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Interaction of drivers and barriers of sustainable property management practice in shopping malls in Lagos, Nigeria

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Extant studies on sustainable property management (SPM) are yet to be reported for shopping malls in developing countries. Shopping malls play a vital role in commercial activities in developing countries. This study investigates the strategies and the interaction of the drivers and barriers to SPM practice being adopted in the management of three randomly selected shopping malls in Lagos, Nigeria. The primary data utilized were elicited with the aid of a questionnaire served on 130 tenants of the three shopping malls. The obtained data were analyzed using statistical tools such as mean ranking, frequency distribution, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and mediation analysis. LED energy saving bulbs (90%) and green leasing (6.9%) are the most and least adopted features while using environmental cleaning procedures (83%) and adopting green leasing (36.4%) are the top and least SPM adopted strategy. Health and wellbeing of occupants (88.4%), cost savings (87%) and regulatory requirements (85%) were ranked the top three drivers while EFA grouped the factors into 2: direct and indirect. Financial and economic barrier (4.2/5) were top while cultural factors (3.97/5) were the least. The interactions of the latent barrier factors were exposed by the CFA and mediated regression models. In conclusion, this article explored SPM within shopping mall operations, presenting evidences that, while beneficial in reinforcing the relevance of sustainability in the real estate sector, ultimately contributes modestly to the broader academic discourse on the subject.

KEYWORDS

sustainability, confirmatory factor analysis, exploratory factor analysis, mediation, property management, shopping mall

Introduction

Sustainable property management (SPM) is a set of practices, guidelines, procedures and strategies aimed at minimizing the environmental impact (mostly adverse) of

properties (residential or commercial) while maximizing their social and economic benefits (Keeping and Shiers, 2009). It involves integrating sustainable principles into the design, construction, operation, and maintenance of buildings and real estate portfolios (Islam et al., 2021). The idea of SPM was developed with the goal of improving people's quality of life (Svensson and Gluch, 2022). It represents a shift from traditional, top-down approaches to property management to one that emphasizes the social and economic context of each decision (Razali et al., 2015). Despite the information that could be extracted from extant literature, it appears that SPM practice in the operation of shopping malls has been neglected with much emphasis being placed on sustainable design, materials, and construction.

Shopping malls are trendy commercial buildings that involve huge investment and has replaced traditional retail outlets (Eduful and Eduful, 2021). Despite being a contributor to the modern economy through globalisation, they are also a part of the major contributors to the negative impact on the environment (Simone and Pezoa, 2021). They constitute the biggest culprits in terms of environmental impact within the commercial buildings sector as a result of their complexity in terms of demands from the various tenants (Yi and Kang, 2020). The impact may range from general waste from restaurants and large retail shops within the malls, electricity consumption and water consumption to pollution. Shopping malls are just a slice of a global concerns of buildings on the environment (Saleh et al., 2023).

The sustainability concept in the built environment has caught the international awareness, and it is now a top issue because the property industry has a significant environmental impact (Razali et al., 2015). Various stakeholders including governments and property developers are thus engaged to promote and achieve sustainability within the built environment. According to Lorenz et al., (2008), much of such emphasis however, has been placed on the new building design and construction phases focusing on building technologies and their construction materials and methods with a few focusing on the operational phase (Ogunba et al., 2023). Nonetheless, in terms of waste management, energy and water conservation, and lowering the total environmental effect of building operations, the built environment represents a significant opportunity for achieving sustainability (Ogunba et al., 2023).

The current practices in existing buildings, however, focus on achieving the objectives of the owner, which is maximizing income from the property and making the tenants comfortable to operate their business (Aghili et al., 2017). No sustainability plans for managing shopping malls in Nigeria have been reported, and this paper seeks to bridge the gap. Failure to implement SPM practices in the operation of shopping malls could result in continued major negative impacts on the overall environment. A search online yielded no documents on policy plans or implementation of SPM in shopping malls in Nigeria. The ones that are available are related to contexts that are outside the scope of this study. Hence, engaging with existing frameworks and theories on SPM is not beneficial because previous studies are needed to contextualize the findings of this study within the larger body of scholarly work, bringing out areas of convergence, corroboration, divergence, and differences. Even when the factors that drive or hinder the application of SPM to shopping malls exist, the interaction of these factors to create new knowledge domains has not been considered. In light of these,

the study aims to assess the strategies and the interaction of factors that drive and hinder sustainable property management practices in shopping malls of Lagos, Nigeria. The aims are further divided into these objectives:

- (i). Ascertain the features, strategies and drivers for implementing SPM practice in shopping malls.
- (ii). Ascertain the drivers for implementing SPM practice in shopping malls.
- (iii). Determine the barriers to implementation of SPM practice.
- (iv). Determine the causal relationships among the barriers to implementation of SPM practice.

The research represents a paradigm shift from a focus on profit maximization to sustaining profit through deliberate plans to incorporate sustainability into the management of shopping malls in Nigeria. This article explores sustainable property management within shopping mall operations, presenting a study that, while beneficial in reinforcing the relevance of sustainability in the real estate sector, ultimately contributes modestly to the broader academic discourse on the subject. The core argument posits that the drive towards sustainable operations should be viewed as a mandate of property owners rather than the tenants, a perspective that underscores the critical role of ownership in steering environmental stewardship.

