

Examining issues influencing the application of green building technologies in Lesotho

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Abstract:

The construction industry is thought to be the largest contributor to greenhouse gas (GHG) emissions (GHG), which harm both humans and the environment. As a result, it is critical that buildings be built and operated in an environmentally friendly manner, with 'mother nature' and future generations in mind. Despite numerous measures taken by countries around the world to introduce green building initiatives (GBIs), less developed countries continue to lag in terms of adopting green building technologies (GBTs). Therefore, the study aims to improve the current state of the Lesotho construction industry's GBIs and to raise awareness that will influence and promote the use of GBTs in the Lesotho construction industry. The qualitative research approach was adopted, and interviews were conducted, posing a series of questions to the construction stakeholders. The respondents were selected purposively based on their availability and willingness to participate in the study. The findings from the study revealed that there is limited knowledge amongst the construction role players. Furthermore, the introduction of mandatory policy and standards as the first step in regulating the construction industry is a strategy that could be used by both the public and private sectors. Based on the findings, it is recommended that a green building (GB) professional body be established to aid in the promotion of GBIs by regulating the Lesotho construction industry. It is also recommended that the government set the example by implementing GBTs in state-owned buildings to facilitate the smooth implementation of the practice to improve the sustainability and energy performance of buildings.

Keywords:

Construction, energy efficiency, green building, stakeholders, strategies, technologies

1 Introduction

The construction industry has contributed significantly to global warming because of the use of fossil fuels which have a negative impact on humans and the environment. According to the International Energy Agency and United Nations Environment Programme (2018), buildings and construction account for more than 35% of total global energy consumption and nearly 40% of total global GHG emissions. It is imperative to ensure that buildings are designed and constructed in a way that is environmentally friendly and preserves their comfort. Hence, designing a renewable

built environment will mean the minimisation of the amount of primary energy consumed by the buildings (Butera, 2010). GB is one of the practices that contribute towards sustainability, hence, implementing GB could play a significant role in the prevention of global warming and climate change, and the reduction of carbon dioxide emissions thus protecting the ecosystem. There are various merits and benefits accompanied by the implementation of GB, such as reduced operating costs upon occupation of the building, and increased property values and rental incomes (Dykstra, 2016). There are also, various GBTs that can be adopted that are necessary to enhance the successful implementation of GB. GBTs such as solar water and green roof technology (Darko *et al.*, 2018), are some of the GBTs that can be adopted. However, the adoption and application of GBTs are lagging in the Lesotho construction industry. The slow rate of application of GBTs in the Lesotho construction industry is attributed to, *inter alia*, limited participation of the local private sector and cooperative associations, limited energy efficiency programmes and activities, undeveloped energy sector coordination and limited clarity regarding institutional responsibilities leading to loss of accountability (Lesotho Energy Policy, 2015). The research, therefore, seeks to investigate the barriers and drivers to the application of GBTs in the Lesotho construction industry through existing literature, and a survey. With the help of the findings of this study, Lesotho will find ways regarding how to promote the application of GBTs, and the importance of investing in GBs to reduce the negative impact of unsustainable construction practices on humans and the environment. This research will eventually benefit the country's construction industry in terms of achieving more sustainable building development.

2 Literature Review

2.1 Overview of the limiting factors regarding the adoption of GBTs

Previous studies in terms of the limiting factors to GBTs adoption have been conducted in recent years. Nikyema and Blouin (2020), Simpeh *et al.* (2020), Chan *et al.* (2018), and Emuze, Shakantu, and Ntsihlele (2012), *inter alia*, have investigated the factors limiting GBTs adoption in Sub-Saharan Africa. For example, Chan *et al.* (2018) examined the critical barriers to the adoption of GBTs in the Ghanaian construction market. The study found that the most significant barriers were higher GBT costs, a lack of government incentives, and a lack of financing schemes. Similarly, Simpeh *et al.* (2021) used a survey to investigate the factors limiting green building implementation in South Africa. According to the study, higher up-front costs for GB, as well as costs associated with green technologies and materials, and certification for GBs, were identified as major barriers to implementing GB. Emuze *et al.* (2012) investigated the GB challenges in terms of sustainable construction and energy efficiency in buildings in Lesotho. According to the findings, insufficient skills / expertise, a lack of education and training, insufficient government investment, a lack of knowledge, and a lack of resources and data all contributed to the limited adoption of the GB concept.

