frontiers | Frontiers in Built Environment

TYPE Original Research
PUBLISHED 25 September 2024
DOI 10.3389/fbuil.2024.1447621

OPEN ACCESS

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RECEIVED 11 June 2024
ACCEPTED 12 September 2024
PUBLISHED 25 September 2024

CITATION
Emere CE, Aigbavboa CO, Oguntona OA and Ogunbayo BF (2024) A principal component analysis of corporate dispositions for sustainable building construction in South Africa.
Front. Built Environ. 10:1447621.
doi: 10.3389/fbuil.2024.1447621

A principal component analysis of corporate dispositions for sustainable building construction in South Africa

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Corporate dispositions have been associated with implementing sustainable building construction (SBC). Prior studies have underscored the need for institutions to adopt sustainable development concepts as an integral part of their operations. Nonetheless, there remains ambiguity about the characteristics essential for enabling SBC, particularly for construction companies. Consequently, this study explored the corporate dispositions influencing SBC implementation in South Africa. The respondents included built environment professionals in the Gauteng province of South Africa. Descriptive and principal component analyses were used to determine the essential characteristics or features. The study found that top management support, competency, availability of finance for the project operation, good project management culture, stakeholders' involvement and commitment, and commitment to innovative construction are the most critical corporate disposition features for SBC implementation. These formed a principal cluster called corporate capability and commitment. The insight from the critical corporate dispositions analysis is anticipated to trigger improvement initiatives and mitigate unsustainable practices and the unaffordability of smart houses in the South African construction industry. The findings suggest that mobilising competent human and financial resources for project operation among construction firms will support the adoption of modern building techniques and the erection of smart houses. Similarly, competitive advantage and committed involvement of the relevant stakeholders, including government and community, can lead to subsidy, alignment of local needs and aspirations, and reducing the high price of erecting sustainable/smart buildings and rental costs.

KEYWORDS

corporate dispositions, sustainable building construction, sustainable housing, green building, principal component analysis, South Africa

1 Introduction

The construction industry's contribution towards housing development and the built environment cannot be overemphasised. The provision of housing is linked to sustainable development (Ibem and Aduwo, 2013). Housing provision has multifaceted effects on advancing people's health, safety, security, and quality of life (Ibem and Aduwo, 2013; Amoah and Smith, 2024). Therefore, the construction industry positively impacts the GDP by assembling the built environments needed for economic activity *inter alia* (Odubiyi et al., 2024). The building sector accounts for approximately 8% of the GDP in developing nations and roughly 6% of the global GDP (Craveiroa et al., 2019; Fluid Construction, 2024). Likewise, it accounts for approximately 3% of South Africa's GDP (SA Building Review, 2024; Statista, 2024). However, even with the significance of the construction industry, its operations lead to negative environmental effects and the depletion of natural resources. Globally, the construction activities' negative impact includes ecological pollution, ozone layer depletion, about 40% green gas (GHG) emissions, and excessive waste generation *inter alia* (Liang et al., 2021; Odubiyi et al., 2024). Similarly, the activities consume about 40%–50% of the world's raw materials and 40%–45% of energy (Murtagh et al., 2020; Emere et al., 2024).

Building construction contributes at least 23% of GHG emissions in South Africa and 4% of all CO2 emissions (Simpeh and Smallwood, 2020; Emere et al., 2024). In South Africa, buildings utilise roughly 23% of the country's electricity, with an additional 5% producing building supplies (Emere et al., 2023). Besides, rapid urbanisation suggests that more houses should be constructed, creating a greater resource demand. These challenges suggest a dire need for sustainable building construction to meet housing development's economic, social and environmental objectives. SBC demands sustainable and green buildings (Tabassi et al., 2016). The embedding of sustainable principles in building construction will allow for improved use of construction resources, embracing sustainable building materials, using innovative building techniques for efficient design creation and waste minimisation, using smart appliances, using renewable energy and supplementary energy systems, and *inter alia* (Adebowale and Agumba, 2023; Emere et al., 2024). SBC will drive the development of designs that enhance occupant comfort and health, better meet the demands of community members, and boost overall performance (Omopariola et al., 2022; Emere et al., 2024). Consequently, SBC is the answer for delivering green and smart buildings to the increasing human population of South Africa. It provides solutions to the constitutional mandate to support the development of sustainable human settlements and improved living standards in households (Department of Human Settlement, 2020).

Unfortunately, implementing SBC in South Africa has experienced many drawbacks. Many construction personnel lack the understanding and competence to adopt passive design principles, sustainable construction materials, techniques and technologies (Mashwama et al., 2020; Mahachi et al., 2022). Many housing qualities have also been found wanting due to serious flaws in the implementation mechanisms, inadequate project management, and little assistance from the government (Amoah et al., 2020; Turok et al., 2022; Coetsee and Grobbelaar, 2023). Besides, there is the issue of non-compliance with the green building regulatory requirements and sustainable development guidelines (Aigbavboa and Thwala, 2019; Emere et al., 2023). Moreover, there is a fear of higher investment costs/perceived high costs (Aigbavboa et al., 2017) and ineffective enforcement and resource mobilisation to promote technical advancements (Saad, 2016). Similarly, poor stakeholder involvement and commitment (Marsh et al., 2021) and unwillingness to abandon traditional building techniques (Aghimien et al., 2019; Owoha et al., 2022) have been challenging. Notably, many developing countries worldwide suffer similar shortcomings (Ametepey et al., 2015; Susanti et al., 2019; Osuizugbo et al., 2020). These drawbacks suggest the need for sound corporate dispositions among construction organisations and all built environment stakeholders. It is still ambiguous as to corporate disposition characteristics to effectively implement SBC and provide adequate housing for all. Therefore, the current study aims to reveal the critical and principal corporate dispositions/features to effectively implement SBC and ensure that lower-income households can access affordable smart houses in South Africa. The key dispositions for SBC in South Africa were depicted using principal component analysis methodologies. This is among the most recent studies conducted in South Africa that offer insights into how corporate dispositions might effectively implement SBC towards sustainable housing development.

