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PROSPECTS AND CHALLENGES OF ADOPTING GREEN MAINTENANCE APPROACH IN COMMERCIAL PROPERTY MANAGEMENT FOR ECO-FRIENDLY ENVIRONMENT

Anyakora, Mike Ifeanyi[1], Odimegwu, Chinwe Ngozi[1], Ikeotuonye, Chiadika Mathilda[1], Onwubuya-Ezeala, Stella Obiageli[1], and Umeora Chukwunonso Obiefuna[2]
[1]Department of Estate Management, Faculty of Environmental Sciences, Chukwuemeka Odumegwu Ojukwu University Uli, Campus, Anambra State, Nigeria
[2]Department of Architecture, Faculty of Environmental Sciences, Chukwuemeka Odumegwu Ojukwu University Uli, Campus, Anambra State, Nigeria

E-mail: mikeanyakora58@gmail.com

Abstract

Global concern for climate change and green environment necessitates adoption of sustainable practices in commercial property maintenance for reduced carbon footprint, conservation of vital resources, and effective contribution to the overall health of the ecosystem. This study examined the prospects and challenges of adopting green maintenance approach in the management of commercial properties with a view to highlighting the core components of green maintenance to be focused on in property management function in the pursuit of sustainable resilient urban environment in Anambra State, Nigeria. Quantitative and qualitative research methodologies were used in mixed study. Primary and secondary data were sourced and utilized in this study. Structured questionnaire was used for primary data collection, while secondary data were gathered through theoretical reviews of existing literature. Convenient sampling method was used in selecting a total of 17 commercial buildings distributed as follows: Awka (7), Onitsha (4), Nnewi (4), and Ekwulobia (2) included in this survey. Data collected were analyzed using both descriptive frequency and percentage statistics were used for analysis. This study found most of the existing commercial buildings were not designed and constructed to comply with the green requirements, nevertheless a combination of green and traditional (hybrid) maintenance approaches has adopted in such commercial buildings, while a few newer buildings are gradually adopting total green practices. This research recommended adoption of green designs and construction methods so as to aid adoption of green maintenance during occupation and use of the buildings.

Keywords: commercial property management, eco-friendly environment, green maintenance

1.0 BACKGROUND TO THE STUDY

Green maintenance is an innovative approach to maintenance of different types of assets including commercial real estate properties. While traditional maintenance approach pays little or no attention to the environment, green maintenance promotes environmental consciousness. Green maintenance uses sustainable practices to reduce ecological impact and promote long-term well-being of the ecosystem.

With the contemporary global concern for climate change and green environment, it is important for property managers to embrace sustainable practices in property maintenance. By integrating sustainable green practices into commercial property maintenance routines, property managers can significantly reduce commercial properties' carbon footprint, conserve vital resources, and contribute to the overall health of the planet. The nascent paradigm shifts from traditional to green maintenance is a strategic move towards a more resilient and environmentally responsible world environment. However, there is scarcity of information on the challenges that may be encountered in adopting green maintenance approach and the relevant professional dispositions required to navigate through those challenges.

Therefore, the need to explore the prospects and challenges of adopting green maintenance approach among Estate Surveyors and Valuers in the management of commercial properties cannot be over emphasized as it is ethically desirable for the attainment of eco-friendly world. Therefore, it is important to explore the prospects and challenges of adopting green maintenance approach among Estate Surveyors and Valuers in the management of commercial properties in Anambra State, Nigeria. Hence, this study is both ethical and desirable for the attainment of eco-friendly world, in addition to filling the existing gap in knowledge.

The goal of this study is to uncover the challenges to adoption of green maintenance approach in commercial property management, provide insights into the principles, and strategies for implementing this new eco-friendly approach. The result of this study will aid property managers' understanding of the core components of green maintenance to be focused on in property management function in the pursuit of sustainable resilient urban environment.

2.0 CONTEXTUAL REVIEWS

The concept of maintenance, traditional maintenance approach, green maintenance approach, components of green maintenance approach (energy – efficient systems, water conservation strategies, use of eco-friendly cleaning and maintenance products etc.), green in-home design is first introduced in the review process, from which the green home rating criteria are highlighted. Then, the benefits of green home design are discussed reviewing their relationships with occupants' health and well-being, also the concept of lifecycle cost is reviewed, and finally the total cost of green home design is reviewed.

2.1 The concept of maintenance

The term maintenance, generally connotes repairs, protection, upholding, preservation, continuance etc. Maintenance entails all technical, administrative, and managerial actions taken during the life cycle of an asset intended to retain the asset in good condition, or to restore it to a state in which it will continue to perform the required function. Therefore, building maintenance consists of all construction works (excluding new capital or extension works) undertaken from time to time in a building's life cycle in order to keep the building in a satisfactory condition for its present and future users (Umeora, et al. 2023). British Standards Institution (No. 3511, 1974) defined building maintenance as "Work undertaken to keep, restore or improve every facility that is to, say every part of a building, contents or site to an acceptable standard to sustain its utility and value". Existing studies stressed that building maintenance is a subject to be considered seriously if buildings are to live up to their expected life span (Eze, Ogbaje, and Zubairu, 2018; Uma, Obidike & Ihezukwu, 2014).

