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Awareness and Extent of Adoption of Eco-Friendly Library Designs: A Study of Five Federal University Libraries in South East Nigeria

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bstract: The research was aimed at establishing the influence of eco-friendly designs on library operations in federal university libraries in the South East zone of Nigeria. The main interest of the study was to investigate the extent of the adoption of these designs in the selected libraries, their operational effects, the benefits accrued, and the set-backs experienced. The study also sought to extend the understanding of sustainable practices in academic libraries. The research adopted a descriptive survey research design that only involved information collection as a way of addressing the research questions. It targeted all the professional staff in the university libraries selected for the study. The study took place in five libraries in five selected federal universities in Nigeria. The data were collected using a structured questionnaire that was designed to guide the staff in providing the necessary information so as to obtain the desired results. The questionnaire was structured on the variables encompassing the research objectives. The data obtained were analyzed in terms of descriptive statistics that included percentages, mean scores, and standard deviations. The main results of this study included a 99% return rate of 200 out of the 202 questionnaires sent out. The study found out that implementation of eco-friendly environments was at a moderate pace with the mean scores on the environment attributes falling between 2.65 and 3.12 and the advanced technologies falling below 2.50 (on a scale from 1 to 4). The study also found out that eco-friendly environment designs influenced the library staff positively with regard to improved operations, and satisfied staff working environment. However, various challenges were identified which included inadequate funding, policy gaps, lack of technical expertise, and resistance to change by staff. The findings imply that while the foundation for sustainable transformation exists, the realization of fully eco-friendly libraries requires increased investment, the development of supportive institutional policies, technical capacity building, and continuous awareness initiatives. Recommendations were made to guide libraries and policymakers toward building sustainable, future-ready academic library environments.

Background to the study

In recent times, sustainability has emerged as a global imperative, influencing virtually all sectors, including education. Libraries, as essential hubs for knowledge access and community learning, have become increasingly eco-conscious. Modern libraries are now being designed to incorporate energy-efficient systems, recycled materials, and natural resources such as bamboo. Technologies like solar panels, LED lighting, rainwater harvesting systems, and automated ventilation are also being adopted to enhance resource efficiency and user comfort (Ashikuzzaman, 2024; Ejiroghene, 2020). Sustainability in libraries extends beyond physical infrastructure. It is also embedded in institutional policies, programs, and services that emphasize environmental conservation, awareness, and community

participation. According to the International Federation of Library Associations and Institutions (IFLA, 2022), libraries are expected to contribute meaningfully to the realization of the United Nations Sustainable Development Goals (SDGs) by promoting environmental responsibility and equitable service delivery (Davitt, 2023; IFLA, 2025). In this context, libraries are transforming into environmental education centers some certified to international green building standards such as LEED (Leadership in Energy and Environmental Design) that model sustainable development in action (Mathiasson & Jochumsen, 2022; Pagore & Chalukya, 2022). Examples such as the Seattle Public Library demonstrate how sustainable designs can significantly reduce operational costs, improve environmental performance, and raise awareness about ecological issues. However, as Thomas (2017) observed, while green library initiatives have gained substantial ground in developed countries, their adoption in developing nations remains inconsistent due to infrastructural challenges, low awareness, and inadequate policy support. This observation is also true of the Nigerian experience. In many federal university libraries across South-East Nigeria, financial constraints, policy gaps, infrastructural deficits, and limited awareness continue to hinder the adoption of eco-friendly practices (Kolawole & Oladokun, 2024). Yet, the urgency of Nigeria's environmental challenges ranging from energy instability to climate vulnerability underscores the necessity of sustainable transformation, especially within educational institutions that shape future generations. While libraries in Nigeria grapple with many competing priorities, including digitization, resource constraints, and service delivery gaps, the integration of sustainability into library design should not be seen as a lesser concern. On the contrary, it offers long-term benefits such as reduced utility costs, healthier environments for learning, and alignment with national and global sustainability goals. Green libraries can also attract external funding, inspire innovation, and signal institutional commitment to the SDGs. Against this backdrop, the study titled Awareness and Extent of Adoption of Eco-Friendly Library Designs: A Study of Five Federal University Libraries in South-East Nigeria explores how sustainable design principles are understood, implemented, and experienced within these institutions. It investigates levels of awareness, the extent of adoption, and their influence on library operations, user experience, and staff performance. Ultimately, the study seeks to generate actionable insights that can inform policy, stimulate resource mobilization, and foster sustainable transformation in Nigerian academic libraries. These five universities were purposively selected from the six federal universities located in South-East Nigeria. The sixth institution Federal University of Health Sciences, Otolo-Nnewiwas excluded due to its specialized academic mandate and limited library infrastructure at the time of data collection.

