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CONFERENCE

AFRICA SMART CITY AGENDA

CONCEPTUALISING · CREATING · CO-PRODUCING

Africa Smart City Agenda

CONCEPTUALISING - CREATING - CO-PRODUCING

Julius Berger Lecture Theatre, University of Lagos.

24th - 26th July, 2018 | 10:00am

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Parallel Sessions

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An Assessment of Residential Users' Perception of Solar Powered Electrically in Lagos. Tenigbade Yewande ODU, Abiola ADEROGBA University of Kwazulu-Natal, Durban. Yaba College of Technology, Lagos.	**Telecommunication Infrastructure Condition and Consumer Brand Loyalty in Lagos Smart City.** M. I. ANYAKORA, Mike IFEANYI, Samuel CHUKWUKEREUBA. University of Lagos, Lagos.	**Sustainable Facilities Management for Smart Building: A Case Study of the Heritage Place, Ikoyi, Lagos.** Olajide J. FAREMI, Olumide A. ADENUGA, Oko John AMEH, Kudirat I. ZAKARIYYAH, Oluladi O. AJAYI, Mayowa I. ADEGORIOLA. University of Lagos, Lagos
Assessment of Citizens Engagement in the Delivery of Smart Energy Systems in Akure, Nigeria. O. O. POPOOLA, A. A. EMMANUEL, T. O. OMOTOYINBO, O. D. ABRAHAM-ALOWONLE	**Rental Values and Residential Properties: Implication for Sustainable Residential Housing in Lekki, Lagos.** Victor U. ILECHUKWU, A. JIMOH, A. AMEEN University of Lagos, Lagos.	**Target Value Design: An Approach to Smart Construction.** O. O. OLAYEMI Federal Polytechnic, Offa
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Sustainable Facilities Management for Smart Building: A Case Study of the Heritage Palace, Ikoyi, Lagos. Olajide A. FAREMI, John O. AMEH, Kudirat I. ZAKARIYYAH, Oluranti O. AJAY, Iniobong B. JOHN, Mayowa I. ADEGORIOLA University of Lagos, Lagos.	**Marketing of Estate Surveying and Valuation Services in the 21st Century: Challenges and Prospects.** Chika UDECHUKWU University of Lagos, Lagos.	**Digital Innovation And Emergence Of Africa Smart Sustainable Cities.** Oluwafunmilayo O. OLUDURO Smartcity Limited, Lagos.
Valorization of Sand Barrier – Lagoon Ecology Assets in Lagos Smart City Conceptualizatio . Olatunji T. ADEJUMO.	**Construction Practices in Coastal Areas of Lagos: Towards Smart Construction Agendas.** Aliu SOYINGBE University of Lagos, Lagos	**Integrating Resilient Cities Considerations Into Flood. Management In Victoria Island Lagos, Nigeria.** Mohammed ABDUL-RAHMAN, Leke ODUWAYE, Oluwafemi OLAJIDE University of Lagos, Lagos.

SUSTAINABLE FACILITIES MANAGEMENT FOR SMART BUILDINGS: A CASE STUDY OF THE HERITAGE PLACE, IKOYI LAGOS.

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Abstract

As smart buildings spring up within the metropolis of Lagos State, Nigeria to provide a safer, more secure, productive and comfortable environment. Among the attendant challenges is the delivery of strategic facilities management services to maximise the building's efficiency and achieve the expected return on investment. This study investigates sustainable facilities management practices in Lagos State using the Heritage Place as a case study. A survey was conducted on 15 facilities management personnel and 64 users of the facility. The mean and relative importance index were used as the descriptive statistical tools while the t-test was employed as the inferential statistical tool. The result shows that the most frequently practised sustainable facilities management practice includes; compliance with the preventive maintenance schedules and prompt response to repairs and corrective work activities in the facility. Although the users of the facility were dissatisfied with the level of implementation of most of the hypothesized sustainable facilities management practice, the result shows marginal satisfaction of the users for integrated pest management and optimised waste management respectively. The study recommends that managers of smart office buildings should sustain the effort at implementing sustainable facilities management practices in order to significantly and continuously improve operations and maintenance activities in the buildings. The efforts of the managers of smart office buildings should be geared to the delivery of strategic facilities management services that meet the expectations of users of these facilities.

