A systematic review of green building practices implementation in Africa

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Received 4 September 2021
Revised 3 January 2022
Accepted 11 April 2022

Abstract

Purpose – The purpose of this study is to conduct a systematic review on encumbrances facing the implementation of GBP in selected African countries. Green building practices (GBP) implementation is germane and promotes the development of a green environment and buildings. Many studies have been conducted on the encumbrances faced with GBP implementation, especially in developing countries. But evidence of a comprehensive study that investigates and analyses these hindrances from different developing countries is missing. Therefore, a systematic review is conducted systematically reviewing the current literature on encumbrances facing the implementation of GBP in selected African countries. Also, the study proffers possible drivers for stakeholders to promote GBP in African countries.

Design/methodology/approach – A total of 38 published papers were identified from the Web of Science, Scopus database and supported with materials from Google Scholar related to Africa's GBP. The continent was divided into five regions, and each region covered three countries.

Special thanks to the contributors for providing knowledgeable contributions to enhance the findings of this paper. Also, the authors appreciate the comments, suggestions, and recommendations provided by the anonymous reviewers, which collectively helped hone and strengthen the quality of this manuscript during the blind peer-review process.

Funding: Faculty of Engineering and the Built Environment and CIDB Centre of Excellence (05-35-061890), University of Johannesburg, South Africa.

Journal of Facilities Management

1472-5967
DOI 10.1108/JFM-09-2021-0096

Findings – Two themes emerged from the analysed review – encumbrances facing GBP implementation and possible drivers for stakeholders to promote GBP in African countries. A total of 18 encumbrances and 18 drivers were identified from the analysed literature and grouped into 6 sub-themes.

Research limitations/implications – Current empirical articles were reviewed to suggest the drivers for stakeholders to promote GBP that emerged from this paper. Thus, to enrich the results from this paper, primary source data of regional studies of GBP in Africa's context should be carried out via the mixed-methods design.

Practical implications – A total of 18 drivers were identified for stakeholders to promote GBP in Africa and form part of the paper's implications. Also, the paper findings would serve as a treasured suggestion for the stakeholders (policymakers, construction practitioners, clients and academics) who are fascinated by the promotion of GBP across African nations.

Originality/value – This is possibly the foremost analysed systematic review study on GBP implementation in Africa. Therefore, it fills the theoretical gap and proffers possible drivers for stakeholders to promote GBP in the African context.

Keywords Stakeholders, Construction, Systematic review, Drivers, African countries, Green building practices

Paper type General review

1. Introduction

The construction sector is one of the largest industries that create economic values and employments for society and the economy. It consumes large amounts of natural resources, and there are adverse environmental impacts (Hyeyon *et al.*, 2016). The authors' submission corroborated the United States Green Building Council (USGBC, 2016) assertion that the industry profoundly impacts the physical environment, human well-being, economy and productivity. Records show that the industry consumes about 40% of total energy production [World Business Council for Sustainable Development (WBCSD), 2008; Darko *et al.*, 2017; Li *et al.*, 2017]. The negative impact of this consumption on the built environment is of great concern to the stakeholders. For the past few years, mitigating this challenge and promoting sustainable construction have created awareness of the significance of green building practices (GBP) globally in the industry (Kibwami and Tutesigensi, 2016a, 2016b; Li *et al.*, 2017). Gou and Xie (2016) affirmed that the past decade had witnessed an increased interest in GBP.

The GBP proffer a platform to mitigate likely hazards from the industry. These hazards may be harmful to the built environment if not checked. For now, there are no specific definitions of the term "green building (GB)" or "green building practices (GBP)". This paper adopts the ASTM Standard E2114-08 definition of a GB as "a building that provides the specified building performance requirements while minimising disturbance to and improving the functioning of local, regional, and global ecosystems both during and after its construction and specified service life" (ASTM E2114–08, 2008, p. 12; Sev Aysin, 2011). Despite the benefits such as sustainable construction and development, the implementation of this concept in the life cycle of construction is not without some huge hindrances (Aldossary *et al.*, 2015; Gan *et al.*, 2015), especially in developing continents such as Africa. Over the years, progressively, studies have been carried out on GB implementation and hindrances associated within Africa, but none regarding a systematic review of GBP implementation in Africa.

Therefore, this study intends to fill the theoretical gap in understanding the hindrances facing the implementation of GBP across selected Africa countries and proffer possible drivers to stakeholders that can promote GBP in Africa. This will be achieved through a holistic, systematic review of hindrances and potential drivers to promote GBP in African

Region. This is pertinent to achieving some of the key sustainable development goals ([SDGs] well-being, Goal 3; clean pipe-borne water and sanitation, Goal 6; affordable energy, Goal 7; and sustainable cities and communities, Goal 11) (UN News Centre, 2018; Ebekozien *et al.*, 2019) that emphasise on sustainable construction and development across the globe. Many studies, for example, Li *et al.* (2017), Darko *et al.* (2019), Lu *et al.* (2020), Ebekozien *et al.* (2021), have shown that GBP can promote sustainable construction and development in the built environment. There has been a scarcity of systematic reviews concerning encumbrances facing Africa's GBP and implementation. This may be the first systematic review paper on GBP implementation in Africa. This paper is timing because the target of the 17 SDGs is less than one decade, and Africa's impact will be significant to the world. Thus, the calls for all-inclusive feasible drivers to promote GBP and enhance resilience in the implementation via stakeholders engagement across Africa cannot be over-emphasised.