2.2 Promotion of GBTs

Anzagira *et al.* (2022) investigated the significant stimulating measures for promoting the adoption of GBTs in developing countries using Ghana as a case study. According to the findings, the top three listed stimulating measures to promote increased use of

GBTs were educational programmes relevant to GBTs for developers, contractors, and policymakers, sufficient information on the cost and benefits of GBTs and mandated GB codes and regulations. Similarly, Darko and Chan (2018) identified increased media coverage, GBTs-related educational and training programmes for key stakeholders, the availability of an institutional framework for effective GBTs implementation, strengthened GBTs-related research and development, and financial and further market-based incentives as important strategies to promote the adoption of GBTs in the Ghanaian construction market.

2.3 Benefits of GBTs

The integration of GBTs into the construction of buildings brings numerous advantages, such as eliminating the negative environmental impact by using less energy and water and providing improved health and well-being of the occupants. As a result, GBs provide greater comfort by creating a healthier indoor climate, which increases workers' productivity, while decreasing workers' absenteeism. Building energy efficiency technologies and policies, for example, have been demonstrated as cost-effective means of collectively improving energy security and productivity, while also improving health and wellbeing, reducing local air pollution, creating jobs, and adapting to climate change (International Energy Agency and United Nations Environment Programme, 2018). The study conducted by Madew (2006) reported a 60% decrease in the consumption of energy and water in GBs, which implied a significant reduction in the building annual utility bills. There is a possibility that the high energy consumption by traditional buildings can be reduced with the application of GBTs in the buildings. In addition, Dall'O' *et al.* (2012) revealed that retrofitting existing traditional buildings with high energy efficient wall technologies and materials has the potential to save the housing industry 24.8% of the energy used. According to Vandermeulen *et al.* (2011), green roof technology serves a variety of functions for a building, including rainwater absorption, insulation, and wildlife habitat creation. Green roof technology also reduces stress for those living nearby by creating a more aesthetically pleasing landscape and assisting in the reduction of urban air temperatures and the heat island effect. Hence, the adoption of GB practices can present low toxic gases emission, therefore, contributing to environmental sustainability. Economic benefits are one of the various benefits provided by the application of GBTs that can play a huge role in the adoption and implementation of GBTs. Zhang *et al.* (2011) study revealed that adopting GBTs such as green roof technology and solar technology and optimisation of the thermal performance of the building envelope, may contribute to green image and reputation which attracts high-income buyers and results in higher sales price when developers sell their properties. At the company level, Darko *et al.* (2018) stated that several benefits can be derived from the adoption of GBTs, including a good company image and increased building value.

3 Research Methodology

The research was carried out via a review of the literature as well as an empirical study. The study employed a qualitative approach in which data interpretation technique is developed to explain the true meaning of the study (Yin, 2009). Face-to-face interviews were conducted, and each interview lasted approximately 30 to 40 minutes. The interviews were digitally recorded to avoid spending time writing and typing down the

notes, which may impact the time of the interview. To avoid any inconvenience, the interviews were conducted at the offices of the interviewees upon scheduling the appointments. The interview process was guided by a semi-structured interview (SSI) guide as suggested by Fellows and Liu (2015). Table 1 presents the guiding questions of the study. The semi-structured interview is an in-depth interview, which is either inductive or open-ended. It entails open-ended questions with no predetermined set of acceptable answers, such as true or false. Rather, respondents' responses to the question can go in any direction they want, and they can use their own language to provide long and detailed responses if they want to (Leavy, 2017). There is flexibility in conducting SSIs such that if unexpectedly a conversation turns from the first question to the fourth, the topics can be reordered on the fly and return to pick up the ones that were skipped. The agenda for the SSIs is certainly not carved in stone, it is not a requirement that an interview guide is followed as set out (Wholey *et al.*, 2010). The aim of the researcher was to obtain a minimum of 10 responses. The responses were expected from category 'A' general contractors, architectural firms, developers / clients as well as from government departments such as Building Design Services and Maseru City Council. Only 8 participants were able to participate in the interviews. Several efforts were made to encouraged construction stakeholders to participate in the study but with little success. The data collected were transcribed prior to analysing to aid data clarity and consistency of analysis. The coding process went through numerous iterations to enable an enhanced understanding of the data. This involved reading the text as well as allocating the themes to the data. The transcripts were prepared using Microsoft Word, and themes to the data were allocated manually.