2 Literature review

2.1 Sustainable building construction (SBC)

Sustainability is a concept that can be applied in various disciplines. It widely focuses on meeting the present's needs without compromising future generations' ability to meet their needs (Al Alwan and Saleh, 2020). It accepts the interrelations of humans and the environment based upon the adjustment of genuine human demands, including social, cultural, environmental, and economic demands (GhaffarianHoseini, 2012). It calls attention to the conservation of natural resources (GhaffarianHoseini, 2012; Tabassi et al., 2016). Conversely, building construction can be described as the technique and industry involved in the assembly and erection of structures, primarily those used for shelter (Swenson and Chang, 2020). Sustainable buildings aim at the "required building performance with minimum adverse environmental impact while encouraging improvements in economic, social, and cultural circumstances" (Häkkinen et al., 2016:651). Similarly, DuPlessis defined "sustainable construction" as the "process applied to the complete construction cycle from the extraction and beneficiation of raw materials, through the planning, design, and construction of buildings and infrastructure, until their final deconstruction and management of the resultant waste. It is a holistic process aiming to restore and maintain harmony between the natural and built environments while creating settlements that affirm human dignity and encourage economic equity" (Du Plessis, 2007; 6). Hence, the term "sustainable building construction" (SBC) can be defined as the construction of buildings in a sustainable and green way (Nelms et al., 2005; Tabassi et al., 2016).

"Green" and "sustainable" emphasise preserving natural resources and ecological awareness. "Green" is strictly focused on environmental health, while "Sustainable" is concerned with environmental health, economic vitality, and social benefits (World Atlas, 2021: online). Hence, green is a subset of sustainability. In other words, sustainable buildings incorporate green building. However, both are almost inseparable. The development of a truly sustainable building requires complex measures to be applied during all the development stages in terms of aesthetics (shape of building and technologies), function (present and future adaptation), and construction (materials used) (Krizmane et al., 2016). Sustainable building is needed for better construction project delivery performance and positive societal contribution. Besides, "sustainable buildings contribute to meeting global goals regarding climate change and human rights, as well as national and local goals of poverty reduction, job creation, economic growth, energy security, public health, and others." (Krizmane et al., 2016:98). Additionally, "Sustainable buildings optimise energy use, protect and conserve water, use environmentally preferable products, enhance indoor environmental quality, and optimise operational and maintenance practices" (Klotz and Horman, 2007:322). By 2056, the world population, economic activity, and energy utilisation will have expanded by at least 50%, fivefold, and triple, respectively, as estimated (Ilha et al., 2009; Akadiri and Olomolaiye, 2012). Building sustainably is, therefore, in increasing demand and essential to ensure that the depletion of resources is mitigated. According to Tabassi et al. (2016), SBC definitions may vary. Nonetheless, its continuing interpretations emphasise that SBC should be economical throughout its life cycle, comfortable, inexpensive to maintain, and compliant with the environmental requirements, both biological and physical (Tabassi et al., 2016).

2.2 Sustainable building construction (SBC) and housing development

In South Africa, sustainability concepts have been regarded as a crucial component of development and curbing the challenges of climate change, the energy crisis, and the depletion of resources (Emere et al., 2023; Moghayedi et al., 2023). Nevertheless, there has not been much progress in the built environment toward applying sustainable construction principles (Moghayedi et al., 2023). Regretfully, South Africa has not fully adopted SBC, unlike developed nations. The building stock in South Africa lacks green and sustainable structures, and those that do exist account for a relatively small portion of the country's construction industry (Simpeh et al., 2023; Emere et al., 2024). Similarly, Masia et al. (2020) corroborate that acceptance among clients and real estate developers is still in its infancy compared to industrialised countries. One reason for the low adoption rate is the absence of mandatory legislative requirements (Emere et al., 2023). For instance, the Green Star building rating system encourages the voluntary application of sustainable construction principles (Moghayedi et al., 2023). Hence, there is a need for a compulsory legal mandate to increase SBC adoption among construction organisations in South Africa.