Keywords: Smart, Sustainable, Facilities Management, Buildings, Practices.

Introduction

The heritage place is the first environmentally certified commercial building in the city of Lagos, Nigeria. The 14-storey building Comprises 15,736 sq. m of office space and 350 parking bays (Heritage Place, 2017). Commercial Office buildings are structures erected to support a commercial strategy, accommodating innovative work processes, and broadcasting a particular set of business values, thereby contributing to the income of an organization owning or renting the building (Olagunju, 2012). According to Adams and Frost (2008), the design, construction, operation, refurbishment and demolition of smart office buildings make use of natural resources. These resources are the prerequisite for certain internal activities such as heating, cooling, vertical transportation, air conditioning among others. The operation and maintenance activities in the interior and exterior of office buildings have major impacts on the economic and social life of the building users as well as on the surrounding environmental quality at any point in time.

Babawale and Oyalowo (2011) posit that environmental sustainability combines the goal of protecting and enhancing the environment in such a way that allows for future needs to be met. Fujita and Takewaki (2011) assert that environmental sustainability as related to commercial office building requires that renewable resources must be consumed at a rate no greater than they can be generated while non-renewable resources must be used no faster than renewables can be put in place as substitutes and pollution wastes must be emitted at a rate within the assimilative capacity of the natural systems that absorb, recycle or render them harmless. As it were, the built and inbuilt premise of commercial office buildings accounts for a surprisingly large portion of all environmental impacts in areas such as energy consumption, carbon dioxide emissions, and waste generation among others (Ucar & Balo, 2010). Consequently, reducing the environmental impacts of commercial office buildings is critical while ensuring their consistent operation and maintenance represents significant potential.

Shi and Gong (2008) opine that the concerns about environmental sustainability as related to operations and maintenance of commercial office building has led to sustainable facility management approach as a means of exercising control and mitigating the tendency of adverse impact. Similarly, Ellison and Sayce (2007) posit that the impact of the built and inbuilt activities of commercial office buildings on the environment coupled with the need to sustain the environment justifies the importance of environmental sustainability under the umbrella of facilities management. Shah (2007) described facility management as a profession that manages the functionality of built environment by balancing economic, social and environmental aspects through continuous performance evaluation and assistance of green building technologies.

Elmualim, Valle and Kwawu, (2012) posit that sustainable facility management is an approach for coordinating the operation of a physical nature and the human environment in an organisation, uniting the whole principle of business administration, as well as, process design and engineering matters related to the environment. Lawrence, Watson and Johnsen, (2012) also defined sustainable facility management as the scope of building efficiency involving the operation and maintenance of building while giving priority to the built environment and functionality of the inbuilt facilities, reducing the environmental impact thereof.

Research on sustainable facilities management with reference to operations and maintenance of commercial buildings are limited. Previous studies have dealt with barriers to sustainable facilities management, identifying various factors such as capabilities, knowledge and organizational issues as the barriers that inhibit sustainability implementation. Capabilities

issues in achieving sustainability in FM including the lack of professional capability, capabilities discrepancies and skills and capabilities magnitude have been emphasized in several extant research studies as being crucial challenges that need to be addressed in an effort to promote sustainability (Hodges 2005; Shah 2007). In addition, issues such as the lack of sustainability knowledge, knowledge chasm and challenges faced in the knowledge transfer process have been highlighted (Elmualim, Czwakiel, Valle, Ludlow, & Shah, 2009; Elmualim, Shockley, Valle, Ludlow, & Shah, 2010; Shah 2007). These have been viewed as the most critical barriers to the implementation of sustainable FM in the management of buildings. Notwithstanding, the facilities manager is at the forefront of delivering sustainable facilities management and contributing to sustainable development (Elmualim et al., 2009).

