FACTORS INFLUENCING THE GROWTH OF GREEN BUILDING IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

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Abstract

This research paper aims at examining the concept of green building with the objective of identifying the key factors that affect the growth of green building in the South African construction industry. A comprehensive literature review was undertaken to provide an overview of the factors limiting the growth of green building globally and in South Africa. A quantitative approach was adopted and data was collected via a questionnaire survey of randomly selected construction professionals in the South African construction industry. Descriptive (mean) and inferential (One way analysis) statistics were used to analyse the data. The results show that key factors hindering the growth of green building are lack of incentives for promoting green building, inadequate cost data for green buildings, and inadequate information regarding the financial and economic benefits and opportunities of green buildings. The study also divulges that there is no significant difference regarding the perceptions of respondents and the major factors inhibiting the growth of green building. Actions towards promoting the green built environment require resolute actions and drive from various parties. Therefore, the identification of key factors will result in the development of effective strategies to enhance the growth of green building in the South African construction industry. Given the benefits derived from green building principles, the paper will add value to construction industry stakeholders who have limited information regarding factors limiting the growth of green building.

1. Introduction

The construction industry is important because of the outputs and outcomes of its activities. It contributes to national socio-economic development by providing the buildings, which are used in the production of all goods and services in the economy (Ofori, 2012). However, how a building is designed, the way and manner it is constructed, and where it is located clearly affects the users of the building, the community, and the environment (Choi, 2009). Thus it can be implied that the construction industry can influence the competitiveness of enterprises within the economy. Construction can also affect the ability of the nation to attract foreign investment. For these reasons, efforts should be made to ensure the continuous improvement of the industry especially in this era of globalisation since all nations are competing nations in order to attract foreign investment. Notably, the construction industry performs poorly with regards to environmental considerations (Ofori, 2012). Construction activities in developing countries may involve excessive resource consumption, and cause land degradation, loss of habitats, air and water pollution, and involve high energy usage and produce approximately 23-40% of the world's greenhouse gas emissions (Ofori, 2012; Gunnell, 2009). The substantial negative environmental impacts of buildings have led to the emerging concept of 'green buildings' (Gunnell, 2009). According to Gunnell (2009), green buildings are designed to be energy and water efficient, use non-hazardous materials and provide healthy productive environments. Green building is defined "as a construction project that is either certified under any recognised global green rating system or built to qualify for certification" (Bernstein & Mandyck, 2013:5).

Green building is growing rapidly across the world as it becomes viewed as a long-term business opportunity. A recent study conducted by McGraw-Hill Construction and United Technologies Climate, Controls, and Security, reveals that 51% of international firms, including architects, engineers, contractors, building owners, and building consultants around the world are focusing on sustainable design and construction as at least 60% of their projects were 'green' by 2015, up from 28% in 2012 (Bernstein & Mandyck, 2013). For instance, it is anticipated that the percentage of construction firms in South Africa incorporating green practices in their business, will rise from 16% in 2012 to a planned 52% by 2015 (Bernstein & Mandyck, 2013). This is the strongest growth among all the survey respondents, indicating a market conducive to green building (Bernstein & Mandyck, 2013). Despite this progress, significant obstacles however remain, erected by the inertia of the building professions and the construction industry and compounded by the difficulty of changing building codes, information asymmetry regarding the possibilities, techniques and potentials of green building solutions, cultural / behavioural, and financial barriers.

Against this backdrop, this paper was developed to identify the major factors that inhibit the growth of green building in the construction industry and to determine whether there is a significant difference between the participants' perceptions and the factors inhibiting the growth of this sector.

1.1 The problem

While the construction industry has made some inroads into promoting green building in South Africa, the industry has experienced a slight growth in adopting green practices. The slow adoption and poor performance of green building is besieged with significant obstacles such as conflicting building codes, and fears of liability and litigation over the performance of new products and systems. Industry professionals, in both the design and construction disciplines, are generally slow to change and tend to be risk-adverse (Osec, 2010). A further key problem facing green building is a lack of knowledge, experience, and understanding of how to apply ecology to construction design (Hankinson & Breytenbach, 2012). Furthermore, the environmental or economic benefit of some green building approaches has not been scientifically quantified, despite their often intuitive and anecdotal benefits (Osec, 2010).

