Sub-Sahara African Academic
Research Publications
December, 2020, Editions

JPAS
Journal of Pure and Applied Science
Vol..17, No.9, ISSN 2318-9315

IDENTIFICATION OF KEY FACTORS OF DEPRECIATION AND OBSOLESCENCE FOR SUSTAINABLE COMMERCIAL BUILDING DESIGN IN LAGOS METROPOLIS

OLOJEDE, I. O., MURITALA, A. O., AJIBADE, N. A., SAKA, J. F., ONI, F.
Department of Estate Management and Valuation, the Oke-Ogun Polytechnic, Saki.

Introduction

The quest for sustainability in built environment has paved way for scholars to take cognizance of several factors that influence the operation and performance of real estate sectors (Babawale and Oyalowo, 2011). Also, the increase in awareness of the impact of global warming and depletion of natural resources triggers the policy makers and relevant authorities to find ways to reduce the negative impacts and to improve the quality of life for building occupants (Baird, 2015).

Real properties are one of the main contributors to greenhouse emissions, accounting for approximately 20% (Stern, 2016). Since conventional properties consume large quantity of resources such as water, land, energy and raw materials during construction and operation (Howe, 2014). The introduction of sustainable real estate in the early nineties was expected to reduce these impacts by minimizing on-site degradation, promoting the efficient use of natural resources and recycling construction waste while enhancing the performance of real estate in terms of effectiveness and efficiency (Lockwood, 2006).The increased contribution of property sector to the economy of developing and undeveloped countries calls for the attention of sustainable buildings (Kibert, 2013).

Real Estate in Lagos especially the commercial buildings has seen a drastic increase in the existing stock. According to (Bello and Bello, 2007) the total space for purpose built office (PBO) space in Lagos has increased significantly. The introduction of sustainable or green buildings in 2009 has brought in a new generation of PBO to Nigerian office space generally

and Lagos specifically. As at 2015, there were 78% of the purposely built offices concentrated in Lagos state with green building certification.
In general, the issue of sustainability and obsolescence is of increasing importance due to the growing concern over the accelerated depreciation and obsolescence for non-sustainable real estate (Babawale, Oyalowo, 2011). The downgrading of buildings due to the impact of depreciation and obsolescence may have originated from the introduction of sustainable real estate features and benefits in the property market.
These negative impacts may contribute to the faster rate of property depreciation in the real estate market. Although, there is lack of research on the impact of sustainability on depreciation and obsolescence on real properties, the element of sustainability obsolescence is an important aspect of debate due to the changing requirements of buildings and increasing perspective of stakeholders towards the benefits of sustainability in buildings (Ibiyemi and Tella, 2013). From the foregoing, this paper investigated the key factors of depreciation and obsolescence in commercial building for sustainability.

Literature Review

Depreciation is a decline or loss in relative value of a property in comparison with the equivalent prime modern or new property, which achieve best rental in the similar sub-market (Baum, 1991; Bowie, 1982; Md Yusof, 1999). It is widely accepted that many factors influence or determine the value of property investment. The review of literature from accounting and economics indicates that causes of depreciation are typically divided into two groups. The first group suggests depreciation arises through ageing process whilst the second group identifies multiple causes of depreciation which actually focuses more on commercial properties (Baum, 1989). According to (Lawce, 2004) depreciation is "the rate of decline in rental/capital value of an asset (or group of assets) over time relative to the asset (or group of assets) valued as new with contemporary specification".
Two broad sources of depreciation are physical deterioration and obsolescence (Wofford, 1983, Baxter, 1971, Salway, 1986). Physical deterioration refers to normal wear and tear of a building through use and

the passage of time. The rate at which physical deterioration progressed is a function of the design and the quality of construction, including the nature of the materials and the level of maintenance carried out (Dubben and Sayce, 1991). Physical deterioration can cause a decline in the utility of a building and subsequently the rent, yield and market value.

