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The Market for Green Buildings in Sub-Saharan Africa: Experts Perspective on the Economic Benefits in Ghana

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Abstract: Part of the ideals of promoting sustainability is the green building (GB) concept. Nevertheless, the uptake and use of GBs amongst most stakeholders in Africa are still on the low. Despite the plethora of studies on the economic benefits of green building, there is a dearth in studying the benefits in Africa. Within these economies, the presence of market restrictions, socio-cultural and political factors may mitigate against these benefits. This study seeks to unearth the economic benefits of GBs within the context of a sub-Saharan African country, Ghana. By adopting a quantitative research approach, a comprehensive literature review was first conducted. This was followed by the use of a questionnaire survey. A structured questionnaire was issued to building consultants in Ghana to elicit their perspectives on the economic gains of GBs. Mean scores, Wilcoxon signed-rank test and Kruskal-Wallis H test were respectively used to rank and assess the level of agreements amongst the various consultants on the economic benefits. Five economic benefits were identified from the study. This includes savings in energy, lower lifetime cost, lower operational cost, increased work productivity and "transforms the construction industry". The findings show that most of the economic benefits identified from literature cannot be realised in the study region, including "high return on investment" and "increase in building value". Consequently, building energy cost seems to play a crucial role in pushing the demand for the GB within the study milieu. The study provides a contextual understanding of economic benefits, useful to construction clients, property owners, real estate investors, consultants and the research environment. The findings are useful in providing market enablers to enhance a large-scale uptake of green construction. It is recommended that the provision of GBs should not be limited to only its impact on the environment and sustainability but also affordability concerns. This study provides a unique contextual perspective on the economic benefit of GB in a sub-Saharan African country.

Keywords: Green building market, Building consultants, Ghana, Economic benefits, Sustainable development

INTRODUCTION

African urban residents are projected to grow from 11.2% in 2010 to 20.2% by the year 2050 (Saghir and Santoro, 2018). The global population is expected to grow to 10 billion by that time (UN-DESAPD, 2019). Meeting this demand requires the construction of buildings and annual investment in infrastructure. These construction

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works have a considerable impact on the environment. Africa offers one of the greatest potentials for growth and subsequently change in the drive against CO^2 emission and climate change (Hogarth, Haywood and Whitley, 2015).

The primary objectives of sustainable development are to achieve environmental, social and economic sustainability (Darko and Chan, 2017). Massive awareness has been created to minimise the adverse effects of construction activities on the environment (Chan et al., 2016). The enormous demands from the construction industry have exerted immense pressure on resources and the environment (Darko and Chan, 2017). These have resulted in acid rains and global warming, which have contributed to unsustainable development (Asadollahfardi et al., 2016). To curtail this shortfall, green building (GB) has been adopted as one of the innovative ways to promote sustainable development (Darko and Chan, 2017). Some benefits derived from GB include good health and well-being, protection of the environment and energy efficiency (Chan et al., 2016). It has been purported that the cost of design and construction at the initial stage is high compared to conventional buildings (Dwaikata and Ali, 2016).

Nevertheless, studies report financial benefits of savings of health, safety costs and energy costs, as there is a reduction in consumption of energy. Moreover, considering the cost of maintenance of buildings, it is more cost-effective to have GBs. That is because less is spent on operations and maintenance costs – as well as the cost involved in reducing pollution in the long run (Dwaikata and Ali, 2018). Olubunmi, Xia and Skitmore (2016) observed that GB business could be measured as an investment that accrues value over some time. GB offers new job opportunities to stakeholders in the building industry as new construction materials, construction methods and designs are developed and adopted. It is perceived that due to the high performance of GB, which leads to satisfaction of tenants and increase in productivity of occupants at workplaces, demand by clients will increase. That will lead to the creation of a competitive market. Despite these economic benefits, GB adoption in Ghana leaves much to be desired (Darko and Chan, 2017). Ofori (2012) has already argued the need to explore explicitly the construction industry from the perspective of developing countries. Presenting contextual differences in performance within developing countries, Ofori (2018) was of the view that to improve, it is imperative to advance knowledge from the context of developing countries. Cobbinah, Erdiaw-Kwasie and Amoateng (2015) contend that the approach to sustainability should consider the ramifications of poverty and urbanisation present in most developing countries. Granovetter (1985), in his seminal work, posits the strong influence that social factors play within the economic space. He opines that individuals do not act as social robots, neither are they, but they are asocial beings. According to Granovetter, an individual's behaviour is affected by, influenced by, even directed by social structures and relations but not determined by them (Storr, 2008). Consequently, Granovetter avoids the pitfall of either having an over or under-socialised view of the individual (Storr, 2008).

Extant literature is replete with studies on the economic benefits of GBs (Dwaikata and Ali, 2018; Zhang et al., 2017). However, there is little known about how these economic benefits are received in sub-Saharan Africa. Various economic indicators and social variables in sub-Saharan African countries such as Ghana present a unique context. Due to that, it is imperative to investigate how stakeholders perceive the economic benefit of green construction. What are the economic benefits of GB in the construction industry in developing markets like

Ghana? This study seeks to uncover the economic benefits of GB in Ghana. The study investigates this by exploring the perception of building consultants in Ghana. For this study, the buildings in focus include both commercial and non-commercial buildings. The sections that follow present a review of the Ghanaian construction market, the property market and the economic benefits for GB.