2.2 Traditional maintenance approach

Traditional approach to building maintenance is reactive in nature as maintenance is carried out in response to breakdowns. Traditional maintenance approach is resource-intensive, leading to increased energy consumption, waste generation, and negative impact on ecosystems. Traditional maintenance approach results in high costs, downtime, waste, and low morale as it often operates within a linear path of "take a resource, make, dispose" model

2.3 Concept of green maintenance approach

Green maintenance approach is innovative, novel, and holistic. In this new approach to maintenance, the environmental impact of maintenance activities is recognized and appropriate strategies are adopted to minimize waste, reduce energy consumption, and use eco-friendly materials. The use of green maintenance approach minimizes the ecological footprint of maintenance activities while promoting efficiency, resilience, and harmony with the natural world. Green maintenance adopts circular and regenerative principles that strive to leave a positive impact on the planet. Green maintenance procedure is cyclical in nature in the use of resources. It adopts a circular and regenerative principles that tend to impact the environment positively.

Green maintenance approach can be applied in various activities areas such as property management, facilities management, landscaping and horticulture, engineering systems maintenance etc. Green maintenance approach integrates eco-friendly methodologies and technologies into maintenance routines in a manner that address not only the immediate needs of assets but also the sustainability of the environment. Therefore, green maintenance approach aligns with the principles of environmental stewardship, conservation, and efficiency.

2.4 Principles and components of green maintenance

Green maintenance approach is anchored on the principles of 3Rs i.e., reduce, reuse, recycle. This principle emphasizes minimizing waste by reducing consumption, repurposing materials whenever possible, and recycling resources to prevent them from ending up in landfills. By adopting a circular economy mindset, green maintenance strives to create a closed-loop system where resources are conserved and reused throughout the lifecycle of various components of green maintenance. The components of green maintenance include energy – efficient systems, water conservation strategies, use of eco-friendly cleaning and maintenance products etc.).

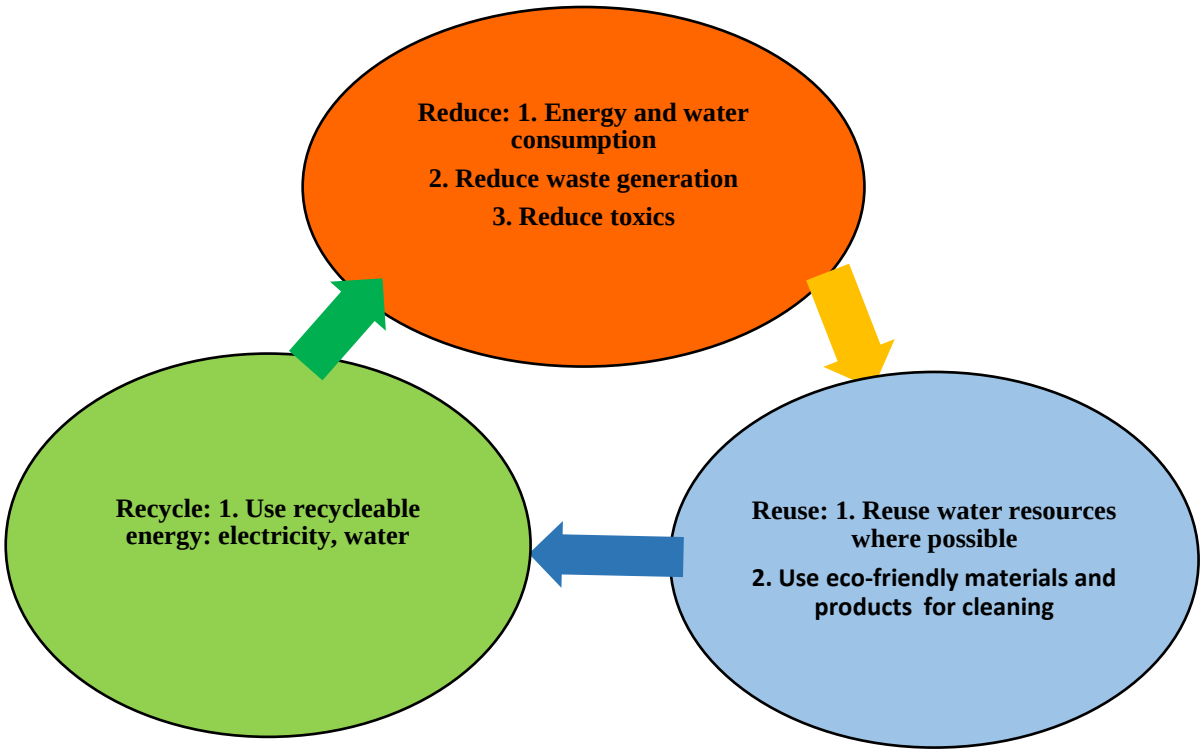

Figure 1: The Cycle of Reduce, Reuse, and Recycle

Overall energy efficiency is the focus of green maintenance. By focusing on energy efficiency, green maintenance reduces operational costs owning and using an asset in addition to mitigating environmental impact associated with excessive energy consumption.

