

Climate Change Knowledge and the Adoption of Green Practices for Sustainability Among Academic Libraries in the Federal Capital Territory, Nigeria

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Abstract

The study examined climate change knowledge and the adoption of green practices for sustainability among academic libraries in the Federal Capital Territory, Nigeria. Adopting a descriptive survey design of a correlational type, the study employed total enumeration sampling, yielding 165 valid responses from librarians across universities, polytechnics, and colleges of education in the FCT. Data were collected through a structured questionnaire administered both online (via Google Forms) and in person. Findings revealed that while e-resource adoption (86.1%), natural ventilation (81.8%), and energy-efficient lighting (71.5%) were widely implemented, capital-intensive measures such as rainwater harvesting (29.7%) and solar-powered devices (35.2%) remained largely unadopted. Library personnel demonstrated a high level of climate change knowledge (aggregate mean = 3.23 on a four-point scale), with the strongest scores in energy conservation ($M = 3.44$) and greenhouse gas awareness ($M = 3.41$), and comparatively lower scores in knowledge of environmental policies ($M = 2.98$). The primary barriers to green practice adoption were inadequate funding ($M = 3.44$), unstable power supply ($M = 3.41$), and insufficient technology availability ($M = 3.29$). Pearson correlation analysis confirmed a statistically significant moderate positive relationship between climate change knowledge and green practice adoption ($r = .360$, $p = .002$, $r^2 = .130$), indicating that knowledge accounts for approximately 13% of the variance in green practice adoption. The null hypothesis was rejected. These findings indicate the need for targeted climate literacy programmes, formal sustainability policies, and institutional resource allocation to bridge the gap between knowledge and practice in Nigerian academic libraries.

Keywords: Climate Change Knowledge; Green Library Practices; Academic Libraries; Nigeria.

Introduction

Academic libraries play a vital role in higher education institutions by serving as central hubs for the acquisition, organisation, preservation, and dissemination of scholarly information. They support teaching, learning, and research while contributing to the intellectual development of their academic communities. Through these roles, libraries foster knowledge creation, promote

human capital development, and ensure the sustainable use of information resources for present and future generations. In recent years, the functions of academic libraries have expanded beyond traditional services to include digital resource management, information literacy training, and the development of inclusive collections that reflect diverse perspectives. These changing responsibilities position libraries as important actors in advancing institutional values, including environmental responsibility and sustainable development within universities and their surrounding communities. The adoption of green practices has therefore become a natural extension of the modern academic library's commitment to sustainability.

Green practices are tools and innovations designed to reduce the amount of energy use and maintain a high standard of quality service or performance. The goal is to minimize energy waste, lower costs, and promote environmental sustainability in libraries, including initiatives such as reducing paper consumption through digital services, implementing energy-efficient technologies, promoting responsible waste management, and encouraging environmentally responsible procurement of resources (Kolawole & Oladokun, 2024). These practices align with the United Nations Sustainable Development Goals, particularly SDG 4 (Quality Education), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) (Gunawan et al., 2020). By incorporating environmentally friendly policies and practices into their daily operations, academic libraries can reduce their ecological footprint while also serving as models of sustainable behaviour within their institutions. In addition, libraries can promote environmental awareness among users through educational programmes, resource curation, and sustainability-focused outreach activities that support broader institutional and global sustainability goals.

Climate change knowledge refers to the level of awareness and understanding individuals possess regarding the causes, impacts, and possible solutions to climate-related challenges. This concept is grounded in the Theory of Planned Behaviour, which emphasises the role of knowledge and attitudes in shaping behavioural intentions and actions (Ajzen, 1991). Empirical studies have shown that individuals and institutions with higher levels of climate literacy are more likely to adopt environmentally responsible practices and sustainability initiatives (Pan et al., 2023; Olujobi et al., 2024; Osuji & Nwuke, 2024; Qamruzzaman, 2025). However, evidence suggests that climate change awareness remains relatively limited in many institutions in developing countries. For instance, Gazzaz and Aldeseet (2021) reported that only a small proportion of university staff demonstrate adequate understanding of key climate change concepts. When library personnel lack sufficient knowledge about climate change and environmental sustainability, they may be less likely to prioritise or advocate for green initiatives such as energy-efficient technologies, digital services, and sustainable resource management.