The South African construction industry's diligence in adopting SBC is critical for sustainable development and everyone's access to smart, affordable housing. There is a need to curb the challenges of unsustainable practices in the construction industry to the climate and environment and provide affordable and sustainable housing to the increasing human population (Moghayedi et al., 2023). South Africa's Constitution establishes the "right of access to adequate housing," a basic human requirement (The Republic of South Africa, 1996). However, the housing backlog in South Africa has been growing over the past few years, and urgent attention is needed for better solutions (Rust, 2022; Moghayedi et al., 2023). Rapid urbanisation brought on by a growing need for reasonably priced housing is one of the main persistent issues South Africa faces (Department of Human Settlement, 2020; Coetsee and Grobbelaar, 2023). People living in poverty who come to cities for work ultimately establish and dwell in unsustainable informal settlements that are constantly growing, exacerbating the problem (Coetsee and Grobbelaar, 2023; Moghayedi et al., 2023). Besides, South Africa's housing program has come under fire for being overly restricted in comparison to housing initiatives in other nations, as it only offers accommodation to a particular income bracket (Aduwo et al., 2022; Coetsee and Grobbelaar, 2023). To break the cycle of poverty and provide low-middle-income households with access to more comfortable housing, which will maximise productivity and create job possibilities, it is imperative that affordable housing be made available (Ferlito et al., 2022). This will add to the economic sustainability of housing development (Coetsee and Grobbelaar, 2023).

Similarly, construction organisations can contribute to environmental sustainability in housing by using sustainable building methods, technologies, and materials (Moghayedi et al., 2021; Emere et al., 2024). Regarding social sustainability, housing should be designed to raise the standard of living and wellbeing of the inhabitants while promoting a feeling of belonging and community apart from being affordable to ensure universal access (Moghayedi et al., 2023). Another key component of socially sustainable housing is its proximity to services, schools, and public transit, which improves accessibility and makes it easier for occupants to get the resources they need (Zhong et al., 2019). The Reconstruction and Development Programme (RDP) housing provisions have come under fire for their subpar construction (Amoah et al., 2022). Comparably, the unfavourable location of many RDP houses has drawn criticism since it frequently results in longer commute times for residents and inadequate spatial planning, and slums because of socio-economic issues (Charlton, 2018; Coetsee and Grobbelaar, 2023). Therefore, good corporate dispositions are needed by the construction companies and stakeholders (including governmental support) to provide adequate solutions regarding SBC and housing development in South Africa. All hands of the involved parties must be on deck in the construction process, and those benefiting or affected by the activities.

2.3 Corporate dispositions

This refers to the actions of a company due to factors such as image, vision, culture, policy, social responsibility and so on (Darko et al., 2017) that can influence sustainable building construction practices. Hence, for this study, corporate disposition is defined as organisational characteristics/factors that affect the practice of sustainable building construction. Du Plessis (2007), institutions, including government, academics, research, professional bodies, and construction firms, must accept sustainable development concepts as an integral part of their operations to create an environment that supports sustainable construction. This will enable them to build their capacity to support sustainable construction and utilise the related technology (Du Plessis, 2007). The following discusses the features related to corporate dispositions.

2.3.1 Identification of organisational benefits of adopting SBC

The knowledge of the benefits of adopting sustainable practices is essential for implementing SBC. Construction organisation can enhance their operations and financial results by integrating sustainable practices. For instance, sustainable construction uses less energy and water, which might result in cheaper operating expenses. This contributes to long-term savings on utility bills and maintenance costs (Construction, 2014; Oguntona et al., 2019). Similarly, adopting sustainable practices can increase an organisation's public image and brand value and attract like-minded financial incentives and like-minded investors (Andelin et al., 2015; Oguntona et al., 2019; Master Builders, 2023).

2.3.2 Social responsibility to protect the environment

Corporate Social Responsibility is "corporate strategies promoting "beyond compliance" voluntary measures that deliver ecological, social, and economic outcomes." (Boyle and McGuirk, 2012:397). There are several understandings of what propels a firm to be socially responsible regarding sustainability. Some companies could be socially responsible for fulfilling the ethical obligation of their business to society, while some, due to economic objectives and as a strategic tool to create more wealth (Boyle and McGuirk, 2012; Ye et al., 2020). Some believe it impacts a company's reputation positively, while others believe it has a detrimental impact (Avotra et al., 2021).

2.3.3 Top management support

Support from top management can positively impact SBC through resource allocation and strategic integration of sustainable principles into the company's operations (Kiesnere and Baumgartner, 2020). Also, creating incentives for employees to engage in sustainable practices can encourage a company-wide culture of sustainability (Kiesnere and Baumgartner, 2020). Furthermore, executive management commitment and mid-level manager support are critical in the decision-making process for green procurement and SBC implementation (Yang and Zhang, 2012; Wong et al., 2016).

2.3.4 Availability of competent personnel

The effective accomplishment of SBC rests on the availability of qualified staff (Aiyetan and Das, 2022). Qualified personnel are needed for high-tech plant and machinery operation and maintenance required for SBC. Competency is also critical for efficient supervision and monitoring of the necessary strategies for efficient construction management, especially mega-projects (Aiyetan and Das, 2022).

2.3.5 Availability of finance for the project operation

An important factor in the successful completion of construction projects is the availability of money. The organisation's financial resources significantly influence SBC (Shan et al., 2017). For example, having sufficient funding to complete the project would allow for the hiring of qualified staff to follow the project management procedures and apply the strategies required to meet the project's goals (Aiyetan and Das, 2022).