The paper focused on the research questions. This is to ensure that an appropriate systematic review is developed. What should be done to promote the greening of buildings across African countries because of their sustainable features? This study analyses the current empirical literature on GBP implementation within African countries. Section 1 addressed the aim and justification for the paper. Section 2 will discuss the methods and material used. The next two consecutive sub-sections systematically review the literature to highlight and examine the current literature concerning GB implementation in Africa, emphasising the encumbrances and possible policies to mitigate them and promote greening of buildings. This comprises the robust debate of results, the study's implications and areas scholars can explore in the future. Section 3 presents the findings and discussion, whereas Section 4 presents conclusion and recommendations.

2. Methods and material

This section focusses on the methods and materials used in the paper. The component of this section is given in the following sub-sections.

2.1 Design adopted

This paper adopted meta-analysis of observational studies in epidemiology guidelines. This is in line with Stroup *et al.* (2000) and Preferred Reporting Items for Scientific Reviews and Meta-Analyses standard (Moher *et al.*, 2009). Referring to the key research question that emerged from this review as earlier stated, two research questions emerged from the major research question and were examined in this study:

RQ1. What are the encumbrances facing GBP implementation in Africa?

RQ2. What are the possible drivers to stakeholders that can promote GBP in Africa?

2.2 Eligibility and exclusion criteria

Well-chosen published papers that described GBs and implementation within African countries were used for this study. Empirical articles from the year 2001 to 2021 were used for this purpose. A total of 21 years period is a satisfactory time to evaluate the progress of previously published articles concerning GB and implementation in Africa. This agrees with Jaafar *et al.* (2021) that used 19 years duration as satisfactory for a review paper. The selection approach adopted for articles was based on peer-reviewed published papers. The papers focussed on GBs, GB implementation, sustainable construction, sustainable development, green rating in Africa countries. Nevertheless, expert opinion and case reports were disqualified from this study. Also, conference proceedings, textbooks, book series, and

review articles were disqualified because of inadequate peer review. Only published articles relevant to GBs in Africa were chosen, as shown in Table 1. This is to fast-track proffering answers to the two research questions generated above.

2.3 Data sources and search approaches

The authors developed the search approach in collaboration with a reference team. The team helped with vocabulary associated with the title and suitable synonyms in the published papers reviewed. In early June 2021, the exploration was finalised from the important databases. "Green buildings", "green building implementation", "sustainable construction", "sustainable development", "hindrances to green building practices" "drivers of green building practices", "green rating", systematic review", "greening in Africa", "green building in Africa", "drivers", "stakeholders", "sustainability", "building", "construction industry", "built environment", and "review" were the search items considered. The paper search for literature from GBP and related topics. The reference group was engaged for mediation with attention to the agreed requirement standards. Scopus and Web of Science were the main databases employed and supported with selected published articles from Google Scholars. Jaafar *et al.*, 2021 reported that journals in the Web of Science database are over 33,000 and 256 disciplines coverage. Whilst Scopus database is over 22,800 articles and 5,000 publishers. This is possibly why Scopus and Web of Science databases are reliable (Salleh *et al.*, 2020).