There is a deficit of housing in Ghana, accompanied by infrastructure such as road networks not being entirely developed (Ghana Statistical Service, 2014). In Ghana, real estate is more attuned to homeownership, with very few engaging in commercial property investment (Megbenu, Nuamah and Muomaalah, 2013). The general perception of real estate investment by the financial sector is of high risk (Megbenu, Nuamah and Muomaalah, 2013). For example, in Ghana, mortgages are offered at a rate of 34% (CAHF, 2019). The Global Financial Index Report 2019 indicates that in 2015, 42% of Ghanaians did not have access to formal financial services (World Bank, 2018). Unfortunately, only about 9% of households can afford the cheapest formal sector dwelling on the market (CAHF, 2019). While there are challenges to financing the property sector, there is a huge gap in meeting the increasing demand and need for these properties. In bridging this gap, construction activities exert pressure on the utilisation of natural resources resulting in adverse effects on the environment. What follows is a review of various economic benefits of GB.

A REVIEW OF ECONOMIC BENEFITS

For any business venture, one key criterion is a high return on investment. Research studies conducted in Singapore showed that property portfolios with a greater concentration of green properties outperform the market. Although this was realised appreciably after 2007 when the Singaporean government implemented environmental policies (Zhang et al., 2017). GBs achieve higher rents and keeps remarkably greater occupancy (Olubunmi, Xia and Skitmore, 2016). The enhanced performance in the rental market is mirrored in a substantial premium for the selling price of Energy Star-labelled and LEED-certified properties (Leskinen, Vimpari and Junnila, 2020). Leasing space in a GB gives a strong indication of the social awareness and superior social responsibility of the occupants. As a result, tenants may be willing to pay higher rents for GB (Jang, Kim and Kim, 2018). Moreover, the market value of a property is as great as the clients are willing to pay for it.

As the property market value appreciates, there is enhanced building marketability. The marketability of the building is not difficult among clients who understand the benefits of GB. According to Ciora, Maier, and Anghel (2016), 10,000 commercial buildings with LEED or Energy Star label from a study conducted on the US market were classified into 900 clusters based on location, indicated an increase in the selling price of 16%. The percentage increase of the selling price demonstrates the degree of marketability. The factors considered in the construction of GB and the comfort it gives its occupants increased the value on them. De Ruggiero et al. (2017) indicated that an Energy Star and LEED building is sold at a premium from 13% to 30%, respectively. That situation shows the extent of value GB poses. Some studies have shown that due to the easy marketability of GB, one of the economic benefits of its development is access to loans. Taking the case of Singapore, cash motivations are bestowed onto project consultants and

developers of new buildings of the gross area of at least 2,000 m^2 with a green mark gold rating achievement (Building and Construction Authority, 2018).

The lower lifecycle cost associated with GB development is another major economic benefit. Comparatively, GB has lower lifetime costs than unsustainable buildings (Simbanegavi et al., 2019). Dwaikata and Ali (2018), in their case study of the lifecycle cost of the Malaysian Real Estate and Housing Developers Association (REHDA), stated that energy cost constituted about 48% of the total life cycle cost of the building. Consequently, reducing energy consumption through GB development will contribute to the reduction of the lifetime cost of the building. Zhang et al. (2017), in the study of the cost-benefit of GB, indicated that GB ensures to achieve about 19% of lower aggregate operational cost. Going green aids to transform the construction industry, including increasing the utilisation of local materials (Zuo et al., 2016).

The selected construction materials affect the environmental performance due to the embodied energy and greenhouse gas emissions (Zuo et al., 2016). Some of these local materials are green, including recycled materials (Zuo et al., 2016). Using these local materials boosts the local economy. GBs also promote a healthy indoor environment (Zhang et al., 2017; Devine and Kok, 2015). With the backdrop of improved environment indoor quality, there is an increase in work productivity and improved health of occupants. In an office environment, staff health and productivity are affected by lighting levels, thermal comfort, air quality and ventilation rates (Shabrin and Kashem, 2017; Simpeh and Smallwood, 2018). Energy efficiency, according to IEA (2015), is defined as the usage of lesser energy in providing the same quality of service. GB development takes into consideration the environment and the efficient usage of resources during its construction. It is not difficult to show a building or construction is green when using energy efficiency (Gladkih et al., 2019).

Several studies have shown that increase in energy savings, high building value, lower design cost and enhancing building market were reasons that made individuals invest in GB (Simpeh and Smallwood, 2018; Dwaikata and Ali, 2018; Deng and Wu, 2014; Gladkih et al., 2019).

A conducive environment is created for workers, better indoor air, better lighting system, reduced health risks and this consequently increases productivity (Zhang et al., 2017; Kheni and Akoogo, 2015). Studies indicate that a healthy environment enhances the regularity of the workers, thereby increasing output (Dwaikat and Ali 2018). Zhang et al. (2016) pointed out that indoor environment quality, which is a feature of GBs enhanced the productivity of GB occupants. Occupants enjoy indoor air and lighting quality, which provides a conducive environment for the occupants of the building and they can work and increase productivity. The conducive working environment has a ripple effect on their health. Consequently, absenteeism from work due to illnesses is reduced to the barest minimum. The company eventually spend less on staff health as well as spending less on operational costs, maintenance costs and other accompanying costs. In the long run, revenue is maximised (Darko and Chan, 2017). These buildings are ecologically friendly and use essential resources such as water and energy efficiently (Chan et al., 2016). From the foregoing, it can be seen that several studies have identified various economic benefits for investing in the GB market. The various identified economic benefits from the literature review are shown in Table 1.