Consequently, knowledge gaps may hinder the adoption of environmentally responsible practices within academic libraries (Adigun et al., 2024). In developing countries such as Nigeria, efforts to address climate change are often complicated by competing economic and development priorities. Many institutions must balance the need for rapid economic growth with environmental protection and sustainability (Yusuf, 2023). Environmental challenges in Nigeria are intensified by factors such as dependence on fossil fuels, deforestation linked to urban

expansion, and inefficient waste management systems (Olujobi et al., 2024). Although national frameworks such as the National Climate Change Policy and Response Strategy exist, their implementation is often limited by inadequate funding, weak institutional capacity, and low public awareness (Hasan & Panda, 2023; Gazzaz & Aldeseet, 2021). Within the Federal Capital Territory (FCT), academic institutions and their libraries have significant potential to promote sustainability and bridge the gap between environmental policy and practical action.

Globally, libraries are increasingly recognised as key contributors to sustainability initiatives and environmental education (Adigun et al., 2024). For example, libraries at the University of California have implemented renewable energy and water conservation systems, while libraries in Scandinavian countries have adopted sustainable architectural designs and zero-waste policies (Athulya, 2023; Amirulkamar et al., 2025). Despite existing challenges such as unstable electricity supply, limited funding, and inadequate technical expertise in Nigeria (Ajani et al., 2025), academic libraries can still serve as platforms for promoting environmental awareness through workshops, partnerships with environmental organisations, and the development of climate-related information resources (Khalid & Batool, 2020; Kalinin et al., 2024). Understanding the role of climate change knowledge in shaping green practices is, therefore, essential for strengthening the sustainability contributions of academic libraries in the FCT.

Theoretical Framework This study is anchored in the Theory of Planned Behaviour (TPB), originally proposed by Ajzen (1991), which extends Fishbein and Ajzen's earlier Theory of Reasoned Action by incorporating perceived behavioural control as a determinant of intention and behaviour. The TPB posits that an individual's behaviour is primarily determined by their behavioural intention, which in turn is influenced by three antecedents: attitude towards the behaviour, subjective norms, and perceived behavioural control. In the context of this study, climate change knowledge functions as a foundational attitudinal antecedent; librarians who possess greater awareness of climate change causes, impacts, and mitigation strategies are theoretically expected to develop more favourable attitudes towards green practices, stronger intentions to adopt them, and ultimately higher rates of actual adoption. The application of TPB to environmental behaviour has been extensively validated in the literature.

Pan et al. (2023) demonstrated that climate literacy significantly strengthened pro-environmental behavioural intentions among Chinese citizens, while Osuji and Nwuke (2024) confirmed similar pathways in Nigerian educational settings. In the library context, Kolawole and Oladokun (2024) applied attitudinal frameworks to explain variation in green practice adoption among Nigerian librarians, finding that knowledge-based attitudes predicted adoption decisions more strongly than structural factors alone. The TPB therefore provides a theoretically coherent lens for explaining why higher levels of climate change knowledge among academic library personnel should be associated with greater adoption of sustainability initiatives, while also acknowledging that structural and institutional factors captured in the TPB's perceived behavioural control component mediate and moderate this relationship. This dual explanatory capacity makes the TPB particularly appropriate for a study conducted in a resource-constrained developing country context where institutional barriers are prominent.

Statement of the Problem

The increasing global urgency of climate change has heightened demands for sustainability across all sectors, including academic libraries, particularly with respect to their resource management and operational practices. Academic libraries, as vital components of higher education institutions, are expected to align with global sustainability goals, including the United Nations Sustainable Development Goal 13 (Climate Action). While libraries in developed countries have widely adopted and implemented environmental sustainability practices, the level of adoption in Nigerian academic libraries remains limited. This situation raises concerns that librarians in these institutions may possess insufficient awareness, understanding, or institutional support to pursue green initiatives effectively. The awareness of climate change and the willingness of librarians to engage in environmentally sustainable practices are key factors that influence the successful implementation of green library initiatives.