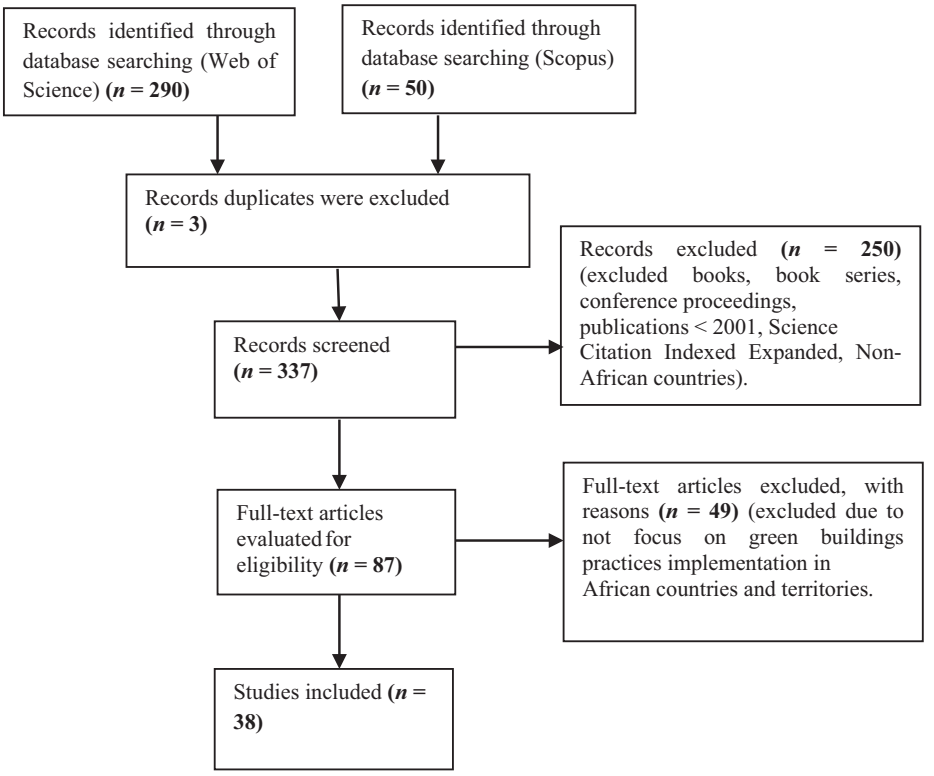
2.4 Systematic review process

In early July 2021, the systematic review process kick-started and comprises four main phases. First, the keywords used for the search are identified. Based on previously published literature and vocabulary, keywords similar to GBP and implementation in African nations were utilised as reported in the earlier sub-section. Second, careful screening is inevitable, and one of the outcomes was three duplicated papers detected and deleted. In continuation of the second phase, out of 337 papers fit to be reviewed, 250 papers were removed. Third, at this phase, also known as the eligibility stage, 49 articles were disqualified after thorough investigation and full examination of the articles in line with the research questions of the paper. The disqualification at this stage is because some of the papers did not emphasise the hindrances of and the drivers promoting GB implementations. At the final phase, 38 empirical papers emerged. They were used for the research, as shown in Figure 1. This presentation agrees with Moher *et al.* (2009) and Ebekozien (2021). Therefore, Figure 1 shows that the identification layer is the first top layer, the screening and the third and fourth layers represent the eligibility and included layers, respectively.

Table 1. Inclusion and exclusion criteria

Criterion	Eligibility	Exclusion
Type of literature	Peer-reviewed journal articles, book chapters in books with editorial committees or doctoral theses with thesis committees	Journals (systematic review), book series, book, conference proceedings.
Timeline	Between 2001 and 2021	<2001
Language	English	Non-English
Indexes	Social Science Citation Index, Emerging Sources Citation Index, Art and Humanities Index (Web of Science)	Science Citation Indexed Expanded (Web of Science)
Countries and territories	African countries	Non-African countries

Source: Adapted from Jaafar *et al.* (2021)



Source: Adapted from Moher *et al*., 2009

Figure 1.
Flow diagram of African green building practices implementation – systematic review

2.5 Data abstraction and analysis

The published papers used were examined and scrutinised tactically and systematically at this phase. The outcome of the findings emphasised detailed results concerning the formulated two research questions as previously generated. The data were extracted by perusal via the paper's synopses at the initial stage, then the full published empirical articles to identify appropriate themes and sub-themes. Thematic analysis was adopted in analysing the literature, and themes related to GBP and implementation in Africa's context were generated with the study research questions as a guide. The following section discusses the findings that emerged from the analysed literature.

3. Findings and discussion

Two main themes were generated from the analysed results of the reviewed empirical papers concerning GBP implementation, emphasising the encumbrances and the drivers to promote GBP in Africa. The themes are encumbrances facing GBP implementation and possible drivers to stakeholders promoting GBP in Africa. The summary of the findings is presented in Figure 2. This section covers the paper's implications, study's limitations and suggested areas for future studies. The results presented in this section are an all-inclusive analysis of current GBP implementation in Africa. The continent (Africa) was divided into