2.3.6 Alternate funding systems consideration

Long-term funding and investment are necessary for sustainable building (Fabian, 2015; Shan et al., 2017). Public funds have always been a significant funding source for environmentally friendly buildings. However, private funding is also required for sustainable building due to the pressure on public resources (Love et al., 2015). Hence, other funding systems should be considered. Private companies, especially in real estate, may be willing to invest for profit or to enhance their corporate social responsibility (Shan et al., 2017). Other funding systems include bank loans, green bonds, foreign aid initiatives, and individual funds (Otek Ntsama et al., 2021).

2.3.7 Pressure from the competitor's corporate involvement

In the current dynamic environment, businesses face ongoing pressure to become more and more involved in and responsive to sustainable development issues. This pressure comes from various social organisations, regulators, competitors, and customers, among other unanticipated causes (Yang and Zhang, 2012; Marichova, 2023). Hence, instead of focusing solely on obtaining higher profit, construction companies must reconsider the ecological, social, and economic interdependence and concentrate on sustainable development. Andelin et al. (2015) indicate that organisations can align themselves to sustainable principles by following the widely known and used Global Reporting Initiative (GRI) sustainable guidelines. "The guidelines require standard contents for sustainability reporting regarding an organisation's profile, governance structures, and processes; and the management practices for sustainability issues which include goals and environmental, social and economic performance indicators" (Andelin et al., 2015:31). The GRI enables companies to compare their reports concerning sustainable guidelines (Thompson and Ke, 2012).

2.3.8 Good project management culture

An organisation's good project management culture ensures that SBC goals are achieved by ensuring better project delivery with minimal risks and errors, thereby saving the cost of materials, plants and labour on site (Barnard, 2023). Decision-making can be geared towards adhering to environmental standards and sustainable principles. This will positively affect the supply chain in terms of material procurement as well as contribute to more environmentally responsible construction projects (Wang, 2021). Besides, it is vital to harness the various project management techniques towards achieving best practices in project performance improvement (Emere et al., 2020).

TABLE 1 CD measuring variables.

Measuring variables	Citations
Identification of organisational benefits of adopting sustainable building construction	Andelin et al. (2015); Oguntona et al. (2019)
Social responsibility to protect the environment	Boyle and McGuirk (2012); Ayarkwa et al. (2017); Darko et al. (2017); Ye et al. (2020)
Top management support	Yang and Zhang (2012); Aktas and Ozorhon (2015); Ametepey et al. (2015); Darko et al. (2017); Yas and Jaafer (2020)
Availability of competent personnel	Low et al. (2014); Darko et al. (2017); Daniel et al. (2018); Tafazzoli (2018); Aiyetan and Das (2022)
Availability of finance for the project operation	Ametepey et al. (2015); Kalua (2015); Susanti et al. (2019); Karji et al. (2020)
Alternate funding systems consideration for sustainable building construction	Kalua (2015); Ayarkwa et al. (2017); Shan et al. (2017); Oguntona et al. (2019)
Pressure from the competitor's corporate involvement	Yang and Zhang (2012); Wong et al. (2016); Darko et al. (2017)
Good project management culture	Emere et al. (2020); Tarver and Brock (2021)
Commitment to innovative construction	Tarver and Brock (2021); Moghayedi et al., 2023
Quest for competitive advantage over counterparts	Low et al. (2014); Windapo (2014); Wong et al. (2016); Ayarkwa et al. (2017); Darko et al. (2017)
Good intra-organisational leadership	Koebel et al. (2015); Tabassi et al. (2016); Darko et al. (2017); Mukerji (2017); Illeperuma and Abeynayake (2022)
Stakeholders' involvement and commitment	Andelin et al. (2015); Wong et al. (2016); Ayarkwa et al. (2017); Darko et al. (2017); Dosumu and Aigbavboa (2018); Chen et al. (2022)
Cultural change promotion for sustainability	Ochieng et al. (2014); Ametepey et al. (2015); Daniel et al. (2018)

2.3.9 Commitment to innovative construction

The organisation's commitment to innovative construction methods and materials adds to SBC. Innovative technologies provide chances to optimise and control the energy usage of a building (Moghayedi et al., 2023). Similarly, adopting modern building methods such as BIM, industrialised building systems, value engineering and lean techniques will lead to sustainable and efficient designs and waste minimisation (Emere et al., 2024). Furthermore, enhancing the utilisation of sustainable materials through process development and implementation can drastically lower the industry's carbon footprint (Adebowale and Agumba, 2023).

2.3.10 Competitive advantage

Construction organisations can achieve a sustainable competitive advantage through different means and by using their uniqueness. Strategies may include adopting a low-cost approach in construction operations, legitimisation/compliance with sustainable building regulations, entrepreneurship orientation, and marketing their green expertise to attract potential investors and clients (Walsh and Dodds, 2017; Ed-Dafali et al., 2023; Gomez-Trujillo et al., 2024). Companies with a stronger position in technological resources or competencies can get a better permanent competitive advantage. In contrast, those with a strong standing in the market can only achieve a better result of transitory competitive advantage (Huang et al., 2015). However, companies can use the short-term competitive advantage resulting from their market position to strengthen their capabilities and technology, strengthening their capacity to compete over the long term (Huang et al., 2015).