Table 1. Economic benefits of GB from extant literature

No.	GB Market: Economic Benefits	Sources
1	Lower operation costs	USGBC (2015), Mousa (2015) and Simpeh and Smallwood (2018)
2	High building value	Ciora et al. (2016), Zhang, Wu and Liu (2018) and USGBC (2015)
3	Lower lifetime cost	Windapo and Goulding (2015) and Zhang, Wu and Liu (2018)
4	Higher return on investment	Zhang, Wu and Liu (2018), Devine and Kok (2015) and USGBC (2015).
5	Help to transform the construction industry	Zhang, Wu and Liu (2018)
6	Increased work productivity	Kheni and Akoogo (2015), Gou, Lau and Prasad (2013), Devine and Kok (2015), Boyle and McGuirk (2012) and USGBC (2015)
7	Enhance building marketability	Zhang et al. (2016)
8	Reduce liability and risk	Dwaikat and Ali (2016)
9	Lower construction cost	Zhang, Wu and Liu (2018)
10	Incentive schemes	Building and Construction Authority (2018) and Zhang et al. (2016)
11	Increase in energy savings	Chan et al. (2016), Zhang et al. (2016), Zhang, Wu and Liu (2018) and Devine and Kok (2015)
12	Cooperate social responsibility advantage	Zhang et al. (2016) and Boyle and McGuirk (2012).
13	Competitive advantage	Windapo and Goulding (2015), Zhang, Wu and Liu (2018) and Boyle and McGuirk (2012).
14	Corporate image: Positive image enhancement	Windapo and Goulding (2015) and Boyle and McGuirk (2012).
15	Attract premium clients and high rental returns	Zhang (2014) and USGBC (2015).
16	Increased construction time certainty	Zhang, Wu and Liu (2018) and Simpeh and Smallwood (2018)
17	Improved project constructability	Zhang, Wu and Liu (2018) and Simpeh and Smallwood (2018)
18	Achieve high quality building	Zhang, Wu and Liu (2018) and Simpeh and Smallwood (2018)
19	Better indoor environmental quality	Windapo (2014), Devine and Kok (2015) and Boyle and McGuirk (2012).
20	Decreased tenant rent concessions	Devine and Kok (2015)
21	Less expenditure on health	Zhang et al. (2016) and Zhang, Wu and Liu (2018)

METHODOLOGY

The study adopts the positivist approach based on the paradigm that economic benefits are objective realities and can be observed, studied, measured and modelled (Bryman and Bell, 2019; Dwaikata and Ali, 2018). The research takes an objectivist ontological perspective with the view that economic benefits exist as external concepts beyond the researchers' influence (Bryman and Bell, 2019). The economic benefits of GB represent knowledge that is objectively known, having been the subject of other studies (Zhang et al., 2017; Dwaikat and Ali, 2018). The article attempts to use this existing knowledge and conduct a perceptual analysis of experts on these benefits. A quantitative method of data gathering was used, with data gathered with the aid of a questionnaire-based survey.

The review of existing literature enabled the identification of 21 economic benefits. As the study explores the perception of building consultants, the use of well-documented economic benefits provides a good basis for the study. An informal interview was conducted as part of the preliminary phase for the design of the questionnaire. The goal of this was to identify benefits that sit within the context and uncover any other benefits that may be missing from the literature. The informal interview was conducted with five key professionals who are experts in GBs and have extensive work experience within Ghana. The interviews led to the confirmation of fourteen GB economic benefits and included some of the benefits being modified to reflect the study context. The interviewees analysed the economic benefits considering the following: (1) The current business environment of the construction and property market, (2) The level of regulation, (3) The current technological level and (4) The clientele demand within the study milieu. Despite the desire for "high-quality building" and "increased construction certainty", the actual economic demand is low as these variables were omitted.

From the interview, out of the 14 identified variables, six have been modified. The modification of these variables was done to reflect the nature of the study environment and the level of development of the construction and property industry. The economic benefits used for the study are displayed in Table 2. Closed-ended questions were used for the survey questionnaire and target respondents were asked to rate these identified variables. The study adopted the use of a five-point scale ranging from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. Further, target respondents were asked to outline any other benefits not provided but deemed relevant for the study.

Table 2. Economic benefits of GB used for the study

No.	GB Market: Economic Benefits
1	Lower operation costs
2	High building value
3	Lower lifetime cost
4	Higher return on investment
5	Help to transform the construction industry including increase utilisation of local materials
6	Increased work productivity and occupancy

(*Continued on next page*)

Table 2. *Continued*

No.	GB Market: Economic Benefits
7	Enhance building marketability
8	Reduce liability and obsolesce risk
9	Lower design and construction cost
10	Easy to finance: Access to loans
11	Increase in energy savings
12	Cooperate social responsibility advantage
13	Attract premium clients and high rental returns high tenant turnover
14	Less expenditure on health

Sampling and Data Collection Method

The study adopted the use of both purposive and snowball sampling approaches. The criterion used for the purposive sample was building consultants with knowledge of GB practice in Ghana. Such a group is difficult to define in terms of population size as there is no professional body or database that such individuals can easily be accessed. In addition to the above, the various professional bodies do not group such individuals into such segments. Consequently, the use of the snowballing approach is adopted. The drawback of such an approach leads to the introduction of bias. Despite this fact, Tenhouten (2017) opines that this non-probability sampling can aid in achieving a representative sample and thereby minimising bias where the study population is highly undefined/unstructured. The other concern was also the willingness of the target respondents to partake in the study. Anecdotal evidence points to the lack of willingness by professionals to engage in such studies within the region. As a result, target respondents were also selected based on their willingness to partake in the study. Studies have used this approach. For example, see Chan et al. (2018). The snowball sampling method was hereafter utilised in acquiring an effective and valid sample size. The initial stage in the snowball sampling was the identification of consultants – both individuals and companies who have been engaged in either the design or construction of GB in Ghana. The initially identified respondents through various referrals and their social network aided in snowballing subsequent respondents.