Conceptual Framework

An eco-friendly library refers to a library whose architectural design; resources, services, and operational policies are built around the principles of en-

vironmental sustainability. According to Daimari (2018), such libraries are intentionally designed to minimize their ecological footprint through the adoption of climate-conscious technologies and environmentally responsible practices. Central to this concept is the idea of sustainability, which promotes efficient resource use, reduced environmental impact, and improved well-being for users and staff (Pagore & Chalukya, 2022; Fedorowicz-Kruszewska, 2020). In the context of this study, the concept of eco-friendly libraries is examined through both structural features and user perceptions within selected federal university libraries in South-East Nigeria. The study focuses on tangible design elements such as solar power systems, energy-efficient lighting (e.g., LED), rainwater harvesting systems, green roofs, use of local or recycled building materials, and digital service delivery platforms. These elements serve as indicators of eco-friendly adoption and are assessed based on how visibly they are integrated into library infrastructure and operations. Additionally, the study explores staff and user awareness of these eco-friendly features, how such features influence library practices, and the extent to which they are being consciously adopted across the selected institutions. For example, features like natural lighting and smart ventilation systems are evaluated not only by their physical presence but also by the level of awareness users and staff have regarding their environmental benefits. This framework aligns with global movements toward sustainable development, especially as articulated in the United Nations Sustainable Development Goals (SDGs), particularly Goal 4 (quality education), Goal 7 (affordable and clean energy), and Goal 13 (climate action) (IFLA, 2025; Davitt, 2023). However, the study situates these global goals within a local Nigerian context, where challenges such as energy instability, limited funding, and policy gaps necessitate adaptive, low-cost, and scalable eco-friendly solutions. Although the terms “eco-friendly libraries,” “green libraries,” and “sustainable libraries” are often used interchangeably in the literature, this study deliberately adopts the term eco-friendly libraries to reflect its specific focus on visible, environmentally responsive design practices in Nigerian federal university libraries. The term underscores practical implementations such as solar installations, LED lighting, and digital resource expansion features that can be directly observed, evaluated, and compared across the study sites. By using this framework, the study critically investigates three main aspects: the awareness of eco-friendly library designs among staff and users, the extent of adoption of such designs in the selected university libraries, and the influence of eco-friendly design on library practices and user experience. These align directly with the study objectives and provide a structured lens for data collection and interpretation within the realities of public university libraries in South-East Nigeria. Although the terms eco-friendly libraries, green libraries, and sustainable libraries are often used interchangeably in literature, they each carry nuanced distinctions in emphasis and scope. Eco-friendly libraries primarily refer to libraries that incorporate environmentally conscious design and operational elements that directly reduce their ecological footprint. These features include solar panels,

LED lighting, rainwater harvesting, recycling systems, and the use of low-impact materials. The term emphasizes practical, visible environmental interventions, often applied without requiring formal certification (Daimari, 2018; Mondal, 2023; Ren & Lu, 2024). In contrast, green libraries typically imply a more structured and formalized commitment to sustainability, often linked to certification frameworks such as LEED (Leadership in Energy and Environmental Design) or GRIHA (Green Rating for Integrated Habitat Assessment). Green libraries not only adopt eco-friendly features but also adhere to recognized standards and metrics of environmental performance, evaluated through internationally accepted systems (Pagore & Chalukya, 2022; IFLA, 2022). Sustainable libraries, on the other hand, adopt a broader, more holistic framework that includes environmental, social, and economic sustainability. This includes equity of access, community resilience, inclusive programming, long-term cost efficiency, and human-centered operations. Sustainable libraries position themselves not only as service points but as agents of sustainable development in alignment with the UN's Sustainable Development Goals (Fedorowicz-Kruszewska, 2020; Davitt, 2023; IFLA, 2025). This study specifically adopts the term "eco-friendly libraries" to emphasize visible, function-oriented environmental design elements relevant to the Nigerian context. These include infrastructural adaptations such as energy-saving lighting, water conservation systems, and digital resource expansion that may not be formally certified but align with environmental best practices. This framing allows the study to practically assess awareness and adoption of sustainable design features in federal university libraries in South-East Nigeria many of which operate in resource-constrained environments where full "green" or "sustainable" accreditation may not yet be feasible (Kolawole & Oladokun, 2024; Okoye et al., 2024).