In green maintenance approach, emphasis is placed on the use of eco-friendly materials and products both in building construction and in maintenance throughout the lifecycle of a building. Eco – friendly materials and products used in green maintenance includes choosing sustainable and responsibly building materials components, as well as utilizing cleaning agents, lubricants, and maintenance products that have minimal impact on the environment. By opting for environmentally friendly alternatives, the overall ecological footprint of maintenance activities is significantly reduced and biodiversity conservation is achieved. The principle of biodiversity conservation emphasizes creating and maintaining landscapes that support local ecosystems, fostering habitat diversity, and promoting the well-being of flora and fauna. Hence, green maintenance approach recognizes that use of any material that is harmonious with nature as building component during construction or at property management stage promotes environmental resilience and overall human health. Usually, the pursuit of sustainable eco-friendly environment in the management of commercial property ought to start with green specifications in building design and the selection of environmentally preferable building material components.

2.5 Benefits of green maintenance

Green maintenance approach produces many benefits, both for the environment, and other stakeholders in the asset. Theoretical review showed that the advantages of green maintenance in the management of commercial property include: cost saving, reduced environmental impact, improved safety and health of occupants and neighbours, enhanced reputation and image of the property and the owner, compliance with regulations and property green ratings.

2.5.1 Cost savings: Green design ensures energy-efficiency in buildings. Energy-efficiency leads to reduced resource consumption often resulting in significant cost savings over time. Cost saving practices in commercial properties lower maintenance cost and contribute to financial sustainability of the investment in the long-term.

2.5.2 Reduced environmental impact: Green maintenance minimizes energy and other resources consumption. It also minimizes waste generation, and pollution, thus leading to an overall healthier environment.

2.5.3 Improved reputation: Commercial real estate investors and properties that prioritize green maintenance are viewed as being environmentally responsible. The presence of green commercial building in a neighbourhood represents a positive public image of the building and the stakeholders' reputation.

2.5.4 Regulatory Compliance: As environmental regulations become more stringent, adopting green maintenance practices in the management of commercial properties will help ensure compliance with evolving environmental regulations and standards, thus reducing the risk of legal tussles.

2.5.5 Improved health and well-being: Green maintenance practices contribute to healthier indoor and outdoor environments, positively impacting the well-being of occupants and users.

2.6 Challenges to adopting green maintenance approach.

Although, green maintenance approach provides many significant benefits in the management of commercial properties, property managers face numerous challenges to its adoption in property management functions. It is important for property managers, and real estate investors to recognize and understand the impediments in order to enable a smooth transition from traditional maintenance approach to green maintenance practice for environmentally responsible maintenance outcome.

2.7.1 Initial cost concerns: One of the primary challenges is the perception of higher upfront costs associated with green technologies and practices. The initial investment required for energy-efficient systems or eco-friendly products can deter some from making the switch.

2.7.2 Lack of awareness: Limited knowledge about the benefits of green maintenance practices can hinder widespread adoption. Without a clear understanding of the positive environmental and financial impacts, organizations may be hesitant to change established routines.

2.7.3 Resistance to change: Resistance to change is a pervasive challenge in any industry. Employees and decision-makers may resist adopting new maintenance practices due to fear of disruption, unfamiliarity, or perceived inconvenience.

2.7.4 Limited availability of green products: In some regions, the availability of eco-friendly maintenance products may be limited. This can be a barrier for those looking to make sustainable choices but facing challenges in sourcing green alternatives.

3.0 THEORETICAL FRAMEWORK

Generally, buildings have a great impact on the sustainable development goals as they actively interact with the environment at every stage in a building life cycle. For example, buildings are responsible for over 30% of carbon dioxide (C02) generated globally, use about 25% of harvested woods for their construction. During occupation and use, buildings release about 50% of fluorocarbons, produce 40% landfill materials, use 45% of energy in operations, emit 40% of Green House Emissions, and use 15% of the world's usable water (Olanrewaju, Teo, and Mohamed, 2021)

Aside from the above highlighted multiple direct impact of buildings on the ecosystem, the indirect impact is perhaps greater than the direct impact. Thus, Anyakora et. al., (2013) stressed that buildings maintain a form of symbiotic relationship with the larger environment in the exchange of environmental, economic and social factors. Green buildings were introduced to lessen the negative impact of buildings on the users, occupants, communities, and the environment (Olanrewaju and Chong 2021).