Figure 2.
Main findings from African GBP implementation

Authors	Countries	Main design	Encumbrances facing GBP implementation in Africa																		Possible drivers to stakeholders that can promote GBP in Africa																				
			A			B			C			D				E			F			G			H			I			J			K			L		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
Windapo and Goulding (2015)	South Africa	MM				√	√					√	√					√			√	√		√		√		√	√	√	√			√	√		√	√	√			
Oguntona et al. (2019)	South Africa	QN																					√				√	√	√	√	√				√		√	√			
Masia et al. (2020)	South Africa	QL	√	√	√	√		√	√	√	√		√	√							√	√			√		√								√	√		√	√		
Mashwama et al. (2020)	South Africa	QN	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√			√	√	√			√					√	√	√		
Sichali and Banda (2017)	Zambia	QL							√	√																	√			√							√			
Oke et al. (2019)	Zambia	QN							√	√		√									√	√					√	√		√	√			√			√	√		
Nyakalala and Madimutsa (2021)	Zambia	QN	√						√			√						√	√	√	√						√			√							√	√	√		
Tanyanyiwa and Juba (2018)	Zimbabwe	QL	√	√	√				√			√								√	√	√					√			√							√	√		
Dalibi et al. (2017)	Nigeria	QN	√	√	√	√	√	√	√	√	√	√		√		√	√	√	√	√	√	√		√	√	√	√					√			√	√	√	√		
Alohan and Oyetunj (2020)	Nigeria	QN	√	√	√	√	√	√	√		√	√		√		√		√	√	√	√	√		√	√	√	√					√			√	√	√	√		
Ebekozien et al. (2021)	Nigeria	QL	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		
Darko and Chan (2018)	Ghana	MM		√	√				√	√	√	√	√						√	√			√	√			√	√	√	√	√						√	√		
Chan et al. (2018)	Ghana	QN	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√		√	√		√	√			√	√	√		
Agyekum et al. (2020)	Ghana	QN	√	√	√				√				√			√				√	√	√	√				√				√			√					√		
Addy et al. (2021)	Ghana	QN	√	√	√	√			√		√	√	√		√				√	√	√	√	√	√			√		√	√	√		√				√	√		
Nikyema and Blouin (2020)	Burkina Faso	MM	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√		√	√		√	√			√	√	√		
Girma et al. (2019)	Ethiopia	QL	√	√	√	√			√				√			√	√	√	√	√	√	√	√	√			√				√				√	√	√	√		
Andaregie and Astatkie (2021)	Ethiopia	MM			√				√			√								√			√				√			√									√		
Khaemb and Mutsune (2014)	Kenya	QN																									√								√					
Onkangi et al. (2018)	Kenya	QN				√							√											√			√			√					√		√	√		
Kimani and Kiaritha (2019)	Kenya	CS			√	√			√															√			√								√		√	√		
Kibwami and Tutesigensi (2016a)	Uganda	MM							√				√											√			√								√		√			
Kibwami and Tutesigensi (2016b)	Uganda	CS							√			√								√										√							√			
Namagembe et al. (2019)	Uganda	QN				√			√			√												√						√							√			

(*continued*)

Elfiky (2011)	Egypt	CS										√							√	√								√							√	√
Khalil (2020)	Egypt	CS				√						√	√							√					√				√	√							√
Abdel-Azim et al. (2017)	Egypt	QN																						√					√								√
Azhary et al. (2020)	Morocco	CS											√											√					√						√		
El-Baz and Laguir (2017)	Morocco	QL				√		√				√	√							√				√		√			√	√							√
Alba and Todorov (2018)	Morocco	CS				√			√	√	√		√			√								√			√	√	√		√			√		√	√
Awaili et al. (2020)	Libya	QN				√			√	√	√	√	√	√					√	√				√			√	√	√						√	√
Antuna-Rozado et al. (2019)	Libya	CS				√							√											√						√							
Akata et al. (2017)	Cameroon	CS				√					√	√	√											√						√							√
Kimengsi and Fogwe (2017)	Cameroom	QN																						√						√						√	√
a Akata et al., (2015)	Cameroon	CS																						√													√
Goldstein et al. (2017)	Gabon	CS																						√													√
Amado et al. (2020)	Angola	CS																						√													√
Pedrosa et al. (2021)	Angola	QL																						√			√										

Encumbrances facing GBP implementation in Africa			Possible drivers to stakeholders that can promote GBP in Africa		
Theme	**Item**	**Description**	**Theme**	**Item**	**Description**
A Financial barriers	1	High cost of green building technologies	**G Financial drivers**	1	Awareness of reduction in whole lifecycle costs and increased property values
	2	Higher initial cost and leads to higher market prices		2	Awareness of resources conservation (energy and water) and leads to high return on investment
	3	Difficulties to access funding for GB		3	Government should create a route to access funding for GB projects
B Stakeholder barriers	4	High absence of awareness within the stakeholders	**H Stakeholders drivers**	4	Stakeholders identity with GBP is germane
	5	An attitude of experts regarding time-consuming and project delays		5	GBP meets contract and developer's requirements if executed by experts
	6	Conflict of interests and uncertainties within the stakeholders		6	GBP encourages an integrated design approach
C Technical barriers	7	Technical staff lack of knowledge on GBP	**I Technical drivers**	7	Education and training of technicians on GBP should be continuous
	8	Absence of local materials on GBP, e.g. panels for electricity		8	Local materials manufacturers should be proactive on GB materials
	9	GB technologies are not locally driven		9	Local GB materials should be innovative and certified for usage
D Policy barriers	10	Majority lacks GB codes, regulations, and rating systems	**J Policy drivers**	10	Government should create GBP-friendly policies
	11	Absence of government incentives to encourage GB		11	Government should create incentive schemes to promote GB such as tax waiver
	12	Absence of local institutes to facilitates R & D		12	Database of GB (planned, under construction, and constructed) is key for planning
	13	Absence of green database and information	**K Design and construction drivers**	13	Better ways to measure and account for costs
E Design and construction barriers	14	Complexity in adopting green building technologies		14	Improved project constructability and waste reduction via technological training
	15	The inadequate design team and construction expertise in GBP		15	Competent team members lead to decrease construction time
	16	The attitude of some design and construction team members	**L Organisation drivers**	16	Design teams should acquaint themselves with green products/processes
F Organisation barriers	17	Lax attitude attached to green building technologies by client		17	Awareness of GBP importance to the prospective client should be pertinent
	18	Resistance to change from the use of conventional technologies		18	Attitudes and traditions should change because of enhanced health and occupant comfort