2.3.11 Good intra-organisational leadership

According to Opoku et al. (2015), formulating policies, implementing processes, and disseminating best practices throughout the organisation are the three most crucial roles that intra-organisational leadership plays in supporting sustainable construction practices. Organisations' leaders should be able to see a future state of affairs, inspire others to share that vision and drive them to overcome obstacles to achieve the intended outcome (Emere et al., 2018). Likewise, harnessing the various leadership styles is critical to influencing construction personnel to meet sustainable project objectives (Emere et al., 2021).

2.3.12 Stakeholders' involvement and commitment

To cultivate relationships, trust, confidence, and buy-in for their major efforts, companies must prioritise stakeholder involvement and commitment (Sedmak, 2021). To determine which social and environmental issues are most important, companies have dialogues with their stakeholders and include them in decision-making (Paravano et al., 2024). Internal and external stakeholders should be engaged to avoid conflicts of interest. Collaboration among project stakeholders to raise living standards and comfort levels, lessen adverse environmental effects, and increase the project's economic viability is made easier by a well-managed stakeholder engagement process (Bal et al., 2013). Stakeholder engagement should, therefore, be a keystone of any "sustainable development" plan (Bal et al., 2013). According to Maier and Aschilean (2020), organisations that implement stakeholder management concepts will be better able to meet the needs and balance the interests of their constituents, thereby increasing the sustainability of the construction industry as a whole (Maier and Aschilean, 2020).

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TABLE 2 Corporate disposition features.

Code	Variables	Consult		Contract		Govt		Private		Total			K-W	
		M	R	M	R	M	R	M	R	M	SD	R	X^2	Sig
CD3	Top management support	4.43	2nd	4.49	1st	4.26	2nd	4.27	3rd	4.38	0.829	1st	2.812	0.422
CD4	Availability of competent personnel	4.41	3rd	4.34	3rd	4.27	1st	4.32	1st	4.35	0.848	2nd	2.240	0.524
CD5	Availability of finance for the project operation	4.44	1st	4.34	3rd	4.16	3rd	4.30	2nd	4.32	0.805	3rd	7.626	0.054
CD8	Good project management culture	4.36	4th	4.32	5th	4.16	3rd	4.15	6th	4.27	0.796	4th	5.049	0.168
CD12	Stakeholders' involvement and commitment	4.31	6th	4.36	2nd	4.09	6th	4.08	8th	4.23	0.842	5th	5.376	0.146
CD9	Commitment to innovative construction	4.34	5th	4.22	8th	4.09	6th	4.18	4th	4.22	0.863	6th	3.600	0.308
CD2	Social responsibility to protect the environment	4.18	8th	4.20	9th	4.07	8th	4.18	4th	4.16	0.800	7th	1.118	0.758
CD11	Good intra-organisational leadership	4.25	7th	4.18	11th	4.07	8th	3.98	12th	4.15	0.795	8th	5.070	0.167
CD1	Identification of organisational benefits of adopting sustainable building construction	4.16	9th	4.14	12th	4.13	5th	4.03	9th	4.13	0.917	9th	0.783	0.854
CD13	Cultural change promotion for sustainability	4.16	9th	4.23	7th	4.04	10th	3.93	13th	4.12	0.864	10th	3.262	0.353
CD10	Quest for competitive advantage over counterparts	4.15	11th	4.20	9th	3.99	11th	4.00	11th	4.10	0.858	11th	2.076	0.557
CD6	Alternate funding systems consideration for sustainable building construction	3.98	13th	4.24	6th	3.94	12th	4.10	7th	4.06	0.830	12th	4.889	0.180
CD7	Pressure from the competitor's corporate involvement	4.07	12th	4.12	13th	3.89	13th	4.03	9th	4.03	0.892	13th	1.676	0.642
Group Mean		4.25		4.26		4.09		4.12		4.18				
Cronbach's Alpha		0.956												

TABLE 3 KMO and Bartlett's test for CD.

Kaiser-Meyer-Olkin measure sampling adequacy		0.939
Bartlett's Test of Sphericity	Approx. Chi-Square	3,153.522
	df	78
	Sig	<0.001

2.3.13 Cultural change promotion for sustainability

Kashima et al. (2019) contend that cultures are dynamic processes rather than static entities. Understanding the culture of an organisation and the local community is important for meaningful engagement towards sustainable initiatives. This will help mitigate conflicts and varying views that dampen achieving sustainability goals (Nguyen and Watanabe, 2017). There should be improvement where the cultural status quo is not favourable to sustainable development; new cultures may be formed (Kashima, 2020). Table 1 presents the measuring variables for this study's latent construct – Corporate Disposition (CD).

3 Research methodology

This study assessed the corporate disposition features of implementing SBC. The study used quantitative data from a questionnaire survey of built environment professionals and a deductive technique based on a positivist philosophical framework. It was assumed that corporate characteristics had an impact on SBC implementation. The questionnaire survey was used due to the quantitative approach, making it easier to gather information from many respondents (Tan et al., 2011). Sections A and B comprised the questionnaire. Section A included demographic data, while Section B included the corporate disposition features to implement SBC. The question aimed to determine the degree to which the corporate dispositions impact the implementation of SBC in South Africa. The respondents were asked to indicate the extent to which the corporate dispositions/characteristics influence sustainable building construction (SBC) implementation in South Africa. Likert scale (5-point) was employed, with "1 = low extent" and "5 = very high extent."

