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A Cross-Sectional Study of Utilization of Green Building Rating Tools by Selected Professionals in the Zambian Building Industry

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Abstract

Green building rating tools used for planning and assessing the impact of buildings on the environment are continually revised in line with user needs. The appropriateness of tools for the Zambian building industry depends on whether the tools adequately meet minimum green buildings standards and the country's environmental aspirations. The utilization of green building rating tools is important if Zambia is to achieve the real benefits of green buildings, however very little is known about the levels of utilization in Zambia. A cross-sectional study of 115 professionals from the building industry in Zambia was undertaken using a sequential mixed method approach, to investigate the level of utilization, preferred criteria and, the barriers and drivers to the utilization of tools. The significance of the study was that it demonstrated the association between utilization of green building rating tools and environmental, technological, economic, and social green buildings practices by selected professionals in the Zambian building industry. There is a need to use materials and practices that are locally based and promote the local economy. The technical needs were met in tools, that were considered easy to use, interesting and comprehensive. Some of the green building rating tools were considered unsuitable due to the absence of appropriate criteria and the main economic challenge was the high cost of certification. The association was significant between utilization and those involved in a variety of projects than those who were involved in only residential buildings. Barriers to utilization were a lack of government regulations on green buildings designs and the high cost of certification. The drivers were environmental benefits, the interest of developers in green buildings, and having technical skills. The study recommends a review of the current building regulations to include green buildings practices and materials and adaptation of appropriate rating tools.

Keywords

Green Buildings Rating Tools, Utilization, Criteria, Barriers, Drivers, Certification, Zambia

1. Introduction

Unsustainable building activities affect the environment, the economy, and the social status of many people in both developed and developing nations. These building activities have caused land degradation, the reduction in the underground water supply, and have depleted woodlands. Buildings are responsible for 30 percent of all greenhouse gas emissions, 65 percent of waste output, 70 percent of electricity consumption, and 12 percent of water consumption [1]. Buildings that are not constructed sustainably can affect the health, safety, comfort, and productivity of occupants [2]. The focal intention of Green buildings is to diminish and reduce the buildings' impact on the environment and human health [3]. Green buildings are designed to enhance the environmental, economic, and social interaction of occupants with minimal negative impact on the environment. Green building rating tools (GBRTS) measure the negative impact of building activities on the environment. Haapio and Viitaniemi [4] state that GBRTS is a yardstick for measuring the environmental performance of buildings and their interaction with the environment. GBRTS assess the sustainability of buildings by scoring the different criterion that adds up to the overall score for certification of the greenness of the buildings. The overall scores for various categories of criteria in GBRTS differ as well as the weighting of individual criterion [5].

The Environmental, Economic and Social Needs of Zambia

Zambia, a southern African country with a population of 17.3 million, has been affected by climate change and is characterized by low rainfall, drought, and degradation of the environment. According to Thurlow *et al.* [6], the challenges that Zambia is faced with include inadequate management of water resources, water pollution, and sanitation. The poor implementation of physical plans has resulted in building structures without essential services and efforts to include such services have put a strain on the ecosystem. Sustainability is high on the Zambian government's agenda as it is a party to all treaties and agreements to reduce greenhouse gas emissions. The environment is key in fostering sustainable development as the economic sectors depend on the existence of natural resources. Therefore, the emphasis has been placed on policies that support the conservation of natural resources sustainably. However, sustainability policies and regulations are fragmented, found in isolated pieces of legislation like the environmental or the tourism policy. There is no specific legislation that guides what type of building structures and materials should be used to achieve sustainable buildings. It is assumed that the building regulations would address environmental concerns in buildings which is not the case in reality.

From the total population, 44 percent is urbanized, and 70 percent of them, lack affordable housing and live in slums with inadequate access to water, sanitation, and extension facilities [7]. According to Chibwe [8], "80 percent of existing housing in Zambia can be classified as informal and, has limited or no formal services such as electricity, water, and sewerage". The poor utilization of resources in housing production has made construction activities unsustainable to meet the present and future population in dare need of housing in Zambia.