Notes: QN = Quantitative; QL = Qualitative; MM = Mixed methods; CS = Case Study

Figure 2.

five regions (West Africa – Burkina Faso, Ghana, and Nigeria; East Africa – Kenya, Uganda, and Ethiopia; Southern Africa – South Africa, Zambia, and Zimbabwe; North Africa – Egypt, Morocco, and Libya; and Central Africa – Angola, Cameroon, and Gabon). Three countries were chosen for good representation in each region, as shown in Figure 2. Findings concerning GBP implementation of 15 nations were analysed across the continent. The covered countries were the most prominent regarding GBP in Africa. During the search for published articles concerning GBP in Africa, some countries such as Sao Tome, Guinea, among others, without a single published paper regarding GBP. This shows that more awareness is required in developing countries to achieve the SDGs.

Figure 2 shows that each region had eight analysed papers apart from Central Africa with six papers. This speaks volumes of the low level of research regarding GBP in the region. Thus, justified the reason for this study. Regarding the research design employed, 5 studies adopted a mixed-methods research design, 7 studies used a qualitative analytical method, 11 studies used a case study research design and 15 studies used a quantitative analytic approach. Concerning the duration of the selected relevant analysed published papers, about 84% were within the year 2017–2021. This again strengthened the findings from the study. Five articles were published in 2021. Next was nine articles published in 2020, six in 2019 and five in 2018. Others are seven articles in 2017, two articles each in 2016 and 2015, respectively, and an article in 2014 and 2011.

3.1 Encumbrances facing green building practices implementation in Africa

This section focusses on the encumbrances facing GBP implementation in African countries. A total of 18 main issues were identified across the analysed literature that affects the implementation of GBP in the African context. They are categorised into six main themes (financial barriers [Theme A], stakeholders' barriers [Theme B], technical barriers [Theme C], policy barriers [Theme D], design and construction barriers [Theme E] and organisation barriers [Theme F]). Findings slightly agree with Chan *et al.* (2018). The authors categorised the 20 barriers into five categories as follows: market-related barriers, government-related barriers, cost and risk-related barriers, knowledge and information-related barriers and human-related barriers in Ghana's GBP context. Nikyema and Blouin (2020) validated Chan *et al.* (2018) grouped pattern but identified 26 barriers and were redistributed within the five groups in Burkina Faso's context. However, this study addressed the issues systematically in Africa's context. Referring to Figure 2, 79% of analysed articles reported that encumbrances are facing GBP implementation across African nations. Findings from the analysed articles show that the outstanding 21% did not focus on the barriers of GBP in their studies, possibly the percent would have been higher. A total of 7 major encumbrances emerged from the identified 18 barriers facing the GBP implementation. This includes difficulty to access funding for GB projects (from Theme A), high absence of awareness within the stakeholders (from Theme B) and technical staff lack of knowledge on GBP (from Theme C). Others are lack of GB codes, regulations, rating systems and absence of government incentives to encourage GBP (both from Theme D) and lax attitude attached to GB technologies by client and resistance to change from the habit of conventional technologies (both from Theme F). Findings show that at least one major barrier emerged across the themes apart from Theme E (design and construction barriers). The reason is that some of the identified barriers are related to some barriers in Themes B and D, respectively.

3.1.1 Theme A: financial barriers. In South Africa (Masia *et al.*, 2020 and Mashwama *et al.*, 2020), Zimbabwe (Tanyanyiwa and Juba (2018), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Ghana (Darko and Chan, 2018; Chan *et al.*, 2018;

Agyekum *et al.*, 2020; and Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020) and Ethiopia (Girma *et al.*, 2019) found the high cost of GB technologies, higher initial cost of construction and inability to access funding as the main challenges facing GBP implementation. Many have raised the concern that clients are not willing to pay extra for the green project if no provision to access funds as an incentive to encourage them. There is insignificant research concerning encumbrances facing GBP in Central Africa and North Africa. Findings from the review show that many housing developers are concerned about instant savings from investments. This action has hindered them from implementing GBP. Likewise, the building owners and clients habitually focus on short-term capital costs because there is inadequate information and data regarding long-term economic benefits and life cycle costs of GBP, especially in developing nations.