This research aimed at examining the extent to which sustainable facilities management (FM) practices influence the level of users' satisfaction in the management of smart commercial buildings in Lagos State Nigeria. The aim of the study was pursued using the following objectives;

1. To identify sustainable FM practices/approaches frequently adopted for the management of commercial office buildings in Lagos State
2. To assess the level of users' satisfaction of Sustainable FM Practices/Approaches adopted for Operation and Maintenance of a commercial Office Building in Lagos State

The hypothesis formulated for the study is stated below:

H_0: There is no significant relationship between sustainable facilities management (FM) practices and the level of users' satisfaction with operations and maintenance of the building.

Literature Review

Kuhlman and Farrington, (2010) define sustainability as maintaining well-being over a long, perhaps even an indefinite period. According to Kuhlman and Farrington, (2010), the report of the UN World Commission on Environment and Development, better known as the Brundtland Report after its chairperson, was welcomed for showing a way out of impending doom. It was this report which adopted the concept of sustainability and gave it the widespread recognition it enjoys today.

Studies (Howe, 2010; Hopwood, Mellor, & Brien, 2005) however further identified sustainable development as the key to sustainability at all levels. Sustainability has also been strongly projected as an integral part of public policies (Bonevac, 2010; Kuhlman and Farrington, 2010) which must be vigorously pursued by both government and organizations policy. The term sustainability has evolved over the years with different people proffering different meanings within the context of their profession. For instance, (Callicott and Mumford, 1997) developed the meaning of the term "ecological sustainability" as a useful concept for conservation biologists; portraying it as the ability to meet human needs without compromising the health of the ecosystems. However, a good number of studies such as (Balslev & Galamba, 2016; Morelli, 2011) have viewed sustainability within the dimensions of economics, social equality and environmental protection.

Halliday, (2008) defines social sustainability as a life-enhancing condition within communities, and a process within communities that can achieve that condition. Alley, (2005) further portrays social sustainability as entailing workers' health and safety, impact on local communities, quality of life, benefits to disadvantaged groups, for example, the disabled.

In Economic sustainability, Alley, (2005) also portrays it as being the ability to create new markets and opportunities for sales growth, cost reduction through efficiency improvements and reduced energy and raw material inputs, Creation of additional value. Goodman (1997) posits that economic sustainability focuses on the efficiency of the use of goods and equity of distribution. The author further portrays it as maintenance of capital or keeping capital intact. In the case of environmental sustainability, it deals with the condition or future of the environment, and considers the life cycle of a product (good or service), from the extraction and processing of the resources, overproduction and further processing, distribution and transport, use and consumption to recycling and disposal (Finkbeiner, Schau, Lehmann, and Traverso, 2010). This has to be assessed with regard to all relevant material and energy flows.

With increasing urbanization, higher in developing countries, the number and size of buildings in urban areas will increase, resulting in an increased demand for electricity and other forms of energy commonly used in buildings. This suggests that development or urbanization is the major cause of various environmental sustainability issues due to increased human activity. Obabori, Ekpu and Ojealaro, (2009) links development as one of the problems facing environmental sustainability. According to Li and Ma (2014), the process of urbanization affects the condition of the environment by changing the levels of polluting emissions as a consequence of the shift in production and changes in the population's behaviour patterns after migrating from rural to urban areas. This means that environmental pollution is mainly a result of the paradigm shift from rural to urban areas. According to Oduwaye and Lawanson (2007), some of the critical problems facing cities the developing world are deteriorating living conditions, increasing rates of death and diseases caused by pollution and poor sanitation. Thus, these authors argue that the environmental and social consequences of urbanization are quite visible such as conversion of environmentally fragile areas to shantytowns by indigent migrants. They highlight the inextricable relationship between environmental degradation and poverty.