The Zambian building industry like other Sub Saharan African countries is growing at a fast rate. The building and construction industry contributes 27.5 percent of the Growth Domestic Product (GDP) with a growth rate of 12 percent in 2014 [9], however, since 2019 this growth has slowed down with a GDP of 2% coming down from 4.0% in 2018 [10]. The economy was hit by drought in the south and west that lowered the 2018/19 agricultural production and hydropower electricity generation considerably. Severe electricity rationing followed, and long periods of electricity load shedding dampened activity in almost all economic sectors [6].

According to the International Labour Organisation the Zambia building industry offers excellent potential for broad-based wealth and job creation, due to its labour intensity, low entry barriers for semi-skilled and unskilled labour, and high concentration of medium to small scale entrepreneurs [11]. The growth of the building industry has come with challenges of high utilization of resources (land, water, and energy). The increase in building activities threatens the availability of arable land near the cities and excessive use of water and energy on construction sites.

The housing sector affects and is affected by the environmental and economic climate in a country. Inadequate funding in the housing sector has resulted in poor and inadequate housing and according to Zambia's Vision 2030, the total housing unit backlog is about one million, and that 110,000 dwelling units are required annually to clear the backlog for the next ten years [12]. Housing development is unaffordable for many Zambian and most of the housing under construction is characterized by inadequate clean water, poor sanitary facilities like flush toilets, and the absence of services like sewer reticulation and electricity.

The social character of the population is that they live in close communities and depend on each other for sustenance. Due to the economic challenges that many of them face, households have had to engage in small businesses which are mostly carried out in their compounds. The housing type varies with individual dwellings and houses clustered into blocks where individual families rent rooms. The type of housing is basic, and the room sizes are small with few windows sometimes due to security or to reduce the cost of construction. Buildings standards are usually not followed due to cost and the materials used are substandard. The main building materials in the urban area are concrete blocks and iron sheets and there is a high dependency on the use of cement. There is very little sustainable building research and innovations lack continuity due to the unavailability of funding.

There are very few buildings that have been rated green in Zambia and most housing projects are undertaken without any assessment. There is an assumption that the professionals in the building industry undertake work with sustainable building practices and materials. Efforts to demonstrate green building practices and materials go undocumented because green buildings are considered a luxury and only undertaken by big corporate entities. Zambia has a Green Building Association that is mandated to oversee green building activities and is active in issues related to green building governance, education and technical training, advocacy, awareness-raising, and green certification that provide means for buildings to be publicly recognized as being green [13]. The association is in its infancy and has not carried out most of its mandate.

To identify the levels of GBRTS utilization and challenges associated with it, a cross-sectional study was undertaken using a sequential mixed method design. The study hypothesized that "the Zambian Building industry has environmental, technical, economic and social needs that are unique, and these influence the level of utilization of GBRTS". The gap the study addressed was to establish environmental, technical, economic, and social variables associated with the utilization of GBRTS in the study population.

2. Literature Review

2.1. Utilization of Green Building Rating Tools

The utilization of GBRTS is growing in many countries and the market value of rated buildings has also increased, for instance, 80,000 projects have participated in Leaders in Energy and Environmental Design (LEED) assessment, across 162 countries [14]. Assessed buildings are becoming attractive not only for the market value but also for the health and environmental benefits gained from these buildings. As more and more players in the building industry are using the GBRTS, even the number of tools available in the industry has increased with 70 being registered so far [15]. The leading assessment tools include British Research Establishment Environmental Assessment (BREEAM), LEED, the French High-Quality Environmental standard (HQE), Comprehensive Assessment System for the Built Environment (CASBEE), Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB), and the Australian Green Star [16].

Studies have shown that Africa has the least number of tools being utilized in the world, most of which are concentrated in the north and the south of Africa [17]. According to McGraw-Hill Construction smart market report [18], by 2015 it is expected that 51 percent of all firms in South Africa will achieve high levels of green building activity, which is more than triple the 16 percent in 2012. This shows that Africa has lagged in comparison with other continents, and the challenge is a lack of economic as well as political drive to develop new tools that are adaptable to their environment. The trend has been the adaptation of GBRTS from other regions. Attempts are being made to develop local GBRTS like the Sustainable Building Assessment Tool (SBAT) from South Africa, but the level of assessment has not yet reached that seen in other established GBRTS. Zambia has also developed the Zambia Sustainability Housing Guidelines (ZSHG), which is a guide to designing and building green buildings, but this guide cannot be used in rating buildings and, very little is known about its practical application.