Historically, the concept of green building, green building regulatory and promotion bodies emerged in some of the leading economies e.g., the U.S. Green Building Council, (USGBC, 1990), Indian Green Building Council (IGBC,2001) etc. Since then, the United Nations has continued to draw the attention of policy makers and government in various countries towards the need of reducing energy use in buildings for sustainable environment. United Nations Economic Commission for Europe (2012) stated that in many countries current style of using resources and energy in buildings is inefficient, outdated, and counts among the drivers of high levels of consumption in those countries.

The U.S. Green Building Council and its Leadership in Energy and Environmental Design (LEED) standards support both public and private entities to pursue green features in commercial buildings among other building types, e.g., residential. While countries like the USA, UK, Canada, Singapore, France, China, have made impressive progress in adoption of green commercial buildings, for a number of reasons the practice of green building especially commercial property investment sub sector is yet to be given a serious attention in many developing countries including Nigeria.

Commercial buildings are of diverse nature, scope, design and tenancies (Nubi, Anyakora, Gambo, and Afe, 2016). Modern commercial buildings, often a mixture of complicated and sophisticated space uses within the same building. Commercial buildings are designed developed to provide conducive, and adequate environment that can support the occupants' businesses, promote the neigbourhood profile, and general aesthetics.

The inability of a commercial building to provide most of the listed attributes engenders a loss to all stakeholders – the occupants, customers/clients, owners, government, and the environment. Commercial buildings consume high amount of electrical energy and water, is prone to defects arising from high level of human traffic movement of goods in and out of the building. It generates various types of waste compared to other type of buildings. Modern commercial buildings are functionally diverse in nature and so require more

maintenance than other building types. Hence, they tend to gulp a lot of funds for both operating and maintenance cost throughout the asset lifecycle (Onwuzuligbo, et. al, 2025).. A commercial building requires effective maintenance to increase its productivities to all stakeholders, or else over a time period it becomes unattractive to both occupiers and customers, and subsequently too expensive to own, operate, and maintain. Buildings generally are made of different components each having a finite lifespan which is usually shorter than that of the building fabric. Moreover, the users of commercial buildings are prone to changes in value systems associated by modernism, and technical innovations. The above expectations call for adoption of green maintenance approach in which weights are already attributed to maintenance of various building subsystems in leading green rating tools. Therefore, it is strategic to ensure that maintenance management of hospital buildings complies with the green requirement.

The perception of a building as a system with multiple subsystems very much applies to commercial buildings. According to Olarenwaju, et al, (2021) and Anyakora, et. al., (2012), the subsystems in a commercial building include electrical energy system, water inflow and outflow system, waste collection and disposal system, roofing system, landscaping system, external decoration system, glazed walling system, swimming pool and recreational system, car parking system, security system, floor finishing system, firefighting system, cleaning system, internet system, public address system etc.

Since the building fabric has longer lifespan than the lifespans of its sub-systems, the proper maintenance approach should systematically consider this fact for a sustainable outcome. In previous study, Olanrewaju and Kafayah (2008) indicated that use of unsustainable approach in building maintenance produces more waste and pollutants (e.g., toxic build-up, carbon dioxide emission). In addition, it also affects building users' well-being as well as consume more energy, water, and other resources.

4.0. METHOD OF DATA COLLECTION AND ANALYSIS

Primary data were collected using structured questionnaire and interviews. The interviews were conducted both online and on sites. The questionnaire was used to solicit information on four distinct sections covering: (a) Respondent's characteristics (Professional background, no. of years of experience in commercial building management, knowledge of green building components. (b) The green attributes of the commercial building under survey focusing on renewable energy supply, water supply system and techniques, and regulatory compliance competencies of the building (c) Perceived benefits of green commercial building e.g., cost savings, reduced environmental impact, improved reputation of the building, regulatory compliance, and improved building users' health and well-being (d) Challenges to green maintenance considering initial cost concerns, lack of awareness, resistance to change, limited availability of green products, and lack of relevant expertise. Furthermore, the respondents were asked to choose the type of maintenance approach which best describes their existing maintenance practice, that is (i) traditional or (ii) green.

In order to elicit authentic response from the highly busy participants, information on other green design and practice details considered in this research were collected through flexible oral interview carried out on convenient timeframes to the respondents. The oral interview followed a semi-structured approach to collect data to collaborate the information gathered from the questionnaire in this research. In this process interviewer asked a structured question in specific area to which the interviewee responds, and from the respond volunteered, more follow up questions were asked. The areas covered using this data gathering protocol are presented below.