Empirical Review

Globally, the relevance and application of eco-friendly library design are gaining traction. In Ukraine, for example, the Lviv Regional Children's Library incorporates sustainability education into its programming, focusing on waste reduction and community-based environmental action (Bodh, 2023). In other regions like Asia and Africa, the movement is also growing. Studies show that libraries are integrating local materials like bamboo and recycled plastics to lower building costs and promote eco-consciousness (Kolawole & Oladokun, 2024). Tariq et al. (2025) identify the main drivers behind eco-friendly libraries as technological advancement, institutional willpower, and internal or external motivational factors. In addition to ecological benefits, these libraries foster improved air quality, natural lighting, and aesthetically pleasing, user-friendly environments that contribute positively to learning, mental wellness, and productivity (Ren & Lu, 2024; Dogan & Gurpinar, 2023). Miao et al. (2024) emphasize the role of computational modeling in optimizing building performance. Their findings suggest that fine-tuning aspects like shading, airflow, and window orientation can result in over 90% ener-

gy savings evidence that supports the long-term value of thoughtful eco-friendly design. Although their study is global in scope, its implications are relevant to the Nigerian context, where funding limitations and infrastructural inefficiencies necessitate innovation. Within Nigeria, particularly in federal universities in the South-East, some institutions are beginning to incorporate sustainable elements into library design. According to Ashikuzzaman (2024), these libraries now feature solar panels, LED lighting systems, and smart air conditioning to reduce operational costs and mitigate energy challenges. The use of Building Automation Systems (BAS) and Energy Management Systems (EMS) is also emerging, offering tailored ventilation, lighting, and climate control that align with user needs and tropical environmental demands. Construction practices increasingly feature recyclable or low-emission materials such as bamboo, recycled steel, and low-VOC finishes (Ashikuzzaman, 2024). Green roofing is becoming more common to reduce temperature fluctuations inside the building. In addition, libraries are adopting water conservation techniques like rainwater harvesting and low-flow fixtures. These design decisions are supported by digital shifts that reduce dependence on physical resources, such as increased use of e-books, online journals, and virtual services. Despite growing examples and international support, gaps remain in the Nigerian academic library context. Specifically, there is limited empirical knowledge on how aware library staff and users are of eco-friendly design principles and to what extent such principles are being implemented. This study addresses that gap by investigating the awareness and adoption of eco-friendly library designs across five federal university libraries in South-East Nigeria.

Despite growing awareness of sustainability imperatives, federal university libraries in South-East Nigeria face a number of barriers to adopting eco-friendly practices. A primary challenge is financial. While eco-friendly technologies can be cost-effective in the long term, their initial installation such as solar panels, smart infrastructure, and sustainable construction materials often requires substantial investment. With libraries already operating on limited budgets, and irregular or inadequate grant allocations, financing the transition remains difficult (Ashikuzzaman, 2024; Oladoja & Ogunmakinde, 2021). As Ajani et al. (2024) note, even libraries in more developed contexts struggle to fund sustainable infrastructure underscoring the scale of the challenge in resource-constrained settings. Technical knowledge gaps and infrastructural limitations compound these financial issues. The transition to eco-friendly operations often requires specialized skills in renewable energy, smart systems integration, and green architectural retrofitting skills that many library personnel may not currently possess (Tariq et al., 2025). Recruiting technical experts or conducting capacity-building initiatives further strains already overstretched resources. In some cases, the local availability of needed technologies and materials is itself limited, making procurement a logistical challenge (Oladoja & Ogunmakinde, 2021). Many libraries in the region are housed in legacy buildings not originally designed for sustainability. Retrofitting older facilities to accommodate energy-efficient systems can be both disruptive

and expensive, often requiring significant architectural modifications that may not be feasible under current funding or planning frameworks (Ashikuzzaman, 2024). Equally pressing is the issue of awareness. Many library stakeholders including administrators, staff, and users lack adequate exposure to sustainability concepts. Khalid, Malik, and Mahmood (2021) attribute this to the absence of environmental education in formal Library and Information Science (LIS) training curricula. Without this foundation, implementation efforts often encounter resistance or passive disengagement (Kang, 2020; Jones & Wong, 2016). Users may not prioritize sustainable services, while staff may hesitate to adopt unfamiliar technologies or practices. Beyond knowledge gaps, the absence of regulatory and policy support is a systemic challenge. Unlike countries with formal green building standards, Nigeria does not yet have strong legislative or institutional frameworks to mandate or incentivize eco-friendly practices in the library sector (Singh & Mishra, 2019; Fedorowicz-Kruszewska, 2023). This lack of guidance makes it difficult for libraries to justify investments or develop long-term plans for sustainability. Cultural and educational barriers also persist. Weak environmental literacy among students, faculty, and local communities reduces the perceived urgency of adopting sustainable models. Without widespread understanding of climate responsibility and green practices, even well-intentioned eco-friendly initiatives may be met with indifference or skepticism (Fedorowicz-Kruszewska, 2023). In summary, while the aspiration to build and maintain eco-friendly libraries exists in federal university libraries in South-East Nigeria, progress is hindered by financial, technical, institutional, and cultural challenges. Overcoming these barriers will require a multi-pronged strategy combining increased funding, stakeholder training, curriculum reform, and supportive policies with active collaboration among government, universities, civil society, and the private sector.

