present actions and the future depends on the awareness of the consequences of our acts and deeds.

The construction industry addresses the three dimensions of sustainability; environmental, social and economic, in different ways (Adetunji *et al*., 2003). Environmental factors in construction encompass the use of natural resources, waste minimization, and energy and water efficiency to prevent a harmful effect on the environment. Social aspects include taking the stakeholders into account which include employees, suppliers and the community. Economic factors include the construction industry’s contribution to economic growth and employment (Kristy, John & Geraldine, 2006). Implementing sustainability is important in the construction industry because its activities have a large impact on the environment. It is estimated that approximately 37% of the world’s total energy consumption is attributed to construction related activities (Rayna, 2005). Construction activities consume approximately half of all the resources humans take from nature (Rayna, 2005). Half of the world's fossil fuel consumption is used to serve buildings. Each year over 420 million tones of resources are used for construction, 6,500 hectares of land is converted from rural to urban, and 90 million tonnes of construction and demolition waste is generated (ibid).

2.1 Challenges of Implementing Sustainable Construction

If SC is to be mainstreamed, the challenges that stand in the way must be clarified and prioritized. There are numerous challenges that inhibit successful implementation of SC. As with implementation of other methods or approaches aimed at increasing the performance of the construction sector, the application process of SC principles is sure to encounter various obstacles. Research findings of a study conducted by Osaily (2010) into

the key barriers of implementing sustainable construction in Palestine have shown that the application of SC concept in the industry has faced challenges pertaining to failure to effectively manage markets, finance, employees, prices and customer satisfaction. Also, management skills such as technical ability and leadership, decision making ability, motivation and aspiration values of managers were all identified as challenges. There is also the challenge of accepting change. Furthermore, financial constraints such as lack of financial resources, limited marketing and human resource management expertise, lack of understanding marketing concept and lack of employees training and development have all been established as obstacles. There is also the challenge of limited strategic planning such as market segmentation, pricing strategies, environmental analysis and limited incentives for innovation. Ineffective information technology, lack of system knowledge, Ignorance of life cycle cost, lack of education and knowledge in sustainable design, and client worries in profitability and pay-back period was also established as barriers (Osaily, 2010). Furthermore, some major challenges associated with the application of SC involve aspects of awareness, knowledge deficit, lack of legislation and lack of easily accessible guidance (Dzokoto & Dadzie, 2013).

According to Häkkinen and Belloni (2011), the fear of higher investment costs for sustainable buildings compared with traditional building and the risks of unforeseen costs are often addressed as challenges for sustainable buildings. The adoption of sustainable building solutions may be hindered because clients are concerned about the higher risk (Hydes & Creech, 2000; Larsson & Clark, 2000; Nelms et al., 2005) based on unfamiliar techniques, the lack of previous experience, additional testing and inspection in construction, a lack of manufacturer and supplier support, and a lack of performance information. These costs are also high as according to Bartlet and Howard (2000), cost consultants have overestimated the capital cost and underestimated the potential cost savings. Hydes and Creech (2000) also posited that these higher costs may be as a result of increases in the consultant's fees and indirectly from the unfamiliarity of the design team and contractors with sustainable building methods. Even though it's a known fact that sustainable practices in construction are estimated to increase initial capital cost generally in the range of 1 – 25%, this can often be offset by significant savings in the operational costs (Kats and Capital, 2003) and user comfort however these savings are not made known to prospective clients. If however life-cycle thinking is critically applied to this practice, developers and building owners will appreciate and receive the benefits or those benefits are rapidly discounted. Sustainability will not only reduce life-cycle cost but also increase productivity of staff using the building (Ibid).

Besides, one of the most critical challenges to SC implementation is the lack of capacity of the construction sector to actually implement sustainable practices (CIB, 1999). This is further reiterated by Häkkinen and Belloni (2011) that sustainable buildings can be hindered by ignorance or a lack of common understanding about sustainability. Rydin et al. (2006) claim that while designers demonstrate confidence in their ability to access and use knowledge in general, this confidence falls when sustainable building issues are addressed. There are also challenges such as lack of building codes, government policies/support and measurement tools amongst others. On the contrary, a new kind of orchestrating and pioneering role of the building authorities and other public actors in the building sector is called for (Rohracher, 2001).