Taking into cognizance the adverse effects of development on the environment through increased human activity, hence the need for sustainable development. In other words, the idea of sustainable development arose essentially from concerns relating to overexploitation of natural and environmental resources (Anand & Sen, 2000). According to Hopwood et al., (2005), the concept of sustainable development is the result of the growing awareness of the global links between mounting environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity. In the context of United Nations (UN) World Committee on Environment and Development, Agenda 21 sustainable development is "Development that meets the need of the present without compromising the ability of the future generations to meet their own needs". From a holistic point of view, studies (Kates, Parris & Leiserowitz, 2016; Obabori, Ekpu & Ojealaro, 2009; Goodland, 1995) have shown the goal of sustainable development to be the attainment of balance among three contending subsystems (economic, social and environmental). This means that sustainability involves economic activity, social equality and environmental sustainability that promote the ability of the present and future generations to live within the earth's capacity to support us. These three dimensions of sustainability must be in harmony as opined by Kuhlman & Farrington, (2010). In other words, economic development, social development and environmental protection are interdependent and mutually reinforcing components of sustainable development.

Zawawi, Khalid, Ahmad, Zahari, and Salim, (2016) posit the proactive operation and maintenance can yield benefits, especially for smart commercial buildings. Such benefits that

could accrue from the implementation of sustainable facilities management practice include; reduced solid and hazardous waste generation, less hazardous air pollution, the extended service life of equipment and building materials, better indoor air quality, and fewer occupant complaints.

Some of the predominant sustainable facilities management practice highlighted in literature include; predictive maintenance activities, preventive maintenance activities, improvement maintenance, corrective maintenance, waste management, water management, the establishment of green procurement policy, integrated pest management, energy audit and erosion control (Barker, 2007; Neve & Selman, 2000). This study examines the level at which all the stated sustainable facilities management practice are implemented at the Heritage Place building.

Research Methodology

The cross-sectional survey research design was adopted for this study. This research strategy was considered suitable because of its ability to view comprehensively and in detail the major questions raised in the study. According to Creswell (2012), this research design is an efficient way of collecting information from a large number of respondents and the ability to use statistical techniques to determine the statistical significance of the data.

The study's population consists of facilities management personnel and users of Heritage Place building, Ikoyi, Lagos. The sample size for the study consists of one hundred (100) facilities management personnel and users of Heritage Place building, Ikoyi, Lagos.

The purposive sampling technique was adopted for the study. According to Cooper and Schindler (2008), purposive sampling is suitable when one or more specific predetermined groups are the targets in data gathering.

The study employed the use of a structured questionnaire as the research instrument. The questions were framed in a close-ended form with the respondents' having choices of the answer to tick for each of the given questions.

Findings and Discussion

Table 1 shows the statistics for the number of questionnaires distribute to those that were retrieved. From the one hundred (100) questionnaires that were administered to respondents, 87 were retrieved. 3 of the retrieved questionnaires were poorly completed and were consequently discarded leaving a total of 79 questionnaires as suitably completed and used for the study. Thus, 79% response rate was achieved for the study.

Table 1: Descriptive result of response to questionnaires administered

Questionnaires	FM Personnel	Users	Total
Administered	30	70	100
Retrieved	19	68	87
Not returned	11	2	13
Used for the study	15	64	79

Table 1 further shows that respondents for the study comprise of facility management personnel as well as users of the Heritage Place building. It is expected that the cross-section of respondents would provide a robust data for the study.

Table 2 shows the gender profile of respondents for the study.

Table 2: Gender of Respondents

Male	Female	Total
58.2%	41.8%	100.0%

Table 2 shows that about 58% of the respondents were male while about 42% of the respondents were female. The result indicates that both gender categories are well represented in substantial proportion without bias.
The respondents were asked to indicate the class of their respective age as at their respective last birthday. Table 3 shows the result of the range of age of the respondents.