Theoretical Framework

This study is anchored in two key frameworks: the Environmental Behavior Theory and the Technology Acceptance Model (TAM). These theories were selected for their specific relevance to the dual focus of the research awareness and extent of adoption of eco-friendly library designs in five federal university libraries in South-East Nigeria. The Environmental Behavior Theory, developed by Paul Stern (2000), explains how environmental actions are shaped by awareness, personal values, and institutional or social contexts. In this study, the theory provides a basis for examining how library users, staff, and administrators develop pro-environmental attitudes toward sustainable design features. It helps assess how internal factors (such as knowledge and motivation) and external influences (like institutional support and peer norms) drive behavioral willingness to engage with and maintain eco-friendly practices within the library setting. The Technology Acceptance Model (TAM), introduced by Davis (1989), complements this framework by focusing specifically on the adoption of technological innovations. Since many

eco-friendly library features such as smart lighting, digital resource platforms, and renewable energy systems depend on user interaction with technology, TAM is instrumental in explaining how perceptions of usefulness and ease of use affect acceptance. By applying TAM, the study investigates whether users and staff find these technologies accessible, relevant, and beneficial enough to support their consistent use and maintenance. Together, these theories capture both the behavioral and technological dimensions of eco-friendly library adoption. This dual perspective ensures a more holistic understanding of how awareness, attitudes, and perceived utility influence the success and sustainability of environmentally conscious practices in academic libraries.

Methodology

This study employed a descriptive survey research design to investigate the influence of eco-friendly library designs on staff operations in federal university libraries within South-East Nigeria. The study specifically targeted all professional library staff across five federal universities, which include: University of Nigeria, Nsukka (UNN); Nnamdi Azikiwe University, Awka (UNIZIK); Federal University of Technology, Owerri (FUTO); Michael Okpara University of Agriculture, Umudike (MOUAU); and Alex Ekwueme Federal University, Ndufu-Alike Ikwo (AE-FUNAI). These five were selected from the six federal universities in the region. The sixth institution Federal University of Health Sciences, Otolo-Nnewiwas excluded due to its specialized scope and limited library infrastructure at the time of data collection. As such, the selected universities were considered representative of the region's established federal university library system. The study population comprised all professional library staff in the selected universities. A census sampling technique was used, given the manageable size of the target population. A total of 200 valid responses were collected. Of these, 64 respondents (32%) were from UNN, 44 (22%) from UNIZIK, 42 (21%) from FUTO, 46 (23%) from MOUAU, and 6 (3%) from AE-FUNAI. In terms of gender distribution, 135 participants (67.5%) were female, while 65 (32.5%) were male. The majority of respondents (97.5%) were librarians, while 2.5% served in administrative roles within the libraries. Data were collected through a structured questionnaire developed to capture information across four thematic areas: (1) awareness of eco-friendly library designs, (2) extent of implementation, (3) perceived benefits, and (4) challenges associated with adopting sustainable practices. A four-point Likert scale was used to measure respondents' views. For implementation-related items, options ranged from Very Low Extent (VLE = 1) to Very Great Extent (VGE = 4). For perception and attitude items, the scale ranged from Strongly Disagree (SD = 1) to Strongly Agree (SA = 4). A mean score of 2.50 was used as the benchmark for interpretation, with values ≥2.50 indicating agreement or high implementation, and <2.50 suggesting disagreement or low adoption. Descriptive statistics means, standard deviations, and percentages were used to analyze the data. Results were presented in tables

to show the distribution of responses and reveal insights into how eco-friendly library environments influence staff efficiency, collaboration, and well-being. Out of 202 distributed questionnaires, 200 were returned fully completed, resulting in a response rate of 99%. Ethical procedures were carefully followed: participation was voluntary, informed consent was obtained, and respondent confidentiality was upheld throughout the research process.

Result and Discussion

Research Question1: To what extent are eco-friendly architectural features and technologies adopted in federal university libraries in South-East Nigeria?