Obsolescence is normally treated as differently from physical deterioration, as it involves a more complex process. Obsolescence is defined as "a decline in the usefulness or utility" (Salway, 1986 and Baum, 1989). In some studies, such as Salway (1986) and Baum (1989), various categories of obsolescence, such as functional, aesthetic, economic etc have been introduced.

Yusof (1999), however, classifies obsolescence into site and building as a property consists of site and building.

Building obsolescence can be regarded as the degree of mismatch between a building and its use (Golton, 1989). As new ones replace standards of performance, obsolescence takes place.

Pioneering studies have found out that depreciation reduces the rental rate for commercial properties by 1.0% in 2011, 3.3% in 2015 and 1.0% in 2017 (Cryve, 2018). Crosby (2016) also noted that "overall rental rate depreciation for UK offices between 1994 and 2009 was at 0.8% per annum.

The innovative and cutting-edge sustainable designs position sustainable buildings on a higher quality rating, separating it from standard buildings. There is a need to assess the buildings individually to identify the influence of sustainability on depreciation (Reed, 2007) as it influences the components of risk premium and property's cash flow model (Babawale, 2014). Therefore, it is crucial that the quality of sustainable or green buildings be represented by its' passive and active design. Review of literature for sustainable building suggests that active and passive design may drive the rental depreciation of commercial buildings.

Firstly, passive design strategy consists of the use of green construction materials (Lockwood, 2006; Hoang, Kinney and Corsi, 2009) low emissivity (Low-E) glass (Esa, Marhani, Yaman, Noor, Rashid, 2001; Mokhtar and Wilkinson, 2015) and, double glazing glass (Anita, 2013) wall insulation from natural resources (Guidry, 2004; APB, 2015), low VOC paint or flooring, sustainable shape, orientation and envelope (Wang, Rivard and Zmeureanu, 2006; Pan, Yin, Huang, 2008), substantial use of day-lighting eco-void wall system, vertical pillars and external louvers (Balaban, 2017).

In addition, for site and soil passive strategy, sustainable building has proper orientation to reduce solar penetration and glare (Chenari and Carrilho, 2016). Consideration of seasonal and daily pattern of sun, wind-flow, shade pattern and water and sited in sedimentary rock and low noise level site or using soundproofing materials for high noise level site (Guidry, 2004). Furthermore, the sustainable building uses drought resistance grasses and native plants, specialized paving materials, water retaining pavements (Balaban, 2017), green roofs and green walls (Lutzkendorf and Lorenz, 2011; APB, 2015). Sustainable building also maximizes the use of day lighting and natural ventilation through Atrium or Atria (Wong and Baldwin, 2016).

Finally, sustainable building status such as green label and green ratings (Lutzkendorf and Lorenz, 2011) are also considered in the passive design strategy as it influenced the depreciation of property assets.

Materials and Method

For the purpose of this study, well structured questionnaires were randomly used to obtain primary data from 236 representing 50% of the total 472 Registered Estate Surveyors and Valuers, who are well versed in the field of commercial property valuation and property management and operate in Lagos Metropolis in accordance with the 2018 edition of the directory of the Lagos Branch of the Nigerian Institution of Estate Surveyors and Valuers (NIESV). The respondents were asked to provide their perceptions on the relevance of the sustainability design elements to depreciation in commercial property.

The questionnaires were designed to contain closed ended questions covering 31 items of the sustainable design variables and factors potentially associated with the rental income depreciation and obsolescence of commercial office buildings in Lagos Metropolis that were pooled from the review of literature.

The participants were instructed to conduct relevance analysis of each item by indicating whether the item can be used to measure the target construct. A 5-point Likert scale was used to rate each item in the form of 'Highly relevant, 'Relevant,' 'Moderately relevant,' 'Slightly relevant' or 'Not relevant' in the order of '5', '4', '3', '2' or '1' respectively to the target construct based on their perspectives.

For the purpose of this study, depreciation was defined as the rate of decline in rental value of an asset (or group of assets) over time relative to the asset (or group of assets) valued as new with the contemporary specification and was included in the questionnaire for the respondents.