Electrical Energy Systems: use of renewable solar, types of electric lamps in use, lamp disposal and recycling procedure, electric lamp types in use, cleaning of fixtures and lamps to gain more light, turn off lights (and other equipment) when not in use, use of photocell switches to control daylight sensors, use of bi-level switching for multiple point control, turn off lights (and other equipment) when not in use, install occupancy/vacancy lightening sensors.

Environmental and Health Considerations in selecting Paints and Painting Methods: volatile organic compounds (VOCs), chemicals of concern, recycled content (exterior applications only),

Energy Efficient Appliances: Including dishwashers, refrigerators, water coolers, and ventilation fans which will typically payback through energy savings in 3 years or less, select a model of new water heaters that uses the least amount of energy,

Water Efficient Products and Supply Systems: Water conserving plumbing fixtures (indicate the water conservation rates for: toilet, lavatory faucets, kitchen faucets, urinals, showerheads), use of low-flow fixtures, use of water sense, used water recycling procedure.

Mechanical System Efficiency: regular preventive maintenance cleaning and inspection schedule for filters, ducts, economizers, dampers, and intake and exhaust fans based on manufacturer suggested procedures, use of inspection plan for heating, ventilation, and air conditioning systems, optimize the start/stop control for the building HVAC building automation system, controlling and minimizing the introduction of dust particles and chemical fumes into building air systems,

Use of "Green" Cleaning Products and Cleaning Frequency: General purpose cleaners, glass cleaners, bathroom cleaners, carpet and upholstery cleaners, floor cleaners (maintenance, strippers, finishes), cleaning and degreasing agents, hand soaps (liquid, foam), specialty cleaners.

Method of Dislodging used Maintenance items: Generator lubricants, cleaning chemicals, and dispensing equipment during maintenance. How indigenous are the plants and flowers in the green landscaped areas etc?

Convenient sampling method was used for selecting of the commercial properties included in this survey. On the whole, a total of 36 commercial buildings distributed as follows: Awka (12), Onitsha (10), Nnewi (8), and Ekwulobia (6) were contacted for participation in this survey. However, acceptance rate to participate is as follows: Awka (7), Onitsha (4), Nnewi (4), and Ekwulobia (2), totaling 17. Analysis and report of findings is based on 17 commercial buildings surveyed in these four commercial towns of Anambra State. Property managers were asked various questions based on their experience with maintenance of the commercial properties. Copies of the questionnaire were specifically addressed to the "maintenance managers" of the commercial properties. Data were analyzed using both descriptive (Frequency count, and percentages) statistics.

5.0 RESULTS OF ANALYSIS, FINDINGS AND DISCUSSION

The results of data analysis on (i) respondents' characteristics, (ii) characteristics of surveyed commercial properties, (iii) green features available in the commercial buildings, (iv) perceived benefits of green designs in commercial buildings, (v) perceived relative importance of factors limiting green maintenance practice in

commercial buildings, and (vi) perceived type of maintenance approach used in management of the commercial buildings are presented in the tables and discussed in the following sections.

5.1 Respondents' Demographic Descriptive Analysis

Data collected from the structured questionnaire on the participants' characteristics comprising of gender, professional background, years of experience in managing commercial buildings, and knowledge of green building components were analysed, result of which is presented in Table 1.

.Table 1. Respondents' aggregated characteristics

Variables	Options	Frequency	Percentage
Gender	Male	15	88.2
	Female	2	11.8
	Total	**17**	**100**
Professional Background	Estate Surveyor and Valuer	10	58.8
	None Estate Surveyor and Valuer	7	41.2
	Total	**17**	**100**
Years of experience in managing commercial buildings	1 – 2years	0	0
	More than 2 – 4 years	1	5.9
	More than 4 – 6 years	2	11.8
	More than 6 – 8 years	5	29.4
	More than 8 years and above	9	52.9
	Total	**17**	**100**
Knowledge of green building components	Very knowledgeable	0	0
	Knowledgeable	1	5.9
	Moderately Knowledgeable	3	17.6
	Somewhat knowledgeable	10	58.8
	Not knowledgeable	3	17.6
	Total	**17**	**100**

Interpretation and Discussions

Table 1 above shows that 15 participants, representing 88.2% are males while 11.8% are females. Information on the table also reveals that a significant number of the participants 41.2% are not Estate Surveyors and Valuers, although the majority of the participants 58.8% are of Estate Surveying and Valuation professional background. The implication of the above finding is that personnel from other professional backgrounds are involved in the management of commercial buildings in Anambra State, Nigeria. In terms of years of experience in managing commercial buildings, a vast majority 82.3% have been involved in the management of commercial buildings for upwards of 6years, while about 17.7% of the participants have experiences ranging between 2 to 6years. Furthermore, the table shows that only 4 of the participants representing 23.5% are relatively knowledgeable of green building components, while a vast majority 76.4% comprise of those slightly knowledgeable or out rightly ignorant of green building components. The fact that less than 24% of the participants are knowledgeable about green building components strongly indicates that green concepts and their applications in commercial building management are at best in the budding stage in Anambra State.