Despite the growing global attention to sustainability, there is still a limited understanding of green library concepts among librarians in Nigerian academic libraries, and existing studies have not adequately explored their level of climate change awareness or the practical efforts they make towards sustainability. Furthermore, the majority of prior studies on green library practices in Nigeria were conducted outside the Federal Capital Territory (FCT), leaving a geographical and contextual gap in the evidence base. The FCT, as the seat of Nigeria's federal government, occupies a uniquely influential position for catalysing sustainability norms across the country's public institutions. Understanding how climate change knowledge influences the adoption of green practices among academic libraries in this specific context is, therefore, both empirically necessary and policy relevant. This study was therefore designed to investigate the relationship between climate change knowledge and the adoption of green practices for sustainability among academic libraries in FCT, Nigeria.

Objectives of the Study

The general objective of this study was to examine the relationship between climate change knowledge and the adoption of green practices for sustainability among academic libraries in the FCT, Nigeria. The specific objectives were to:

- i. identify the types of green practices adopted by academic libraries for sustainability in FCT, Nigeria;
- ii. assess the level of adoption of green practices for sustainability among academic libraries in FCT, Nigeria;
- iii. examine the level of climate change knowledge among staff of academic libraries in FCT, Nigeria;
- iv. identify the challenges faced in the adoption of green practices for sustainability in academic libraries in FCT, Nigeria; and
- v. determine the relationship between climate change knowledge and the adoption of green practices for sustainability among academic libraries in FCT, Nigeria.

Research Hypothesis

The following null hypothesis was tested at the 0.05 level of significance:

H01: There is no significant relationship between climate change knowledge and the adoption of green practices for sustainability among academic libraries in FCT, Nigeria.

Literature Review

Types and Level of Adoption of Green Practices in Academic Libraries

Green practices have become an important area of focus in academic libraries as institutions seek to reduce their environmental impact and promote sustainability. Studies have identified several practices that libraries can adopt, including energy conservation, waste reduction, recycling initiatives, and the use of digital resources to minimise paper consumption. Kolawole and Oladokun (2024) reported that academic libraries can support sustainability through the adoption of energy-efficient lighting, water conservation measures, and recycling programmes. Similarly, Emmanuel and Okojie (2022) noted that the expansion of digital library services reduces dependence on paper-based resources and contributes to environmentally responsible information management. Singh and Mishra (2023) examined the environmental impact of library technologies in selected universities in India using a descriptive survey design with 180 respondents, and found that devices such as printers and photocopiers significantly contribute to carbon emissions in libraries, recommending the adoption of green printing policies, digital services, and energy-efficient equipment.

The level of adoption of green practices in academic libraries has also received attention in the literature. Several studies have reported that while awareness of sustainability is increasing, the implementation of green practices remains uneven across institutions. Eze and Okafor (2023) investigated sustainability engagement among library professionals in South-East Nigeria using a survey design involving 180 librarians, finding that many librarians support practices such as the use of electronic resources, energy conservation, and environmental awareness programmes, although the extent of implementation varies among institutions. Adeyemi et al. (2024) similarly found that while green library practices were recognised in selected libraries in Kwara State, their adoption was constrained by financial limitations and the absence of institutional sustainability frameworks. These studies provide useful insights into sustainability practices in libraries; however, they focus on regions outside the FCT and do not provide empirical evidence on the level of adoption of green practices among academic libraries in the FCT.

Climate Change Knowledge Among Library Personnel

Climate change knowledge among library professionals has been identified as an important factor influencing environmental practices in libraries. Igbo et al. (2022) examined the role of environmental knowledge in the adoption of green practices among librarians in five Nigerian universities and found that librarians with higher levels of environmental knowledge were more likely to promote digital resources, reduce paper use, and support energy-efficient technologies. Similarly, Orewa (2024) investigated the understanding of climate change, mitigation, and adaptation among academic libraries in Nigeria, observing that while librarians generally valued climate-related information, many lacked adequate environmental literacy training necessary to actively promote sustainability initiatives. Amirulkamar et al. (2025) examined the relationship between climate change knowledge and sustainability practices among academic staff, finding

that climate knowledge significantly influenced the adoption of energy conservation practices, paperless communication, and support for institutional sustainability policies. These studies confirm the importance of knowledge in supporting sustainable behaviour; however, they provide limited evidence regarding the specific level of climate change knowledge among academic library staff in the FCT.