Professionals in the built environment with backgrounds in engineering, project management, construction management, architecture, quantity surveying, and town and regional/urban planning were among the respondents. In all, 281 completed questionnaires were obtained, exceeding the minimum requirement for factor analysis which is 150 sample size (Pallant, 2020). This study adopted a convenience sampling technique over random sampling based solely on chance. However, a significant drawback of convenience sampling is its unclear generalisability (Obilor, 2023). Nevertheless, its application was deemed appropriate in this study's context. Convenience sampling is helpful when randomisation is impractical, such as in large populations (Etikan et al., 2016). Thus, it was determined that this sample approach would fairly represent the construction practitioners in the Gauteng province of South Africa, averaging 333,000 (Statista, 2023). Besides, the nature of the study demands that responders be knowledgeable and experienced to contribute significantly. Therefore, randomisation might not be the best option to accomplish this. Similarly, the study's time constraint, respondent availability, and desire to participate were considered while choosing the convenient sampling technique (Etikan et al., 2016). Moreover, the convenience sampling technique is most appropriate because the information gathered came from the respondents' perspectives, and the researcher intended to develop and test hypotheses in detail in subsequent studies (Golzar et al., 2022).

The study's data were analysed using the Statistical Package for Social Sciences (SPSS) version 29 programme. Outputs included descriptive statistics like frequency, mean, and standard deviation; factors were also rated. Similarly, the correlations/associations between variables of the collected data were investigated using exploratory factor analysis (EFA). Several associated variables were reduced and resized into the key component (s) using principal component analysis (PCA) (Pallant, 2020). This increased interpretation while minimising information loss (Jolliffe and Cadima, 2016). The key factors were extracted using the Varimax method rotation and eigenvalue above one. The scree plot further supported the identified component (s).

Additionally, using Cronbach's alpha criterion of 0.70, the acquired data's dependability and internal consistency were evaluated. The obtained data exhibited great reliability and internal consistency, with a 0.956 average value for the variables (Pallant, 2020).

4 Findings

4.1 Demographical data

Regarding the respondents' background, construction managers (21.4%), engineers (20.6%), and quantity surveyors (19.6%) were ranked first, second and third respectively. Others included project managers (17.1%), architects (14.6%), and town/urban and regional planners (6.0%). The sample included the various backgrounds within the South African built environment (Council for the Built Environment, 2018), which added to the authenticity of the collected data. Concerning industrial experience, most respondents had six to 10 years of experience (19.6%), followed by those with one to 5 years (18.1%), eleven to 15 years (15.7%), sixteen to 20 years (14.6%), twenty-one to 25 years (11.4%), twenty-six to 30 years (8.1%), less than 12 months (6.8%), and those with more than 30 years (5.7%). Similarly, 44,8% had Honours/Btech degrees, 24.2% had master's degrees, 14.6% had bachelor's degrees, 10.7% had national diplomas, and 5.7% had doctorates. Based on the organisational/work sector, 34.5% were affiliated with consulting firms, 26.3% with contracting firms, 24.9% with government agencies/establishments, and 14.2% were privately practising. Overall, the demographic data results showed that the participants were well-prepared to answer the questionnaire since they had sufficient knowledge and expertise.

4.2 Descriptive statistics and Kruskal–Wallis (K-W) H-Test

Table 2 presents the results of corporate dispositions (CD) influencing sustainable building construction implementation in

TABLE 4 Total variance explained for CD.

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.554	65.800	65.800	8.554	65.800	65.800
2	0.884	6.797	72.597			
3	0.658	5.061	77.659			
4	0.487	3.746	81.405			
5	0.400	3.074	84.478			
6	0.374	2.876	87.355			
7	0.352	2.707	90.061			
8	0.273	2.102	92.164			
9	0.265	2.039	94.203			
10	0.239	1.840	96.043			
11	0.219	1.684	97.727			
12	0.165	1.272	98.999			
13	0.130	1.001	100.000			

Extraction method: Principal component analysis

TABLE 5 Component matrix for CD.

Component matrix	
	Component
	1
Commitment to innovative construction	0.858
Good intra-organisational leadership	0.844
Top management support	0.841
Good project management culture	0.836
Stakeholders' involvement and commitment	0.820
Social responsibility to protect the environment	0.816
Availability of competent personnel	0.806
Cultural change promotion for sustainability	0.804
Identification of organisational benefits of adopting sustainable building construction	0.796
Quest for competitive advantage over counterparts	0.794
Alternate funding systems consideration for sustainable building construction	0.779
Availability of finance for the project operation	0.774
Pressure from the competitor's corporate involvement	0.770