3.0 Methodology

This study is largely placed within a deductive methodological approach of reasoning. Thus, the paper employed a combination of primary data (i.e. using questionnaire in a survey) and was supplemented by secondary source of data (i.e. literature review) to present informative facts on the level of awareness and challenges of SC in Ghana. Three categories of practitioners within the construction industry were chosen for the study; these were Architects, Quantity Surveyors and Structural Engineers. The study design led to a choice of only practitioners registered with their various professional bodies. The choice of practitioners registered with the various professional bodies was to obtain the list of practitioners within the Ghanaian construction industry. Stratified sampling procedure was applied to generate the sample for the study. The three groups of practitioners were employed as the strata in stratification to allow for a proportional representation of practitioners across board. Simple random sampling was then employed in selecting the practitioners within the various strata to avoid researcher biases in the selection. Applying the Kish Formula for sample size determination (Kish, 1965), a sample size of 100 practitioners was chosen from the total population of 413 practitioners registered with their professional bodies.

The questionnaire used for this study consisted of 13 questions categorized into three themes: basic characteristics, level of awareness of sustainable construction and challenges of sustainable construction implementation. The first section of the questionnaire was aimed at establishing the background of respondents in the study including years of experience, educational qualification, category of organization working with, their positions in the organization. This information was crucial for the understanding of the knowledge base of the

respondents regarding the subject under study. The second section dealt with assessing the level of awareness of the concept of SC. The last section had respondents rank their perception of the challenges of implementing SC on a Likert rating scale of 1 to 4 with 1 = 'Not Severe', 2 = 'Slightly Severe', 3 = 'Severe', and 4 = 'Very Severe'. This 4 point scale was chosen to prevent respondents from providing neutral answers. Closed-ended questions were mainly prepared but options were given for respondents to add to the list of possible answers. Face-to-face approach to administering questionnaires was adopted to administer the 100 questionnaires to respondents in the Greater Accra Region of Ghana where the concentration of practitioners is highest. Fifty-eight (58) of the total questionnaires were dispensed to Architects, thirty-seven (37) to Quantity Surveyors and five (5) to Structural Engineers. In total, 83 questionnaires (83%) were retrieved from the respondents for analysis.

The data gathered were analysed using the Statistical Package for Social Sciences (SPSS) and Microsoft excel software. Descriptive statistics such as percentages, tables and frequencies were used to summarize information on background of respondents and also the level of awareness of the concept of SC. Severity index analysis (SI) was used herein to determine Architects, Quantity Surveyors, and Structural Engineers' perceptions of the severity of the identified challenges of SC implementation in Ghana. The severity index analysis (Idrus, et al., 2011) uses weighted percentage scores to compare the relative importance of the criteria under study. The frequency analysis was first carried out to determine the frequency of responses which were then used to calculate severity indices (Idrus et al., 2011). The Spearman's rank correlation coefficient (ρ) was used to show the degree of agreement between the rankings of the respondents (Architects, Quantity Surveyors and Structural Engineers). The Spearman's rank correlation is a non-parametric test which does not require the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than means and, as a result, if the data include one or two outliers, their influence is excluded.

4.0 RESULTS

4.1 Background of Respondents

The result of the background of respondents as presented in Table 1 indicates that of the 83 respondents in the survey, 48 (58%) were Architects by profession, 30 (36%) were Quantity Surveyors whilst 5 (6%) were Structural Engineers by profession. A large part (47%) of the respondents' professional experience ranges between 6 – 10 years. It was also revealed that the entire respondents had some form of tertiary education with bachelor's degree being the highest (27%). Of all the respondents, 16% work with contractors, 48% work with consultancy firms whilst 29% work with clients.

4.2 Awareness and knowledge of the Concept of Sustainable Construction

Questions relating to this aspect of the study revealed that 83% of the respondents indicated that they have heard of sustainable construction whilst 17% respondents indicated that they have not heard of this concept. Respondents who indicated they have heard of SC were asked to indicate where they first heard of the concept. Table 2 shows where they first heard of the concept; 71% inform they heard of the concept through their academic work, while a concurrent 10% informed they have heard of the concept through the media and in workshops/conferences. Whilst only 3% of respondents said they heard of the concept through the internet.

