Benefits and Drivers of Implementing Green Building Projects in South Africa

O A Oguntona¹, O I Akinradewo¹, D L Ramorwalo¹, C O Aigbavboa¹ and W D Thwala¹

¹SARChI in Sustainable Construction Management and Leadership in the Built Environment, Faculty of Engineering and the Built Environment, University of Johannesburg, South Africa
Corresponding Author: architectoguntona12@gmail.com, oluseguno@uj.ac.za

Abstract-
Several negative environmental issues are attributed to the activities of the construction industry (CI) globally with South Africa as no exception. Hence, the introduction of sustainability concepts in order to address these challenges which continually threaten the health and existence of both the human and natural environment. Green building (GB) as a sustainable concept aims to address the social and economic concerns and not only the environmental issues in the built environment. The paper, therefore, evaluates the beneficial factors and ways of promoting the implementation of GB projects in South Africa. The study employs a structured questionnaire survey as an instrument for data collection. The study gathered data from construction professionals (architects, civil engineers, quantity surveyors, project managers, construction managers, and construction project managers) who are sustainability proponents. A quantitative approach to data analysis was utilised using percentage, standard deviation, and mean item score. From the data analysed, the results revealed improved indoor air quality, ecosystem protection, increased energy efficiency, enhanced health and well-being of occupants, and minimised CO₂ emissions as the top five benefits of GB projects implementation. Availability of more financing options, improved market for green products/materials, education and training on GB technologies, provision of economic incentives, and affordability of GB materials are identified as the top drivers of GB projects implementation. The findings from this study will help create awareness and encourage the adoption and implementation of GB projects which in turn has the potential to combat the severe environmental challenges caused by the activities of the CI.

Key words: Construction industry, Green building, Environmental challenges, Sustainable construction, Sustainability

1. Introduction
Construction industry plays a significant role in being the main contributor to the country’s economy. It is well-known that the construction industry has vital inputs and output activities. It assists with shaping the socio-economics of the citizens by providing relevant buildings such as schools, hospitals, and other necessary facilities, which are used to produce goods and services for the people [1]. However, the location of the building, the type of materials used, the way it is built has an impact on the individuals and the building itself [2]. Despite the positive inputs and output activities, the industry also has a negative impact on the environment, economy, and society. According to the United Nations Environment Programme [3], there is about 40% of the energy used and 30% of greenhouse gases given off globally every year in the construction industry. Construction industry excessively uses cement and steel products.
Developing countries like South Africa has an intensive consumption of resources which lead to pollution of land and air, degradation of the land and high level of energy consumed and destruction of the wild which is home to animals [1,4]. To meet up with the necessary requirement of the environment, construction industry professionals came up with the concept of green building to try reducing the effects of global warming by building an infrastructure which is environmentally friendly [4].

Sustainable development is built of dimensions namely; environmental, economic and social sustainability. Green building is a fundamental strategy to eliminate the negative impacts and improve the sustainability of the construction industry [5]. Green building is considered the practice of creating structures and using processes that are environmentally responsible and resource efficient throughout a building life cycle US Environmental Protection Agency [6]. Green building can reduce the emission of carbon dioxide, usage of energy, water, and air pollution, excessive consumption of raw materials and other negative impacts towards the environment. It saves costs to implement and build more green buildings in developing countries like Ghana and South Africa because this will reduce the carbon footprint in the future. Promotion of healthy, energy efficiency and being environmentally friendly has made green building concept a primary consideration in the recent construction of infrastructure [7]. It has, therefore, become imperative for the construction industry to adopt the implementation of green building concept due to urbanisation and high energy usage. This study is aimed at assessing the benefits and drivers of implementing green building projects in South Africa.

2. Sustainable Construction and Green Building

Sustainability is a term which is associated with activities that have the thoughts of accomplishing eco-friendliness [8]. The concept of sustainability was created to discover solutions to the negative activities upon the environment as results of human actions [9]. The construction industry can cause negative effects to the environment by means of waste generation, excessive usage of natural resources, pollution of air, wastes, water, and other damages to the environment [10]. It is involved with excessive use of raw materials which results in land degradation, pollute air and water, produce a sizeable amount of waste and high energy usage [1]. The negative impacts arising from the construction activities can be amended by developing a sustainable venture to carry out construction projects.