Items	Mean	SD	Decision
The library building incorporates natural lighting to reduce electricity usage.	3.10	0.43	Accepted
Solar panels or other renewable energy sources are used in the library.	2.04	0.64	Rejected
The library uses energy-efficient lighting (e.g., LED bulbs).	3.19	0.51	Accepted
Water-saving fixtures (e.g., low-flow taps) are installed in the library.	2.57	0.29	Accepted
The building materials used are environmentally sustainable (e.g., recycled materials).	2.30	0.45	Rejected
The library uses Building Automation Systems (BAS) to manage lighting and temperature.	1.90	0.72	Rejected
The library emphasizes digital services (e.g., e-books, online journals) to reduce physical resource usage.	3.24	0.57	Accepted
Grand Mean	**2.62**	**0.51**	**Accepted**

The findings of Research Question 1 reveal that federal university libraries in South-East Nigeria are gradually adapting eco-friendly architectural techniques, though at a basic level. The general adoption is moderate (Grand Mean = 2.62), and the adaptation is generally uniform across all institutions (SD = 0.51). Due to their affordability and ease of installation, features such as natural lighting (Mean = 3.10) and energy-efficient LED (Light Emitting Diode) lighting (Mean = 3.19) are more commonly adapted. Similarly, the use of some digital services such as e-books and online journals (Mean = 3.24) is part of the global thrust to adopt digitization in libraries. However, more advanced green technology such as solar panels (Mean = 2.04), building automation (Mean = 1.90), and sustainable building materials (Mean = 2.30) are rarely adopted. This is the same as the findings of Ifijeh and Yusuf (2020) that Nigerian libraries are interested in the sustainable

environment, but the implementation is hampered by the absence of policy to drive it and the lack of adequate funding.

Research Question2: How do eco-friendly library designs impact the operations and practices of library staff? n = 200

Statement	Mean	SD	Decision
Eco-friendly features reduce energy costs and improve resource management	3.43	0.19	Accepted
The library staff is trained to incorporate features of eco-friendly library designs into their daily routines.	3.28	0.11	Accepted
Staff productivity is enhanced by the eco-friendly library environment.	3.23	0.07	Accepted
Eco-friendly library designs have contributed to innovation in service delivery.	3.17	0.03	Accepted
Eco-friendly practices are integrated into the daily work schedule of library staff.	3.14	0.06	Accepted
The use of sustainable practices has improved the library's operational efficiency.	3.09	0.11	Accepted
The eco-friendly environment has improved staff collaboration and engagement.	3.06	0.14	Accepted
Grand Mean	**3.20**	**0.10**	Accepted

The findings from Research Question 2 reveal that eco-friendly library designs have a clear and consistent positive influence on the daily operations and work practices of library staff in federal university libraries in South-East Nigeria. With a strong grand mean of 3.20 and low variability (SD = 0.10), the respondents agreed across the board that features such as energy-saving designs (Mean = 3.43) and staff training on sustainable practices (Mean = 3.28) enhance their roles. These elements not only improve productivity (Mean = 3.23) and operational efficiency (Mean = 3.09) but also foster innovation (Mean = 3.17) and stronger collaboration among staff (Mean = 3.06). This result mirrors the findings of Okpidi-Urhibo, (2023), who emphasized that green library environments can significantly boost staff morale, productivity, and innovation by providing healthier and more efficient workspaces. Similarly, Olaleye and Adebayo (2020) found that integrating sustainability into library workflows enhances staff engagement and improves service delivery, making eco-friendly practices a driver of institutional effectiveness.

Research Question 3: What are the perceived benefits of sustainable library environments among library staff? Staff (n = 200)

Items	Mean	SD	Decision
The sustainable design of the library contributes to a more comfortable and healthier work environment.	3.33	0.02	Accepted
I am well informed about the eco-friendly features and initiatives implemented in the library.	3.36	0.01	Accepted
Eco-friendly environment enhances my focus and work productivity.	3.35	0.00	Accepted
Sustainable practices in the library promote teamwork and staff collaboration.	3.37	0.02	Accepted
I feel more motivated and engaged working in a library that values sustainability.	3.33	0.02	Accepted
The eco-friendly features of the library reduce stress and improve my job satisfaction.	3.38	0.03	Accepted
Working in an eco-friendly library environment has made me more conscious of sustainable practices in my personal and professional life.	3.38	0.03	Accepted
Grand Mean	**3.35**	**0.02**	Accepted

The findings of Research Question 3 indicated that the library staff in these institution appreciate the benefits of sustainable libraries. It had a high grand mean of 3.35 with minimal variability (SD = 0.02). In addition, the staff felt that they had improved in terms of comfort and health; focus and productivity; awareness of eco-friendly features; mood and social interaction and personal habits (means = 3.33-3.38). Specifically, the staff felt more motivated (m=3.33), energized (M = 3.34), focused and productive (M = 3.35), more knowledgeable about the environment (M = 3.36), less stressed (M = 3.38), more collaborative (M = 3.37), and more eco-conscious in their personal lifestyles (M = 3.38). Research Question 3 results are similar to those obtained by Alegbeleye et al. (2020) who observed that sustainable environments boost employee morale, reduce stress, and improve work culture in academic libraries. Ifijeh and Yusuf (2020) noted that green libraries improve not only environmental performance but also employee morale and organizational engagement.