2. Review of factors limiting the growth of green building

2.1 Capacity barriers

One of the most critical challenges to building green is the lack of industry skill of the construction sector to actually design and implement green practices. Hankinson & Breytenbach (2012) contend that the industry is hampered by a lack of technical expertise to actually develop and implement green practices. Hankinson & Breytenbach report that professionals within the built environment are not yet fully trained in green construction principles and thus lack education and experience to properly carry out such practices. This is because it was not studied or comprehensively covered at tertiary institutions, since it is a specialised field of study. Jacobs (2011) also identifies lack of knowledge about green practices, lack of knowledge about the effects of non-green practices on the environment, lack of training and education as the main barriers to the implementation of green building. This is further reiterated by Häkkinen & Belloni (2011) that green building practices can be hindered by ignorance or a lack of common understanding about sustainability. Rydin *et al.* (2006) argue that not only are professionals supposed to be knowledgeable, professionals need to form an integrated team from conception to inception comprising of the developer / owner, project manager, contractor, architect, services engineer, structural engineer, civil engineer, environmental engineer, landscape consultant, cost planner, and building surveyor. This team needs to have the best available information on products and tools to achieve sustainable construction, however, Williams & Dair (2007) lament that, this was not the case. In their research, evidence of hindrance due to a lack of information was an experience common to most stakeholder groups. In several cases, stakeholders admitted to not being aware of sustainable measures or alternatives that fall within their remit. Similarly, installing green technologies and materials requires new forms of competencies and knowledge, yet it was evident from the research that not all those with responsibilities in this area had the necessary experience or expertise to meet the challenge. This view is supported by the International Labour Orginasiation (ILO) (2011) that the main reason for labour shortages and lack of industry skill in this area is that skill requirements change as green building designs, technologies and practices are introduced or changed, so that previously satisfactory skills sets are no longer adequate.

2.2 Cultural and social resistance

The South African construction industry process has not evolved over the past decades. As a result, Djokoto *et al.* (2014) contend that the industry presents itself as a sector which is traditionally very difficult to change especially with respect to construction methods practiced and building materials used. Besides, firms follow the consumption patterns of clients who normally worship modernity and the development model of developed countries with its vices and problems. Furthermore, the construction sector in developing countries such as South Africa is dominated by firms that are not interested in technology changes that involve risks and extra costs (Du Plessis *et al.*, 2002). Construction in South Africa favours the use of 'brick and mortar' and discourages any other alternative to these building materials and services. As a result, communities, clients, and stakeholders do not demand innovative building solutions, relying instead on conventional methods (Housing in Southern Africa (HISA), 2014). According to Djokoto *et al.* (2014), this illustrates typical resistance to change, and thus a major barrier.

2.3 Lack of incentives for promoting green building

According to Ndihokubwayo, Crafford & Buys (2013), green building principles have recently gained momentum in the South African construction industry. Despite this progress, there is a lack of incentives for demonstrating best green practice. Diyana & Abidin (2013) contend that motivational factors and grounds of expectations derived during the forethought process will influence stakeholders in the construction industry to commit and decide to venture into new practice such as green construction. Therefore, understanding of what can initiate the commitment of 'first-time' developers or to maintain the interest of 'experience' developers for green construction can generate further recommendations to create a viable environment to induce wider acceptance on the practice. Peterson (2007) concurs that incentive can inspire, encourage, and stimulate individuals and project teams to achieve great accomplishments. Barbour (2005) affirms that the economic rationale for incentives seeks to correct market failures including, information asymmetries, the public good nature of investment in research and development, and infant industry protection. In the context of South African construction industry, infant industry could be seen as the adoption of green principles, which are not yet widely implemented across various professional participants in construction project (Ndihokubwayo, Crafford & Buys, 2013).