3.1.2 Theme B: stakeholders' barriers. Concerning stakeholders' barriers, three major barriers were identified across South Africa (Masia *et al.*, 2020 and Mashwama *et al.*, 2020), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018) and Burkina Faso (Nikyema and Blouin, 2020). Referring to Figure 2, among the three barriers associated with the stakeholders' barriers as a theme, the absence of awareness was ranked highest. The stakeholders in this context are policymakers, construction practitioners (contractors and consultants), clients and building manufacturers. The low awareness of GBP in many African countries is of great concern. This is because GBP is associated with several advantages such as enhanced human and well-being, increased water efficiency, improved productivity, improved indoor and outdoor environmental quality, among others (Ebekozien *et al.*, 2021).

3.1.3 Theme C: technical barriers. Regarding technical barriers, three major issues were identified across South Africa (Masia *et al.*, 2020 and Mashwama *et al.*, 2020), Zambia (Sichali and Banda, 2017 and Oke *et al.*, 2019), Nigeria (Dalibi *et al.*, 2017 and Ebekozien *et al.*, 2021), Ghana (Darko and Chan, 2018 and Chan *et al.*, 2018), Burkina Faso (Nikyema and Blouin, 2020), Morocco (Alba and Todorov, 2018), Libya (Awaili *et al.*, 2020). Referring to Figure 2, among the three barriers associated with the technical barriers as a theme, technical staff lack of knowledge about how to manage GBP was ranked highest. Inadequate knowledge and expertise regarding the technical "know-how" are some of the gaps associated with GBP implementation in developing nations (Addy *et al.*, 2021). Chan *et al.* (2018) affirmed that lack of knowledge and expertise are critical than the training for project workers.

3.1.4 Theme D: policy barriers. From the identified four barriers connected with policy theme as presented in Figure 2, item 10 (majority lacks GB codes, regulations and rating systems) and item 11 (absence of government incentives to encourage GBP) were both ranked high across South Africa (Mashwama *et al.*, 2020), Nigeria (Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018), Burkina Faso (Nikyema and Blouin, 2020) and Libya (Awaili *et al.*, 2020). The absence of fiscal incentives from the government has negatively affected the implementation of GBP in many developing countries. Inadequate knowledge of the long-time benefits may have enhanced the issue of incentives.

3.1.5 Theme E: design and construction barriers. Regarding Theme E, three major issues were identified across South Africa (Mashwama *et al.*, 2020), Nigeria (Dalibi *et al.*, 2017 and Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018) and Burkina Faso (Nikyema and Blouin, 2020). Referring to Figure 2, among the three barriers associated with design and construction barriers, though none was ranked highest, these issues are interrelated with some of the barriers grouped in Themes B and D, respectively.

3.1.6 Theme F: organisation barriers. Referring to Figure 2, regarding Theme F, the client's lax attitude attached to GB technologies (Item 17) and resistance to change from applying conventional technologies (Item 18) were ranked among the highest seven items from the identified 18 barriers categorised into six groups. The two barriers cut across South Africa (Masia *et al.*, 2020 and Mashwama *et al.*, 2020), Zambia (Oke *et al.*, 2019 and Nyakalale and Madimutsa, 2021), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Ghana (Darko and Chan, 2018; Chan *et al.*, 2018; and Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020), Ethiopia (Girma *et al.*, 2019), Egypt (Elfiky, 2011) and Libya (Awaili *et al.*, 2020). It is difficult to separate technology from the implementation of GBP but many developing countries in Africa are behind in terms of digital innovation, including the construction sector. This may be one of the reasons the two items linked with the technology (Theme F) were ranked high among the seven significant barriers to GBP implementation in Africa's context environment. The analysed literature shows that limited technology availability is one of the major obstacles that key stakeholders should tackle if the continent wants to see improvement in GBP implementation.

3.2 Possible drivers to stakeholders that can promote green building practices in Africa

This section proffers possible drivers to stakeholders in the green construction sector and can promote GBP in African countries. A total of 18 possible main drivers were identified across the analysed 38 articles in the African context. They are grouped into six main themes (financial drivers [Theme G], stakeholders' drivers [Theme H], technical drivers [Theme I], policy drivers [Theme J], design and construction drivers [Theme K] and organisation drivers [Theme L]). Findings disagree with Darko *et al.* (2017). The authors categorised the 64 drivers from the selected 42 empirical studies into five main groups of GB drivers (property-level, corporate-level, individual-level, project-level and external drivers). Darko *et al.* (2017) findings were not within the African context. However, this study proffer drivers systematically in Africa's context. Referring to Figure 2, majority of the analysed articles proffer a minimum of two or more drivers to promote GBP implementation across African nations. A total of 6 major drivers emerged from the identified 18 drivers to promote the implementation of GBP. This includes awareness of reduction in whole life cycle costs and increased property values (from Theme G), stakeholders' identity with GBP is germane (from Theme H) and education and training of technicians on GBP should be continuous (from Theme I). Others are government should create GBP-friendly policies (from Theme J) and awareness of GBP importance to the prospective client should be pertinent, and attitudes and traditions should change because of enhanced health and occupant comfort (both from Theme L).