Implementing SPM practices in the management of shopping malls in Nigeria can bring several benefits. First, SPM can help reduce the environmental impact of shopping malls by promoting energy efficiency, water conservation, waste reduction, and the use of sustainable materials. This can contribute to the preservation of natural resources and the reduction of greenhouse gas emissions. Second, SPM practices can lead to cost savings for shopping mall owners through reduced energy and water bills, lower waste disposal costs, and increased operational efficiency, which can also enhance the long-term value of the property. Third, SPM practices can enhance the overall shopping experience for tenants and customers. Features such as improved indoor air quality, natural lighting, and green spaces can create a more conducive business environment, leading to higher tenant satisfaction. Lastly, SPM practices are a step towards improving the wellbeing of customers and contributing to the achievement of sustainable development goals.

Materials and methods

This study has two populations. The first population is the number of shopping malls in Ikeja, Lagos, Nigeria, and the second population is the number of tenants in the shopping malls. A two-stage sampling design would have been the best approach, but the unavailability of data (sampling frame) for the number of shopping malls in the study area led to the choice of using purposive sampling for selecting the shopping malls and simple random sampling for recruiting the tenants (respondents). The questionnaire was designed using insights from those found in Liu et al. (2022) and Fateye et al. (2023). Three shopping malls were chosen using purposive sampling: Ikeja City Mall, Purple Maryland, and Jara Shopping Mall. These three shopping malls contain many retail shops and experience high volumes of transactions, making

TABLE 1 Limitations, strengths and weaknesses of the statistical methods.

Method	Limitation	Strength	Weakness
Frequency analysis	Limited explanatory power	Simple to interpret, provides a quick overview	Does not account for underlying relationships between variables
Mean ranking	Assumes equal intervals between rankings, may not capture variation in preferences	Easy to understand, allows for comparison of multiple factors	Ordinal data (rankings) limits statistical analysis compared to interval or ratio data
EFA	Results can be subjective depending on researcher interpretation	Reduces complexity by grouping related variables into factors. Simple to interpret.	Does not test a pre-defined model, requires a large sample size for reliable results
CFA	Relies on strong theoretical foundation for the model being tested	Provides statistical evidence for the hypothesized relationships	Less flexible than EFA, requires careful model specification and large sample size. Difficult to interpret
Mediation regression	Requires careful selection of the mediator and clear theoretical justification for the model	Provides a more detailed understanding of the latent association	More complex to interpret than other methods, requires specific assumptions about the data

purposive sampling one of the best options. Similar articles that can be explored include [Mohammadi et al. \(2020\)](#) and [Attiq et al. \(2022\)](#). Simple random sampling was used to recruit the respondents, while the tenants occupying the three shopping malls that were purposively chosen. This sampling technique was chosen because it has been found to be effective, especially when there is no restriction on how the sample size is selected, as is the case in this study where every tenant has an equal chance of being selected as a sample. Examples of the application of simple random sampling in contexts similar to this study can be found in [Nisbet et al. \(2020\)](#) and [Maepa \(2021\)](#). The three shopping malls contained a total of 180 retail shops: 100 in Ikeja City Mall, 50 in Purple Maryland, and 30 in Jara Shopping Mall. Samples were to be taken from one tenant from each shop. Simple random sampling yielded 123 samples. However, 200 questionnaires were administered, but only 130 were retrieved, which is the final sample size. Out of the 130 respondents, 82 were from Ikeja City Mall, 31 from Purple Maryland, and 17 from Jara Shopping Mall.

The questionnaire was divided into five sections. The first section contained six questions on demographics: gender, highest level of education, work experience, location of the mall, goods and services provided, and years of operation within the malls.

The second section contained a list of fourteen (14) sustainable features, with response options of “yes” or “no.”

The third section contained nine (9) strategies being adopted in the shopping malls. The responses were in a Likert scale format, coded as follows: always (AL) coded as 5, very often (VO) coded as 4, often (O) coded as 3, rarely (R) coded as 2, and never (N) coded as 1.

The fourth section contained six drivers or reasons for implementing SPM in the shopping malls. The responses were in a Likert scale format, coded as follows: strongly agree (SA) coded as 5, agree (A) coded as 4, neither agree nor disagree (N) coded as 3, disagree (D) coded as 2, and strongly disagree (SD) coded as 1.

The last section contained 5 major variables and their corresponding latent or sub-variables. The responses and coding were similar to those in section four.

The first is the financial and economic barrier (EA) with four latent variables namely: sustainable measures require a huge initial capital outlay (E1), landlords prioritizing short-term financial gains over long-term sustainability goals (E2), lack of adequate funding for implementing sustainable measures (E3), and tenant reluctance to pay higher rentals (E4). The second is the knowledge and awareness barrier (EB) with four latent variables namely: lack of training on sustainable property management practice (E5), lack of awareness and knowledge of green leases (E6), limited engagement with stakeholders (E7), and limited access to information (E8). The third is the technical barrier (EC) with four latent variables namely: old building designs limiting the alteration and installation of new sustainable equipment such as solar panels (E9), limited availability of sustainable products and services (E10), complexity in terms of implementation (E11), and compatibility issues with existing systems and services (E12). The fourth is the regulatory and policy related barrier (ED) with four latent variables namely: lack of consistent standards for sustainable property management practices (E13), regulations not supporting or incentivizing sustainable property management practices (E14), limited government support (E15), and limited enforcement of the sustainable standards (E16). Finally, the fifth is the cultural and behavioral barrier (EE) with four latent variables namely: resistance to change by building owners (E17), perceived lack of demand for sustainable features by tenants (E18), lack of ownership for the various roles leading to successful sustainable property management (E19), and lack of effective communication between landlord and tenants (E20).

Frequency analysis, mean ranking, exploratory factor analysis (EFA), confirmatory factor (CFA) and mediation regression were used for analysis. P-value less than 0.05 is considered significant.