2.4 Inadequate cost data for green buildings

The lack of attention to the costs associated with green construction seems to be a global phenomenon. Choi (2009) states that one of the major barriers is the need for reliable cost information for green features, without this information, it is difficult for the market to justify the occasionally higher up-front costs for a green development project. Kats & Capital (2003) reveal that there is still little published data about actual cost premiums for green buildings. For instance in the United States this information gap is exacerbated by the fact that the USGBC does not require that cost information be included with submissions for LEED certification. Many developers keep cost information proprietary. As a result, Nelson (2008) acknowledges that there are more ways to expand the four pillars of sustainability and one of the ways is to expand Full-Cost Pricing to True-Cost Pricing. Debatably, the True-Cost Pricing goes beyond covering the costs of the infrastructure and includes long-term environmental and community externalities, such as for example, energy savings, green space, and green job creation. While there has been a plethora of research seeking to determine the direct or tangible costs of green building, the indirect or intangible costs remain unexplored in construction. Love (2002) argues that this is because it is difficult, if not impossible to quantify such costs in purely monetary terms. As a result, Choi (2009) emphasises the need to look at the indirect costs as well when determining the total costs of green construction.

2.5 Inadequate information regarding the financial and economic benefits and opportunities of green buildings

Another significant issue of concern is the availability of information regarding the full benefits that green building can offer, which is deemed to be worrisome in the South African construction industry (Bernstein & Mandyck, 2013; Cruywagen, 2013). Milne (2012) is of the view that the valuation industry relies on past evidence of sales prices to determine the appropriate capitalisation rates to use when valuing a property. The author laments that until there are a greater number of rated green buildings in South Africa that have been transacted, the full benefits of green buildings may not be reflected in their valuations. According to Häkkinen & Belloni (2011), this barrier persists due to the lack of quantitative documentation of benefits and uncertainties associated with green buildings. Choi (2009) dictum that if green development is to move from being a niche market to the norm for construction projects there is a need for reliable cost and benefit information of green building. Therefore, the benefits and performance of green buildings must be documented and communicated to expand the market for green development. Further, there should also be tools that help brokers, appraisers, property search specialists who are directly involved in marketing green properties to be able to easily communicate the benefits to clients (Choi, 2009).

2.6 Limited range of green products and materials

Reliability of information from product suppliers and manufacturers is a major concern as well, “for instance, product suppliers and manufacturers are developing and marketing products that are environmentally responsible. However, without certifications ensuring that a product is indeed environmentally responsible, designers find it hard to decipher what is authentic from that which is not.” (Hankinson & Breytenbach, 2012: 4-5). According to Tam, Hao & Zeng (2012), if the design team members do not have sufficient time and funding to search for new green products, components and technologies, green building designs cannot be implemented. Therefore, a limited range of green products and materials may restrict the opportunities to create cost efficient designs.

2.7 Delays in obtaining certification and permits for green buildings

Inadequate or conflicting government regulation (Milne, 2012) coupled with the difficulty in gaining green certification is the main barrier to implementing green building features (Nurick & Cattell, 2013). Empirical evidence suggests that revision of many building codes impede and delay the process of implementing green building. For instance, the process of reaching agreement on the vision and goals of a design requires lots of public review meetings, working with community and building code officials to agree on a design (Garman *et al.,* 2011).

3. Research Methodology

An exploratory research approach was adopted for the study. The mixed-mode quantitative survey was used to elicit information from the respondents through a structured questionnaire that, inter-alia, requested for information relative to the factors impeding the growth of green building in the South African built environment. Respondents included architects, construction managers, construction project managers, contractors, consulting engineers, and quantity surveyors. A total of 344 questionnaires were sent out by e-mail, 71 were duly completed and returned, representing a response rate of 21%.

The data was encoded using the Statistical Package for the Social Science (SPSS) and results were carefully analysed statistically using the descriptive statistics. The one-way analysis of variance (ANOVA) was applied to determine the statistically significant difference between the perceptions of respondents’ and factors impeding the growth of green building. The ANOVA is the commonly used method to evaluate the differences in means for more than two groups. The level of significance for the ANOVA was 0.05.

4. Findings and Discussion

The respondents were given the opportunity to rate statements with regard to the factors impacting negatively on the growth of green building in the South African built environment on a five-point likert-scale question of strongly disagree to strongly agree.

Where: Strongly Disagree = 'SD'; Disagree = 'D'; Neutral = 'N'; Agree = 'A'; Strongly Agree = 'SA'

4.1 Lack of incentives for promoting green building

Figure 1 shows that the majority of the respondents (52.1%) agreed that there is lack of incentives for promoting green building. Also, 26.8% strongly agreed with the same statement. Furthermore, quite a small percentage (11.3%) of the sample remained neutral relative to the statement, followed by 4.2% of the respondents who disagreed with the statement and only 4.2% of the sample were unsure relative to the statement.