For this study, GB is defined as a building that has obtained a recognised international building certification such as the Building Research Establishment Environmental Assessment Method (BREEAM), South Africa's Green Star Certification, The Green Star SA-Ghana, US's Leadership in Energy and Environmental Design (LEED) Certification and the World Banks' Excellence in Design for Greater Efficiencies. A total of 123 responses were collected at the end of the survey report. The survey was done over a period of four months, within which some contacts had to be followed up. The response rate of this study is similar to studies on GB adoption in developing countries (Hwang, Shan and Supa'at, 2017; Darko, Zhang and Chan, 2017; Addy et al., 2020). The review of these responses showed that eight were incomplete and 12 were invalid. The total number of valid responses used for the survey is 103. The profile of the respondents is displayed in Table 3. The respondents comprised 26 architects, 16 engineers and 61 quantity surveyors.

Table 3. Demographic data

Variables	Freq.	Years of Experience					Level of Education				Total
		1 to 5	6 to 10	11 to 15	16 to 20	> 20	HND	First Degree	Master's Degree	PhD	
Architect	26	5	5	7	3	6	3	6	17	–	26
Engineer	16	10	4	1	1	–	–	6	10	–	16
Quantity surveyor	61	32	18	8	3	–	–	32	27	2	61
	103										103

Notes: HND = Higher national diploma; PhD = Doctor of Philosophy.

Data Analysis and Results

Statistical methods with Statistical Package for Social Sciences (SPSS) version 21.0 were adopted to analyse the dataset. For reliability assessment, Cronbach's alpha coefficient was calculated for the identified economic benefits to establishing the internal consistency of the items. The calculated value for Cronbach's alpha coefficient was 0.827, which indicates high data reliability. For the test of normality, the Shapiro-Wilk test was adopted. For this test, the null hypothesis was that the sample is from a normally distributed population. The alternate hypothesis was that it was not from a normally distributed population. A *p*-value of 0.05 was used for the test. From the analysis, all the p values were below 0.05. Resultantly, the null hypothesis is rejected, meaning that the data is not normally distributed. The mean scores of each of the variables were computed to measure the extent of agreement or disagreement on the variables. From the questionnaire, a value of 3 is considered neutral and hence for a mean to be relevant, it must have a value of more than 3.0. Resultantly, values below this are rejected as it represents a disagreement to the variable. "Increase in energy savings" was ranked first with a very high mean value of 4.02 out of the 103 responses, with "Lower lifetime cost" and "Increased work productivity and occupancy" being second and third, respectively, as indicated in Table 4.

Table 4. Analysis of GBs economic benefits

Descriptive Statistics: Means scores and Median Values					Wilcoxon Signed Rank Test		Kruskal Wallis Test of Retained Variables		
No.	**Economic Benefits**	**Mean Statistic**	**Std. Deviation**	**Median**	**Sig (p-Value)**	**Decision**	**Chi-Square**	**df**	**Asymp. Sig.**
1	Increase in energy savings	4.0215	1.10314	4	0.930	Accept	2.214	2	0.331
2	Lower lifetime cost	3.9247	0.86271	4	0.180	Accept	1.325	2	0.516
3	Increased work productivity and occupancy	3.8387	0.93588	4	0.600	Accept	0.082	2	0.960
4	Help to transform the construction industry including increase utilisation of local materials	3.8387	0.99226	4	0.160	Accept	1.784	2	0.410
5	Lower operational cost	3.8280	1.15743	4	0.590	Accept	3.435	2	0.179
6	High building value	3.6559	1.00536	4	–	Reject			
7	Higher return on investment	3.6129	0.89725	4	–	Reject			
8	Enhance building marketability	3.6022	0.92242	4	–	Reject			
9	Cooperate social responsibility advantage	3.5699	1.02573	4	–	Reject			
10	Reduced liability and obsolesce risk	3.2151	0.84506	3	–	Reject			
11	Lower design and construction cost	2.8710	1.06553	3	–	Reject			
12	Easy to finance: Access to loans	2.7957	1.01681	3	–	Reject			
13	Less expenditure on health due to environmentally friendly building	3.7549	1.13832	4	–	Reject			
14	High tenant turnover due to better indoor environmental quality	3.4608	1.07787	4	–	Reject			

The variables that were rejected include "Lower design and construction cost" and "Access to loans" with a mean value below 3.0. To check the hypothesis of the importance of these values, the Wilcoxon signed-rank test was used. This test is an alternative to the one-sample *t*-test for non-parametric data. As the data is not normally distributed, the Wilcoxon signed-rank test was used to evaluate the data at a 95% confidence interval. The null hypothesis was that the variable is relevant (H_0: η = η0) and the alternative hypothesis was that the variable is not relevant (H_a: η = η0), where η0 is the hypothesised median (η0 was fixed at 4.0). From the hypothesis test in Table 4, five of the variables had *p*-values higher than 0.05 and thus the null hypothesis was retained. The remaining variables had *p*-values lower than 0.05 and this led to the null hypothesis being rejected. This analysis shows that most of the economic benefits are not relevant within the study milieu.