3.2.1 Theme A: financial drivers. In South Africa (Windapo and Goulding, 2015; Masia *et al.*, 2020; and Mashwama *et al.*, 2020), Zimbabwe (Tanyanyiwa and Juba (2018), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018; Agyekum *et al.*, 2020; Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020) and Ethiopia (Girma *et al.*, 2019) suggested three drivers that promote GBP implementation. Among the three drivers, awareness of reduction in whole life cycle costs and increased property values was ranked most significant driver to promote GBP implementation in Africa's context as presented in Figure 2 under Theme G. The knowledge of reduction in life cycle costs of GB projects need to be shared with Africa's stakeholders in GB businesses. There are data and statistical details of how GB projects bring down life cycle costs in developed countries. An example is Bond's (2011) findings with a cost savings of about

$1,000 per annum in Australia and New Zealand. Similar studies should be conducted in Africa's context, and it will assist in a long way to promote GBP among the stakeholders.

3.2.2 Theme H: stakeholders' drivers. Concerning stakeholders' drivers, three significant drivers were identified across South Africa (Windapo and Goulding, 2015), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Morocco (El Baz and Laguir, 2017) and Angola (Pedrosa *et al.*, 2021). Referring to Figure 2, among the three drivers associated with the stakeholders' drivers as a theme, Stakeholders identity with GBP is germane within the stakeholders' drivers theme was ranked highest. Awareness and knowledge have a great role to play here. Every stakeholder is expected to be knowledgeable regarding GBP. Identity with GBP has a relationship with integrated project delivery that drives performance based on the early collaboration of the team.

3.2.3 Theme I: technical drivers. Regarding technical drivers, three major were identified across South Africa (Windapo and Goulding, 2015; Oguntona *et al.*, 2019; and Mashwama *et al.*, 2020), Zambia (Oke *et al.*, 2019), Nigeria (Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018; Darko and Chan, 2018; and Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020), Morocco (Alba and Todorov, 2018), Libya (Awaili *et al.*, 2020) and Libya (Awaili *et al.*, 2020). Referring to Figure 2, among the three drivers associated with the technical drivers as a theme, education and training of technicians on GBP should be a continuous exercise was ranked most significant highest within Theme I. This theme has a connection between driver nos. 7 and the other two drivers. First, education and training are required to thrive innovation. Also, training and knowledge are required for building materials manufacturers to be proactive in locally manufacturing GB products. All parties should be ready to do the needful for this to be achieved.

3.2.4 Theme J: policy drivers. For the identified three drivers connected with policy theme as presented in Figure 2, item 10 (government should create GBP-friendly policies was ranked most significant within Theme J across South Africa (Windapo and Goulding, 2015 and Oguntona *et al.*, 2019), Zambia (Oke *et al.*, 2019), Nigeria (Ebekozien *et al.*, 2021), Ghana (Chan *et al.*, 2018; Darko and Chan, 2018; and Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020), Egypt (Khalil, 2020) and Morocco (El Baz and Laguir, 2017). Findings from Theme j show that there is a connection between the three drivers. Create an incentive scheme that will promote GB is a component of a government GBP-friendly policy. Database for record-keeping and planning cannot be feasible if no policy to actualise it.

3.2.5 Theme K: design and construction drivers. Regarding design and construction drivers, three major drivers were identified across South Africa (Windapo and Goulding, 2015 and Masia *et al.*, 2020) and Nigeria (Dalibi *et al.*, 2017 and Ebekozien *et al.*, 2021). Referring to Figure 2, among the three drivers associated with design and construction drivers, though none was ranked highest, these drivers are inter-related with some of the drivers grouped in Themes 1 and K, respectively. For example, as revealed in item 14, technological training is a component of innovation and training.

3.2.6 Theme L: organisation drivers. In Theme L, referring to Figure 2, awareness of GBP importance to the prospective client should be pertinent (Item 17) and attitudes and traditions should change because of enhanced health and occupant comfort (Item 18) were ranked among the highest sis items from the identified 18 drivers categorised into six groups. The two drivers cut across South Africa (Windapo and Goulding, 2015; Masia *et al.*, 2020 and Mashwama *et al.*, 2020), Zambia (Oke *et al.*, 2019 and Nyakalale and Madimutsa, 2021), Nigeria (Dalibi *et al.*, 2017; Alohan and Oyetunji, 2020; and Ebekozien *et al.*, 2021), Ghana (Darko and Chan, 2018; Chan *et al.*, 2018; and Addy *et al.*, 2021), Burkina Faso (Nikyema and Blouin, 2020) and Ethiopia (Girma *et al.*, 2019), Kenya (Onkangi *et al.*, 2018 and Kimani and Kiaritha, 2019), Egypt (Elfiky, 2011), Morocco (Alba and Todorov, 2018),

Libya (Awaili *et al.*, 2020) and Cameroon (Kimengsi and Fogwe, 2017). The analysed literature in Figure 2 shows that drivers 17 and 18 recorded the highest score regarding possible drivers to stakeholders promoting GBP in Africa. Awareness and the potential benefits of GBP have taken centre stage as the key to thriving the implementation within Africa. The attitude will change positively if the stakeholders know the saving benefits associated with GBP on their projects. It is likely to spend a little higher today to make more savings and long span of the facilities in the future. This shows that the government and professional institutions within the construction sector in Africa have a key role in bringing this awareness to the stakeholders.