Table 3: Age of Respondents

25 – 30 years	31 – 35 years	36 – 40 years	Over 40 years	Total
43.0%	26.6%	19.0%	11.4%	100.0%

From table 3, the result shows that 43% of the respondents are within the age bracket of 25-30 years, about 27% of the respondents are of age 31-35years, 19 % of the respondents are of age 36-40 years, while about 11% of the respondents are over the age of 40 years. it could thus be established that the respondents were not minors but mostly mature adult whose opinion could be regarded as reliable.

Table 4 shows the level of education of the respondent to the survey.

Table 4: Educational Qualification

OND	HND	B.Sc.	M.Sc.	Others	Total
2.5%	19.0%	39.2%	29.1%	10.1%	100.0%

Table 4 shows that 2.5% of the respondents had OND, 19% of the respondents had HND, 39.2% of the respondents had B.Sc., 29.1% of the respondents had M.Sc. and 10.1% of the respondents possess another level of educational qualification. The inference drawn from the result indicates that the respondents have acquired an appreciable level of education and are capable of comprehending the questions posed to them. The respondents significant level of education also implies that the respondents are knowledgeable people whose opinion the subject of an investigation could be relied upon.

Table 5: Respondents Work Experience

Less than 1year	1 – 5 years	6 – 10 years	Above 10 years	Total
17.7%	24.1%	38.0%	20.3%	100.0%

Table 5 shows that at the Union Bank Building, 8.0% of the respondents have had work experience of less than 1year, 47.7% of the respondents have had work experience of 1-5years, and 38.6% of the respondents have had work experience of 6-10years while 5.7% of the

respondents have had work experience of above 10years. Further, at the Heritage Place Building, 17.7% of the respondents have had work experience of less than 1year, 24.1% of the respondents have had work experience of 1-5years, and 38.0% of the respondents have had work experience of 6-10years while 20.3% of the respondents have had work experience of above 10years. Respondents are presumed to be better informed by the reason of their years of experience. Therefore, we can safely assume that responses collated are reliable given respondents' years of experience in the industry.

Sustainable FM Practices for Operation and Maintenance

One of the objectives of the study is to identify sustainable FM practices/approaches frequently adopted for operation and maintenance of a commercial office building in Lagos state (FM personnel) in Lagos State. To achieve this objective, sixteen (16) FM practices were identified from previous studies. The respondents were asked to rate the level of implementation of each of the sustainable facilities management practices using a 5-point Likert scale ranging from never to always. The result of the analysis is shown in Table 6.

Table 6: Sustainable FM Practices for Operation and Maintenance of Buildings

Sustainable FM Practices	Mean	Rank
HVAC maintenance (system efficiency and occupant comfort)	5.00	1st
Lift maintenance	5.00	1st
Prompt repairs and corrective measures of facilities	4.90	3rd
Daily maintenance and Constant check of all facilities	4.80	4th
A constant check of smoke alarms and detectors	4.74	5th
Optimal Solid Waste management	4.56	6th
Water management (water metering and minimum indoor plumbing fixture and fittings efficiency)	4.27	7th
Green Procurement Policy (Procurement of environmentally friendly commodities and products)	4.22	8th
Integrated Pest Management	4.06	9th
Lighting System Upgrade	3.78	10th
Building Exterior Management (Cleaning of building exterior)	3.66	11th
Green & Non-toxic cleaning	3.64	12th
Green Landscaping of buildings	3.40	13th
Energy Audit	3.04	14th
A new environmental control system, i.e CO2, FAHU, filtration, etc.	2.56	15th
Erosion control and Landscape Management	1.00	16th