For the agreement among the various groups, the Kruskal-Wallis H Test, which is a non-parametric test was used. This test is a variant of the analysis of variance (ANOVA) and useful to compare means of more than two groups while avoiding the violations of the ANOVA assumptions. After the mean score and Wilcoxon sign rank test, the five accepted variables were further subjected to the Kruskal-Wallis H Test. To determine the extent of agreement among the various professionals, the significance level was set at a conventional confidence level of 95%. The results of the analysis are displayed in Table 4. The *p*-values and the chi-square are critically examined to assess the level of significant variations among the groups. The null hypothesis is rejected if the *p*-values are less than 0.05 ($p < 0.05$). The null hypothesis posited was that there is no statistically significant difference in agreement between the different professional groups. The alternative hypothesis was that there is a statistically significant difference in agreement between the different professional groups. From Table 4, it can be seen that all the *p*-values are more than 0.05, meaning that the null hypothesis is retained. The result provides support for the fact that there is a high level of agreement amongst the various professionals on the five economic benefits.

DISCUSSION

The findings of the article present different results from what is largely known in extant studies. While in most of the advanced economies, most of these benefits can be appreciated, studies in emerging markets posit fewer benefits as compared to developed markets. In Ghana, the results posit lesser benefits in comparison to other emerging markets. A case in point, USGBC (2015) identified several economic benefits from GB in the USA including, but not limited to, lower operating costs, high return on investment, enhanced building marketability and increased productivity. Similar studies in developed economies have uncovered such results in the UK (Fuerst et al., 2015) and Canada (Darko, Zhang and Chan, 2017; Devine and Kok, 2015). However, in some Asian countries, the results differ slightly. Zhang et al. (2016) point to a lack of interest from clients in purchasing a GB with some developers not believing in GB's strong financial incentives.

However, other benefits from GB can be realised including savings in energy costs, environmental concerns, comfort, health and productivity and a company's social responsibility (Zhang et al., 2016). It is important to point out that most of the economic benefits seem to relate better to well-established markets where clients, house owners and renters know exactly what they are looking for, have access to

the capital and can consider the long-term cost. Comparing the study results to these two different scenarios further reveals how socio-economic settings affect the value of GBs. It is not surprising that very few of these benefits are valued within the study context.

The results also show that increase in energy savings is the most attractive economic incentive with GB development. Darko and Chan (2017) pointed out that energy usage within GBs is appreciably low. With high-cost savings on energy, the tenants and owners of a commercial building can save some of the capital for other operations and activities and make more profits. Zhang et al. (2016) revealed that office buildings that are green save more than 50% of their expenditure on energy consumption. It is a smart economic practice to have energy-efficient commercial buildings since you will spend less on energy with a favourable influence on performance and make more profit. In Ghana, with the expansion of four major cities, the demand for residential energy has seen a sharp increase (Kumi, 2017; Eshun and Amoako-Tuffour, 2016). The past decade has been characterised by some nationwide power outages and load shedding over certain periods indicating supply-demand mismatch (Kumi, 2017). There is also the issue of low tariffs and high subsidies, which has resulted in tariffs being repeatedly increased (Eshun and Amoako-Tuffour, 2016). Consequently, with rising building energy costs and poor power supply, it makes economic sense to invest in GBs.

The study also showed that the second most attractive economic reason for investing in GBs is the lower lifetime cost. Even though it is argued that the upfront capital for GB is expensive, its life cycle cost is low. According to the respondents, GBs development is an attractive venture in the business market due to its lifecycle cost. Comparatively, GB is noted to have lower lifetime costs than unsustainable buildings (Dwaikata and Ali, 2018). Across the life of the building, various costs are incurred, including maintenance costs and end-of-life costs. The study showed that investing in the GB would help to lower these costs. This finding agrees with the study by Twumasi-Ampofo et al. (2017). In their study, they explored selected public buildings in Ghana and revealed the high cost of maintaining such buildings. They asserted that one of the major causes of this is the use of poor-quality materials and advocated for the use of sustainable innovative building systems (Twumasi-Ampofo et al., 2017). Lifecycle cost has been a major incentive driving the uptake of GB (Olubunmi, Xia and Skitmore, 2016). The third highest economic benefit from the study is increased work productivity and occupancy. Studies in Ghana have also opined the need for better ergonomics to enhance the productivity of workers (Agbozo et al., 2017). Users of buildings will consequently prefer a GB to improve productivity than a non-GB.

The fourth rated variable for investing in GBs by construction consultants is the advantage of transforming the construction industry, including the increased utilisation of local materials. The article portends that the development of local sustainable materials and their usage will create diverse opportunities across the construction supply chain including the creation of jobs.