3.3 Implications of this paper

This study contributes to the existing literature on GBP implementation in Africa. The contribution to the theoretical gap forms part of the implications and broad relevance. This will be done in three ways. First, the systematic review on GBP implementation was conducted extensively across Africa. Major countries that have been involved in the greening of buildings and research on greening such as South Africa and Ghana were well captured as reviewed in the literature. Despite the benefits of GBP across the globe with several studies conducted in advanced countries, there was still a paucity of a systematic review concept in Africa's context. Therefore, this study tries to fill the existing literature gap by contributing to the body of knowledge in understanding the encumbrances facing GBP and the drivers to stakeholders that can promote GBP in Africa's context. Second, the 18 barriers and 18 drivers that come out from this study are instructive in offering a novel sight to the construction practitioners, policymakers, clients, suppliers, and construction materials manufacturers concerning the benefits of GBP implementation on construction projects across Africa.

This result cleared the perception that green technologies are more expensive in the long run and will stir up some pertinent policy improvements that will drive the promotion of GBP implementation. Also, the life cycle costs of some projects have rebuffed the claim that GB projects are more expensive to maintain in the long run. There is a need for similar studies of life cycle costs within the continent to reflect the African context. Third, this paper systematically examined the encumbrances facing GBP implementation across Africa and proffered possible drivers to stakeholders promoting GBP in Africa's context. The usefulness of this paper to policymakers and construction practitioners as a guide to achieving the SGDs associated with construction and development sustainability in Africa and extended to other parts of the globe cannot be over-emphasised. This contribution form part of the implication. Also, this review offers more theoretical information about GBP implementation in Africa.

3.4 Limitations and future direction

The methodology adopted in the analysis made this paper limited. This mechanism was utilised to fill the current theoretical gap of papers that covered GBP implementation across African countries. Understanding this concept (GBP) became inevitable across African countries. Thus, more areas of study need to be considered in the future. First, the mixed-methods approach in the reviewed papers had the least Figure 5. Future studies should consider adopting a more mixed-methods approach. Also, none of the papers addressed issues or compared two or more countries regarding the encumbrances and drivers associated with GBP. This study recommends that in the future, GBP implementation challenges and feasible drivers should be tailored towards regional studies such as West African countries, East African countries, among others. Also, data collection should be

from the primary source for the analysis and supported with the secondary data during the discussion of findings. Future scholars should explore these areas as part of the new front burners.

4. Conclusion and recommendations

In less than a decade, the world will record the SDGs. In contributing to achieving these goals, the construction sector has been promoting the implementation of sustainability. One way to accomplish this is by implementing GBP. This concept is not without some challenges, especially in developing countries. Findings show that GBP implementation is critical for achieving sustainable construction and development. This practice is presently low across Africa. To address the research questions, 18 barriers and 18 drivers were identified from a comprehensive systematic reviewed literature within Africa's context. Findings show that to implement sustainability within the construction industry, GBP implementation should be promoted. Sustainability construction and development via GBP has received global attention and implementation but is very low within African countries. Thus, the need for this study with possible drivers to stakeholders that can promote GBP in Africa's context. The emerged drivers summarised in this paper have general applicability for all stakeholders interested in pursuing GBP. This paper may offer a valuable platform and advocate to deepen the stakeholders (policymakers, construction practitioners, construction materials manufacturers, clients, and suppliers) understanding of what drives people to participate in GBP implementation. This may further promote the development of GBP implementation across African countries.

Therefore, mitigating the barriers that may threaten GBP implementation should be an all-inclusive effort of key stakeholders in the GB business. The output will promote GBP implementation within the stakeholders and the construction industry in African nations. Thus, from the systematic review, possible measures were suggested to promote GBP implementation across the continent via the following major recommendations:

- The paper recommends more holistic awareness and benefits of GBP from design to building maintenance. The awareness should emphasise the reduction in full life cycle costs and increase in property values.
- The study suggests that the African government should create a route to access GB-related projects funding via a friendly loans policy. The proposed initiative would motivate developers and other stakeholders to embrace GBP, and by extension, promoting construction sustainability.
- Also, the paper recommends that the government create an enabling environment for local materials manufacturers to be proactive and innovative towards manufacturing local GB materials. Thus, industry–research collaboration is pertinent in this direction to achieve the SDGs connected with sustainability across African countries, and by extension, to other parts of the world with similar GBP issues.

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