Respondents who indicated they have heard of SC were further asked to indicate whether they understand what the concept is about. It was found that 9% of the respondents said they understand what the concept of SC is about whilst 41% indicted they do not understand the concept. Also, it was established that 37 % of the respondents indicated they have a low awareness and knowledge of SC; 36% claimed to have very low awareness of the concept whilst 23% indicated to have moderate awareness and knowledge of the concept. Only 2% of the respondents informed they have an excellent awareness and knowledge of SC.

When the respondents were asked of the practical application of SC, it was found through the questionnaire survey that 68% of the respondents have no practical knowledge of the concept, while 23% stated that they seldom apply it in their work processes, but not often, while only 2% of the respondents indicated that they regularly use the knowledge of SC when carrying out their work.
When it was further evaluated whether the concept of SC will be used when enforced by legislation from government or by their own undertaking to sustainable development; it was found that 94% of the respondents overwhelmingly agreed that rules and legislation from government will be necessary to enforce the concept

thereby binding them to implement it, but not through their own understanding. However, 6% of the respondents indicated that they do not need laws to implement and maintain the environment and natural resources.

4.3 Challenges of Sustainable Construction Implementation

The severity indices of the challenges of SC implementation are presented in Table 3.

From Table 3 it can be seen that *'cultural change resistance'* is the most severe challenge of implementing SC (with SI of 94%), as Architects and Structural Engineers ranked as the first most severe challenge while Quantity Surveyors ranked it as the second most severe challenge. *'Lack of government commitment'* overall is ranked second (with SI of 92%) on the list of challenges as the second most severe challenge associated with implementing SC. Quantity Surveyors ranked it as the first most severe challenge whilst Architects and Structural Engineers ranked it as the third most severe challenge of implementing SC. '*Fear of high investment costs*' is ranked third (with SI of 91%) on the list of challenges as the third most severe challenge associated with SC implementation. Structural Engineers ranked it as the 2nd most severe challenge, Quantity Surveyors ranked it third whilst Architects ranked it as the fourth most severe challenge. In general, '*lack of professional knowledge'* is the fourth most severe challenge (with SI of 90%) and hence ranked fourth on the list of challenges of implementing SC. *'Lack of legislation'* overall is ranked fifth (with SI of 88%) on the list of challenges as the fifth most severe challenge associated with SC implementation.

4.4 Agreement analysis

The Spearman's rank correlation coefficient (ρ) was used to show the degree of agreement between the rankings of any two parties. The Spearman's rank correlation is a non-parametric test. These tests do not require the assumption of normality or the assumption of homogeneity of variance. They compare medians rather than means and, as a result, if the data include one or two outliers, their influence is excluded (Fugar & Agyakwah-Baah, 2010). The Spearman's rank correlation coefficient (ρ) was calculated as follows:

$$\rho = \frac{1 - 6\Sigma d^2}{n(n^2-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

d = the difference between the ranks given by any two respondents for an individual challenge and

n = the number of challenges or groups, which in this case is 30 challenges or 6 groups.

The rank correlation coefficients for the SC implementation challenges are 0.72, 0.84, and 0.69 for Architects and Quantity Surveyors, Architects and Structural Engineers and Quantity Surveyors and Structural Engineers respectively. This shows high agreement between the rankings.

4.5 Significance test

To determine whether the parties displayed significant agreement in their rankings, the null hypothesis that "Architects and Quantity Surveyors, Architects and Structural Engineers and Quantity Surveyors and Structural Engineers do not agree on ranking of severity of SC implementation challenges was tested using a t-test at a 95% confidence level. The null hypothesis was rejected in all three cases. The alternate hypothesis that all three parties generally agreed on the ranks was accepted.

The rank correlation coefficients calculated for the six groups of SC implementation challenges were 0.82, 0.79 and 0.91 for Architects and Quantity Surveyors, Architects and Structural Engineers and Quantity Surveyors and Structural Engineers respectively. Again utilising a *t*-test at a 95% confidence level of the same null hypothesis for the groups of SC implementation challenges resulted in the rejection of the null hypothesis in all three cases. Therefore, all the three parties generally agree on the ranking of the groups of SC implementation challenges.