Mean ranking helps to identify the most frequently adopted SPM strategies in ordinal data and the factors that most influence their implementation. Also, calculating the mean reveals which strategies and factors tenants ranked highest. The frequency analysis showed how often specific SPM practices occur within the shopping malls, hence providing categories that could help identify patterns in the analyzed data. EFA helps uncover hidden patterns within

TABLE 2 Summary of respondents' demographic information.

Variables	Frequency	Percentage
Gender (A1)		
Male	59	45.4
Female	71	54.6
Highest Level of Education (A2)		
OND	15	11.5
HND/B.Sc	72	55.4
M.Sc	37	28.5
Ph.D	2	1.5
Others	4	3.1
Work experience (A3)		
0–5 years	73	56.2
6–10 years	56	43.1
11–15 years	1	0.7
16 years and above	0	0
Location of the Mall (A4)		
Ikeja City Mall	82	63.1
Purple Maryland	31	23.8
Jara Mall	17	13.1
Goods and Services Provided (A5)		
Supermarket	3	2.3
Electronic gadgets and equipment	20	15.4
Food Court	25	19.2
Pharmaceuticals	3	2.3
Others	79	60.8
Years of operation within the Malls (A6)		
0–5 years	75	57.7
6–10 years	48	36.9
11–15 years	4	3.1
16 years and above	3	2.3

OND, ordinary national diploma; HND, higher national diploma; B.Sc, Bachelor of Science; M. Sc, Master of Science; Ph. D, doctor of philosophy.

TABLE 3 Sustainable features in buildings as responded by the tenants of the 3 shopping malls.

Sustainable features	Admitted	Rank
LED energy saving bulbs	117 (90.0)	1
Waste separation bins	111 (85.4)	2
Dual flush toilets	100 (76.9)	3
Recycling provisions	100 (76.9)	4
Natural lighting provision	93 (71.5)	5
Efficient heating/AC system	86 (66.2)	6
Digital water metering devices	77 (59.2)	7
Motion sensor switches	67 (51.5)	8
Sensor wash hand basins	67 (51.5)	9
Solar energy panels	56 (43.1)	10
Intelligent/sensor urinals	40 (30.8)	11
Harvesting of rainwater to use in sinks	22 (16.9)	12
Roofs with landscaped garden	17 (13.1)	13
Reduction of impact using green leases	9 (6.9)	14

TABLE 4 Mean rank of the SPM strategies being adopted in the management of the three shopping malls.

SPM strategies	Mean	Percentage	Rank
Using environmental cleaning procedures	4.15	83.0	1
Water conservation	3.97	79.4	2
Waste reduction	3.91	78.2	3
Energy efficient and renewable energy	3.83	76.6	4
Sustainable maintenance materials	3.73	74.6	5
Efficient heating/AC system	3.61	72.2	6
Sustainable landscaping	3.54	70.8	7
Sustainable procurement	3.45	69.0	8
Green Leasing	1.82	36.4	9

TABLE 5 Ranking of drivers that motivates the implementation of SPM.

Driver	Mean	Percentage	Rank
Health and wellbeing of occupants	4.42	88.4	1
Cost savings	4.35	87.0	2
Regulatory requirements	4.25	85.0	3
Corporate social responsibility	4.05	81.0	4
Brand differentiation	3.93	78.6	5
Tenant demand	3.90	78.0	6

TABLE 6 Communalities for the perceived drivers that motivates the implementation of SPM in the management of the shopping malls.

Component	Initial	Extraction
Cost savings	1.000	0.602
Regulatory Requirements	1.000	0.683
Tenant demand	1.000	0.536
Corporate social responsibility	1.000	0.456
Health and Wellbeing of occupants	1.000	0.342
Brand differentiation	1.000	0.617

a large set of interrelated variables (drivers and barriers to SPM). In this study, EFA likely grouped the various drivers and barriers into smaller, more manageable factors based on their relationships. CFA builds upon the insights from EFA by testing a pre-defined model of how the identified factors (e.g., direct vs. indirect drivers) influence SPM practices. CFA helps confirm the validity of the proposed relationships and provides a more statistically rigorous picture of the interaction between factors and SPM adoption. Finally, mediation regression was used to analyze how certain factors might indirectly influence the adoption of SPM practices. It provides a more complete understanding of the factors influencing SPM practices by considering both direct and indirect effects, which multiple linear regression or correlation may not reveal.

Having described the various applicability, it is worthy to note the various limitations and strong and weak points of the statistical methods, which are presented in Table 1.

Frequency analysis was used in the demographic analysis, analyzing sustainable features in as responded by the tenants of the 3 shopping malls. Mean ranking was used in ranking the following: SPM strategies being adopted in the management of the three shopping malls, drivers that motivates the implementation of SPM, and five major barriers to implementing SPM. EFA was used to obtain the major factors of the perceived drivers that motivates the implementation of SPM in the management of the shopping malls. CFA was used to compute the latent relationship among barriers to the implementation of SPM. Mediation regression was used to obtain Mediating relationships among the barrier factors.

Result

Demographic analysis

The summary of demography details of respondents is summarized in Table 2.

The demographic analysis showed more female than males are tenants in the shopping malls. Majority have spent between one and 5 years at the shopping malls and B.Sc/HND holders.

Sustainable features in the shopping malls

A list of fourteen (14) features in the questionnaire whereby the tenants would choose the ones available within their shops or the mall at large which is the measure of the sustainable features in the three shopping malls. The detailed responses (those that admitted adopting the sustainable features) are presented in Table 3.

LED energy saving bulbs are the most adopted feature in SPM which corroborates the works of Lai et al. (2023) while reduction of the impact of adverse effects of buildings on the environment using green leases is the least known feature. It appears that there is low awareness on the benefits of green leasing especially in developing countries (Alohan and Oyetunji, 2021).