5.2 Descriptive Analysis of the characteristics of surveyed commercial buildings

The result of the analysis of data elicited from the participants on the profile of the surveyed commercial properties highlighting age of the building, number of floors, number of tenants, and the mode of ownership is shown in Table 1.

Table 2. Aggregated profile of surveyed commercial properties' characteristics

Variables	Options	Frequency	Percentage
Age of Building,	1 – 2years	1	5.9
	More than 2 – 4 years	3	17.6
	More than 4 – 6 years	3	17.6
	More than 6 – 8 years	4	23.5
	More than 8 years and above	6	35.3
	Total	**17**	**100**
No. of Floors,	1	4	23.5
	2	3	17.6
	3	6	35.3
	4	4	23.5
	5	0	0
	Total	**17**	**100**
No of Tenants	15 - 24	2	11.8
	25-34	5	29.4
	35 – 44	5	29.4
	45-54	3	17.6
	55 and above	2	11.8
	Total	**17**	**100**
Ownership,	Private	17	100
	Public	0	0
	Total	**17**	**100**

Interpretation and Discussions

A cursory look at the above table shows that a vast majority (76.4%) of the commercial buildings covered in this study were within the age bracket of more than 4 years and over 8years, while close to 24% were relatively new being within the age bracket of 2 to 4years. This shows that buildings could have some green features depending on the green awareness level of the building owners and willingness to adopt green practices.

The commercial buildings density analysis revealed that 41.1% of the commercial buildings are in 1 – 2 floors design, while 58.8% are designed on floors ranging from 3 – 4. This implies that commercial buildings can be designed to consist of multiple building densities depending on the investment decisions, targets, owner's preference, and development control. The Frequency count of the number of tenants in the commercial buildings in this study showed that 41.2% of the buildings between 15 – 34 tenants, while 58.8% have tenants ranging 35 to 55 and above. Information on the table shows that ownership of the commercial buildings covered in this research is wholly private.

5.3 Descriptive Analysis of green features in surveyed commercial buildings

Data collected from the structured questionnaire on green attributes of the surveyed commercial buildings comprising of: use of renewable electrical energy systems (solar power), use of water efficient products and supply systems, mechanical systems efficiency, use of "green" cleaning products, use energy efficient appliances, sustainable method of dislodging used maintenance items, Environmental and Health Considerations in selecting Paints and Painting Methods, regulatory compliance competencies of the building were analysed, result of which is presented in Table 3.

Table 3. Aggregated green attributes data of the surveyed commercial buildings

Variables	Options	Frequency	Percentage
Use of renewable electrical energy systems (Solar power)	Yes	15	88.2
	No	2	11.8
	Total	**17**	**100**
Use of water efficient products and supply systems	Yes	10	58.8
	No	7	41.2
	Total	**17**	**100**
Mechanical systems efficiency	Yes	11	64.7
	No	6	35.3
	Total	**17**	**100**
Use of "green" cleaning products	Yes	4	23.5
	No	13	76.5
	Total	**17**	**100**
Use of energy efficient appliances	Yes	2	11.8
	No	15	88.2
	Total	**5**	**29.4**
Sustainable method of dislodging used maintenance items	Yes	6	35.3
	No	11	64.7
	Total	**17**	**100**
Environmental and Health Considerations in selecting Paints and Painting Methods	Yes	8	47.1
	No	9	52.9
	Total	**17**	**100**
Regulatory compliance competencies of the building	Yes	2	11.8
	No	15	88.2
	Total	**17**	**100**

Interpretation and Discussions

In terms of use of renewable electrical energy systems in the commercial buildings, a vast majority 88.8% confirmed that solar energy is used to powering the lightening systems in the buildings. While 11.8% of the commercial buildings make use of public electricity and stand-by generator. Information on the table indicates that on the one hand 58.8% of the commercial buildings make use of efficient water products and supple systems, while on the other hand 41.2%, use inefficient water products and supply systems. The analysis of the mechanical systems found in the commercial buildings in Anambra State shows that 64.7% are efficient while 35.3% are inefficient. Data on cleaning activities shows that use the of green cleaning products is not popular in the commercial buildings as 76.5% do not use green cleaning products as against

23.5% that do. Assessment of the energy efficiency of the appliances in the commercial buildings indicated that energy inefficient appliances are used in a vast majority 88.2% while very few 11.8% use energy efficient appliances. Analysis of responses on methods of dislodging used maintenance items reveal that in 64.7% of the commercial buildings; used lubricating oils and other waste items are dislodged in unsustainable manner, however, sustainable method is employed in 35.3% of the commercial buildings. The environmental and health implications of the choice of paints and the painting methods used in the commercial buildings was also investigated. The result of analysis in the table shows that in the construction of 52.9% of the buildings; the environmental and health implications of paints and painting methods were considered, while it was considered in 47.1%. The extent of to which the buildings complied with Indian green building or US green building regulations was assessed; and the result showed that 88.2% failed green regulatory competencies, however, 11.8% were competent.