It is argued that individual characteristics of each country, such as the climate and type of building stock, necessitate a unique GBRT and the downside is that to a varying degree, assessment tools for different countries vary in the use of criteria [16]. Sharifi and Murayama [19] argued on the importance of having assessment tools that are region-specific or that take into consideration adaptation to the local environment. The Green Building Council of Australia (GBCA) initially planned to adapt the LEED or BREEAM programs to suit Australian conditions, however cultural issues indicated that a locally developed rating tool would be more appropriate [20]. Gibson [21] stated that this would mean GBRTS must be sensitive to those criteria that are key to enhancing and projecting specific environmental concerns. According to Elmeligy [22], there are significant differences in terms of scope of the environmental issues addressed, metrics, and performance standards and, that it is necessary to consider special requirements for each country because each one has different needs to achieve sustainability. The challenge that most developing countries face is the lack of appropriateness of the GBRTS criteria to assess their environmental, social, cultural, and economic environment. The fact that various GBRTS are being developed worldwide, shows that there is a gap in the current tools that need to be addressed.

Zambia has lagged in developing assessment tools and there are very few buildings with green certification. The environmental, economic, and social challenges in utilizing the current tools in Zambia, is that assessment of energy, water, materials, and sustainable site may not aid in achieving sustainability in the areas of concern. For example, the climate is cool and dry from May to August, hot and dry from September to November, and warm and wet from December to April, and the concern for most parts of the year is to remove heat from the buildings using affordable ventilation systems, which may not be applicable in some GBRTS and, the materials considered sustainable in Zambia may be different from those considered in GBRTS. The construction practices are also different for different countries, and the uniqueness of each county has to be born in mind. Reed *et al.* [16] has argued that individual characteristics of each country, such as the climate and type of building stock, necessitate a unique GBRT for use and to varying degrees, assessment tools for different countries use different parameters.

2.2. The Barriers to the Use of Green Building Rating Tools

Barriers limit or hinder the development of green buildings, and also reduce the utilization of GBRTS. Several studies have explored the barriers of green buildings [23] [24] [25] [26] [27] and have classified them into the following broad groups:

1) Financial:

- Lack of funding and support from the private sector
- The high initial cost of green technologies and systems

2) Governmental:

- Unsupportive government policies and regulation
- Unavailability of incentives
- Technical;
- Lack of skilled personnel
- Lack of information and awareness

3) Cultural and market:

- Lack of environmental concern
- Bad after-sale services
- Resistance-to-change
- Lack of collaboration

Others have identified lack of building codes, regulations, awareness, and knowledge as factors that could hinder the use of GBRTS [28] [29], while others are classified them into economic, cultural, capacity/professional barriers [14] [16] [18] [30] [31] [32] [33].

2.3. The Drivers to the Use of Green Building Rating Tools

The drivers to green buildings are attraction or forces towards the utilization of GBRTS. These drivers have been divided into five main categories: external drivers, corporate-level drivers, property-level drivers, project-level drivers, and individual-level drivers [14]. According to Arif, *et al.* [34] the drivers to the adaptation of green buildings were: Regulations, cost savings through a reduction in energy costs and waste minimization; promotion of corporate green image; and corporate social responsibility. Others have included, low operational and maintenance costs and pressure of environmental regulations pertaining to emissions as major factors that drive the green building materials market across the globe [35]. Also, governments in developed countries have introduced policies and incentives to encourage green construction, which supplements the growth of this market. Others have identified the cost of assessment and actual environmental benefits as key drivers.

2.4. Criteria Section

The criteria for assessing green buildings are similar in all GBRTS, however the weighting given to each criterion differs from one tool to the other. The names for the criteria may differ but the actual parameters that are being measured may be similar. The study looked at the various criteria, selected those that were common, and used them for ranking among the respondents. Others have divided them into five categories of criteria assessment being environmental, economic, social, cultural, and management. These were further divided into, Energy, materials efficiency, indoor environment, water, waste management, transport, emissions greenhouse gas emission, land use, economic, transport, social, and management.