5.0 DISCUSSION

5.1 Awareness and Knowledge of Sustainable Construction in the Ghanaian Construction Industry

On the subject of SC, it was revealed from the study that, some of the respondents who professed to have heard of SC do not understand what the concept is all about. This does imply that there is a knowledge shortfall of the concept as far as practitioners are concerned. The findings relating to this aspect revealed that the respondents first heard of the concept through academic work which does surmise that SC can be promoted through academic work. Hence, there will be the need to review the current curriculum of construction programmes to cover the concept of SC as this is currently lacking in most construction programmes offered in Ghana.

The assessment of the level of knowledge and awareness of SC reveals that some of the respondents havea working knowledge of the concept whilst others do not. Besides, most of the respondents agreed that the level of application of SC principles is very low in Ghana. More than half of the respondents indicated to have low level of awareness and knowledge of SC. However, to be able to adopt and implement this concept in the construction industry in Ghana, there is the need for all stakeholders in the construction industry to be aware and to also have some knowledge of the concept. The move to SC will first happen when a working knowledge of what it involves is properly disseminated. The study results vary a little from a study conducted by AlSanad, Gale and Edwards (2011) on the level of awareness of SC of stakeholders in Kuwait. Their study revealed that respondents had moderate level of awareness and knowledge about SC. This suggests that their level of awareness and knowledge is a little bit ahead of the respondents in this study. Williams and Dair (2006) identified in their study that evidence of challenges due to a lack of awareness of SC was an experience common to most professionals in the construction industry. In several cases, stakeholders admitted to not being aware of sustainable measures or alternatives that fall within their remit. Michiko (2000) posited that more awareness of SC means more concern about implementing and adhering to the principles of SC. Thus, there is the need to create and elevate awareness of the concept.

On the case of the level of application of the concept, majority of the respondents indicated their level of application of SC to be very low in Ghana. This revelation is not astounding since most of the respondents' level of awareness of the concept is low hence not apply the concept in their work. Rydin et al. (2006) asserted that lack of application of SC principles is as a result of lack of confidence of professionals when the issues of SC design arise. This presupposes that professionals within the built environment need to be fully acquainted with SC principles in order to apply the concept. The present level of poor application of the concept can also be attributed to the shortfall in monitoring and enforcement of legislation by regulators. Even though there are no specific laws on SC in Ghana, there are however some laws on environmental protection that can aid in protecting the environment from construction activities. However its enforcement tends to be very weak. In addition, practitioners are not taking any initiative to develop their knowledge on the concept, which is a negative signal as far as SC implementation in Ghana is concerned. CIB (1999) reported that there is lack of capacity of the construction sector to actually implement sustainable practices, hence the need to build the capacity of construction professionals. Häkkinen and Belloni (2011) also opined that sustainable construction implementation is hindered by ignorance or lack of understanding about SC. Williams and Dair (2006) also identified that installing sustainable technologies and materials requires new forms of competencies and knowledge, so it is evident that not all those with responsibilities in this area have the necessary experience or expertise to meet the challenge. However, with the aim of competing and participating in the global market, the knowledge and competencies of this concept is important as it is now being given a global attention.

Respondents were asked whether they will implement the concept on their own or as a result of legislation from government. The results indicated that, almost all the respondents overwhelmingly agreed that rules and legislation from government will be required to enforce the concept thereby binding them to implement it. The success of SC implementation is highly reliant on the commitment of government and the formulation of legislation. Dadzie and Dzokoto (2013) put forward that SC implementation would be successful if stakeholders, especially government, put in place legislation that will require corporate sustainability policies and also the development of various policy documents to enforce sustainability in all aspects of their development. Furthermore, due to the many benefits associated with sustainable design and construction, governments and their agencies should lead the crusade by progressively incorporating sustainable design and construction practices into new construction projects so that private organizations and individuals can emulate (Dadzie & Dzokoto, 2013). In order to effectively apply SC, it lies with the government to link the implementation with the formulation of legislation on SC, through creation of new polices, and/or by giving some incentives to developers who make efforts to apply this concept in their projects.