The level SPM strategies being adopted in the management of shopping malls

In the quest to achieve sustainability, there are several strategies being implemented in the management of buildings inclusive of shopping malls. These strategies are usually in alignment with the sustainable features present in the buildings. This study identified nine (9) strategies from extant literature. The details summary of the result obtained from the respondents are presented in Table 4. The result is presented using mean rank and the percentage of the mean to the highest possible mean of five (5).

Using environmental cleaning procedures, water conservation and waste reduction are the top three SPM strategies while green leasing is the least adopted SPM probably because of its low awareness. However, a study has shown that developers in Nigeria's capital city have above average knowledge of green leasing (Oyewole et al., 2019). Hence, it appears that there is a wide knowledge gap between landlords/developers/investors and tenants as regards to the benefits of green leasing (Oyewole et al., 2019). Apart from green leasing, generally, there appears to be low adoption of SPM strategies in property management and construction management (Ahmed et al., 2023).

Drivers that motivate the implementation of SPM the mean ranking

The drivers that motivates the tenants are then ranked using mean with a summary of the responses are shown in Table 5. The result is presented using mean rank and the percentage of the mean to the highest possible mean of five (5).

TABLE 7 Total variance explained for the perceived drivers that motivates the implementation of SPM in the management of the shopping malls.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.168	36.125	36.125	2.168	36.125	36.125
2	1.069	17.824	53.950	1.069	17.824	53.950
3	0.881	14.681	68.631			
4	0.749	12.485	81.116			
5	0.670	11.170	92.286			
6	0.463	7.714	100.000			

TABLE 8 Component matrix for the perceived drivers that motivates the implementation of SPM in the management of the shopping malls.

Driver	Component	
	Direct	Indirect
Cost savings	0.671	
Tenant demand	0.669	
Corporate social responsibility	0.676	
Health and wellbeing of occupants	0.574	
Regulatory Requirements		0.694
Brand differentiation		0.577

Table 5 shows that health and wellbeing of occupants, cost savings and regulatory requirements were ranked the top three drivers (in that order) that motivate implementation of SPM strategies in shopping malls. On the other hand, corporate social responsibility ranked fourth, brand differentiation ranked fifth and tenant demand ranked sixth. The analysis also showed that health and wellbeing of occupants ranked first with mean of 4.42 and percentage of 88.4. A general overview of the results therefore indicated that health and wellbeing of occupants, cost savings and regulatory requirements had higher rankings hence considered as the most important drivers of implementation for SPM strategies in shopping mall management.

Factor analysis

Factor analysis was then applied, but first, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Barlett's test of Sphericity were carried out to determine the adequacy of conducting the factor analysis. Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.651 which is acceptable, and the Bartlett's Test of Sphericity was significant (Chi-square = 94.059, $p = 0.000$; Degrees of Freedom = 15). The tests showed that factor analysis is adequate

for the analysis of the given data. The communalities showed the degree of extraction based on the initial and is shown in Table 6.

The extraction method used was the principal component analysis and all the extraction values are good and ranges between 0.342 and 0.683. The total and cumulative percentage of the total variance explained by the factor model is presented in Table 7.

Out of the six (6) dimensions, the exploratory factor analysis model reduced the data to two dimensions. The model extracted two components or two major factors. The two factors explained 53.95% of the total variance of the model.

Lastly, using the cutoff point of 0.35, the component matrix table is presented in Table 8.

The factor analysis yielded two major variables or drivers that motivate the implementation of SPM in the management of the shopping malls. The drivers can be broadly divided into two and these are:

1. Direct drivers: Cost savings, tenant demand, corporate social responsibility and health and wellbeing of occupants.
2. Indirect drivers: Regulatory requirements and brand differentiation.

Conducting a correlation test revealed that the two major drivers are not correlated (Pearson correlation = 0.000; p -value = 1.000), an indication that the two major drivers are totally different.

The drivers are classified into two categories, and these are either direct or indirect drivers. Direct drivers are those that relate directly to the stakeholders involved in the management of the shopping malls whereas indirect drivers relate to third party influence.

The integration of cost savings, tenant demand, corporate social responsibility, and the health and wellbeing of occupants especially in a multicultural settings like Nigeria has become increasingly important in the real estate industry (Iroham et al., 2023). Developers and property owners of shopping malls who prioritize these factors can create more attractive and SPM, which can, in turn, lead to lower rent defaults, low attrition rates, higher occupancy rates, optimum property utilization, increased property values, and a positive impact on the environment.

Compliance with regulations ensures that properties meet minimum environmental standards permissible by law, while brand differentiation allows shopping malls to stand out by

TABLE 9 Mean ranking of the five major barriers to implementing SPM.

Barriers		Mean	Rank
	E1	4.53	
	E2	4.14	
	E3	4.15	
	E4	3.98	
Financial and economic	EA	4.20	1
	E5	4.20	
	E6	4.22	
	E7	4.06	
	E8	4.23	
Knowledge and awareness	EB	4.18	2
	E9	4.02	
	E10	3.97	
	E11	4.00	
	E12	4.05	
Technical	EC	4.01	4
	E13	4.10	
	E14	4.06	
	E15	4.04	
	E16	3.89	
Regulatory and policy related	ED	4.02	3
	E17	3.93	
	E18	3.92	
	E19	3.96	
	E20	4.07	
Cultural and behavioural	EE	3.97	5

exhibiting their profound commitment to corporate social responsibility, sustainability and attracting environmentally conscious stakeholders or investment in green technologies that will promote SPM. This paper has highlighted that shopping malls must operate under the established laws guiding land use, tax and other regulations while striving to distinguish themselves from competitors. Hence, their competition must be within the competitive space allowed by law. This is very important because tenants in shopping malls often sell related goods. A case of supermarket chains has been studied (Odongo and Motari, 2022).