Sustainability and green buildings are the terms which can be used interchangeably. Green building (GB) is broadly acknowledged concept which works on implementing sustainable development, that considers the environmental, economic and social structures [11,12]. There are three pillars of sustainability namely environment, society and economy which form a greater part of the supportability rating frameworks and have been produced in accordance with the pillars [13]. Green buildings are buildings that use resources like energy, water, materials and more efficient than buildings that are built to code [14]. These buildings are designed, built and operated to boost health, environmental, productivity and economic performance over the conventional buildings. US Green Building Council [15]. Gunnell [4] defines green buildings as buildings that are designed and built up to be energy and water efficient and use the building materials that are bio gradable and not harmful to the environment and administer healthy working/staying surroundings. Furthermore, [16] defined a green building as a facility that is healthy, designed and constructed with ecological principles and efficiently used resources. Likewise, [17] states a green building as a high-performance building that has minimal impacts on human health and the environment. He further noted that a green building is not only
designed to consider and reduce its lifecycle environmental impacts but its water and energy consumption as well. Major characteristics of green buildings include improved environment and human health, natural and material resources efficiency, and water and energy efficiency. Green buildings are not only designed, built, and operated to have better environmental performance, but to also improve productivity and the health and well-being of occupants [18].

2.1 Benefits of Green Building Projects
The population of the world is increasing daily and it is estimated to grow from 7 billion to 9 billion by 2050 according to the United Nations Environment Programme [3]. The more the population grows, it will result in massive pollution of water and air, which put a strain on the environment. Additionally, increases the demand for water, energy and natural resources thus it overburdens the ecosystem. The benefits of the green building are extensive, and they consist of the sustainability aspects namely economy, environment and social [3,19]. Researchers argued that from the building life cycle perspective green building performs better than conventional building and they identified various benefits relating to green building. There are financial benefits derived from the reduced consumption of energy and water, lower maintenance and operational costs, in addition to improved health and productivity efficiency increase of ten times higher than the additional construction costs required to meet the green design criteria. Furthermore, it is argued that adopting green building saves approximately 30% of energy. Moreover, according to [17] green building uses less energy and water of approximately 30 to 50% compared to conventional buildings. The study by [20] showed that green buildings reduce approximately 60% of energy and water consumption in buildings which significantly reduce the operation costs. He further on, mentioned green building brings the higher market value of 10% and the higher rental rate ranges from 5% to 10%. There are six green buildings using from 25% to 75% less energy and code-compliant buildings in the United States [21]. Adding to this, [22] found that green manufacturing facility by Leadership in Energy and Environmental Buildings (LEED) green rating system reduces energy by 30% and increases the productivity of the employees by 25%. Green buildings offer many benefits in developing countries just like in developed countries. Here are some of the similar benefits discovered by numerous researchers: Monetary Benefits of the Green Building Concept [23-25]; Higher Return on Investments Through Green Building [26]; Green Building’s Marketability [23,27,28]; The Efficiency and Productivity of The Green Buildings [22,26,29]; Attracting and Retaining Corporate and Government Tenants [27,30]; Reducing Liability and Risk through Green Building [17,26].

2.2 Drivers of Green Building
In recent years, green building technologies have gradually been implemented to minimize the negative impacts of the construction industry on the environment, economy, and society. In order to encourage widespread adoption of green building technologies, a better and deeper understanding of the drivers for implementing green building technologies is necessary. Love [31] conducted a study which identifies the drivers of the green building in Australia as the need to improve occupant’s health and well-being, improving multidisciplinary collaboration, increasing the conversation of non-renewable resources, reduction in whole life cycle costs, marketing and landmark development, and attract the premium clients and high rental returns. As identified by [32], there are main drivers toward sustainable construction as energy conservation, resource conservation, and waste reduction. In addition, [33] disclosed that building up a green reputation and good image, gaining competitive advantage, commitment on corporate social responsibility, reduction construction costs, developing unique green
products and maintenance costs are the most important driving factors of green building in Chinese built environment sector. Serpell [34] highlighted the dominant drivers of green building to be corporate imagine, cost reduction and market differentiation in Chile. Bond [35] highlighted the drivers of the sustainable development within the business property of New Zealand as ecological effects, occupant’s demand, money related advantages, corporate social obligation and beliefs by the individuals. Falkenbach [36] categorised the drivers of the green buildings into external drivers, corporate-level and property-level drivers based on the previous research related to sustainability.