3. Materials and Methods

The research question for the study was: Does utilization of GBRTS depend on country-specific environmental, technological, economic, and social needs? To answer the research question, an explanatory sequential mixed method design was used to undertake the study. The quantitative data was analysed using descriptive and inferential statistics and the qualitative data was analysed using the procedure of theme development. The results of the two studies were interpreted concurrently.

A paper questionnaire survey was undertaken between July and August 2018 in Lusaka and the Copperbelt province of Zambia. The sample size was 115 participants in the survey and 30 respondents in the interviews. The sample was drawn from two major areas, Lusaka the capital city, and the Copperbelt province, the hub of the copper mines in Zambia. The selection of the study area was significant because 75 percent of the professionals were located in these two provinces. The composition of the population included all the registered architects on the Zambia Institute of Architects membership list based in Lusaka and the Copperbelt province, heads of departments in institutions training Architects and Engineers, Association of Consulting Engineers, Surveyors Institute, Zambia Institute of Planners, Zambian construction firms in grade one only and developers. A random selection of 70 architects and 20 professionals from each Institute was carried out. Information was collected using a face to face a structured questionnaire and interviews. To draw the sample population for the questionnaire, data were imputed from the study population in an excel spreadsheet and using the Rand function a random number was assigned to each name and sorted in ascending order and 150 professionals were selected. The response rate was 77 percent, which was higher than the accepted 30 percent to 40 percent used in [36] [37].

The questionnaire was divided into three sections. The first section was for social-economic data and the type of tools utilized; the second section had environmental criteria ranking questions and the third addressed barriers and drivers using the Likert scale. The dependent variable was utilization of GBRTS, while the independent variables were; years of experience, types of projects undertaken, cost of certification of GBRTS, the suitability of tools to the local environment, GBRTS were easy to use, tools were interesting to use and comprehensive. In the qualitative study, the respondents were asked to describe their understanding of GBRTS, their experience, the challenges, policies, barriers, and drivers in utilizing GBRTS.

4. Results and Discussion

The study established that 69 percent were aware of the GBRTS, only 37 percent had utilized the GBRTS. The awareness in the study was higher in comparison to Alsanad [38] who had 63 percent awareness. However, awareness of GBRTS did not translate to high utilization, and this is supported by Zhou *et al.* [39] who showed that the level of awareness on a certain green requirement is higher than the performance. The correlation between awareness and utilization was statistically significant (p = 0.005) and this correlation has been supported by Toronto green development standard (2006), which stated that public awareness about the green building was an important component in increasing the demand for green buildings.

Binomial logistic regression was run on variables that were statistically significant like profession, years of experience, type of organization, the type of projects undertaken, and gender, to see how predictable the variables were with the utilization of GBRTS as shown in **Table 1**. The variable projects show that those who had undertaken both residential and non-residential buildings had 7 times increased odds of utilizing the GBRTS compared to those that had undertaken only residential buildings, OR = 7.004 (95% CI; 2.279 - 21.5; P ≤ 0.001). This showed that those who had the opportunity to undertake a variety of projects were more likely to utilize GBRTS. There were 4 times increased likelihood that those who were architects would fall in the group that utilized the tools OR = 3.6 (95% CI; 0.911 - 14.542; P ≤ 0.051), showing that architects had greater opportunity to utilize GBRTS than the other professionals in the study population.

Table 1. Variables in the Equation for relationship between utilization and Social-economic variables.

	Unadjusted			Adjusted		
Predictors for utilization of GBRTS	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Years of experience	1.008	0.958 - 1.060	0.076	0.957	0.753 - 1.217	0.072
Gender	0.633	0.241 - 1.663	0.353	0.570	0.231 - 1.404	0.222
profession	3.639	0.911 - 14.542	**0.051**	3.339	0.821 - 14.452	0.068
Type of organization	0.241	0.041 - 0.883	**0.039**	0.151	0.029 - 0.793	**0.025**
Type of projects	7.004	2.279 - 21.522	**0.001**	2.368	0.129 - 43.351	**0.003**

4.1. The Technological Needs

Technological characteristics were the experiences of the respondents who had undertaken green building certification. **Table 2** shows that the variable cost of the assessment, even though not statistically significant (OR = 0.5, 95% CI; 0.191 - 1.546, p = 0.25) was 0.5 times less likely for the respondents to have used the GBRTS if they found them costly. The interviews revealed that low utilization

Table 2. Variables in the Equation for the relationship between utilization and technological experiences.