Table 6 shows the analysis for the sustainable FM practices frequently implemented for operation and maintenance of the Heritage Place building in Lagos State. The result shows the rank order of the sustainable facilities management practices. The top-ranked sustainable

facilities management practices include HVAC maintenance (system efficiency and occupant comfort) and Lift maintenance with maximum mean scores of 5.00 respectively. Prompt repairs and corrective measures of facilities ranked 3rd among the sustainable facilities management practices with a mean score of 4.90. The result suggests the level of importance of the function of the HVAC system in achieving thermal comfort in smart buildings. The tie of lift maintenance with HVAC maintenance shows that both systems are critical to the operations of smart office buildings. While the lift system is very crucial in the movement of people and goods in the building, the HVAC system is essentially meant to provide a healthy and comfortable indoor environment with acceptable indoor air quality. Therefore, the maintenance of these facilities requires adequate attention as it must function without interruption.

The result further shows that the least ranked sustainable facilities management practices include a new environmental control system, i.e. CO2, FAHU, filtration, etc. ranked 15th with a mean score of 2.56 and erosion control and Landscape Management ranked 16th with a mean score of 1.0. Issues relating to Energy Audit, New environmental control system, i.e CO2, FAHU, filtration, etc. and Erosion control and Landscape Management could be regarded as non-frequently implemented sustainable FM practices in the building.

Users' satisfaction level with Sustainable FM Practices

The second objective of this study is to assess the users' satisfaction level of Sustainable FM Practices implemented during operation and maintenance of the Heritage Place building. In order to accurately measure the satisfaction level of respondents, the Expectation Disconfirmation Theory (EDT) was employed. The EDT measures the gap between the expected level of service and the perceived level of service. For this study, the gap in service was measured by plotting the values of expected and perceived service level. Expectations are related to the pre-experience time period that users have initial expectation or desire about sustainable FM practices. Experience of perceived performance is related to the post experience time period that the users gets based on his experience of actual service delivery.

The result of the difference can be positive or negative. When users' perceived performance is better than their expectation, a positive disconfirmation will occur. However, when users perceived performance is worse than they expected, the negative disconfirmation will occur. Positive disconfirmation will lead to customer satisfaction and negative disconfirmation means implies dissatisfaction.

To achieve this objective, the sustainable FM practices were presented to the respondents for them to assess. The mean score of both the expectations and perceptions of FM practices were measured on a 7- point Likert scale ranging from very low to extremely high. The result of the analysis is shown in Figure 1.