Research Question 4:What challenges hinder the implementation of eco-friendly practices in federal university libraries in South-East Nigeria? Total Respondents (n = 200)

Items	Mean	SD	Decision
Inadequate funding and high initial costs make the adoption of eco-friendly technologies unaffordable for libraries.	3.35	0.79	Accepted
Lack of technical expertise and limited staff training hinder the implementation of eco-friendly practices in libraries.	3.43	0.82	Accepted
Retrofitting old library buildings for sustainability is too costly and technically challenging.	3.28	0.85	Accepted
Eco-friendly technologies and materials are not readily available in the Nigerian market.	3.37	0.81	Accepted
There is little or no policy or regulatory support to guide and encourage eco-friendly practices in libraries.	3.35	0.82	Accepted
Library management does not prioritize sustainability in strategic planning and budgeting.	3.34	0.80	Accepted
Library users and staff have limited awareness of the benefits of eco-friendly libraries.	3.40	0.83	Accepted
There is general resistance to change due to thelack of environmental education and cultural support for sustainability.	3.36	0.84	Accepted

Findings from Research Question 4 show that, although federal university libraries in South-East Nigeria are ready to adopt eco-friendly strategies, there are significant obstacles they cannot overlook. All means are above 3.2 and a grand mean above 3.30, showing that library staff consider the challenges such as the lack of funds (Mean = 3.35) and the lack of expertise (Mean = 3.43) to be significant. In addition, the following are also challenges in retrofitting: high cost of retrofitting older buildings (Mean = 3.28), limited availability of sustainable materials (Mean = 3.37), and weak institutional policies (Mean = 3.35) reflective of what Ifijeh and Yusuf (2020) noted about the absence of policy frameworks and weak institutional commitment. Also, the low awareness and poor resistance to change among staff and users (mean = 3.40 and 3.36) show the cultural and educational gaps that make it even harder to adopt sustainability. In short, while the intention to go green is there, these libraries – like others studied before – require targeted investments, staff training, stronger policies, and broader awareness campaigns to make that wish a reality.

In comparison to developed nations, where government incentives, clear green building codes, and an ingrained culture of sustainability facilitate the adop-

tion of eco-friendly infrastructure, Nigerian libraries often operate within structurally unstable environments (Fedorowicz-Kruszewska, 2023; Singh & Mishra, 2019). For instance, academic libraries in countries like the United States and Germany benefit from consistent electricity supply, well-funded sustainability programs, and long-term environmental policies that significantly reduce the barriers to implementation (Fedorowicz-Kruszewska, 2020; Phuyal et al., 2023). Nigerian libraries, by contrast, are frequently hindered by irregular power supply, limited capital investment, and an absence of coordinated environmental legislation. Even among countries at a similar level of development such as Ghana, India, and Bangladesh some progress has been achieved through strategic public-private partnerships and the integration of sustainability into national education and infrastructure policies (Khalid et al., 2021). In Nigeria, however, the fragmentation of regulatory bodies and the minimal engagement of the private sector have limited the range of available support. While some of these barriers are not unique to Nigeria, the combination of persistent financial, technical, and policy-related constraints presents a uniquely challenging context for the widespread adoption of eco-friendly library models.

Conclusion

This study investigated the Awareness and Extent of Adoption of Eco-Friendly Library Designs: A Study of Five Federal University Libraries in South East Nigeria. Based on the analysis of data collected from 200 professional library staff members, it was concluded that the level of adoption of eco-friendly design features is moderate, with basic elements such as natural lighting, LED lighting, and improved ventilation more commonly implemented. However, more advanced technologies like solar panels and automated energy systems remain largely absent due to financial, technical, and institutional constraints. The study further established that eco-friendly library environments have a positive effect on staff productivity, morale, and collaboration, thereby enhancing overall library operations. Major barriers to full-scale adoption were identified, including limited funding, the lack of supportive institutional policies, insufficient technical expertise, and resistance to change among staff.

In comparison to developed countries where libraries benefit from consistent utility supply, green building incentives, and long-standing sustainability policies, Nigerian libraries operate within structurally disadvantaged systems. Even in countries with similar levels of development, such as Ghana, India, or Bangladesh, eco-friendly adoption has advanced further due to stronger national policies and public-private collaborations. In Nigeria, the absence of coherent regulatory frameworks and minimal private sector involvement further deepens implementation challenges. Thus, while similar barriers exist globally, their severity and persistence in the Nigerian context create uniquely difficult conditions for eco-friendly library transformation. Therefore, it can be concluded that while federal university libraries in South-East Nigeria have made initial strides toward sustainable