5.2 Challenges of SC implementation

The challenges identified from literature and corroborated by industry practitioners were ranked according to their severity. The results presented in Table 3 shows that the five most severe challenges to implementation of SC in Ghana are cultural change resistance, lack of government commitment, fear of higher investment costs, lack of professional knowledge, and lack of legislation respectively. The weakest challenges include lack of system knowledge, lack of market segmentation, lack of employees training and development and delay in decision making among others. The discussion of this part of the paper is focused on the six groups of SC implementation challenges in descending order of their ranking.

5.2.1 Socio-Cultural Challenges

This group consists of lack of demand for sustainable products and cultural change resistance as the major challenges to implementation of SC. Cultural change resistance has been documented as a major challenge of implementing SC. The Ghanaian construction industry has operated in a particular style for a long period of time as such it presents itself as a sector which is traditionally very difficult to change especially with respect to construction methods practiced and building materials used. This change resistance results in a lack of demand by clients and stakeholders of construction projects affecting its eventual supply. Williams and Dair (2006) in the same vain identified lack of sustainability measures by stakeholders as by far the most commonly recorded challenge; further they stated that the lack of demand of SC by clients is a commonly recognized challenge. This challenge was also cited as the most significant challenge by eighty-four per cent (84%) of respondents as a construction project cannot be done along sustainable lines without the owner or developer's "full support for sustainable concepts" (Ibid). The success of SC is highly dependent on the desire of stakeholders in the construction industry to be committed to change and working towards congruent goals and objectives.

5.2.2 Political Challenges

This group comprises lack of government policies/support**,** lack of building codes on sustainability**,** lack of government commitment**,** and lack of legislation. Dadzie and Dzokoto (2013) posited that SC concept would be successful if stakeholders especially government put in place legislation that will require cooperate sustainability policies and also the development of various policy documents to enforce sustainability in all aspects of their development. The effect of lack of government commitment on the implementation of SC in Ghana confirms results from literature (Rohracher, 2001; Osaily, 2010). Also, the success of SC is highly dependent on the commitment of government and the formation of legislation.

SC cannot be successfully implemented without the commitment of government. Since the government is a key stakeholder in the industry, it has to play a major role such as providing the enabling environment for effective implementation of SC. Due to the many benefits associated with sustainable design and construction, governments and their agencies should also spearhead the movement by gradually incorporating sustainable design and construction practices into new construction projects so that private organizations and individuals can emulate (Dadzie & Dzokoto, 2013).

5.2.3 Knowledge/ awareness Challenges

The knowledge/ awareness challenges group consists of lack of awareness of professionals**,** lack of professional knowledge**,** lack of awareness of clients**,** lack of awareness of benefits**,** ignorance or misunderstanding about sustainability**,** lack of education and knowledge in sustainable design. Häkkinen and Belloni (2011) stated that SC can be hindered by ignorance or a lack of common understanding about sustainability. Williams and Dair (2006) identified in their study that evidence of challenges due to a lack of information was an experience common to most stakeholder groups in the construction industry. In several cases, stakeholders admitted to not being aware of sustainable measures or alternatives that fall within their remit. Similarly, installing sustainable technologies and materials requires new forms of competencies and knowledge, yet it was evident from their research that not all those with responsibilities in this area had the necessary experience or expertise to meet the challenge (William & Dair, 2006). The construction industry is made up of different actors with different interest (clients, consultants and contractors) who have to come and work together as a team in order to ensure the successful completion of a project. There is therefore the need to create and improve awareness and knowledge of SC amongst the various actors in the construction industry in Ghana.