These results coincide with those established by Schleich, (2012) where the drivers were classified as property level, corporate level and external drivers. In this case, the direct drivers would represent both the property level and corporate level drivers as they all relate to the organisation directly. On the other hand, external drivers are those that relate to indirect drivers.

Barriers to implementation of SPM

Mean ranking

The summary of the mean rank of the barriers to implementing SPM strategies in the management of shopping malls is presented in Table 9.

Table 9 revealed that financial and economic; and knowledge and awareness related barriers were ranked first and second with means of 4.20 and 4.18 respectively. Regulatory and policy related barriers were ranked third with a mean of 4.02 whereas technical related barriers were ranked fourth with a mean of 4.01. Cultural and behavioural barriers were ranked fifth with a mean of 3.97. This therefore implies that financial and economic and knowledge and awareness related barriers are the major contributors towards lower levels of implementation of SPM strategies in the management of shopping malls which corroborates the findings of Mustafa et al. (2021). However, this research is restricted to shopping malls.

Correlation across the barriers using confirmatory factor analysis (CFA)

CFA was used to find the correlations and relationship among the five major barriers called the factor variable or exogenous variable (EA, EB, EC, ED and EE) and the 20 latent or observed or endogenous variables (E1, E2, ..., E20). The CFA used the maximum likelihood estimation in estimating the values of the variables and the path diagram is shown in Figure 1.

From the path diagram (Figure 1), it could be seen that not all loadings are valid, and the researcher can decide whether to eliminate them or not. A factor loading of values above 0.60 is recommended (Steenkamp and Maydeu-Olivares, 2023). Using the recommendation, the validity of the latent (observed) variables are shown in Table 10.

From the results in Table 10, only one (E3) in EA was considered valid with an estimate of 0.742 which is above the set factor loading value of 0.60. The rest of the other variables are below the set factor loading value (E1 = 0.418, E2 = 0.429 and E4 = 0.587). Under EB, only E7 with a loading value of 0.612 is valid as the rest of them have values below 0.600. The loading values for E5, E6 and E8 are 0.538, 0.542 and 0.489 respectively. All the variables under EC (E9 to E12) were considered valid as all of them had loading values above 0.600 which are E9 = 0.723, E10 = 0.834, E11 = 0.718, and E12 = 0.603. Three variables in ED were considered valid and their values are E13 = 0.704, E14 = 0.898 and E15 = 0.641. Only one variable, being E16 with a loading value of 0.493, was invalid. In the last set of variables under EE, three of the variables being E17, E18 and E19 were valid with loading values of 0.649, 0.632 and 0.694 respectively, whereas variable E20 had a loading value of 0.541 as such it was invalid. These