2.2.1 External Green Building Drivers. External drivers can be described as the drivers which are set by organisations such as the United Nations (UN), governments, trade unions, organisations and companies that are building green. Many governments have increased their involvement with green building development in the past years. Governments also adopted regulations and policies which offer incentives as a part of promoting green building technologies and energy efficiency [37]. The green building phenomenon is becoming more common in many countries and it is expected to grow and include more regulatory requirements [38]. Europe was the first one to come up with regulations which commission energy efficiency and comfort improvements of the buildings [39] and this was motivated by the need to reduce the energy consumption of the conventional buildings. The governmental regulations and policies were proved to be effective in driving and promoting the green building awareness [40]. Kyoto Protocol is an international policy endorsed by the United Nations (UN) which requires state parties globally to commit in reducing the greenhouse gas emission [41], which is one of the regulations driving the green building implementation and adoption.

2.2.2 Corporate-Level Green Building Drivers. Image benefit is one corporate-level driver which was identified by the [36]. Uniqueness is one way to gain a competitive advantage to the property. It is necessary to establish a good reputation for the organizations in order to make it in their industries. Andelin [38] states that corporate image reflects a company’s values and it defines the attractiveness of the company and its products in the market. According to [33] company’s commitment to the green building can be a good image to the company and building a good reputation and gaining competitive requires one to adopt a good green strategy to their businesses. Three biggest drivers towards pursuing green building practices are identified as corporate image, culture, and vision. Key drivers for organization to adopt GB is to invest in GB and achieve the high standard environmental performance, social performances which attract the customers thus increasing the organisation’s culture. [42,43]. A study in South Africa by [44] concluded that a good public image was the top driver for construction firms to look out for when considering green practices. A company can increase its image by showing its commitment through social responsibility.

2.2.3 Property-Level Green Building Drivers. Stakeholders such as tenants are demanding green buildings due to the benefits it offers such as environmental impact and occupancy cost. Reed [45] believes that stakeholders can maximise the capital value of the buildings by decreasing costs, increasing income and decreasing the capitalization rates. Green building can reduce the operations and maintenance costs of the buildings and this drives the green building market.

3. Research Methodology
This research study adopted the quantitative research approach to evaluate the benefits and drivers of green building projects in South Africa. Quantitative research is the systematic
process of testing and evaluating the variable interactions [46]. The study was carried out in the Gauteng province of South Africa. The combination of literature review and structured questionnaire survey was used to achieve the aims of the study. The targeted population for this study is construction stakeholders (Construction Project Managers, Architects, Quantity Surveyors, Construction Managers, Civil Engineers, and Structural Engineers) in the South African construction industry who are knowledgeable regarding green building projects and are aware of its benefits and the drive behind the concept. Random sampling was used for the research study because there is a large group of respondents and individuals needed to be given an equal chance of being part of the study. The questionnaire was developed using information gathered from the reviewed literature. Statistical Package for Social Sciences (SPSS) Version 22 software was employed for the analysis of retrieved data using descriptive statistics (mean item score) and standard deviation tools. Reliability test was carried out on the data collection instrument using Cronbach’s alpha and the result shows that benefits of green building projects and drivers of green building projects have 0.842 and 0.838 values respectively.

4. Findings and Discussion

4.1. Background Information of Respondents
Findings relating to the professional qualification of the respondents revealed that 17.6% are architects, 21.6% are quantity surveyors, 13.7% are civil engineers, 19.6% are construction projects managers, 19.6% are construction managers and 7.8% are structural engineers. The findings further revealed that 19.6% of the respondents have a diploma degree, 19.6% has a master’s degree and 2.0% has a doctorate degree. 66.7% of the respondents work for private organisations and 33.3% works in government establishments. Findings also revealed that 37.3% of the respondents had an experience that ranged from 1-5 years, 43.1% had an experience in the range of 6-10 years while 19.6% has an experience range from 11-15 years. Furthermore, findings relating to the numbers of the green building projects the respondents are currently involved in showed that 45.1% are currently not involved with any project, 25.5% are currently involved with 1-2 projects, 17.6% are involved with 3-4 projects, 5.9% are involved with 5-6 projects, 2.0% are currently executing 7-8 projects and lastly 3.9% are involved with more than 8 projects. Findings relating to the respondents’ number of green building projects previously involved in, revealed that 17.6% had never been involved in any green building project, 39.2% were previously involved with 1-2 projects, 25.5% were once involved with 3-4 projects, 15.7% were previously involved with 5-6 projects and 2.0% were once involved with 7-8% projects. Based on this, the responses of the 17.6% who has never been involved in a green building project were removed from the analysis.