One of the major economic benefits of investing in GB is an increase in energy savings. The reliability and cost of building energy in Ghana have become an issue in the past decade. Boamah and Rothfub (2018) observed that there has been a recent surge in acquiring solar home systems (SHS) as power back-ups due to the energy situation by a section of the population. Boamah and Rothfub (2018) describe these groups of people as "energy elites"; individuals who require uninterrupted access to electricity and want some autonomy in electricity

provision. This seems to suggest that given the context of the study, only a niche group is and will be willing to invest in GBs. To illustrate this point further, very few clients are concerned about life cycle costs. A study on cost planning practices in Ghana revealed that life cycle cost was part of practices that were rarely done among construction professionals (Kissi, Agyei-Kumi and Badu, 2017). Maepa et al. (2017) in the review study also observed that there is a dearth of studies on life cycle assessment revealing a lack of concern for the environment and an excessive focus on initial cost. The major concerns of clients are to lower costs and complete the building. Resultantly, unless there is a substantial decrease in cost, it is expected that it will be business as usual. Interestingly, lower design, construction cost and access to loans were ranked very low and not important. That lends weight to the notion that contextual realities may restrict the drive to invest in GB (Addy et al., 2020).

Further, there are challenges in the property market associated with financing and affordability. Despite these issues, environmental concerns cannot be overlooked. Consequently, one may wonder how affordable are GBs and how many individuals have the capital outlay to go in for green? As it stands now, the economic benefit of investing in GB is not a pressing need in Ghana and only a few elites will be interested in going green. Intervention from the government and improvement on regulations in the property market will help to alleviate these challenges. Specifically, a comprehensive policy on green construction should be developed. The policy should explore the development of affordable GBs. Further, this policy could also explore the development of the local material industry in Ghana and the development of localised based technology for construction. To achieve a more comprehensive GB market, an entire value chain of interventions is required.

CONCLUSION

The study has explored the economic benefits of investing in GBs in a sub-Saharan African country, Ghana. The findings from the study provide insights into the economic benefits of investing in GB. Amongst these include energy savings, lower lifetime cost, increased productivity and transformation of the construction activity. The current regulatory and business environment may however restrict some of these benefits and limit it to only a few investors and clients with the financial capacity. It is asserted that government regulations should not only consider affordability dimensions of building products, but also sustainability. The development of the construction technology of a country and increased utilisation of sustainable local materials is imperative in achieving less environmental impact. A myriad of benefits also accrues from such initiatives, including the creation of jobs and increasing affordability; a critical criterion in developing countries. It is worth noting that the data collected were based on the perception of the building consultants rather than a typical case study against some measurable economic and business indicators. The responses, therefore, reflect their opinions and the need to investigate further these to assess their reliability. The relatively low response from the survey also provides some limitations to the study. Despite these limitations, the study provides a profound opportunity for much to be gleaned from these findings and potential value for further studies on the subject.

REFERENCES

Addy, M.N., Adinyira, E., Danku, J.C. and Dadzoe, F. (2020). Impediments to the development of the green building market in sub-Saharan Africa: The case of Ghana, *Smart and Sustainable Built Environment,* 10(2): 193–207. https://doi.org/10.1108/SASBE-12-2019-0170.

Agbozo, G.K., Owusu, S.I., Hoedoafia, M.A. and Atakorah, Y.B. (2017). The effect of work environment on job satisfaction: Evidence from the banking sector in Ghana. *Journal of Human Resource Management*, 5(1): 12–18. https://doi.org/10.11648/j.jhrm.20170501.12

Asadollahfardi, G., Panahandeh, A., Amir Khalvati, A. and Sekhavati, A. (2016). Life cycle assessment of construction phase of monorail project in Qom, Iran. *Pollution*, 3(1): 81–99. https://doi.org/10.22059/POLL.2017.59575.

Boamah, F. and Rothfub, E. (2018). From technical innovations towards social practices and socio-technical transition? Re-thinking the transition to decentralized solar PV electrification in Africa. *Energy Research and Social Science*, 42: 1–10. https://doi.org/10.1016/j.erss.2018.02.019.

Boyle, T. and McGuirk, P. (2012). The decentred firm and the adoption of sustainable office space in Sydney, Australia. *Australian Geographer*, 43(4): 393–410. https://doi.org/10.1080/00049182.2012.731304.

Bryman, A. and Bell, E.A. (2019). *Social Research Methods*. 5th Ed. Oxford: Oxford University Press.

Building and Construction Authority (2018). *Sustainable Construction Materials for Buildings*. Singapore: Building Construction Authority. https://doi.org/10.1080/19373260.2010.491641.

CAHF (Centre for Affordable Housing Finance) (2019). *Housing Finance in Africa: A Review of Africa's Housing Finance Markets*. Johannesburg: Centre for Affordable Housing Finance in Africa (CAHF). Available at: http://housingfinanceafrica.org/app/uploads/2019_yearbook-20.12.2019-compressed.pdf [Accessed on February 2020].

Chan, A.P.C., Darko, A., Ameyaw, E.E. and Owusu-Manu, D.G. (2016). Barriers affecting the adoption of green building technologies. *Journal of Management in Engineering*, 33(3): 04016057. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000507.

Chan, A.P.C., Darko, A., Olanipekun, A.O. and Ameyaw, E.E. (2018). Critical barriers to green building technologies adoption in developing countries: The case of Ghana. *Journal of cleaner production*, 172: 1067–1079. https://doi.org/10.1016/j.jclepro.2017.10.235.

Ciora, C., Maier, G. and Anghel, I. (2016). Is the higher value of green buildings reflected in current valuation practices? *Accounting and Management Information System*, 15: 58–71,

Cobbinah, P.B., Erdiaw-Kwasie, M.O. and Amoateng, P. (2015). Rethinking sustainable development within the framework of poverty and urbanisation in developing countries. *Environmental Development*, 13: 18–32. https://doi.org/10.4324/9781315658834.