5.4 Descriptive Analysis of respondents' perceptions about the benefits of green designs in commercial buildings

Data collected from the structured questionnaire on the respondents' perceptions of important benefits of green design in commercial buildings were analysed, and result presented in Table 4. The information on the table shows the respondent's perceptual importance of: cost, environmental impact, reputation and image of the building, regulatory compliance, and building users' health and well-being.

Table 4. Respondents' perceived benefits of green designs in commercial buildings

Variables	Options	Frequency	Percentage
Cost savings	Very Important	2	11.8
	Important	3	17.6
	Moderately Important	6	35.3
	Somewhat Important	5	29.4
	Not Important	1	5.9
	Total	**17**	**100**
Reduced environmental impact,	Very Important	2	11.8
	Important	3	17.6
	Moderately Important	7	41.2
	Somewhat Important	5	29.4
	Not Important	0	0
	Total	**17**	**100**
Improved reputation and image of the building	Very Important	2	11.8
	Important	4	23.5
	Moderately Important	6	35.3
	Somewhat Important	2	11.8
	Not Important	3	17.6
	Total	**17**	**100**
Regulatory compliance	Very Important	2	11.8
	Important	3	17.6
	Moderately Important	5	29.4
	Somewhat Important	3	17.6
	Not Important	4	23.5
	Total	**17**	**100**

Improved building users' health and well-being	Very Important	3	17.6
	Important	6	35.3
	Moderately Important	5	29.4
	Somewhat Important	2	11.8
	Not Important	1	5.9
	Total	**17**	**100**

Interpretation and Discussions

Information in Table 4 reveals the respondents' perceptions on the benefits of green designs in commercial buildings in Anambra State, Nigeria. On the one hand, a higher percentage, 63.9 % of the respondents confirmed that green designs in commercial buildings lead to savings in cost during the building lifecycle. While on the other hand 29.4% perceived green designs in commercial building as being of little importance in cost savings efforts; whereas, 5.9% of the respond are of the opinion that there are no cost savings benefits for using green designs in commercial buildings. Next, the analysis of the respondents' perceptions on adoption of green designs in commercial building in reducing environmental impact shows that a vast majority understand the importance of green designs in reducing environmental impact. Although 29.4% say that use of green designs is just somewhat important in reducing environmental impact.

Furthermore, the theoretical claim that adoption of green design in buildings lead to improved reputation and image of the building was assessed. The result of the analysis shows that 70.6% perceived adoption of green design in commercial building as being able to improve the building's reputation and image. Although, 11.8% say; adoption of green design in commercial is just somewhat important in improving the building's reputation and image, whereas 17.6% claimed that it is not important. The next descriptive analysis was on the respondents' perceptions on the importance of adoption of green design in ensuring regulatory compliance. Result of the analysis showed that on the one hand, majority of the respondents (58.8%) consider adoption of green design in commercial building as being important for in ensuring the building's compliance regulation, while on the other hand, 23.5 % of the respondents confirmed that it is not important in their own opinion. Nevertheless, the remaining group, 17.6% said that green design in commercial buildings is only somewhat important in ensuring regulatory compliance.

The importance of using green design in commercial building on improving building users' health and well-being was the next variable investigated in this survey. Analysis of the information gathered on this variable showed that a whopping 82.3% of the respondent believe that use of green design in commercial building is important for improved building users' health and well-being. In addition, another group; 11.8% also believe that using green design in commercial building is just somewhat important in bringing about improved building users' health and well-being. Lastly, 5.9% of the respondents hold the view that use of green design in commercial building does not necessarily lead to improved building users' health and well-being.

5.5 Descriptive Analysis of respondents' perceptions about the benefits of green designs in commercial buildings

Data collected from the structured questionnaire on factors impeding green maintenance practice in the surveyed commercial buildings comprising of: initial cost concerns for green design, lack of awareness of green design benefits, resistance in changing to green concept, limited availability of green products to be used, lack of relevant expertise in green (design, construction, and installation) were all analysed, and result presented in Table 5.