Table 1: The themes and guiding questions

Theme	Key guiding questions
Factors limiting the adoption of GBTs	• What are the constraints affecting the adoption of GBTs in the Lesotho construction industry? • Amongst the factors, which one is perceived to be the most significant impeding the adoption of GBTs and why?
Awareness of GBTs	• What measures can be put in place to heighten the awareness among the construction stakeholders regarding GBTs?
Promoting the adoption of GBTs	• What measures can be put in place to promote the adoption of GBTs in the Lesotho construction industry? • Amongst the measures stated above, which one is perceived as the most important to promote the adoption GBTs and why? • Are you aware of monetary and non-monetary incentives? • Which one do you perceive to be very promising in terms of promoting GBTs in the Lesotho construction industry?

4 Findings and Discussion

4.1 Demographics of respondents

Table 2 presents the demographic data of the respondents. Four out of eight respondents (50%) were from the private sector, while the remaining 50% were from the public sector. 7 out of 8 (88%) of the respondents provided their years of experience in

construction. It is also evident that 75% of the respondents had been in construction for more than 10 years, however, only 1 (13%) of the respondents had less than 10 years' experience. 4 out of 8 (50%) of the respondents possess a national diploma and bachelor's degree, whereas the remaining 50% possess a master's degree. 75% of the respondents were males, while 25% were females. 75% of the respondents who provided their age were 30 years and older.

Table 2: Demographic data of respondents

Participant	Division	Years of experience in construction	Qualification	Gender	Age (Optional)
P1	Construction	7	B-Tech	Male	30
P2	Construction	12	BSc	Male	33
P3	Municipality	18	MSc	Female	42
P4	Municipality	25	NDip	Male	51
P5	Local Government	Not provided	MSc	Female	Not provided
P6	Architect / BDS	33	RIBA / MA	Male	56
P7	Architect	20	MA	Male	Not provided
P8	Construction	25	NDip	Male	45

4.2 Limiting factors regarding the adoption of GBTs

Regarding the factors limiting the application of GBTs amongst the Lesotho construction industry, the respondents were posed questions aimed at revealing what they perceive are impeding their application and adoption. Therefore, the factors such as high initial investment, lack of skills, and resistance to change were identified as limiting the adoption of GBTs.

Regarding high initial investment, two of the interviewees representing 25% of the respondents indicated this as a factor that limits the adoption of GBTs. They indicated financial constraints as the most influential factors limiting the adoption of GBTs. For example, it cost more to incorporate a doubled glazed window in comparison to ordinary glazed window as one interviewee indicated (P1).

The lack of skills relating to GBTs was indicated as another factor limiting the application of GBTs. To support this finding, 38% of the respondents opined that there was a skills shortage regarding these technologies. Therefore, skills shortage hinders the adoption and application of GBTs. One of the interviewees was quoted as saying: "The lack of relevant skills and research with respect to GBTs is a major factor influencing the application of GBTs, subsequently, this will force the outsourcing of skilled professionals or personnel for implementation." (P3)

All the respondents alluded to the fact that resistance to change had played a role in impeding the adoption of GBTs in the Lesotho construction industry. The majority (75%) of the respondents revealed that the government has not played its part in introducing regulations and policies that cater for these innovative technologies to be introduced in the country's construction industry. The slow application was also indicated to be hindered by ignorance amongst the communities who considered electricity as a better option. For instance, P2 indicated that there is a lack of desire in terms of accepting the innovative ideas put forward for the adoption of GBTs.

4.3 Ways of instilling the knowledge among construction stakeholders

To identify the appropriate ways in which to raise the awareness among the construction stakeholders regarding GBTs, a series of questions were posed. The interviewees indicated how the awareness process can be initiated and who should bear most responsibility regarding the issue of GBTs. Therefore, the following techniques were regarded the most effective and efficient way for raising the awareness of GBTs:

- Government responsibility;
- Awareness campaigns;
- Sensitisation by municipalities and local governments;
- Professionals' knowledge;
- Demonstration projects;
- Appreciation, and
- Outsourcing

It is believed that the government should be taking the leading role to ensure the introduction of GBTs in the Lesotho construction industry. 38% of the respondents believed that the government should draw clear policies and regulations in the industry to govern the construction industry as well as being at the forefront in sensitising the public regarding the GBTs. The study revealed that municipalities and local governments could be vested with the power to take responsibility for the areas under their jurisdiction. They could embark on sensitisation programmes for raising awareness and instilling the knowledge amongst the construction stakeholders with respect to the GBTs. One of the participants highlighted that there should be green projects that are put out for tender (P7).