Darko, A. and Chan, A.P.C. (2017). Review of barriers to green building adoption. *Sustainable Development*, 25(3): 167–179. https://doi.org/10.1002/sd.1651.

Darko, A., Zhang, C. and Chan, A.P.C. (2017). Drivers of green building: A review of empirical studies. *Habitat International*, 60: 34–49. https://doi.org/10.1016/j.habitatint.2016.12.007.

De Ruggiero, M., Forestiero, G., Manganelli, B. and Salvo, F. (2017). Building's energy performance in a market comparison approach. *Buildings*, *7*(1): 16. https://doi.org/10.3390/buildings7010016.

Deng, Y. and Wu, J. (2014). Economic returns to residential green building investment: The developers' perspective. *Regional Science and Urban Economics*, 47: 35–44. https://doi.org/10.1016/j.regsciurbeco.2013.09.015.

Devine, A. and Kok, N. (2015). Green certification and building performance: Implications for tangibles and intangibles. *Journal of Portfolio Management*, 41(6): 151–163. https://doi.org/10.3905/jpm.2015.41.6.151.

Dwaikat, L.N. and Ali, K.N. (2018). Green buildings life cycle cost analysis and life cycle budget development: Practical applications. *Journal of Building Engineering*, 18: 303–311. https://doi.org/10.1016/j.jobe.2018.03.015.

_____. (2016). Green buildings cost premium: A review of empirical evidence. *Energy and Buildings*, 110: 396–403. https://doi.org/10.1016/j.enbuild.2015.11.021.

Eshun, M.E and Amoako-Tuffour J. (2016). A review of the trends in Ghana's power sector. *Energy, Sustainability and Society*, 6: 9. https://doi.org/10.1186/s13705-016-0075-y.

Fuerst, F., McAllister, P., Nanda, A. and Wyatt, P. (2015). Does energy efficiency matter to home-buyers? An investigation of EPC ratings and transaction prices in England. *Energy Economics*, 48: 145–156. https://doi.org/10.1016/j.eneco.2014.12.012.

Ghana Statistical Service (2014). *Gross Domestic Product 2014*. Accra, Ghana: Ghana Statistical Service. Available at: http://www2.statsghana.gov.gh/docfiles/publications/2014%20GDHS%20%20Report.pdf [Accessed on September 2019].

Gladkih, A.M., Konyuhov, V.Y., Galyautdinov, I.I. and Shchadova, E.I. (2019). Green building as a tool of energy saving. *IOP Conference Series: Earth and Environmental Science*, 350: 012032. https://doi.org/10.1088/1755-1315/350/1/012032.

Gou, Z., Lau, S.S.-Y. and Prasad, D. (2013). Market readiness and policy implications for green buildings: Case study from Hong Kong. *Journal of Green Building*, 8(2): 162–173. https://doi.org/10.3992/jgb.8.2.162.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91(3): 481–510. https://doi.org/10.1086/228311.

Hogarth, J.R., Haywood, C. and Whitley, S. (2015). *Low-carbon Development in Sub-Saharan Africa*. London: Overseas Development Institute. Available at: http://newclimateeconomy.report/2015/wp-content/uploads/sites/3/2015/11/FFS-Reform-in-Africa_NCE-ODI_final.pdf [Accessed on March 2020].

Hwang, B.G., Shan, M. and Supa'at, N.N.B. (2017). Green commercial building projects in Singapore: Critical risk factors and mitigation measures. *Sustainable Cities and Society*, 30: 237–247. https://doi.org/10.1016/j.scs.2017.01.020.

IEA (International Energy Agency) (2015). *Technology Roadmap Nuclear Energy*. Paris: IEA/NEA. https://www.oecd-nea.org/pub/techroadmap/techroadmap-2015.pdf [Accessed on March 2020].

Jang, D.C., Kim, B. and Kim, S.H. (2018). The effect of green building certification on potential tenants' willingness to rent space in a building. *Journal of Cleaner Production*, 194: 645–655. https://doi.org/10.1016/j.jclepro.2018.05.091.

Kheni, N.A. and Akoogo, M.A. (2015). Determinants of sustainable construction practices in Ghana using structural equation modelling. *Journal of Sustainable Development*, 8(3): 67. https://doi.org/10.5539/jsd.v8n3p67.

Kissi, E., Agyei-Kumi, T. and Badu E. (2017). Exploring cost planning practices by Ghanaian construction professionals. *International Journal of Project Organisation and Management*, 9(1): 83–93. https://doi.org/10.1504/IJPOM.2017.083112.

Kumi, E.N. (2017). *The Electricity Situation in Ghana: Challenges and Opportunities, CGD Policy Paper*. Washington DC: Center for Global Development. Available at: https://www.cgdev.org/sites/default/files/electricity-situation-ghana-challenges-and-opportunities.pdf [Accessed on September 2019].

Leskinen, N., Vimpari, J. and Junnila, S. (2020). A review of the impact of Green Building Certification on the cash flows and values of commercial properties. *Sustainability*, 12(7): 2729. https://doi.org/10.3390/su12072729.

Maepa, M., Bodunrin, M.O., Burman, N.W., Croft, J., Engelbrecht, S., Ladenika, A.O., MacGregor, O.S. and Harding, K.G. (2017). Review: Life cycle assessments in Nigeria, Ghana and Ivory Coast. *International Journal of Life Cycle Assessment*, 22: 1159–1164. https://doi.org/10.1007/s11367-017-1292-0.