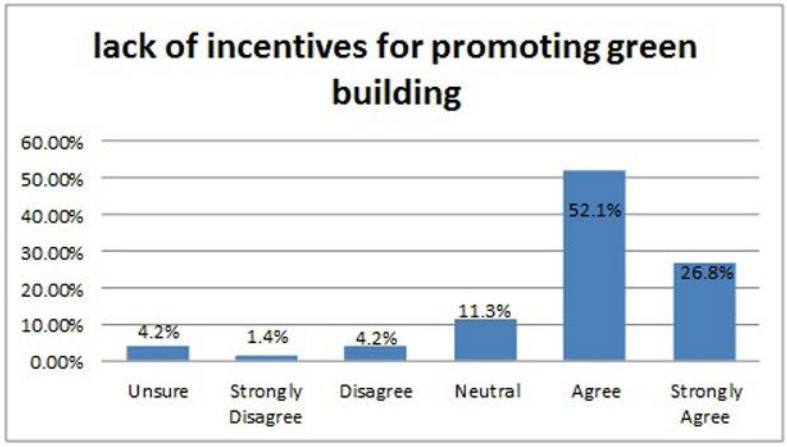

Figure 1 Lack of incentives for promoting green building

4.2 Inadequate data regarding the cost benefit analysis of green buildings

Respondents were asked to what extent they agree that inadequate cost data for green buildings impacts negatively on the growth of green building. More than 60% of the respondents concurred with the opinion that the industry lacks adequate cost data for green building, and 14.1% strongly agreed. However, a small portion (2.8%) of the sample were neutral relative to the statement, 14.1% disagreed and 8.5%% of the sample were unsure (Figure 2).

Relative to greening existing buildings, 16.9% strongly agreed that there is inadequate cost data for greening existing buildings; 45.1% agreed; 14.1% were neutral; 14.1% disagreed, and 9.9% were unsure (Figure 2).

In response to the statement that there is inadequate information regarding the financial and economic benefits and opportunities of green buildings, more than 43% of the respondents agreed, 15.5% strongly agreed. 16.9% were neutral, 19.7% disagreed, and only 2.8% were unsure (Figure 2).