practices, achieving fully eco-friendly library environments will require deliberate, coordinated efforts involving investment, policy reforms, technical capacity development, and sustained advocacy.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Library management should prioritize the gradual implementation of advanced eco-friendly technologies such as solar panels and automated systems by integrating them into library development plans and seeking alternative funding sources, including partnerships with private sectors and non-governmental organizations.
2. University administrations should formulate and enforce institutional policies that support sustainable library practices, including the allocation of specific budget lines for environmental sustainability initiatives.
3. Professional associations, such as the Nigerian Library Association (NLA), should organize regular training and workshops to build the technical capacity of library staff in sustainable and green technologies.
4. Individual librarians should take personal initiatives to advocate for and adopt eco-friendly practices within their professional spaces, fostering a culture of environmental responsibility.
5. Non-governmental organizations and private enterprises focusing on sustainability should be engaged as key stakeholders to provide financial, technical, and advisory support for the transformation of library spaces into eco-friendly environments.
6. Academic institutions offering Library and Information Science (LIS) programs should incorporate courses on sustainable library development and green technologies into their curriculum to prepare future librarians for eco-friendly practices.
7. Library users should also be sensitized through awareness campaigns to embrace and support eco-friendly initiatives within libraries, thereby creating a broader culture of sustainability within the academic community.

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Świadomość i zakres wprowadzenia ekologicznych projektów bibliotecznych: badanie przeprowadzone w pięciu federalnych bibliotekach uniwersyteckich w południowo-wschodniej Nigerii

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Loveth Nnenne Ugwuanyi jest badaczką i bibliotekarką cyfrową na Uniwersytecie Stanowym Nauki i Technologii Enugu (ESUT) w Agbani w stanie Enugu w Nigerii. Obecnie kontynuuje studia magisterskie na Wydziale Bibliotekoznawstwa i Informacji Naukowej na Uniwersytecie Stanowym Nauki i Technologii Enugu (ESUT) w Agbani. Jej obszar zainteresowań badawczych obejmuje zrównoważone projektowanie bibliotek, architekturę biblioteczną, cyfrowe systemy informacyjne, sieci biblioteczne, zachowania użytkowników bibliotek akademickich, zrównoważone praktyki biblioteczne, sztuczną inteligencję i uczenie maszynowe. Z wielkim entuzjazmem zachęca do stosowania przyjaznych dla środowiska praktyk i innowacji cyfrowych w bibliotekach akademickich.

Dorcas Nnedinso Ugwu jest bibliotekarką cyfrową na Uniwersytecie Stanowym Nauki i Technologii Enugu (ESUT) w Agbani w stanie Enugu w Nigerii. Jest autorką kilku publikacji z zakresu innowacji bibliotecznych, zarządzania zasobami cyfrowymi i usług informacyjnych zorientowanych na użytkownika. Jej zainteresowania badawcze obejmują bibliotekarstwo cyfrowe, zrównoważone praktyki biblioteczne, umiejętność korzystania z informacji oraz rozwój bibliotek akademickich. Angażuje się w rozwój wiedzy poprzez badania naukowe oraz promocję nowoczesnych technologii w bibliotekach akademickich.

Słowa kluczowe: ekologiczne projekty bibliotek; praktyki biblioteczne; Ffderalne biblioteki uniwersyteckie; południowo-wschodnia Nigeria; zrównoważona architektura

Abstrakt: Badania miały na celu ustalenie wpływu projektów ekologicznych na działalność federalnych bibliotek uniwersyteckich w południowo-wschodniej strefie Nigerii. Głównym celem badania było określenie zakresu wdrożenia tych projektów w wybranych bibliotekach, ich skutków operacyjnych, uzyskanych korzyści i doświadczanych niepowodzeń. Badanie miało również na celu poszerzenie wiedzy na temat zrównoważonych praktyk w bibliotekach akademickich. W badaniu przyjęto projekt opisowy badania ankietowego, który obejmował jedynie gromadzenie informacji jako sposób odpowiedzi na pytania badawcze. Skierowano go do wszystkich profesjonalnych pracowników bibliotek uniwersyteckich wybranych do badania. Badania przeprowadzono w pięciu bibliotekach na pięciu wybranych uniwersytetach federalnych w Nigerii. Dane zostały zebrane za pomocą ustrukturyzowanego kwestionariusza, który został zaprojektowany tak, aby pomóc personelowi w dostarczeniu niezbędnych informacji w celu uzyskania pożądanych wyników. Kwestionariusz został skonstruowany w oparciu o zmienne obejmujące cele badań. Uzyskane dane przeanalizowano pod kątem statystyk opisowych, które obejmowały procenty, średnie wyniki i odchylenia standardowe. Główne wyniki tego badania obejmowały 99% wskaźnik zwrotu na poziomie 200 z 202 wysłanych kwestionariuszy. Badanie wykazało, że wdrażanie ekologicznych środowisk przebiegało w umiarkowanym tempie, przy czym średnie wyniki w zakresie atrybutów środowiska sytuowały się w przedziale od 2,65 do 3,12, a w zakresie zaawansowanych technologii poniżej 2,50 (w skali od 1 do 4). Badanie wykazało również, że projekty ekologicznego środowiska pozytywnie wpłynęły na personel biblioteki w odniesieniu do poprawy funkcjonowania i satysfakcjonującego środowiska pracy personelu. Zidentyfikowano jednak różne wyzwania, do których należały: niewystarczające finansowanie, luki w polityce, brak wiedzy technicznej i opór pracowników przed zmianami. Wyniki sugerują, że chociaż istnieją podstawy do zrównoważonej transformacji, realizacja w pełni przyjaznych dla środowiska bibliotek wymaga zwiększenia inwestycji, opracowania wspierających polityk instytucjonalnych, budowania potencjału technicznego i ciągłych inicjatyw uświadamiających. Opracowano zalecenia, które mają pomóc bibliotekom i decydentom w budowaniu zrównoważonych, przyszłościowych środowisk bibliotek akademickich.