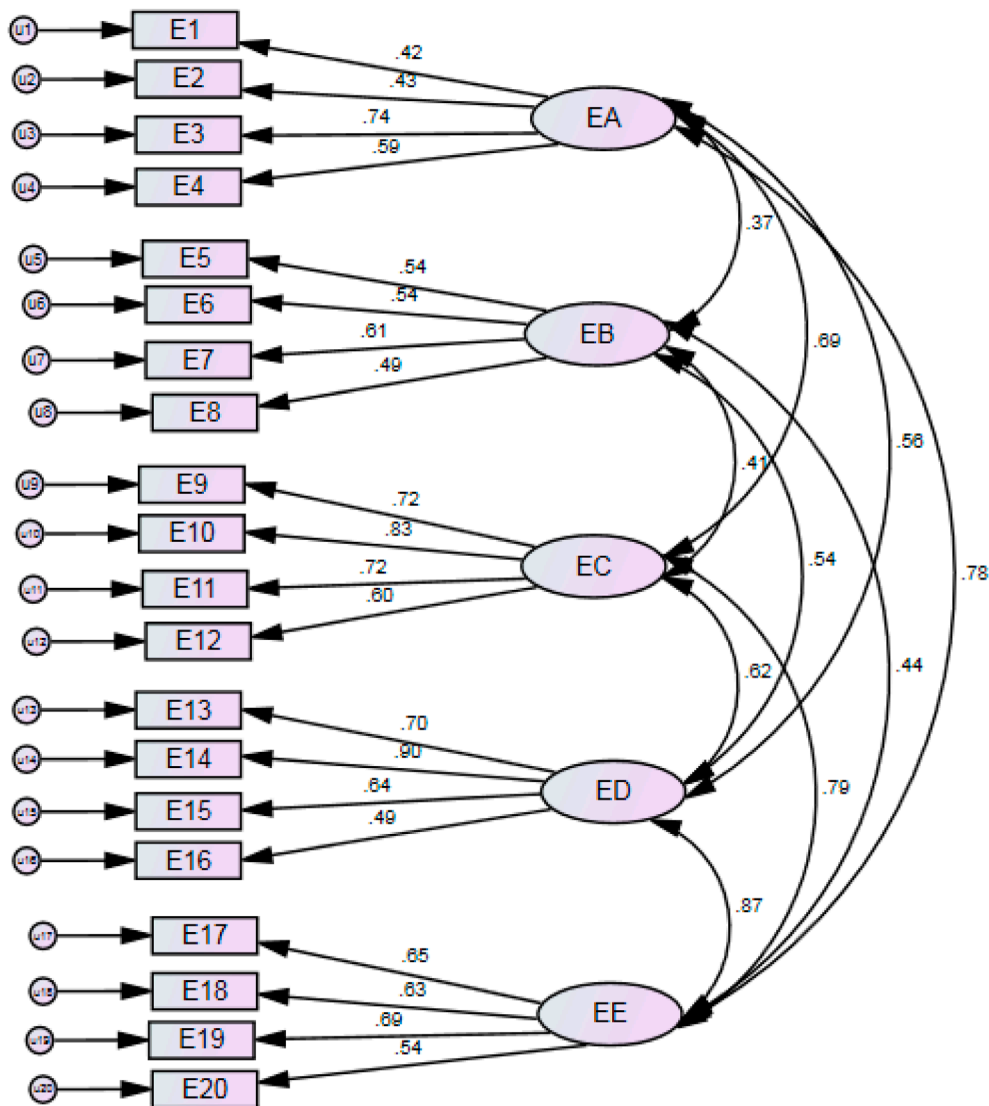


FIGURE 1 Relationship among barriers to implementation of SPM CFA model.

results therefore imply that the only the only variables in terms of barriers to implementation of SPM strategies which would matter in any research built up from this research are the ones that were considered valid with loading values above 0.600.

Note: Those invalid latent variables can be removed from the questionnaire for future statistical analysis.

All the covariance estimates are significant, an indication that a meaningful relationship exists among the factor variables (EA, EB, EC, ED and EE). The correlations as displayed in the path diagram are presented in Table 11.

Generally, as revealed from Table 11, there is a positive correlation among the factor variables as all the estimates are on the positive side. Furthermore, the correlation was ranked to determine the depth of the correlation against each variable. From Table 11, EE <--> ED was ranked first with an estimate value of 0.865 whereas EE <--> EC, EE <--> EA, EA <--> EC and EC <--> ED were ranked second, third, fourth, and fifth with estimate values of 0.792, 0.775,

0.687 and 0.621 respectively. On the other hand, EA <--> ED, EB <--> ED and EE <--> EB were ranked sixth, seventh and eighth and their estimate values were 0.560, 0.540 and 0.440 respectively. Finally, EB <--> EC and EA <--> EB were ranked ninth and 10th with estimate valued of 0.415 and 0.374 in that order.

Finally, several diagnostic tests were performed to determine the reliability of the CFA model, and these were summarized in Table 12.

The overall analysis on this is that the CFA model gave a fair fit as recommended. See Montoya and Edwards (2021), Tjebane et al. (2022), and Tschense and Wallot (2022) for details.

The results on analysis of barriers to the implementation of SPM revealed that the highly considered barriers to implementation of SPM are financial and economic related. These include sustainable measures requiring huge initial capital, lack of adequate funding for implementing the measures, landlords prioritizing short term financial gains over long term sustainability goals and tenant reluctance to pay higher rentals. The second ranked group of barriers

TABLE 10 Loadings and validity status of the latent variables that measures the barriers to implementing SPM.

	Estimate	Validity
E1 <--- EA	0.418	Invalid
E2 <--- EA	0.429	Invalid
E3 <--- EA	0.742	Valid
E4 <--- EA	0.587	Invalid
E5 <--- EB	0.538	Invalid
E6 <--- EB	0.542	Invalid
E7 <--- EB	0.612	Valid
E8 <--- EB	0.489	Invalid
E9 <--- EC	0.723	Valid
E10 <--- EC	0.834	Valid
E11 <--- EC	0.718	Valid
E12 <--- EC	0.603	Valid
E13 <--- ED	0.704	Valid
E14 <--- ED	0.898	Valid
E15 <--- ED	0.641	Valid
E16 <--- ED	0.493	Invalid
E17 <--- EE	0.649	Valid
E18 <--- EE	0.632	Valid
E19 <--- EE	0.694	Valid
E20 <--- EE	0.541	Invalid

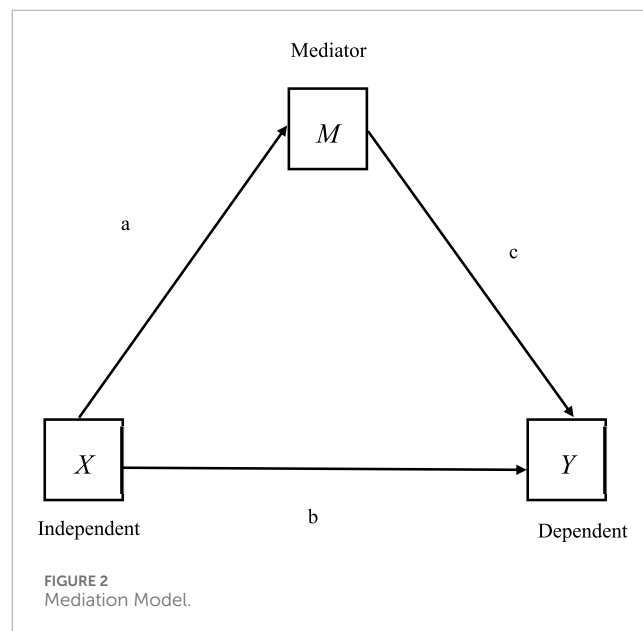
TABLE 11 Correlation of the factor variables that measures the barriers to implementing SPM.

	Estimate	Rank
EA <--> EB	0.374	10
EB <--> EC	0.415	9
EC <--> ED	0.621	5
EE <--> ED	0.865	1
EA <--> EC	0.687	4
EA <--> ED	0.560	6
EE <--> EA	0.775	3
EB <--> ED	0.540	7
EE <--> EB	0.440	8
EE <--> EC	0.792	2

TABLE 12 Model fit of the CFA that measures the barriers to implementing SPM.