38% of the respondents believed that embarking on demonstration projects is another way of raising awareness among the public and could even increase the interests towards the uptake of GBTs. The public will start to appreciate GBTs once they have seen buildings that have incorporated these technologies. In addition, 25% of the respondents believed that creating awareness regarding the benefits of GBTs to the public and construction stakeholders could aid in increasing the adoption and incorporation of the technologies in buildings. For instance, P5 stated that the public could only adopt GBTs because they were persuaded by the benefits that accompany these technologies as well as demonstration projects. The demonstration projects might be an excellent example that could arouse the interest of all construction stakeholders in incorporating the GBTs.

Outsourcing the knowledge regarding the innovative technologies could be vital, one of the respondents believe this could assist in broadening the horizon of professionals already in the construction industry. The majority of the respondents unanimously agreed that outsourcing, especially by the public sector could enhance the skills of the workers and their knowledge, thus improving their awareness of the GBTs.

4.4 Techniques of promoting the adoption of GBTs

With respect to measures to be employed for promoting the adoption and application of GBTs, the following factors were regarded appropriate for encouraging the implementation thereof:

- Introduction of regulations and enforcement;
- Incentivising and rewarding;
- Social responsibility;
- Easy of transformation or innovation, and
- Providing enabling environment.

Bringing forth regulations to govern the construction industry as well as the adoption of new technologies could improve the rate of adoption of GBTs. 63% of the respondents agreed that the introduction of regulations could play a pivotal role in promoting the adoption of GBTs. The interviewees perceived that regulations, together with a mandatory policy, could be the driving force behind the incorporation of GBTs. The respondents believed that the provision of incentives and rewards schemes could encourage the adoption of these technologies, especially where the public and developers realise there is potential gain in terms of incorporating GBTs in their construction projects. An example cites is: “If the government could introduce incentives and rewards, then the public could start appreciating the GBTs and adopt them in their future construction projects.” (P1 and P2).

25% of the respondents believed that the private sector could embark on introducing the GBTs to show their social responsibility. The social responsibility could contribute to the organisation’s image and reputation as well as playing a vital role in procuring future projects. Furthermore, 25% of the respondents believed that the private sector could be easily transformed in comparison to the public sector. Therefore, the government should create an enabling environment for the private sector to do the implementation. The government could create an enabling environment through providing training for familiarising the stakeholders with GBTs.

5 Conclusions

There have been new technologies that have been adopted and incorporated into the design and construction of buildings. Although there has been an increase in the incorporation of GBTs in buildings worldwide, the Lesotho construction industry is still behind regarding this issue. Hence, the study aims to improve the current state of the Lesotho construction industry's green building initiative and to raise awareness that will promote the use of GBTs. The research found that there are factors influencing the application of the GBTs in Lesotho. The factors, *inter alia*, include lack of knowledge and understanding regarding GBTs, higher initial cost in terms of investment, shortage of expertise, and skills required for the application of the technologies, and resistance to

change from the industry role players. Having examined the factors limiting the application of the GBTs, the measures of raising awareness amongst the stakeholders were identified. One of the most significant measures is for the government to lead by example by taking proactive steps to ensure the adoption and application of GBTs. The interviewees indicated several strategies ranging from awareness campaigns through seminars and workshops, sensitisation by local governments, and outsourcing the services of international experts and agencies to train the industry practitioners. The findings revealed that the benefits of GBTs need to be well articulated for stakeholders to understand as this could influence their interest to adopt the technologies. Furthermore, other strategies that could be employed by both the public and private sectors include the introduction of policies and standards as the first step of regulating the construction industry. The policies and standards will set a precedent that should be followed by all the stakeholders. While some interviewees believe the private sector should be taking the leading role in easy transformation as well as enhancing their public image and reputation, others highlighted that the government should provide an enabling environment to the stakeholders who embark on the implementation.

6 Recommendations

Lesotho is a micro-economy country, and its economy and infrastructure development are still expected to grow. Therefore, the government and private sector should make a concerted effort in adopting and incorporating GBTs in their future projects. For the successful adoption and application of GBTs within the Lesotho construction industry, the following recommendations are made:

- The government should bring together the services providers such as Lesotho Electricity Company (LEC) and Water and Sewerage Company (WASCO) and strategise in terms of how to minimise both the energy and water usage in buildings by encouraging the adoption of GBTs;
- The government should incentivise and reward those who adopt and incorporate GBTs, either through retrofitting or incorporation in new buildings;
- The parastatals such as the Lesotho National Development Corporation should also come on board in the future, they should be the first stakeholder that embarks on GB demonstration projects, and
- This study was aimed at improving the prevailing state of the Lesotho construction GB initiative and strategies to promote the application of GBTs. Further research relating to the property market, and educational facilities is thus recommended.

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