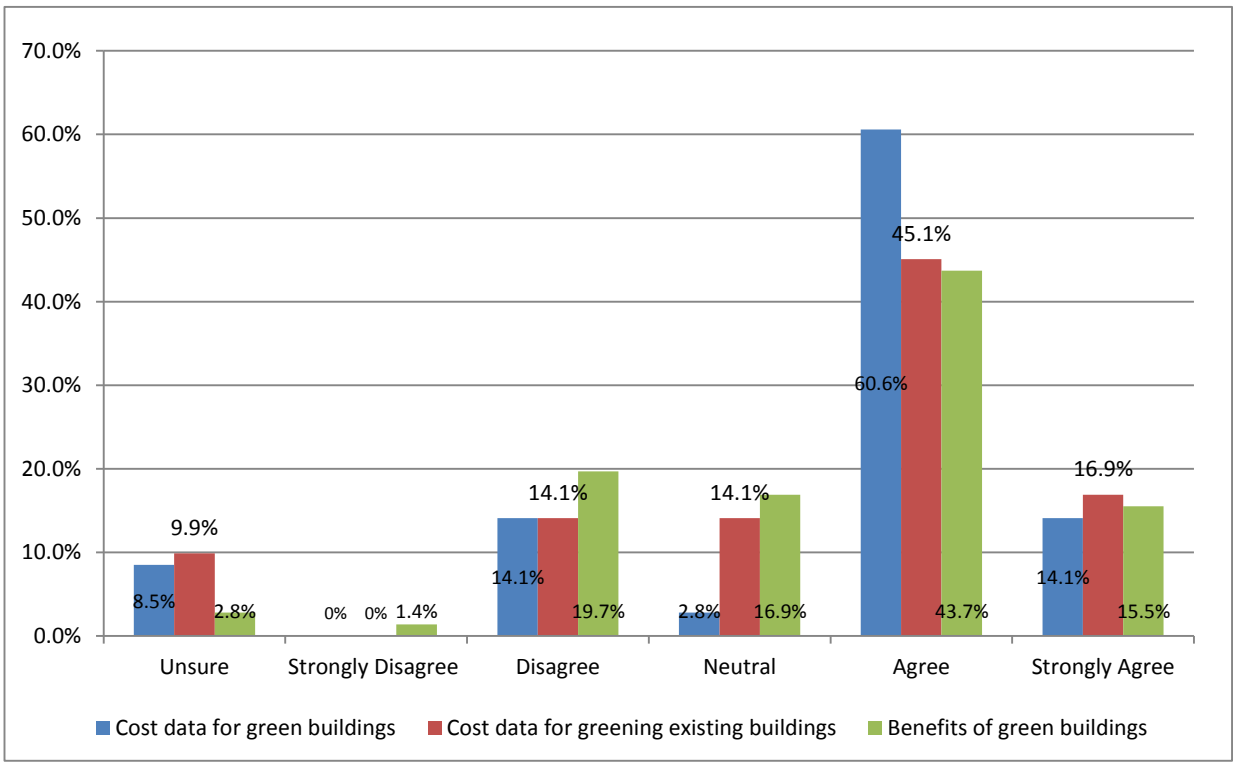

Figure 2 Cost benefit analysis of green buildings

4.3 Limited range of green products and materials

With regard to the above statement, Figure 3 indicates that the greater percentage (45.7%) of the sample agreed there is a limited range of green products and materials. 10% strongly agreed, 14.3% were neutral, 24.3% disagreed, and 2.9% were unsure.

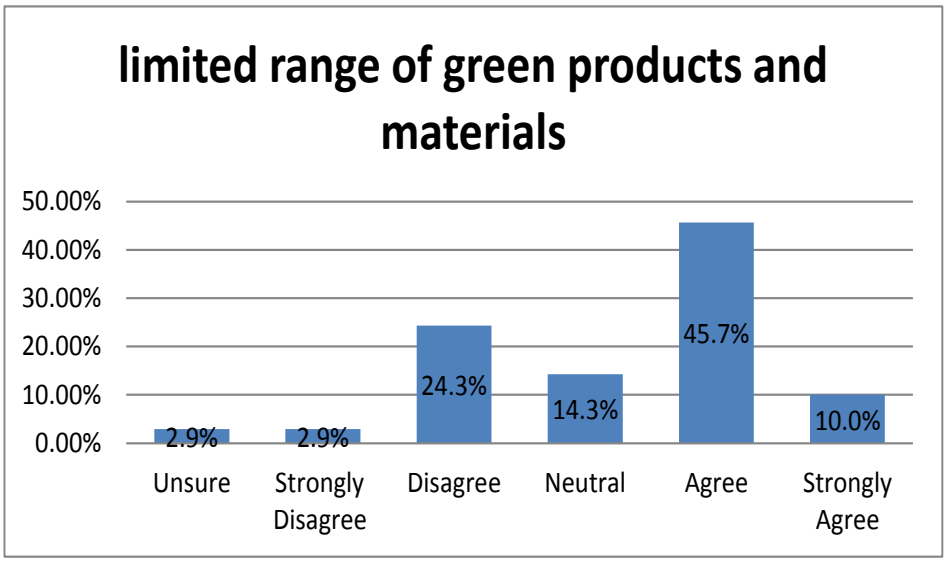

Figure 3 Limited range of green products and materials

4.4 Cultural and social resistance

Figure 4 depicts the perceptions of respondents regarding cultural and social resistance to green buildings, 21.7% strongly agreed; 29.0% agreed; 14.5% were neutral. However, 21.7% and 5.8% disagreed and strongly disagreed respectively, whilst 7.2% were unsure.