Extraction Method: Principal Component Analysis
a. 1 components extracted

South Africa. Results indicate that the overall top five rated variables were *top management support* (MS = 4.38; SD = 0.829), *availability of competent personnel* (MS = 4.35; SD = 0.848), *availability of finance for the project operation* (MS = 4.32; SD = 0.805), *Good project management culture* (MS = 4.27; SD = 0.796), and *stakeholders' involvement and commitment* (MS = 4.23; 0.842). However, the penultimately ranked variable was *alternate funding systems consideration for sustainable building construction* (MS = 4.06; 0.830), while the least ranked was *pressure from the competitor's corporate involvement* (MS = 4.03; 0.892). For the individual groups of the organisation/work sectors, respondents affiliated with consulting firms prioritised *the availability of finance for the project operation* and *top management support* more than other variables. Similarly, respondents affiliated with contracting firms prioritised *top management support* and *stakeholders' involvement and commitment.* The *government-affiliated professionals and professionals affiliated with private sectors prioritised the availability of competent personnel.* However, unlike the latter, the former preferred top management support to the availability of finance. The mean for the entire group of responses was 4.18, while the individual group mean for consulting, contracting, government and private sectors were 4.25, 4.26, 4.09, and 4.12, respectively. Based on their working organisations, respondents' opinions regarding these variables did not significantly differ, according to the K–W test results. This indicates that all the variables were highly affirmed as critical contributors to SBC implementation in South Africa. Additionally, as per Kothari and Garg (2014), the MS values indicate each variable's significance and statistical relevance at the set 3-point threshold. Furthermore, the measuring variables exhibited

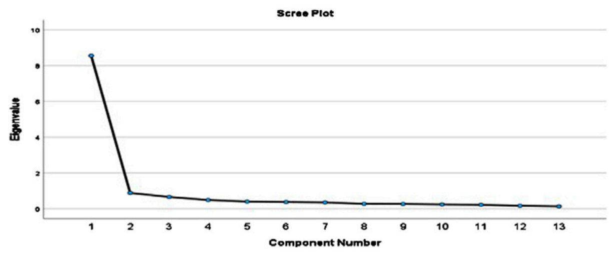

FIGURE 1
Scree plot CD.

outstanding internal consistency and reliability, as seen by Cronbach's alpha value of 0.956, which was higher than the criterion of 0.70 (Pallant, 2020).

4.3 Principal component analysis for corporate dispositions (CD)

The first step in this approach was exploratory factor analysis (EFA). Using EFA, thirteen (13) CD measurement variables were examined. Table 3 indicates the Kaiser-Meyer-Olkin (KMO) sample adequacy test and Bartlett's test of sphericity. The KMO score was higher than the minimum of 0.6 needed to proceed with factor analysis, at 0.939 (Pallant, 2020). Factorability was further reinforced by the 0.001 result of Bartlett's test of sphericity. Similarly, principal component analysis (PCA) and the varimax rotation approach were used to extract and rotate the variables. One principal component factor achieved a value above one. It was extracted with the same percentage and cumulative percentage variance of 65.800, surpassing the minimum threshold of 50%, as shown in Table 4 (Emere et al., 2023).

The component matrix results are shown in Table 5, where the principal components are used to categorize the factor loadings of the CD measurement variables.

The variables loading in the extracted principal component had significant values above 0.5 (Pallant, 2020). Similarly, Figure 1s scree plot revealed a significant gap following the initial component factor before displaying the insignificant remaining components having eigenvalues smaller than one gradually meandered off.

4.3.1 Component 1 - corporate capability and commitment

The extracted component was named corporate capability and commitment. As shown in Table 5, this comprised ten variables with their loadings, namely, Commitment to innovative construction (0.858), Good intra-organisational leadership (0.844), Top management support (0.841), Good project management culture (0.836), Stakeholders' involvement and commitment (0.820), Social responsibility to protect the environment (0.816), Availability of competent personnel (0.806), Cultural change promotion for sustainability (0.804), Identification of organisational benefits of adopting sustainable building construction (0.796), Quest for competitive advantage over counterparts (0.794), Alternate funding systems consideration for sustainable building construction (0.779), Availability of finance for the project operation (0.774), and Pressure from the competitor's corporate involvement (0.770).

5 Discussions

Table 2's descriptive statistics results demonstrated that the key corporate disposition variables characterising the successful implementation of SBC included Top Management support, Availability of competent personnel, Availability of finance for the project operation, Good project management culture, and Stakeholders' involvement and commitment. Respectively, they were the top five ranked in descending order out of the thirteen variables.

The finding on top management support concurs with the study's hypothesis. Top management involvement is critical for a holistic, practical perspective. The organisation's top management's backing will guarantee that the required steps are performed for SBC. Measures include strategic integration and resource allocation of sustainable principles into the company's operations (Kiesnere and Baumgartner, 2020). Top management support/commitment is essentially for adopting SBC (Aktas and Ozorhon, 2015; Darko et al., 2017; Yas and Jaafer, 2020). The availability of competent personnel confirms many scholars' findings that incompetence is a significant barrier to adopting sustainable practices (AlSanad, 2015; Ametepey et al., 2015). Competency can be achieved through the transference of skills through education and training. Similarly, the availability of finance for the project operation being among the predominant factors indicates that financial capability is critical for implementing SBC (Darko et al., 2017; Susanti et al., 2019; Karji et al., 2020). Access to adequate funding can serve as a motivation and help mitigate the tendency to cut corners when applying sustainability principles. The finding that good project management culture is a predominant factor supports Andelin et al. (2015) position that corporate culture, which alludes to an organisation's practices, behaviours, and convictions, influences SBC. A strong project management culture guarantees achieving SBC goals by promoting improved project delivery with fewer risks and errors (Barnard, 2023). Likewise, the finding on stakeholders' involvement and commitment being a predominant factor confirms many authors' positions, suggesting that the lack of it is a critical barrier to SBC (Osuizugbo et al., 2020; Aghimien et al., 2021; Marsh et al., 2021).