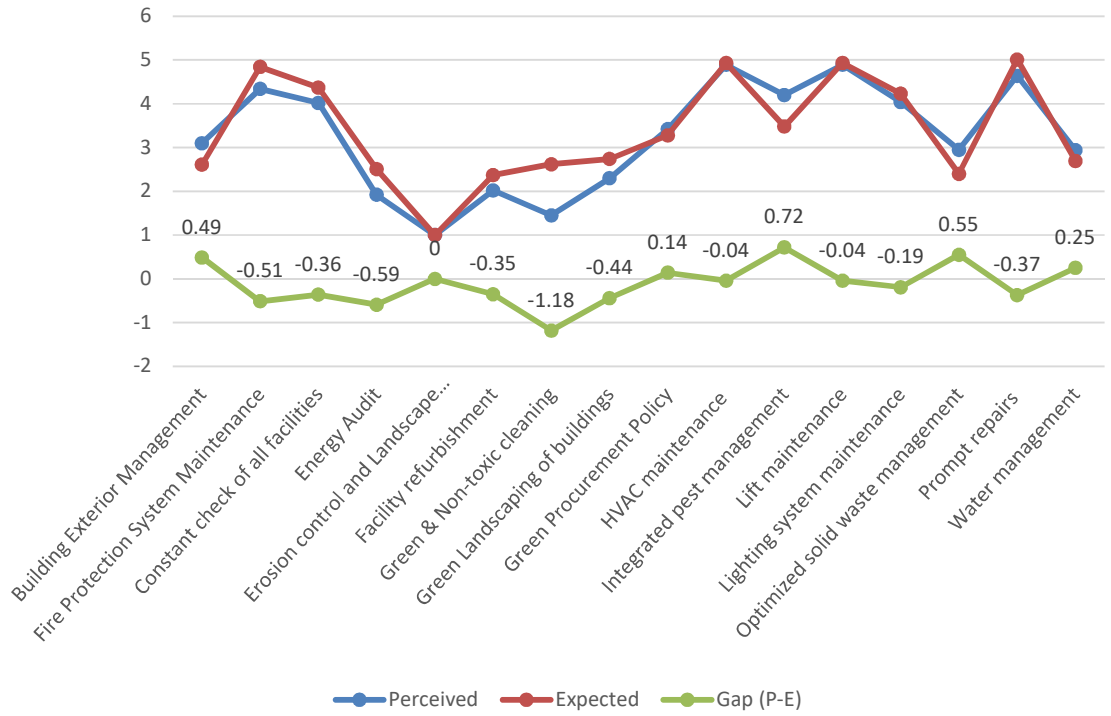

Figure 1: Level of Satisfaction with Sustainable FM Practices

Figure 1 shows that the respondents are unsatisfied with the level of implementation of the majority of the sustainable FM practices as most of the results show negative disconfirmation. The sustainable FM practices for which the respondents express satisfaction with the level of implementation include; building exterior management (0.49), green procurement policy (0.14), integrated pest management (0.72), optimized solid waste management (0.55) and water management (0.25)

Sustainable facilities management practices such as constant check of smoke alarms and detectors, daily maintenance and constant check of all facilities, energy audit, facility refurbishment, green and non-toxic cleaning, green landscaping, HVAC maintenance (system efficiency and occupant comfort), lift maintenance, lighting system upgrade and maintenance, and prompt repairs have negative disconfirmation. This implies that the respondents are dissatisfied with the level of implementation of these sustainable facilities management practices.

Furthermore, the postulated hypothesis for the study was tested using the Spearman's Correlation Co-efficient. The postulated hypothesis for the study is:

H_0: There is no significant relationship between sustainable facilities management (FM) practices and the level of users' satisfaction with operations and maintenance of the building.

The result of the correlation analysis is shown in Table 7

Table 7: Correlation analysis between sustainable FM practices and level of satisfaction

	Sustainable FM practices	Level of satisfaction with operation and maintenance services
Sustainable FM practices	1	
Level of satisfaction with operation and maintenance services	-0.33394	1

Table 7 shows a correlation value of -0.33. The result implies that there is a significant relationship between sustainable FM practices and the level of users' satisfaction with operations and maintenance of the building. The negative correlation implies that as the implementation of sustainable FM practices increases the level of dissatisfaction decreases.

Conclusion

The study examines the extent to which sustainable facilities management (FM) practices influence the level of users' satisfaction with operation and maintenance services in smart office buildings. Premised of the analysis of the data collected for the study, the following conclusions were drawn:

Only 75% of sustainable facilities management practices are frequently implemented in smart office buildings in Lagos State. Frequently implemented sustainable facilities management practices include; the maintenance of heating, ventilation and air conditioning systems, periodic maintenance of lift system and prompt repairs of failed system or component. This suggests that facilities managers consider the HVAC and vertical transportation systems as the most critical systems for the smooth running of smart office buildings.

Users of smart office buildings are dissatisfied with the level of implementation for 69% of sustainable facilities management practices in the operation and maintenance of the building as their perceived level of implementation is grossly below their expectation. The study shows that the more sustainable facilities management practices are employed in the operation and maintenance of smart office buildings, the more satisfied the building users would be.

The study recommends that managers of smart office buildings should sustain the effort at implementing sustainable facilities management practices in order to significantly and continuously improve operations and maintenance activities in the buildings. In addition, smart buildings stakeholders should endeavour to implement in the totality of all the sustainable facilities management practices as this would enhance the functionality of the building, retard decay and ultimately impact positively on the environment.

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