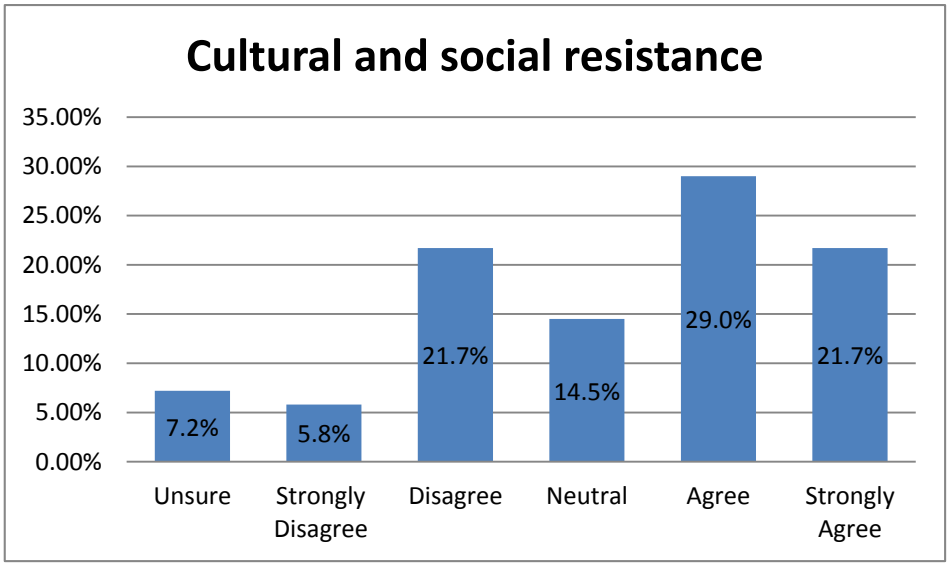

Figure 4 Cultural and social resistance

4.5 Lack of capacity

34.3% agreed that the lack of growth in the development of green building is attributed to lack of capacity. 15.7% strongly agreed; 20% were neutral; 18.6% disagreed; 2.9% strongly disagreed, and 8.6% were unsure (Figure 5).

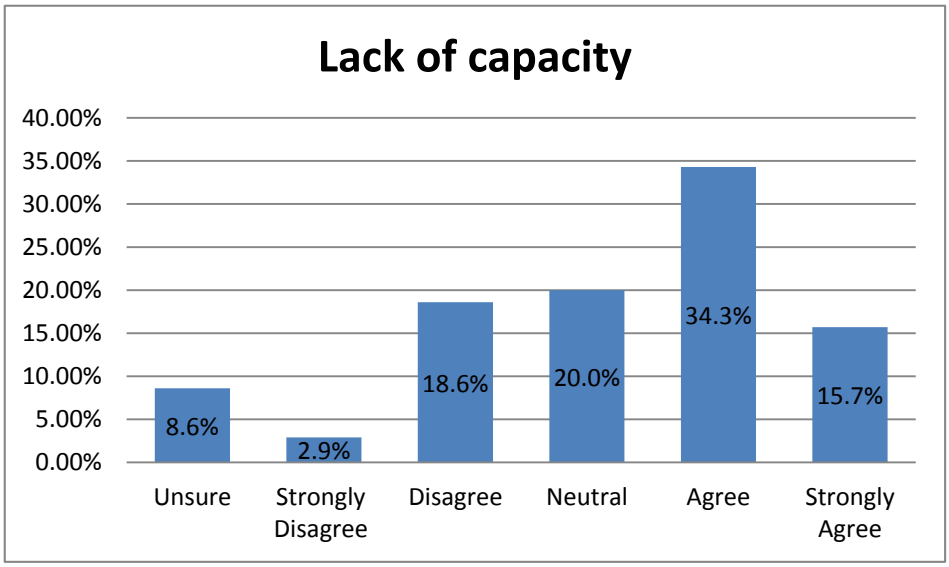

Figure 5 Lack of capacity

4.6 Delays in obtaining certification and permits for green buildings in terms of statutory permits

Figure 6 shows that 25.4% of the sample agreed that delays in obtaining certification and permits for green buildings in terms of statutory permits impacts negatively on the growth of green building, and 15.5% strongly agreed. However, 22.5% were neutral, 15.5% disagreed, and 19.7% were unsure. A percentage of 1.4% was recorded for strongly agree.