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Bewusstsein und Umfang der Umsetzung ökologischer Bibliotheksprojekte: Eine Untersuchung von fünf föderalen Universitätsbibliotheken im Südosten Nigerias

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Schlüsselwörter: ökologische Bibliotheksprojekte; Bibliothekspraxis; staatliche Universitätsbibliotheken; Südostnigeria; nachhaltige Architektur

Zusammenfassung: Das Ziel der Untersuchung war es, den Einfluss ökologischer Projekte auf das Funktionieren von Universitätsbibliotheken in Südostnigeria zu bestimmen. Die Hauptaufgabe der Studie bestand darin, den Grad der Umsetzung dieser Projekte in ausgewählten Bibliotheken, die Auswirkungen auf ihr Funktionieren, die erzielten Vorteile sowie die aufgetretenen Schwierigkeiten zu untersuchen. Darüber hinaus sollte die Studie das Wissen über nachhaltige Praktiken in wissenschaftlichen Bibliotheken erweitern. Die Untersuchung basierte auf einem deskriptiven Umfrageentwurf, der ausschließlich die Informationssammlung als Methode zur Beantwortung der Forschungsfragen umfasste. Die Studie bezog sich auf alle Mitarbeiterinnen und Mitarbeiter der für die Untersuchung ausgewählten Universitätsbibliotheken. Die Analyse wurde in fünf Bibliotheken von fünf ausgewählten staatlichen Universitäten Nigerias durchgeführt. Die Daten wurden mithilfe eines strukturierten Fragebogens erhoben, der den Mitarbeitenden helfen sollte, die notwendigen Informationen für die gewünschten Ergebnisse bereitzustellen. Der Fragebogen wurde anhand von Variablen konstruiert, die die Forschungsziele abbildeten. Die gewonnenen Daten analysierte man mittels beschreibender Statistik, die prozentuale Werte, Mittelwerte und Standardabweichungen umfasste. Die wichtigsten Ergebnisse dieser Untersuchung umfassten eine Rücklaufquote von 99 % (200 von 202 verteilten Fragebögen). Die Studie zeigte, dass die Umsetzung umweltfreundlicher Maßnahmen in moderatem Tempo voranschritt, wobei die durchschnittlichen Werte für Umweltattribute im Bereich von 2,65 bis 3,12 lagen und die für fortschrittliche Technologien unter 2,50 (auf einer Skala von 1 bis 4). Die Untersuchung ergab ferner, dass umweltfreundliche Projekte positive Auswirkungen auf das Bibliothekspersonal hatten, insbesondere in Bezug auf die Verbesserung der Arbeitsabläufe und die Zufriedenheit der Mitarbeitenden im Arbeitsumfeld. Es wurden jedoch verschiedene Herausforderungen identifiziert, darunter unzureichende Finanzierung, politische Lücken, fehlendes technisches Wissen und Widerstand des Personals gegen Veränderungen. Die Ergebnisse legen nahe, dass zwar Grundlagen für eine nachhaltige Transformation bestehen, die vollständige Umsetzung umweltfreundlicher Bibliotheken jedoch eine verstärkte Investition, die Entwicklung unterstützender institutioneller Politiken, den Aufbau technischer Kapazitäten und kontinuierliche Sensibilisierungsinitiativen erfordert. Es wurden Empfehlungen ausgesprochen, um Bibliotheken und Entscheidungsträger bei der Schaffung nachhaltiger, zukunftsfähiger Umgebungen in wissenschaftlichen Bibliotheken zu unterstützen.