5.2.4 Financial Challenges

This group comprises fear of higher investment costs**,** fear of long Pay-back period**,** client worries in profitability**,** ignorance of life cycle cost**,** lack of financial resources. The influence of financial challenges on the implementation of SC has been well recognized. According to Häkkinen and Belloni (2011), the fear of higher investment costs for sustainable buildings compared with traditional building and the risks of unforeseen costs are often addressed as challenges for sustainable buildings. Hydes and Creech (2000) opined that these perceived higher costs may be as a result of increases in the consultant's fees and indirectly from the unfamiliarity of the design team and contractors with SC methods. Even though it is known that sustainable practices in construction are estimated to increase initial capital cost normally in the range of 1 – 25%, this is counterbalanced by humongous savings in the operational costs (Kats & Capital, 2003) and user comfort. The additional financial cost of providing measures to improve the sustainability of construction works has been cited by many researchers as being a major challenge to the realisation of SC (Häkkinen & Belloni, 2011; Nelms et al., 2005; Hydes & Creech, 2000; Larsson & Clark, 2000). Though it is documented that the long-term benefit is worth the initial increase in investment, the perceived long-term benefits are normally not expressed in terms of financial

return but focused instead on the environmental and social benefits that the developer believed the technology or methodology could deliver.

5.2.5 Technical Challenges

The technical challenges group comprises lack of environmentally sustainable materials**,** lack of sustainability measurement tools**,** lack of exemplar 'demonstration project'**,** lack of easily accessible guidance**,** lack of technical ability**,** chronic skills and labour shortages as the major challenges to the implementation of sustainable construction. These challenges are considered technical because they have a direct impact on the successful implementation of SC principles. Rydin et al. (2006) asserted that designers in the construction industry are not confident when the issues of SC design arise. This suggests that professionals within the built environment need to be fully acquainted with SC principles in order to implement it. According to Osaily, (2010), the availability of locally sourced 'green' building products, such as advanced glazing systems etc., proved difficult for many SC projects. Products had to be imported from elsewhere in many cases, either directly by the project team or through a locally approved distributor. A lack of appropriate guidance appeared to exist for designers in the implementation of SC projects. It is important that technical information on SC is made available to design professionals in an appropriate format, and to the contractors ultimately responsible for implementing the design. Access to such information was cited as a challenge to the use of such techniques by Osaily (2010).

5.2.6 Management/Leadership Challenges

The effect of good management and leadership on the success of SC has been well documented (Osaily, 2010; Rydin et al., 2006; Nelms et al., 2005; Rohracher, 2001; Hydes & Creech, 2000 etc.). This group consists of lack of leadership**,** lack of market segmentation**,** lack of motivation and aspiration of managers**,** Delay in decision making. The management and leadership of the construction industry and individual organisations have a major role to play in achieving successful implementation of SC (Osaily, 2010). The success of SC implementation lies on the commitment of managers and leaders in developing and implementing an effective plan and adequately providing the required resources and support to manage changes arising from the implementation (Osaily, 2010). Without the support and innovative management and leadership in implementing SC, the concept implementation may face numerous difficulties.

6.0 CONCLUSION

SC researches continue to receive attention among academia and industry. However, until now, most studies on this field have focused on SC issues in developed countries. This paper has highlighted some fundamental issues of the subject in the context of a typical developing country. Drawing extensively on the theoretical foundations of SC in the literature studied, and analyzing a set of data collected from construction practitioners (Architects, Quantity Surveyors, and Structural Engineers) in Ghana, this paper has critically examined the level of awareness and knowledge of SC and the potential challenges of implementing SC in Ghana. This study has shown that there is low awareness and knowledge of sustainable construction in Ghana. Therefore the level of application of the concept is also very low. However, the study revealed that rules and legislation on sustainable construction from government will be required to enforce the implementation of sustainable construction principles in Ghana. From 31 challenges identified from literature as potential challenges to the implementation of SC, the result shows that the five most severe challenges to implementation of SC in Ghana are cultural change resistance, lack of government commitment, fear of higher investment costs, lack of professional knowledge, and lack of legislation respectively. This work however, proposes that, more discussions, seminars, training, and workshops on sustainable construction should be initiated to enhance the level of awareness and knowledge amongst stakeholders in the construction industry in Ghana. The paper further proposes the development of appropriate policy framework and regulations to mainstream SC in Ghana. Finally, strong measures should also be put in place to overcome the identified challenges to implementing SC in Ghana.