Megbenu, E.O., Nuamah, F.A. and Muomaalah, M.M. (2013). Perception of the financial sector towards real estate investment in Sub Saharan Africa: A case study Ghana. In S. Laryea and S.A. Agyepong (eds.), *Proceedings of the West Africa Built Environment Research (WABER) Conference 2013*. Johannesburg: WABER Conference, 857–866.

Mousa, A. (2015). A business approach for transformation to sustainable construction: An implementation on a developing country. *Resources, Conservation and Recycling*, 101: 9–19. https://doi.org/10.1016/j.resconrec.2015.05.007.

Ofori, G. (2018). Construction in developing countries: Need for new concepts. *Journal of Construction in Developing Countries*, 23(2): 1–6. https://doi.org/10.21315/jcdc2018.23.2.1.

_____. (2012). *New Perspectives in Construction in Developing Countries*. Abingdon, UK: Taylor and Francis.

Olubunmi, O.A., Xia, P.B. and Skitmore, M. (2016). Green building incentives: A review. *Renewable and Sustainable Energy Reviews,* 159: 1611–1621. https://doi.org/10.1016/j.rser.2016.01.028.

Saghir, J. and Santoro, J. (2018). *Urbanization in Sub-Saharan Africa: Meeting Challenges by Bridging Stakeholders.* Washington DC: Centre for Strategic and International Studies. Available at: http://thegreentimes.co.za/wp-content/uploads/2019/03/Urbanization-in-Sub-Saharan-Africa.pdf [Accessed on September 2019].

Shabrin, N. and Kashem, S.B. (2017). A comprehensive cost benefit analysis of green building. Paper presented at the 94th IIER International Conference. Dhaka, Bangladesh, 1–2 February.

Simbanegavi, P., Shani, Z., Watkins, J. and Ramruthan, K. (2019). Making rental housing in the gap-market more affordable through green building technology. In C. Aigbavboa and W. Thwala (eds.), *CIDB 2019: The Construction Industry in the Fourth Industrial Revolution*. Cham, Switzerland: Springer, 241–251. https://doi.org/10.1007/978-3-030-26528-1_24.

Simpeh, E.K. and Smallwood, J. (2018). Analysis of the benefits of green building in South Africa. *Journal of Construction Project Management and Innovation*, 8(2): 1829–1851. https://doi.org/10.36615/jcpmi.v8i2.161.

Storr, V.H. (2008). The market as a social space: On the meaningful extra economic conversations that can occur in markets. *The Review of Austrian Economics*, 21: 135–150. https://doi.org/10.1007/s11138-007-0034-0.

Tenhouten, W.D. (2017). Site sampling and snowball sampling: Methodology for accessing hard-to-reach populations. *Bulletin of Sociological Methodology*, 134(1): 58–61. https://doi.org/10.1177/0759106317693790.

Twumasi-Ampofo, K., Ofori, P.A., Osei Tutu, E., Cobinah, R., Twumasi, E.A. and Kusi, S. (2017). Maintenance of government buildings in Ghana: The case of selected public residential buildings in Ejisu Ashanti. *Journal of Emerging Trends in Economics and Management Sciences* 8(3): 146–154.

UN-DESAPD (United Nations, Department of Economic and Social Affairs, Population Division) (2019). *World Population Prospects 2019: Highlights*. New York: United Nations. Available at: https://population.un.org/wpp [Accessed on September 2019].

USGBC (United States Green Building Council) (2015). The business case for green buildings. Available at: https://www.usgbc.org/articles/business-case-green-building [Accessed 10 February 2020].

Windapo, A.O. (2014). Examination of green building drivers in the South African construction industry: Economics versus ecology. *Sustainability*, 6(9): 6088–6106. https://doi.org/10.3390/su6096088.

Windapo, A.O. and Goulding, J.S. (2015). Understanding the gap between green building practice and legislation requirements in South Africa. *Smart and Sustainable Built Environment,* 4(1): 67–96. https://doi.org/10.1108/SASBE-01-2014-0002.

World Bank (2018). *Ghana Financial Sector Development Project*. Washington DC: World Bank. Available at: http://documents.worldbank.org/curated/en/768071536096255699/Ghana-Financial-Sector-Development-Project [Accessed on September 2019].

Zhang, L., Sun, C., Liu, H. and Zheng, S. (2016). The role of public information in increasing homebuyers' willingness-to-pay for green housing: Evidence from Beijing. *Ecological Economics*, 129: 40–49. https://doi.org/10.1016/j.ecolecon.2016.05.010.

Zhang, L., Wu, J. and Liu, H. (2018). Turning green into gold: A review on the economics of green buildings. *Journal of Cleaner Production*, 172: 2234–2245. https://doi.org/10.1016/j.jclepro.2017.11.188.

Zhang, X. (2014). Paradigm shift toward sustainable commercial project development in China. *Habitat International*, 42: 186–192. https://doi.org/10.1016/j.habitatint.2013.12.009.

Zhang, Y., Wang, J., Hu, F. and Wang, Y. (2017). Comparison of evaluation standards for green building in China, Britain, United States. *Renewable and Sustainable Energy Reviews*, *68*: 262–271. https://doi.org/10.1016/j.rser.2016.09.139.

Zuo, J., Xia, B., Chen, Q., Pullen, S. and Skitmore, M. (2016). Green building rating for office buildings: Lessons learned. *Journal of Green Building*, 11(2): 131–146. https://doi.org/10.3992/jgb.11.2.131.1.