The questionnaire was divided into two sections; Section A and B. Section A solicits demographic-related questions such as gender, educational and professional qualifications, working experience in the real estate sector. Understanding on commercial property sector in general and sustainable building questions was also included to observe their knowledge perception. Section B focuses on the relevance assessment of sustainable design constructs.

Descriptive statistics such as simple percentages, mean and standard deviation were used to analyze the data obtained.

Results and Discussion

Data Background

A total of 143 questionnaire out of 236 questionnaire administered were retrieved from the respondents, this represents a response rate of 60.6%.

Table 1: Year of experience of respondents

Years	Frequency	Percentage
1-10	17	11.89
11-20	43	30.07
21-30	59	41.26
30+	24	16.78
Total	143	100.00

Source: Field survey, 2019

From Table 1, 58 percent of the respondents have long years (i.e. more than 20 years) of experience in professional real estate practice. Hence, information supplied by most of the respondents are reliable and valid for the attainment of the objectives of this study.

Table 2: Respondents' knowledge of Lagos commercial Property sector

Level of Knowledge	Frequency	Percentage
Highly Knowledgeable	104	72.73
Knowledgeable	25	17.48
Somewhat Knowledgeable	14	9.79
No Knowledge	-	-
Total	143	100.00

Source: Field survey, 2019

Table 2 shows that 104 respondents representing 72.73 percent of the respondents have in-depth knowledge of commercial property sector in Lagos Metropolis. This is not unconnected with the dominant feature of commercial properties in Lagos property market, hence; the respondents are the suitable target population for the study.

Table 3: Respondents' knowledge of Lagos Sustainable commercial building

Sustainable commercial building	Frequency	Percentage
Highly Knowledgeable	104	72.73
Knowledgeable	25	17.48
Somewhat Knowledgeable	14	9.79
No Knowledge	-	-
Total	143	100.00

Source: Field survey, 2019

The result of analysis from Table 3 shows that most of the respondents (79 percent) have good knowledge of Lagos sustainable commercial building. This implies that just would be done to the questions relating to sustainable design factors of commercial building depreciation.

Ranking of Relevant Sustainable Design Items Relevant to Depreciation

Mean analysis provides insight into the ranking of the most relevant to less relevant sustainable design items that contribute to commercial property depreciation. Table 4 and Table 5 highlight the summary of mean, standard and ranking for sustainable design paradigm based on the perception of participants.

Firstly, Table 4 depicts the results for Sustainable Status and Materials, Presentation and Finishes. For sustainable building status factor, the leading ranking is sustainable ratings with a Mean of 4.22 followed by a sustainable label with a mean obtained 4.14 with a total average score of 4.18, conclusively there is a strong relationship between the sustainable status factor and commercial property depreciation and obsolescence.

Secondly, for materials, presentation and finishes factor, the top ranking is Low emissivity glass (M = 3.74), followed by low-VOC carpet and flooring (M = 3.53) and Double glazing glass (M = 3.31). The lowest ranking factors with the mean of 3.11 and 2.76 were the used of Green materials for construction, Sustainable wall insulation and Low VOC paint respectively. The overall mean of 3.26 for materials, presentation and finishes factor suggests a less relevance level to commercial property depreciation and obsolescence.

Table 4: Mean scores for sustainable status and materials, presentations and finishes

Main factor	S/n	Sub-factors	N	Mean	Ranking within group
Status	1.	Sustainable Label	143	4.14	2
	2.	Sustainable Rating	143	4.22	1
		Total		4.18	
Materials, Presentations and Finishes	3.	Used of green materials	143	3.11	4
	4.	Low emissivity glass	143	3.74	1

	5.	Double glazing glass	143	3.31	3
	6.	Low VOC paint	143	2.73	5
	7.	Low VOC carpet	143	3.53	2
	8.	Sustainable wall	143	3.11	4
		Total		3.26	