Challenges to Green Practice Adoption in Academic Libraries

Despite the growing interest in green library practices, several challenges continue to hinder their adoption in many academic institutions. Adeyemi et al. (2024) reported that many universities in Nigeria lack adequate funding to invest in renewable energy systems, energy-efficient equipment, or environmentally friendly building materials. Emmanuel and Okojie (2022) observed that limited environmental literacy among library staff can reduce their capacity to implement sustainable initiatives, while Adekoya et al. (2024) noted that many Nigerian universities operate without clearly defined sustainability frameworks, making it difficult for libraries to implement and monitor green practices effectively. Ivwighrehweta and Adjogri (2025) found that librarians working in institutions with clear policies, training programmes, and administrative support were significantly more likely to adopt environmentally friendly computing practices, underscoring the centrality of institutional readiness. Salau et al. (2024) further observed that many academic buildings in Nigeria were not originally designed with sustainability considerations, making retrofitting expensive and logistically challenging. These infrastructural limitations, combined with irregular power supply and limited access to environmentally friendly materials, are consistently identified as major barriers to sustainability adoption in Nigerian academic libraries.

Literature Gap

The foregoing review demonstrates that while the literature on green library practices and climate change knowledge is growing, significant gaps remain. First, the majority of relevant Nigerian studies were conducted in the South-East, South-West, or Kwara State contexts, leaving the FCT empirically unexamined. Second, prior studies have examined green practices and climate knowledge largely in isolation, without testing the statistical relationship between these two variables within a library-specific population. Third, the application of the Theory of Planned Behaviour to the specific domain of library personnel's green practice behaviour in a Nigerian context has not been empirically validated. This study addresses all three of these gaps simultaneously, providing the first correlational evidence on the relationship between climate change knowledge and green practice adoption among academic library personnel in the FCT.

Methodology

This study adopted a descriptive survey research design of a correlational type to assess climate change knowledge as a predictor of green practice adoption for sustainability among academic libraries in the FCT. A correlational design was appropriate because the study sought to determine the nature and strength of the relationship between two measured variables, which are climate change knowledge and green practice adoption, without manipulating either variable (Siedlecki, 2020). The target population comprised all professional librarians employed in

academic libraries within the FCT, including those in federal and state universities, polytechnics, and colleges of education. Given the manageable and geographically defined nature of the population, a total enumeration sampling approach was adopted, meaning that all 165 accessible academic librarians within the FCT institutions constituted the study sample. This approach eliminated sampling error and ensured maximum representativeness within the study context.

Data were collected through a structured questionnaire administered both online and in person. The online version was created using Google Forms and distributed via the Nigerian Library Association (NLA) FCT chapter WhatsApp group and selected institutional library platforms. Printed copies were also administered face-to-face to respondents who could not be reached digitally. Participants were given one month to complete the questionnaire, and 165 valid responses were obtained, representing a 100% usable return rate from those who participated. The questionnaire comprised four sections: demographic information; types and level of green practice adoption (nominal/binary scale); climate change knowledge (four-point Likert scale); and challenges to green practice adoption (four-point Likert scale). The four-point scale (4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly Disagree) was employed to compel directional responses and avoid the central tendency bias associated with five-point scales (Garland, 1991).