	Unadjusted			Adjusted		
Predictors for utilization of GBRTS	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Cost of tools	0.544	0.191 - 1.546	**0.25**	0.401	0.127 - 1.270	0.12
Easy to use	7.208	1.149 - 45.219	**0.035**	6.653	1.488 - 29.740	**0.013**
Interesting	3.789	0.989 - 14.515	**0.049**	3.659	1.282 - 10.444	**0.037**
Comprehensive	1.182	0.421 - 3.322	**0.05**	0.42	0.104 - 1.757	0.239

was associated with the high cost of certification and most clients or developers considered it a luxury to include assessment in any building project. The tools were easy to access by 76 percent of the study population, while 85 percent thought the cost of certification was high. This has been supported by Ofori and Kien and Shi *et al.* [40] [41] who stated that "It is well recognized that additional cost, incremental time, and lack of knowledge on technologies are the critical considerations for decision making on implementing green construction".

The variable easy to use was statistically significant OR = 7.2 (95% CI; 1.149 - 45.490, P > 0.035) showing that there were 7 times increased odds of the respondents utilizing the tools if they found them easy to use, however, the interviews revealed that the majority of the participants thought the tools were not easy to use (82 percent) but they considered them interesting (70 percent). They expressed a lack of experience to use the tools since most of the assessments were done by experts coming from outside of the country. The association between interesting and utilization of the GBRTS was significant and showed that there were 4 increased odds of the group that found the tools interesting to fall into the dependent variable utilization of GBRTS, OR = 3.780 (95% CI; 0.989 - 14.515, P > 0.01). The informants supported this as they found the practice of sustainability in buildings an interesting topic and, expressed the desire to use the tools as assessors.

The experience of the respondents concerning the comprehensiveness of the tools with utilization was statistically significant and there was a 1.18 increased odds that those who perceived the tools to be comprehensive would fall into the utilization group OR = 1.182 (95% CI; 0.421 - 3.322, P > 0.01). However, the informants felt that the criteria in the current rating tools were not adaptable to the local environment therefore they could not give a true value of green buildings achievements in terms of the social, economic, and cultural criteria. Less than half (45 percent) thought that the tools were relevant, others thought it was difficult to choose which tool would be more applicable to the Zambian context as they lacked criteria relevant to the environment.

The relationship between the dependable variable: type of GBRTS (LEED, BREEAM, GREEN STAR, CASBEE, and SBAT) and independent variables: profession, awareness, cost of the assessment, easy to use, relevant, and comprehensiveness of the tools, as shown in **Table 3**, was only significant in the LEED tool. There was an increased odds of 4 times that those who found the LEED tool easy to use would fall into the predicted group utilization OR = 3.9 (95% CI; 1.2 - 12.4, P > 0.01), and those who found it interesting to use had 9 times increased odds of falling into the group that utilized the LEED tool. The selection of the LEED tool to be interesting and easy to use could infer that it has the right environmental, economic, technological, and social criteria suitable for Zambia.

Table 3. Variables in the equation for the relationship between the LEED tool and selected variables.

	Unadjusted			Adjusted		
Predictors for utilization of LEED tool	Odds ratio	95% CI	p-value	Odds ratio	95% CI	p-value
Interesting	8.57	2.204	**0.021**	6.18	1.36 - 28.01	0.018
Easy to use	3.9	1.2 - 12.4	**0.021**	3.68	0.933 - 14.53	0.05
Relevance	0.864	0.283 - 2.639	0.79	0.413	0.107 - 1.59	0.2
Comprehensive	4.064	1.3 - 12.7	**0.016**	2.912	0,876 - 9.676	0.081

4.2. The Environmental Needs

Table 4 shows the preference of environmental criteria with energy use, having the highest mean scale (4.6) close to the maximum of 5 and the mode and median were (5). This implies that most people ranked energy use to have a high score in the GBRTS and it also had the lowest Std. deviation (0.5) seconded by health and wellbeing (0.7), thirdly material use (0.8), and fourthly waste management (0.9). The rest had diverse Std. (1.01 - 1.1) meaning the selection of the respondents was diverse concerning those criteria.