Source: Field Survey, 2019

Table 5: Mean scores for sustainable design configuration

S/N	Sub-factors	N	Mean	Ranking within group
1.	Extensive use of Atrium/ Skylight	143	3.46	3
2.	Sustainable building shape	143	3.46	3
3.	Sustainable building envelope	143	4.18	2
4.	Design promoting the use of day light	143	4.24	1
5.	Eco-void walls	143	3.46	3
6.	Vertical pillars	143	2.79	5
7.	External Louvers	143	3.22	4
	Total		3.54	

Source: Field Survey, 2019

From Table 5, within the Sustainable design configuration factors, the highest ranking are the sustainable building envelope (M = 4.24) followed by design that promote day lighting (M = 4.18), followed by an extensive use of atrium or skylight (M = 3.46), sustainable building shape (M = 3.46) and Eco-void walls (M = 3.46). The lowest rank with means of 3.22 and 2.79 are the external louvers and vertical pillars. In general, with a total mean of 3.54, sustainable design configuration factor has a moderate relationship to depreciation and obsolescence.

Table 6 depicts the results for Site and soil characteristics while Table 7 presents Rooftop and on-site greenery. For Site and soil characteristics, the top ranking are dominated by five elements including Sustainable site orientation (M = 3.98), Site near to mass transit (M = 3.98), Non-toxic soils (M = 3.98), Low risk of landslide (M = 3.98) and Low noise level or provide soundproofing materials (M = 3.98). Next ranking are designated to Consideration for shade pattern (M = 3.95), Non-spongy soils (M = 3.53) and Consideration for seasonal & daily sun pattern (M = 3.46). Although, the lowest rank consists of Consideration of wind flow (M = 3.27) and Consideration of water around and through site (M = 3.27). With the average total mean of 3.72, it shows that there is a moderate relationship between the sustainable site and soil characteristics and depreciation and obsolescence.

From Table 7, the highest ranking item from the rooftop and on-site greenery consist of Water retaining pavements with the mean obtained 3.88 followed by Green walls (M = 3.64) High solar reflectance paving materials (M = 3.45 and Green roofs (M = 3.45). The use of Drought-resistant native plants item is the lowest ranking with the mean obtained 2.96. With a total mean of 3.48, it shows that rooftop and on-site greenery factor is moderately relevant to depreciation.

Table 6: Mean scores for sustainable site and soil characteristics

S/N	Sub-factors	N	Mean	Ranking within group
1.	Sustainable site orientation	143	3.98	1
2.	Site near to mass transit	143	3.98	1
3.	Pedestrian friendly site	143	3.53	3
4.	Consider season and daily sun	143	3.46	4
5.	Consider wind flow	143	3.27	5
6.	Consider shape pattern	143	3.95	2
7.	Consider water around	143	3.27	5
8.	Non-toxic soils	143	3.98	1
9.	Non-spongy soils	143	3.53	3
10.	Low risk of landslide	143	3.98	1

11.	Low noise level	143	3.98	1
	Total		3.72	

Source: Field Survey, 2019

Table 7: Mean scores for sustainable rooftop and onsite greenery

S/N	Sub-factors	N	Mean	Ranking within group
1.	Drought resistant native plants	143	2.96	4
2.	High solar reflectance	143	3.45	3
3.	Water retaining pavements	143	3.88	1
4.	Green roofs	143	3.45	3
5.	Green walls	143	3.64	2
	Total		3.48	

Source: Field Survey, 2019

Mean ranking of main sustainable design factors

All the 31 factor items were grouped into five different main headings. The relative correlation of each of the main factors is presented in Table 8. From the table, status with mean 4.18 is considered the most relevant design factor in commercial building depreciation while site and soil characteristics (mean = 3.72) rated second. Other relevant factors are design configuration (mean = 3.54) and rooftop and on-site greenery (mean = 3.48). The least and less relevant factor remains the materials, presentation and finishes (mean = 3.25).