4.2. Benefits of Green Building Projects in South Africa
The result in Table 1 reveals the respondent’s ranking of potential benefits of green building projects in Gauteng, South Africa. It reveals that improve indoor air quality was ranked first with mean score of 4.69 and (SD) = 0.510, protect ecosystem was ranked the second with mean of 4.65 and (SD) = 0.559, increase energy efficiency has been ranked the third with mean of 4.63 and (SD) = 0.564, enhance health and well-being of occupants was ranked the fourth with mean score of 4.61 and (SD) = 0.658, minimise CO₂ emissions was ranked the fifth with a mean score of 4.59 and (SD) = 0.669. The respondents ranked decrease in healthcare costs eighteenth with a mean score of 3.92 and (SD) = 1.036, alleviate poverty was ranked nineteenth with a mean score of 3.49 and (SD) = 1.120 and reduce absenteeism of employees was ranked the twentieth with a mean score of 3.20 and (SD) = 1.281.
The findings of the study revealed that green building adoption in the construction industry will improve energy efficiency and minimize CO₂ emissions as submitted by [17] and [20] that green buildings reduce approximately 60% of energy and water consumption in buildings which significantly reduce the operation costs. With the energy efficiency of the building put in place, resource consumption is reduced to the barest minimum which, therefore, increases the rental value of the building, enable higher investment return and lower maintenance cost.

### 4.3 Drivers of Green Building Projects in South Africa

Table 2 shows the respondents ranking of drivers of the green building projects development. It reveals that availability of more financing options was ranked the first with mean score of 4.53 and (SD) = 0.504, improved market for green products and materials was ranked the second with mean score of 4.47 and (SD) = 0.504, education and training on green technologies was also ranked the second with mean of 4.47 and (SD) = 0.542, providing economic incentives was ranked the fourth with mean score of 4.45 and (SD) = 0.577, improved affordability of the green building materials was ranked the fifth with a mean score of 4.45 and (SD) = 0.642, providing green building innovation and certification was ranked the thirtieth with mean score of 4.16 and (SD) = 0.162, providing green building innovation and commitment was ranked the seventieth with mean score of 4.02 and (SD) = 0.707.

| Ways to promote development of green building projects | mean | Std. Deviation | Rank |
|--------------------------------------------------------|------|----------------|------|
| Availability of more financing options                  | 4.53 | 0.504          | 1    |
| Improved market for green products and materials         | 4.47 | 0.504          | 2    |
| Education and training on green technologies            | 4.47 | 0.543          | 2    |
Providing economic incentives 4.45  0.577  4
Improved affordability of the green building materials 4.45  0.642  4
Improving government support and intervention 4.41  0.606  6
Increasing client demand 4.29  0.576  7
Increasing conservation of non-renewable resources 4.29  0.642  7
Increasing clients premium and high rentals 4.29  0.701  7
Increased use of reusable and recyclable building elements 4.25  0.717  10
Developing policy monitoring system 4.24  0.710  11
Improving green building technology 4.18  0.623  12
Providing green building innovation and certification 4.16  0.612  13
Improving the performance of national economy 4.16  0.809  13
Improving multi-disciplinary collaboration 4.10  0.640  15
Increasing property values 4.06  0.810  16
Providing green building innovation and commitment 4.02  0.707  17

These findings are in agreement with the submissions of [37] and [38] that green building is driven by government providing economic incentives by making more financing options available for investors. This is an indication that when the government gives support and intervention to the key stakeholders of the construction industry, there is an upward shift in the adoption of green buildings. This also means that there will be an improved market for green products and materials thereby improving the affordability of green building materials. Also, the findings agree with [40] who opined that developing policy monitoring by the government proved to be effective in driving and promoting green building awareness.

5. Conclusion and Recommendations
This research paper aims to evaluate the green building projects in South Africa construction industry and promote green sustainability. In order to achieve this, the benefits and drivers of green building were examined. Based on the findings from the gathered data within the Gauteng province of South Africa, the major benefits and drivers of the green building were identified. From the study, it can be concluded that green building projects are the future of the construction industry, they consist of many benefits which are not only based on the buildings itself, but also the environment, social responsibility and the overall economy. There are numerous ways which green building benefits the world from reducing the emission of carbon dioxide, which is the global problem, and pollution of air and water, protect the ecosystem, reduces operational and maintenance costs, reduces water and energy consumption, it improves the building air quality and many more. It can also be concluded that the best way to promote the development of green building in the construction industry is for the government to make more financing options available to key stakeholders of the construction industry. It is, therefore, recommended that the government set up regulations and policies that will gear up the construction industry stakeholders to fully implement green buildings. This, in turn, have the potential to combat the severe environmental challenges caused by the activities of the CI. The study was limited to Gauteng province of South Africa due to time and cost constraints, further study can, therefore, be carried out in other provinces of South Africa for a nationwide overview of green building benefits and drivers for the construction industry.

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