Table 5. Respondents' perceived relative importance of factors limiting green maintenance practice in commercial buildings

Variables	Options	Frequency	Percentage
Initial cost concerns	Very Important	8	47.1
	Important	4	23.5
	Moderately Important	1	5.9
	Somewhat Important	3	17.6
	Not Important	1	5.9
	Total	**17**	**100**
Lack of awareness	Very Important	9	52.9
	Important	5	29.4
	Moderately Important	2	11.8
	Somewhat Important	1	5.9
	Not Important	0	0
	Total	**17**	**100**
Resistance to change	Very Important	6	35.3
	Important	4	23.5
	Moderately Important	2	11.8
	Somewhat Important	3	17.6
	Not Important	2	11.8
	Total	**17**	**100**
Limited availability of green products	Very Important	8	47.1
	Important	5	29.4
	Moderately Important	1	5.9
	Somewhat Important	1	5.9
	Not Important	2	11.8
	Total	**17**	**100**
Lack of relevant expertise	Very Important	8	47.1
	Important	5	29.4
	Moderately Important	3	17.6
	Somewhat Important	1	5.9
	Not Important	0	0
	Total	**17**	**100**

Interpretation and Discussions

The respondents' perceptions of the factors limiting green maintenance practice in commercial buildings was the next variable investigated in this survey. Analysis of the data collected on this variable showed that a whopping 76.5% of the respondents believe that initial cost of procuring green designs is an important factor limiting adoption of green maintenance approach in the management of commercial buildings. As important an initial cost of green design is to this first group, nevertheless, another group of the respondents 17.6% sees it as only being of somewhat importance. While, one of the respondents representing 5.9% initial cost concern is of no importance in adopting green maintenance practice. This implies that regardless of the cost of green design, construction, and installation that green maintenance approach could still be pursued in the

management of commercial buildings. From the information on the table, all the respondents (100%) were of the view that lack of awareness the concept of green design, its benefits, and the associated technology is another important factor that limit adoption of green maintenance approach in commercial buildings. Life is dynamic, and change is constant in every sphere of life, so analysis revealed that 88.2% of the respondents' perceived resistance as an important factor limiting adoption of green maintenance practice in the management of commercial buildings. Nonetheless, 11.8% of the respondents maintained that resistance to change does not limit green maintenance practice. Data on the relative importance of availability of green products in adoption of green maintenance practice was collected based on the same 5-points scale. From the result of the analysis, 88.2% of the respondents indicated that limited availability of green products in Nigerian building materials' market is an important factor limiting the adoption of green maintenance practice in the management of commercial buildings. While a few 11.8% were of contrary view. Once again, all the respondents (100%) agreed that paucity of relevant green expertise in Nigerian built environment sector is another important factor that limit adoption of green maintenance approach in the management of commercial buildings.

5.6 Descriptive Analysis of types of maintenance approach use in the management of commercial buildings

Data collected from the structured questionnaire on the respondents' perceptions on the type of maintenance approach used in management of the commercial buildings were analysed, and result as presented in Table 6. The maintenance approach was sub-divided into: traditional (none green), green, and hybrid (combination of traditional and green)

Table 6. Respondents' perception of the type of maintenance approach used in management of the commercial buildings

Variables	Options	Frequency	Percentage
Existing maintenance approach in use	Traditional	9	52.9
	Green	3	17.6
	Hybrid	5	29.4
	Total	**17**	**100**

Interpretation and Discussions

It is evident from the information on Table 6 that the traditional maintenance approach is still popular in the management of commercial buildings in Anambra State Nigeria as indicated by a majority (52.9%) of the respondents. On the one hand, 17.6% of the respondents are using green maintenance approach, while on the other hand, 29.4% confirmed using a mixture of traditional and green maintenance approaches. The implication of the above findings is that, although traditional maintenance approach obtains in majority of the commercial buildings in Anambra State, nevertheless green maintenance approach is gradually being adopted by commercial property managers. Summation of the respondents using green and hybrid (combination of green and traditional) maintenance approaches is significant (47%).

Hopefully, green maintenance practices will gain more grounds in near future as awareness of it benefits increases and the supply of technical expertise becomes readily available at construction, installation, and maintenance stages. This study established that essentially green maintenance in building is implemented

primarily to ensure high building performance which leads many benefits e.g., savings in costs - high savings energy and water costs and a reduction in waste generation pollution and carbon emission, just to mention a few.

6.0 CONCLUSION AND RECOMMENDATIONS

This research has extensively explored the prospects and investigated the challenges associated with the adoption of green maintenance practices in commercial buildings. Although most commercial buildings in Anambra State Nigeria were not designed and constructed to comply with the green requirements, nevertheless a combination of green and traditional (hybrid) maintenance approaches can still be adopted in the older commercial buildings, while total green practices will be pursued in the newer ones. This study has shown that adoption of the green maintenance approach in the management of commercial buildings building provides immense benefits to all the stakeholder groups.

Consequently, this study makes the following recommendation:

Real Estate investors and developers are encouraged to choose green designs, and construction methods which are provide the pedestal for full implementation of green maintenance practices at the occupation and management stage.

Managers of commercial buildings are enjoined to improve their knowledge of green concepts for effective implementation of green maintenance practice.

Builders, Engineers, Architects, Estate Surveyors and Valuers, Technicians etc. in the built industry are also advised to improve their knowledge of green concepts, and acquaint themselves with green implementation procedures at every stage in the building lifecycle.

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