Moreover, the PCA results confirmed *Corporate Capability and Commitment* as principal for SBC in South Africa. This principal component revealed Commitment to innovative construction as a top factor. Commitment to innovative construction will lead to capacity building by acquiring adequate skill and knowledge of using modern building techniques for efficient designs, minimisation of waste generation, performance optimisation and delivery of sustainable and smart housing (Hussin et al., 2013; Emere et al., 2024). Commitment to innovation accommodates adopting innovative/sustainable building materials and methods to ensure energy savings and improve the use of construction resources (Moghayedi et al., 2023; Adebowale and Agumba, 2023). For instance, residential properties must have higher energy efficiency to reduce running costs and lessen the inevitable effects of climate change (Ling and Niig, 2016). Additionally, to preserve resources, promote their efficient use, and address the issue of resource consumption without consideration for the physical constraints of resources, the circular economy model must replace the linear economy model (Hossain et al., 2020; Emere et al., 2024).

Similarly, the principal component revealed the importance of Good intra-organisational leadership. Proper leadership is critical considering the complexity of the construction process, which necessitates the involvement of people, cultures, and different/

uncertain circumstances. Leaders are influencers. Leaders in construction organisations should be able to envision the future, motivate others to embrace that vision, and push past challenges to accomplish the desired result (Emere et al., 2018). Besides, there is a need for organisational leaders to possess critical leadership traits such as communication skills, visioning, courage, integrity, problem-solving skills and so on (Emere et al., 2019). Great leaders will understand the need for SBC and ensure top management support and a good project management culture for actualising the project success objectives and sustainable development goals. The results on Stakeholders' involvement and commitment further provide evidence that all parties (external or internal) should prioritise sustainability initiatives. Hence, there is a need for dialogues with stakeholders and for them to be included in decision-making to avoid conflicts of interest and misunderstandings (Paravano et al., 2024). This also will help build healthy relationships, trust, confidence, and implementation of the set objectives (Sedmak, 2021). Consequently, the involvement of all stakeholders will contribute to social responsibility to protect the environment and promote cultural change for sustainability, which were also found to be essential corporate dispositions to implementing SBC.

6 Conclusions, implications and recommendations

This study examined the various corporate disposition factors to effectively implement SBC in South Africa. Results were obtained using a questionnaire survey, descriptive analysis and principal component analysis (PCA). The responses revealed that all the factors were vital, as the mean item scores exceeded 3.00. PCA was used to extract a key cluster, Corporate Capability and Commitment. This cluster revealed essential elements such as Commitment to innovative construction, Good intra-organisational leadership, Top Management support, Availability of competent personnel, Availability of finance for the project operation, Good project management culture, and Stakeholders' involvement and commitment, among others.

This study contributes to the body of knowledge. No study has explored the principal corporate dispositions for implementing SBC in South Africa. It is also one of the more recent studies conducted in South Africa that sheds light on the elements needed for SBC to be implemented successfully. The study confirmed *Corporate Capability and Commitment* as a fundamental cluster to driving SBC implementation in South Africa. Hence, there is a need for intellectual, financial, and skill empowerment and the responsibility to achieve sustainability objectives in the construction industry. The study recommends that construction organisations adequately consider the revealed critical features in the cluster to direct improvement initiatives. It will lessen the resistance to abandoning traditional techniques. It is recommended to convert from a linear to a circular economic model. The research also suggests that to promote technical developments, resources be mobilised, and rules be adequately enforced. Mobilising competent human and financial resources for project operation among construction firms, especially SMEs, will support the adoption of modern building techniques and the erection of smart houses. In South Africa, modern construction methods like BIM, industrialised building systems, value engineering and management, and lean methods ought to be welcomed and given priority. It is also possible to achieve societal acceptance of new and innovative technology by implementing awareness initiatives in the built environment by professional bodies (Emere et al., 2024). Building costs and long-term housing expenses can be reduced using innovative, sustainable housing designs, materials, and technologies to improve affordability (Moghayedi et al., 2023). Likewise, a quest for a competitive edge among construction firms can decrease the bidding cost of developing smart and sustainable buildings. Additionally, the devoted participation and collaboration of the government and the local community with construction firms can result in subsidies, aligning local goals and needs, and lowering rental expenses for smart and sustainable buildings. Furthermore, the study's findings provided valuable insights into how good corporate dispositions can enhance SBC and provide affordable and smart houses.

The study has certain drawbacks. The study was limited to Gauteng. Therefore, additional research can be conducted using data from other South African regions for a broader view. Similarly, the study adopted a convenient sampling technique. Different sampling techniques and methodological approaches may be used to confirm the generalisability of the findings.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Faculty of Engineering and the Built Environment Ethics Committee, University of Johannesburg, South Africa. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CEE: Conceptualization, Funding acquisition, Methodology, Writing–original draft, Writing–review and editing. COA: Conceptualization, Methodology, Supervision, Writing–review and editing. OAO: Conceptualization, Methodology, Writing–review and editing. BFO: Methodology, Writing–review and editing.

Funding

The author(s) declare that financial support was received for the research, authorship, and/or publication of this article. The National Research Foundation Scholarship of South Africa provided funding for this study (NRF Grant No: PMDS2205036000).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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