Statistic	Value
Chi-square value (CSV)	282.064 ^a
Degrees of Freedom (DF)	160
CSV/DF	1.763
Root Mean Square Residual (RMR)	0.0709
Normed Fit Index (NFI)	0.729
Relative Fit Index (RFI)	0.678
Incremental Fit Index (IFI)	0.861
Tucker-Lewis Index (TLI)	0.830
Comparative Fit Index (CFI)	0.857
Root Mean Square Error of Approximation (RMSEA)	0.077
Akaike Information Criterion (AIC)	422.064
Expected Cross Validation Index (ECVI)	3.272
Hoelter index (HI) at 0.05	88
Hoelter index (HI) at 0.01	94

^ap-value <0.05.



was knowledge and awareness related. Under this barrier, there are issues to do with lack of training, lack of awareness and knowledge of green leases, limited engagement with stakeholders and limited access to information pertaining to SPM. These results are similar to those from a study conducted by Ogunba et al. (2023) where they revealed that there is lack of prerequisite skills and inadequate training on how green leases operate.

TABLE 13 Mediation models summary.

Y	X	M	a	b	c	Comment
EA	EB	EC	0.4266*	0.0964	0.3569*	
EA	EB	ED	0.3821*	0.1162	0.3466*	
EA	EB	EE	0.3884*	0.1049	0.3700*	
EA	EC	ED	0.4428*	0.2839*	0.2213*	Valid
EA	EC	EE	0.6020*	0.2284*	0.2550*	Valid
EA	ED	EE	0.7675*	0.1472	0.3044*	
EA	EC	EB	0.2590*	0.3569*	0.0964	
EA	ED	EB	0.2942*	0.3466*	0.1162	
EA	EE	EB	0.2405*	0.3700*	0.1049	
EA	ED	EC	0.5617*	0.2213*	0.2839*	Valid
EA	EE	EC	0.6141*	0.2550*	0.2284*	Valid
EA	EE	ED	0.6173*	0.3044*	0.1472	
EB	EA	EC	0.6467*	0.1170	0.2143*	
EB	EA	ED	0.5084*	0.1315	0.2441*	
EB	EA	EE	0.6561*	0.1320	0.1883*	
EB	EC	ED	0.4428*	0.1713*	0.1980*	Valid
EB	EC	EE	0.6020*	0.1811*	0.1293	
EB	ED	EE	0.7675*	0.2083*	0.1120	
EB	EC	EA	0.3819*	0.2143*	0.1170	
EB	ED	EA	0.3808*	0.2441*	0.1315	
EB	EE	EA	0.3952*	0.1883*	0.1320	
EB	ED	EC	0.5617*	0.1980*	0.1713*	Valid
EB	EE	EC	0.6141*	0.1293	0.1811*	
EB	EE	ED	0.6173*	0.1120	0.2083*	
EC	EA	EB	0.2556*	0.5741*	0.2839*	Valid
EC	EA	ED	0.5084*	0.4478*	0.3911*	Valid
EC	EA	EE	0.6561*	0.3291*	0.4840*	Valid
EC	EB	ED	0.3821*	0.2389*	0.4914*	Valid
EC	EB	EE	0.3884*	0.2075*	0.5642*	Valid
EC	ED	EE	0.7675*	0.1717	0.5082*	Valid
EC	EB	EA	0.2486*	0.2839*	0.5741*	Valid
EC	ED	EA	0.3808*	0.3911*	0.4478*	Valid

(Continued on the following page)

TABLE 13 (Continued) Mediation models summary.

Y	X	M	a	b	c	Comment
EC	EE	EA	0.3952*	0.4840*	0.3291*	Valid
EC	ED	EB	0.2942*	0.4914*	0.2389*	Valid
EC	EE	EB	0.2405*	0.5642*	0.2075*	Valid
EC	EE	ED	0.6173*	0.5082*	0.1717	Valid

*P-value <0.05.

TABLE 14 Mediation models summary Continued.

Y	X	M	a	b	c	Comment
ED	EA	EB	0.2556 ^a	0.4386 ^a	0.2731 ^a	Valid
ED	EA	EC	0.6467 ^a	0.2948 ^a	0.3302 ^a	Valid
ED	EA	EE	0.6561 ^a	0.1396	0.5621 ^a	
ED	EB	EC	0.4266 ^a	0.2172 ^a	0.3866 ^a	Valid
ED	EB	EE	0.3884 ^a	0.1570 ^a	0.5795 ^a	Valid
ED	EC	EE	0.6020 ^a	0.1130	0.5479 ^a	
ED	EB	EA	0.2486 ^a	0.2731 ^a	0.4386 ^a	Valid
ED	EC	EA	0.3819 ^a	0.3302 ^a	0.2948 ^a	Valid
ED	EE	EA	0.3952 ^a	0.5621 ^a	0.1396	
ED	EC	EB	0.2590 ^a	0.3866 ^a	0.2172 ^a	Valid
ED	EE	EB	0.2405 ^a	0.5795 ^a	0.1570 ^a	Valid
ED	EE	EC	0.6141 ^a	0.5479 ^a	0.1130	
EE	EA	EB	0.2556 ^a	0.5946 ^a	0.2406 ^a	Valid
EE	EA	EC	0.6467 ^a	0.3542 ^a	0.4667 ^a	Valid
EE	EA	ED	0.5084 ^a	0.3297 ^a	0.6419 ^a	Valid
EE	EB	EC	0.4266 ^a	0.1479	0.5637 ^a	
EE	EB	ED	0.3821 ^a	0.1072	0.7359 ^a	
EE	EC	ED	0.4428 ^a	0.3490 ^a	0.5715 ^a	Valid
EE	EB	EA	0.2486 ^a	0.2406 ^a	0.5946 ^a	Valid
EE	EC	EA	0.3819 ^a	0.4667 ^a	0.3542 ^a	Valid
EE	ED	EA	0.3808 ^a	0.6419 ^a	0.3297 ^a	Valid
EE	EC	EB	0.2590 ^a	0.5637 ^a	0.1479	
EE	ED	EB	0.2942 ^a	0.7359 ^a	0.1072	
EE	ED	EC	0.5617 ^a	0.5715 ^a	0.3490 ^a	Valid

^aP-value <0.05.