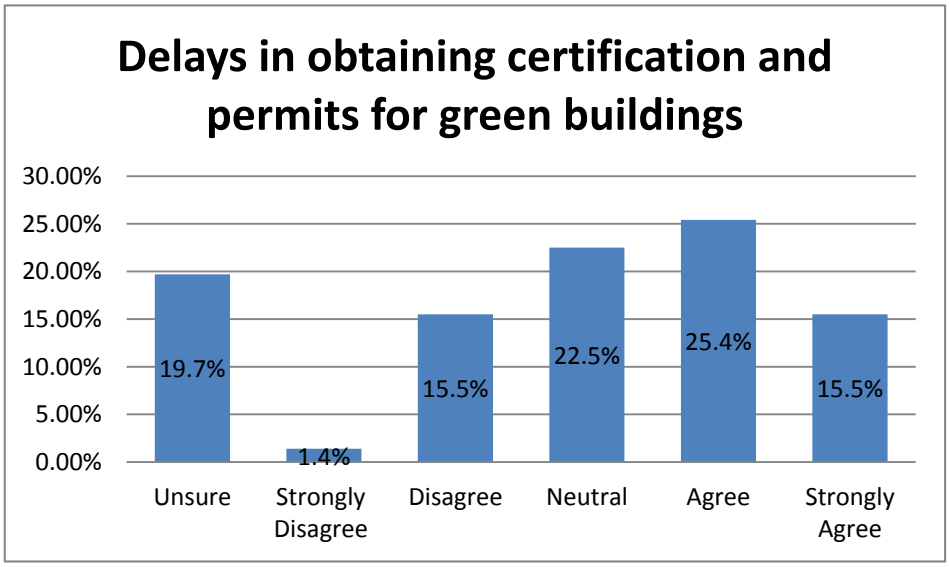

Figure 6 Certification and permits for green buildings

The responses to the survey were subsequently ranked using a mean score (MS) ranging between 1.00 and 5.00 to rank the factors that impede the growth of green building in the industry (Table 1). It is notable that all the eight factors listed in Table 1 have MSs above the midpoint of 3.00, which indicates that in general the respondents can be deemed to agree with all the statements.

Lack of incentives for promoting green building, which is ranked first with a MS of 4.86, may have the greatest negative impact on the growth of green building, followed by inadequate cost data for green buildings (4.49), inadequate information regarding the financial and economic benefits and opportunities of green buildings (4.44), inadequate cost data for greening existing buildings, (4.35), and a limited range of green products and materials (4.27). Given that the MSs of the aforementioned are $> 4.20 \leq 5.00$, the concurrence is between agree to strongly agree / strongly agree. Cultural and social resistance with (4.17), lack of capacity (4.16), and delays in obtaining certification and permits for green buildings (3.79) have MSs $> 3.40 \leq 4.20$, which indicates the concurrence is between neutral to agree / agree.

Table 1 Ranking of the factors impacting negatively on the growth of green building

Factor	Mean	SD	Rank
Lack of incentives for promoting green building (e.g. financial and non-financial incentives)	4.86	1.16	1
Inadequate cost data for green buildings	4.49	1.36	2
Inadequate information regarding the financial and economic benefits and opportunities of green buildings	4.44	1.18	3
Inadequate cost data for greening existing buildings	4.35	1.44	4
Limited range of green products and materials	4.27	1.19	5
Cultural and social resistance	4.17	1.50	6
Lack of capacity	4.16	1.43	7
Delays in obtaining certification and permits for green buildings	3.79	1.69	8

4.7 Lack of incentives for promoting green building

The findings of this study confirmed that there are inadequate mechanisms in place for promoting green building in South Africa. More than half of the respondents agreed that there are a lack of incentives for promoting green building. This result confirms Ndihokubwayo, Crafford & Buys' (2013) contention and it is consistent with that of Milne (2012) who asserts that the South African construction industry seems to be lagging behind in terms of the provision of incentives to developers who meet green ratings, and consultant team members who engage in green design practices on their projects and the lack of incentives for demonstrating best green practice. The provision of incentives will undoubtedly reduce the high up front cost for green projects. Arditi & Yasamis (1998) support this notion by asserting that incentive provisions are used in construction contracts to reduce contract costs, to minimise contract duration and to maintain acceptable levels in health and safety, productivity, technological progress, innovation, management efficiency, and quality of construction.