Table 8: Main factors' mean ranking

S/N	Sub-factors	N	Mean	Ranking
1.	Status	143	4.18	1
2.	Materials, presentations and finishes	143	3.25	5
3.	Design configuration	143	3.54	3
4.	Site and soil characteristics	143	3.72	2
5.	Rooftop and onsite greenery	143	3.48	4

Source: Field Data Analysis, 2019

Conclusion

This study has successfully identified and analyzed the relevant sustainable design factors that most likely contribute to the commercial property depreciation and obsolescence. In view of this, the sustainable design element needs to be integrated as new variables in commercial property depreciation assessment in Nigeria. Further study using market based evidence is needed to investigate the direct impact of sustainable building design paradigm towards commercial property depreciation in Nigeria is hereby recommended.

References

Babawale G. K, Oyalowo B. A. (2011). Incorporating sustainability into real estate valuation: The perception of Nigerian valuers. Journal of Sustainable Development, 4(4):236–248.

Balaban O. (2017). Sustainable buildings for healthier cities: Assessing the co-benefits of green buildings in Japan. Journal of Cleaner Production, 163 (1):68-78.

Baird G. (2015). Users' perceptions of sustainable buildings-Key findings of recent studies. Renewable Energy, 7(3):77-83.

Baum, A. (1997). The causes and effects of Depreciation in office buildings: a ten year update, a paper presented at the RICS conference, the Cutting Edge.

Baum, A. (1991). Property Investment, Depreciation and Obsolescence. Routledge, London.

Bowie, N. (1982), 'Learning to take account of depreciation' in Estate Times.

Wong, I., Baldwin A. N. (2016). Investigating the potential of applying vertical green walls to high-rise residential buildings for energy-saving in sub-tropical region. Building and Environment, 17 (97):34-39.

Dubben, N. and Sayce.S (1991). Property Portfolio Management - An Introduction, Routledge, London.

Esa, M. R., Marhani, M. A., Yaman, R., Noor, A. A., Rashid, H. A.(2011). Obstacles in implementing green building projects in Malaysia. Australian Journal of Basic and Applied Sciences, 5(12):1806-1812.

Golton, B. L. (1989). 'Perspective of building obsolescence' in Land and Property Development-New Directions, Ed Richard Grover, E & F.N Spon.

Guidry, K. (2004). How green is your building? An appraiser's guide to sustainable design. Appraisal Journal, 72(1):57-68.

Hoang, C. P., Kinney, K. A., Corsi, R. L. (2009). Ozone removal by green building materials. Building and Environment, 44(8):1627-1633.

Howe, J. C. (2010). Overview of green buildings. National Wetlands Newsletter, 33(1):3–14.

Kibert, C. J. (2017). Sustainable construction: Green building design and delivery. New Jersey,
John Wiley and Sons.

Lawce, V. (2004). The definition and measurement of rental depreciation in investment property. England, University of Reading.

Lockwood, C. (2006). Building the green way. Harvard Business Review, 84(10):143–144.

Lützkendorf, T., and Lorenz, D. (2011). Capturing sustainability-related information for property
valuation. Building Research and Information, 39(3):256-273.

Md Yusof, A. (1999). Modelling the Impact of Depreciation- A Hedonic Analysis of Offices in the City of Kuala Lumpur, Unpublished PhD thesis, University of Aberdeen.

Pan, Y., Yin, R., Huang, Z.(2008). Energy modeling of two office buildings with data center for green building design. Energy and Buildings, 40(7):1145-1152.

Salway, F. W. (1986). Depreciation of Commercial Property, CALUS Research Report. 1986

Stern, N. (2006). The economics of climate change. England, Cambridge University Press.

Wang, W. Rivard, H., Zmeureanu, R. (2006). Floor shape optimization for green building design. Advanced Engineering Informatics, 20(4):363-378.

Wong, I. and Baldwin, A. N. (2016). Investigating the potential of applying vertical green walls to high-rise residential buildings for energy-saving in sub-tropical region. Building and Environment, 9(7):34-39.