The midpoint of the ranking was a sustainable site and the least ranked criterion was management, this is similar to the criteria found in many GBRTS. Preference was first based on environmental criteria, economic and lastly social/cultural criteria, this is in agreement with Bahaudin *et al.* [42] who mentioned that "energy efficiency, water efficiency, and indoor environment quality are the most vital elements to be considered in the green building criteria developed by the councils under consideration, followed by site planning & management, materials & resources, environmental protection, and innovation".

The ranking of the criteria based on the relative importance index **Table 5**, shows that energy use (RII = 1) was the most preferred criterion, followed by materials use and health and well-being (RII = 0.9), and the least was social sustainability (RII = 0.7). Most of the environmental needs of the professionals have been addressed in the GBRTS, but some informants mentioned that the tools lack criteria suitable to the local environment and therefore could not give a true value of their green building achievements. Some cited SBAT to be more applicable to the African context than other tools. Others felt that the issue of green buildings was demonstrated when they used local building materials. One informant

Table 4. The descriptive results for the preference of criteria for assessment.

		Energy criterion	Health and wellbeing	Water management	Material use	Sustainable site	Waste management	Transport	Economic sustainability	Social integration
N	Valid	115	115	115	115	115	115	115	115	114
	Missing	4	4	4	4	4	4	4	4	5
Mean		4.6000	4.0435	3.5739	4.365	4.009	3.435	3.478	2.443	2.518
Median		5.0000	4.0000	4.0000	4.000	4.000	4.000	4.000	2.000	2.500
Mode		5.00	4.00	4.00	5.0	4.0	4.0	4.0	2.0	2.0[a]
Std. Deviation		0.49204	0.66743	1.05182	0.7761	1.0554	0.8898	1.1030	0.9660	1.0152

Table 5. Relative important index results for the assessment of criteria for GBRTS.

Statement: How would you rank each of the following criteria in assessing green buildings	Strongly agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly disagree (1)	Total	Total Number	A*N	RII	Rank
Energy	375	140	12	0	0	527	110	550	0.958	1
Water	325	124	18	16	0	483	110	550	0.878	4
Health and well-being	350	120	12	12	0	494	110	550	0.898	3
Material use	425	80	9	4	0	518	110	550	0.941	2
waste management	100	304	12	10	5	431	110	550	0.783	7
transport	75	328	15	8	8	434	110	550	0.789	6
a sustainable site	60	340	30	6	0	436	110	550	0.792	5
Management	50	140	45	60	20	315	110	550	0.572	10
Econ. sustainability	50	216	45	42	10	363	110	550	0.660	8
Social sustainability	25	240	60	20	15	360	110	550	0.654	9

mentioned that the building industry was slowly adapting to environmentally friendly constructions despite the current economic challenges. They cited the use of hydra form blocks in the construction of buildings as one strategy, but they were quick to mention that the building specifications are mostly aligned to concrete, thus the embodied energy of those materials is usually high and very costly.

4.3. The Barriers to the Utilization of Green Building Rating Tools

A list of barriers from the literature [29] [30] [31] [32] [33] was selected from which the respondents were asked to rank based on their preference. The results of the ranking are shown in Table 6 and the highest barrier is lack of regulations and policy to guide on the utilization of GBRTS (RII = 0.81) followed by the price of green building certification (RII = 0.7) and the least ranked barrier was the unavailability of incentives to promote GBRTS.

The informants supported this preference when they mentioned the absence of government policy in supporting the development of green buildings as a hindrance to the utilization of GBRTS. Some key informants mentioned the

Table 6. Relative important index results for barriers to utilization of GBRTS.