Mediating relationships among the barrier factors

According to [Gunzler et al. \(2013\)](#), structural equation modeling which is similar to CFA provides a very general, flexible framework for performing mediation analysis. CFA showed significant correlation among the five barrier factors. A mediational hypothesis is a kind of statistical test that assumes that the relationship between an independent and dependent variable is mediated by (or accounted for by) a third variable. The third variable is what is known as a mediating variable.

A combination of the five barrier factors yielded sixty (60) analyses where a barrier is used as a dependent variable (Y), an independent variable (X) and a mediating variable (M). The simple mediation model is shown in [Figure 2](#).

Mediation was performed for the 60 combinations and the parameters; a, b and c were estimated as presented in [Tables 13, 14](#) respectively.

Out of the 60 mediation models, 32 (53.3%) are valid and recommended because the coefficients of the models are significant (p -value < 0.05) and hence can explain the magnitude and strength of the relationship between two barrier factors mediated by a third one. The mediation model has unearthed some hidden relationships among the barriers to implementing SPM in the surveyed shopping malls. Mediation model helps researchers uncover the underlying mechanisms and pathways through which variables are related, providing a clearer understanding of the relationships between variables ([Nordhall et al., 2020](#)).

Research limitation

1. The absence of a sampling frame containing all the details of shopping malls in Ikeja, Lagos, Nigeria, restricted the sample to only three perceived to have large shops and transaction volumes.
2. Most of the original plans of the selected shopping malls were distorted, making it difficult to completely enumerate the retail shops and estimate the number of tenants. For instance, spaces originally designated as car parks inside the shopping malls have been converted to shops. Additionally, some of the shops are occupied by more than one tenant.
3. A mediation model can suggest causal pathways, but it does not prove causality ([Agler and De Boeck, 2017](#)).
4. The interpretation of the results of the factor analyses is subjective, particularly in the area of model evaluation ([Golay et al., 2018](#)). Researchers may have different views.

Conclusion

The study has critically examined sustainable property management practices in shopping malls in Lagos, focusing on three shopping malls. This was achieved by investigating the sustainable features, SPM strategies, drivers, and barriers to implementation of SPM in these shopping malls. In conclusion, implementing SPM practices, especially in developing countries,

can be challenging. However, adopting or adapting the strategies mentioned, maximizing the drivers, and minimizing the barriers can help achieve sustainability while optimizing rents and other benefits in shopping malls and buildings in general. To overcome these barriers, it is important to raise awareness about the benefits of SPM among shopping mall owners, renters, and stakeholders, provide financial incentives and support, invest in training and capacity building, and engage stakeholders in the decision-making process. Collaboration between governments, property owners, tenants, and other stakeholders is crucial for the successful implementation of strategies to green buildings and maximize the utilization of shopping malls. By understanding these factors, property owners, including shopping mall owners, managers, renters, and policymakers, can work together to promote SPM practices that benefit both the environment and the stakeholders.

Recommendations

The study made seven recommendations that could guide policy actions.

1. Educate shopping mall owners, renters, and stakeholders about the benefits of SPM practices. Highlighting the positive impacts on sustainability and financial returns can encourage adoption.
2. Provide financial incentives and support for implementing SPM practices. This can include tax breaks, subsidies, or grants to offset initial costs and encourage investment in sustainability.
3. Invest in training programs and capacity building initiatives to enhance the knowledge and skills of shopping mall owners, managers, and staff in sustainable property management.
4. Involve stakeholders (property owners, tenants, Government, private investors, and market leaders) in the decision-making process regarding SPM practices. This can help identify specific needs and concerns, leading to more effective and sustainable solutions. In addition, foster collaboration between the stakeholders. Working together can facilitate the sharing of best practices, resources, and expertise, leading to more successful implementation of SPM strategies.
5. Maximize the drivers of SPM implementation reported in this article while minimizing the barriers.
6. Encourage the adoption of green building standards and certifications in shopping malls. This can help improve sustainability practices and increase the marketability of the malls.
7. Monitor and Establish mechanisms to monitor and evaluate the implementation of SPM practices in shopping malls. This can help track progress, identify areas for improvement, and ensure accountability.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the (patients/ participants OR patients/participants legal guardian/next of kin) was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

LN: Conceptualization, Data curation, Software, Writing – review and editing, Investigation, Supervision, Writing – original draft, Writing – review and editing. CA: Conceptualization, Data curation, Software, Writing – review and editing, Investigation, Supervision, Writing – original draft, Writing – review and editing. IM: Conceptualization, Data curation, Software, Writing – review and editing, Investigation, Supervision, Writing – original draft, Writing – review and editing. CI: Conceptualization, Data curation, Software, Writing – review and editing, Investigation, Supervision, Writing – original draft, Writing – review and editing. DO: Conceptualization, Data curation, Software, Writing – review and editing, Investigation, Supervision, Writing – original draft, Writing – review and editing. HO: Investigation, Validation, Resources, Writing – review and editing, Methodology. OS: Investigation, Validation, Resources, Writing – review and editing, Methodology. SN: Investigation, Validation, Resources, Writing – review & editing, Methodology.

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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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