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Table 1: Respondents background information

Respondents' characteristics	**Frequency(n=83)**	**Percentage (%)**
Profession of Respondents		
Architects	48	58
Quantity Surveyor	30	36
Structural Engineers	5	6
Years of professional experience		
1 -5 yrs	12	15
6 - 10 yrs	39	47
11 -15 yrs	16	19
16 - 20 yrs	7	8
Above 20 yrs	9	11
Category of Respondents Organisation		
Contractor	13	16
Consultant	40	48
Client	24	29
others	6	7
Educational Qualification		
Diploma/HND	3	4
B - Degree	27	33
M - Degree	19	22
Doctorate Degree	8	10
Others	26	31

Table 2: Means through which respondents first heard of Sustainable Construction

	Frequency	Percentage (%)
Media	7	10
Workshop/Conference	7	10
Academic Work	49	71
Internet	2	3
Magazines/ Newsletters	4	6
Total	69	100

Table 3: Severity of Challenges of Sustainable Construction Implementation in Ghana

Challenges	Architects		Quantity Surveyors		Structural Engineers		Overall	
	S.I.	Rank	S.I.	Rank	S.I.	Rank	S.I.	Rank
Financial Challenges		**4th**		**4th**		**4th**		**4th**
fear of higher investment costs	90%	4th	91%	3rd	92%	2nd	91%	3rd
fear of long pay-back period	84%	8th	83%	7th	88%	5th	85%	7th
client worries in profitability	87%	6th	83%	7th	82%	8th	84%	8th
ignorance of life cycle cost	66%	23rd	63%	24th	63%	23rd	64%	24th
lack of financial resources	60%	26th	63%	24th	60%	25th	61%	25th
Political Challenges		**2nd**		**2nd**		**2nd**		**2nd**
lack of government policies/support	75%	15th	81%	11th	81%	10th	79%	13th
lack of building codes on sustainability	82%	12th	80%	12th	78%	14th	80%	12th
lack of government commitment	92%	3rd	94%	1st	90%	3rd	92%	2nd
lack of legislation	89%	5th	88%	4th	87%	6th	88%	5th
Management/ Leadership Challenges		**6th**		**6th**		**6th**		**6th**
lack of leadership	70%	18th	68%	20th	63%	23rd	67%	21st
lack of market segmentation	51%	28th	51%	28th	53%	28th	51%	28th
lack of motivation and aspiration of managers	62%	25th	57%	26th	58%	26th	59%	26th
delay in decision making	44%	30th	44%	30th	47%	30th	45%	30th
Limited incentives for innovation	79%	13th	74%	16th	72%	18th	75%	16th
Lack of employees training and development	47%	29th	48%	29th	52%	29th	49%	29th
Technical Challenges		**5th**		**5th**		**5th**		**5th**
lack of environmentally sustainable materials	67%	22nd	71%	18th	72%	18th	70%	19th
lack of sustainability measurement tools	69%	20th	68%	20th	70%	20th	69%	20th
lack of exemplar 'demonstration project'	68%	21st	65%	22nd	65%	21st	66%	22nd
lack of easily accessible guidance	73%	17th	70%	19th	73%	17th	72%	18th
lack of technical ability	75%	15th	78%	14th	75%	15th	76%	15th
chronic skills and labour shortages	66%	23rd	65%	22nd	64%	22nd	65%	23rd
Socio-Cultural Challenges		**1st**		**1st**		**1st**		**1st**
lack of demand for sustainable products	84%	8th	83%	7th	82%	8th	83%	9th
cultural change resistance	96%	1st	92%	2nd	94%	1st	94%	1st
Knowledge/ Awareness Challenges		**3rd**		**3rd**		**3rd**		**3rd**
lack of awareness of professionals	86%	7th	87%	6th	85%	7th	86%	6th
lack of professional knowledge	93%	2nd	88%	4th	89%	4th	90%	4th
lack of awareness of clients	83%	11th	83%	7th	80%	11th	82%	10th
lack of awareness of benefits	84%	8th	79%	13th	80%	11th	81%	11th
lack of system knowledge	52%	27th	56%	27th	57%	27th	55%	27th
ignorance or misunderstanding about sustainability	78%	14th	77%	15th	79%	13th	78%	14th
lack of education and knowledge in sustainable design	70%	18th	74%	16th	75%	15th	73%	17th

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