Barriers ranking	Very important (5)	Important (4)	Moderately Important (3)	Slightly important (2)	Unimportant (1)	Total	Total Number	A*N	RII	Rank
Lack of regulations and policy	275	92	45	34	1	447	110	550	0.81	1
The price green buildings certification	150	136	48	32	15	381	110	550	0.70	2
Lack of technical skills	140	100	78	32	16	366	110	550	0.67	3
Absence of locally developed GBRTS	130	72	96	28	21	347	110	550	0.63	4
the interest of developers in GBRTS	60	80	54	50	36	280	110	550	0.51	5
Lack of significant demand and supply of green buildings in the market	50	75	52	48	30	275	110	550	0.47	6
Lack of publicity	48	72	50	45	28	243	110	550	0.43	7
The high initial investment	43	70	48	42	20	223			0.39	8
higher costs of green products and materials	**40**	67	45	40	18	170	110	550	0.35	9
Unavailability of incentives	44	50	35	30	10	169	110	550	0.31	10

need for the government to introduce bye-laws that mandate the greening of buildings so that developers and clients buy into green technology and help finance green building projects. Literature supports these results as well, according to Fisher *et al.*, Sutherland, Golove *et al.*, Varone *et al.* and Ofori [43] [44] [45] [46] [47] governments have an important role to promote green buildings and they are the biggest clients in the building industry thus they should be in the forefront in supporting any program that encourages the rating of buildings. According to Onososen *et al.* [48] when the respondents in their study were asked on the availability of a guiding policy or framework for improvising the capacity of professionals to provide technical advice on green buildings, most of them agreed that it was non-existent while a few agreed otherwise.

The high price of green buildings certification was a barrier to utilization and the informants mentioned that there was a need to use cheaper and user-friendly tools, train both skilled/unskilled labour including occupants. In contrast, other studies found a lack of financial incentives for reducing building maintenance costs and high start-up capital investment as a barrier [49]. The lack of incentives to use GBRTS in Zambia has made green building assessment a luxury. Efforts towards greening buildings go unnoticed as a result, many professionals do not want to spend too much time applying green building technology if they will incur an extra cost when putting the information together. Some of the informants mentioned that the barrier to utilizing GBRTS was that developers and clients were not enthusiastic in assessing the greenness of their buildings, thus funding was not made available for rating green buildings.

Most of the respondents agreed that there was low capacity in the professionals to undertake green building assessment. There was a poor transfer of knowledge and the informants felt they lacked the skills to certify green buildings. The CIB report [50] found that a lack of capacity in the construction sector to implement sustainable practices was a barrier to utilization. Little information is published on GBRTS in Zambia and this was seen when the informants were asked about ZSHG, half of them were not even aware of its existence.

4.4. The Ranking of Drivers to the Utilization of GBRT in Zambia

The respondents were asked to rank 7 drivers in the order of preference (from 1 = most important to 5 = unimportant). Table 7 shows that the most preferred driver to utilizing GBRTS was regulations and policy that encourages the utilization of GBRT (RII, 0.82), followed by environmental benefits of GBRTS (0.77) and the least was the promotion of corporate green image (RII, 0.52).

The introduction of policy and regulations could drive the utilization of GBRTS because the informants felt they needed an external force that would oblige them to assess their buildings and to consider green building practices in their work. The need to have policies and regulations that support the utilization of GBRTS as a driver has been supported in the literature as seen from Varela [51] who mentioned that countries with green legislations play an important role being one of the main engines of the Green Buildings. According to Atsusaka, Samari, Fisher *et al.*, Sutherland, Golove *et al.*, Varone *et al.* and Ofori [42] [43] [44] [45] [46] [52] the role of governments in promoting green building is undeniable and effective, rules and regulations should be replaced with enforcing new ones to support green building development. Even though Alsanad [38] showed that educational programs were perceived to be the most important factor to promote and expedite efforts towards green and sustainable projects in

Table 7. Relative important index results for drivers to the utilization of GBRTS.

Question:	Very important (5)	Important (4)	Moderately Important (3)	Slightly important (2)	Unimportant (1)	Total	Total Number	A*N	RII	Rank
Government regulations	275	108	45	18	5	451	110	550	0.82	1
Envi. Benefits of GBRTS	205	132	51	32	4	424	110	550	0.77	2
Reduced cost of GBRTS	135	144	66	28	12	385	110	550	0.70	3
The interest of developers/ clients in GBRTS	145	96	87	28	15	371	110	550	0.67	4
Technical knowledge/training	125	100	78	36	17	356	110	550	0.64	5
Recognition of Green building achievements	120	95	75	33	15	338	110	550	0.60	6
promotion of the corporate green image	110	90	72	30	10	312	110	550	0.52	7

Kuwait, he agrees that other important factors include set rules and legislation. According to Chan *et al.* [53], they indicated that incentives from the government and other private parties, such as financial institutions, interested in green building developments have had the highest level of influence in driving construction stakeholders to embrace GBTs.