4.8 Inadequate cost data for green buildings

The responses indicated that inadequate cost data for green buildings is one of the major factors hampering the growth of green building. This view is supported by Cruywagen (2013), Milne (2012), and Kats & Capital (2003). The authors argue that there is still little published data regarding the actual costs and cost premiums for green buildings. This may imply that it is not always clear what the initial impact green buildings will have on construction costs. This finding may in part explain the resistance to green building that exists in the industry (Hoffman & Cowie, 2014), which may subsequently impact negatively on the growth of green building given that investors and developers are unlikely to change behaviour if information on the cost of green building is fragmented. This is corroborated by Nurick & Cattell (2013: 92) that the cost of implementing green building features is the main barrier to implementing green building. As a result, green building is perceived to be more expensive than conventional building making green building less competitive and attractive to investors.

4.9 Inadequate information regarding the financial and economic benefits and opportunities of green buildings

The study also revealed that there is inadequate information regarding the financial and economic benefits and opportunities of green buildings. This finding also ties in with findings from Milne (2012) who reported that while there seems to be consensus on the environmental benefits of green buildings, there is a lack of accurate and thorough financial and economic supporting information. According to Kats & Capital (2003), there is a consistent concern, both within and outside the built environment, over the lack of accurate and thorough financial and economic information regarding the benefits of green building. Naumann *et al.* (2011) argue that the benefits of green building projects are much more difficult to value since benefits are often assessed in purely qualitative terms, or quantified only in terms of the extent of green infrastructure protected or maintained.

4.10 The one-way analysis of variance (ANOVA) Test

The ANOVA test was performed to determine whether the perceptions concerning the first three factors impacting negatively on the growth of green building differ among construction participants. The test in Table 2 reveals no significant difference between construction participants' perceptions for lack of incentives ($p = 0.748$), inadequate cost data for green buildings ($p = 0.949$), and inadequate information regarding the financial and economic benefits and opportunities of green buildings ($p = 0.707$). Therefore, it can be concluded that perceptions on the predominant factors impacting negatively on the growth of green building do not differ among construction participants.

Table 1 ANOVA Test

Factor		Degrees of Freedom	F	Sig
Lack of incentives for promoting green building (e.g. financial and non-financial incentives)	Between groups Within groups Total	22 47 69	0.766	0.748
Inadequate cost data for green buildings	Between groups Within groups Total	22 47 69	0.524	0.949
Inadequate information regarding the financial and economic benefits and opportunities of green buildings	Between groups Within groups Total	22 47 69	0.802	0.707

5. Conclusion and Recommendation

This paper examined some of the critical factors affecting green building implementation for the local construction industry. The study identified eight factors including; lack of incentives for promoting green building; inadequate cost data for green buildings; inadequate information regarding the financial and economic benefits and opportunities of green buildings and inadequate cost data for greening existing buildings. The others are limited range of green products and materials; cultural and social resistance; lack of capacity and delays in obtaining certification and permits for green buildings. The research findings reveal that all the factors have MSs above the midpoint of 3.00, which indicates that in general the respondents can be deemed to agree with all the statements.

It is apparent from the research findings that the lack of incentives for promoting green building, inadequate cost data for green buildings, and inadequate information regarding the financial and economic benefits and opportunities of green buildings are the three major factors affecting the growth of green buildings. The ANOVA test was conducted to check if perceptions of respondents differ with regard to the major factors inhibiting the growth of green building. However, the test revealed no significant difference, implying that there is a consensus on the part of the respondents that the factors identified are indeed critical factors hampering the progress of green building. These impediments lead to a range of consequences that affect stakeholders' (developers, client, consultants & contractors) understanding, values, behaviour, and attitudes toward green building.

Based on the perceptions expressed in the responses to the research, the following measures are recommended to improve the implementation of green buildings in the local construction industry.

The government needs to initiate a strategy by establishing various incentives schemes that will serve as a catalyst to enhance the growth of green building. The green building sector could be incentivised either through monetary or non-monetary incentives. There is a need to create a co-ordinated knowledge hub to document and provide the existing and emerging information on the true cost of going green, the benefits and performance of green building, market and environmental trends, as well as monitoring and evaluation data. This can significantly build up the industry confidence in expanding the market for green development.

The results of this study are based on perceptions of built environment stakeholders in South Africa and may differ to some extent from respondents elsewhere in the world. This creates an opportunity for further research to obtain a wider perspective on the factors limiting the growth of green buildings globally.

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