Reducing the cost of certification would drive the professionals towards being involved in green building assessment. Developers and client's interest and ability to pay for assessment was cited as another important driver, if developers and clients took a leading role of promoting green building practices, the professionals would be encouraged to join. Many of the informants mentioned the challenge of affordability to train as assessors and if they could have affordable tools many would engage in green building assessments. One informant mentioned that the professional's knowledge and skills in the use of GBRTS should be a driver to educate the clients and the developers on the benefits of using GBRTS and opening up opportunities for professionals to undergo training in GBRTS could drive more professionals to become assessors.

Others stated that proof that GBRTS can gauge the greenness of buildings and thus demonstrate the environmental, social, and economic benefits of green buildings, would increase utilization. It was mentioned that the driver to the utilization of GBRTS is the demonstration that the assessment of buildings will improve the health and wellbeing of the users.

Many of the informants had not heard of the ZSHG, a local green building guide developed by the Ministry of Local Government, this demonstrated low dissemination of information about green building practices among professionals. Recognition of green building achievement was ranked low among the drivers, but the informants did point out the importance of recognition of those that have achieved green buildings to encourage others to take part in green building practices and assessment.

Windapo [37] stated that in their study, people interviewed indicated that they considered marketing potential and increased rent to be important benefits of green buildings and healthy indoor air quality to be the least important among the drivers of green building. The results in the study showed that both environmental, health benefits, and economic drivers were highly ranked. The informants supported these results as they mentioned that, proof that green buildings can reduce negative environmental impacts and can improve the health and wellbeing of the occupants was a key driver. Some studies considered other factors as drivers for the implementation of green buildings such as [54] [55] [56] who considered factors like green technology and techniques, reliability and quality of specification, leadership, and responsibility, stakeholder involvement, and guide and benchmarking systems.

The informants selected developers as an important catalyst in driving the utilization of GBRTS, while in other studies the clients or the tenants of buildings were the drivers. According to Bond [57] nearly half of the stakeholders queried in a survey commissioned by the GBCA (Green Building Council of Australia) indicated that tenant demand was driving their involvement with green buildings.

5. Conclusion

The findings in this paper agree with the hypothesis that the Zambian Building industry has environmental, technical, economic, and social needs that are unique, and these influence the level of utilization of GBRTS. The consideration for environmental criteria by the respondents was met in the GBRTS, however the shortcomings in the current tools were the absence of materials and practices that are locally based and that promote the local economy. Some of the technical needs were only met in the LEED tool, particularly ease of use, interest, and comprehensiveness. Some of the GBRTS were said not to be relevant as they had criteria that were not suitable for the Zambian building industry. The economic needs were not met, in that the respondents found the certification process to be too expensive. The social characteristics were also unique in that the utilization of the tools was associated with architects and those engaged in a variety of projects. The positive correlation between utilization and architects meant that architects could be a catalyst in influencing the utilization of GBRTS. The selection of environmental criteria over social and economic criteria shows that quantifiable benefits on the environment as well as improved health and well-being of building occupants may also improve utilization of GBRTS. Some of the preference for the barriers and drivers were unique in the study as lack of policies and guidelines, lack of skills to undertake an assessment and cost were the major barriers, and the drivers were regulations and policy that encourages the utilization of GBRT, environmental benefits and reduced cost of certification.

Recommendations

As a result of the findings of this study and the conclusions, the following recommendations are made:

1) The laws and regulations specifically dealing with the assessment of green buildings should be enacted;

2) Professionals in the building industry could be given subsidized training in using the GBRTS, and appropriate and affordable GBRTS could be developed for the Zambia building industry;

3) The tools that the respondents selected as suitable, interesting, and increased knowledge in GBRTS could be adapted for use in Zambia;

4) The Ministry of Local Government should facilitate the development of the ZSHG into a rating tool.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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