To ensure content validity, the questionnaire was reviewed by three experts in library and information science and one specialist in measurement and evaluation, who assessed each item for clarity, relevance, and alignment with the study objectives. Following expert review, a pilot test was administered to 25 librarians from academic institutions outside the FCT to assess reliability. Cronbach's alpha coefficients for the knowledge scale ($\alpha = .82$) and the challenges scale ($\alpha = .79$) both exceeded the acceptable threshold of .70 (Nunnally & Bernstein, 1994), confirming adequate internal consistency. Responses were analysed using IBM SPSS Statistics Version 29. Descriptive statistics, including frequency counts, percentages, means, and standard deviations, were used to address Objectives 1 through 4. For interpreting Likert-scale means, a decision rule was applied: mean scores of 1.00–1.49 = Low; 1.50–2.49 = Moderate; 2.50 and above = High. Pearson Product-Moment Correlation (PPMC) was used to test the null hypothesis at the 0.05 significance level. Ethical protocols were strictly observed throughout the study. Informed consent was obtained from all participants before data collection. Participants were assured of the confidentiality and anonymity of their responses, informed that participation was entirely voluntary, and advised of their right to withdraw at any stage without consequence. No personally identifiable information was collected. All data were stored securely and used exclusively for academic purposes. As the study involved adult professionals in a non-clinical survey context, formal institutional ethics committee clearance was not required; however, institutional access permissions were obtained from all participating library heads.

Analysis and Presentation of Results

Types of Green Practices Adopted by Academic Libraries for Sustainability in FCT

Objective 1 sought to identify the types of green practices adopted by academic libraries for sustainability in the FCT. Respondents indicated whether each practice was adopted or not adopted in their library. The results are presented in Table 1.

Table 1: Types of Green Practices Adopted by Academic Libraries in FCT, Abuja, Nigeria (N = 165)

S/N	Green Practice	Adopted	Not Adopted
1	Use of energy-efficient bulbs and lighting systems	118 (71.5%)	47 (28.5%)
2	Paper recycling initiatives	92 (55.8%)	73 (44.2%)
3	Waste sorting and segregation inside the library	80 (48.5%)	85 (51.5%)
4	Use of natural ventilation to reduce energy consumption	135 (81.8%)	30 (18.2%)
5	Adoption of e-resources and digital services to reduce print dependence	142 (86.1%)	23 (13.9%)
6	Use of solar-powered devices and renewable energy systems	58 (35.2%)	107 (64.8%)
7	Rainwater harvesting and water conservation systems	49 (29.7%)	116 (70.3%)
8	Display of environmental awareness posters and information campaigns	110 (66.7%)	55 (33.3%)
9	Tree planting and landscaping initiatives on library premises	88 (53.3%)	77 (46.7%)
10	Implementation of energy-saving operational policies	102 (61.8%)	63 (38.2%)

The results in Table 1 reveal a diverse range of green practices across academic libraries in the FCT. The most widely adopted practices were the use of e-resources and digital services to reduce print dependence (86.1%), the use of natural ventilation (81.8%), and the adoption of energy-efficient lighting (71.5%). Environmental awareness displays (66.7%), energy-saving policies (61.8%), and paper recycling initiatives (55.8%) were also moderately to widely adopted. Tree planting was reported by approximately half (53.3%) of respondents. However, capital-intensive infrastructure-based practices showed markedly lower adoption: solar-powered devices (35.2%) and rainwater harvesting (29.7%) were adopted by fewer than four in ten libraries. Waste sorting was not yet adopted in the majority of libraries (51.5%). These findings indicate that academic libraries in the FCT predominantly engage in low-cost, operationally accessible green practices, while infrastructural sustainability investments remain limited.

Level of Adoption of Green Practices for Sustainability Among Academic Libraries in FCT

Objective 2 sought to assess the level of adoption of green practices for sustainability among academic libraries in the FCT. Respondents rated the extent to which each green practice was integrated into their library's operations on a four-point Likert scale (4 = Strongly Agree/Very High; 1 = Strongly Disagree/Very Low). The results are presented in Table 2.

Table 2: Level of Adoption of Green Practices Among Academic Libraries in FCT, Nigeria (N = 165)

S/N	Green Practice / Item	SA (f/%)	A (f/%)	D (f/%)	SD (f/%)	Mean	SD	Remark
1	E-resources and digital services are actively integrated into library operations	89 (53.9)	72 (43.6)	3 (1.8)	1 (0.6)	3.51	0.57	High
2	Energy-efficient lighting systems in regular use	79 (47.9)	74 (44.8)	9 (5.5)	3 (1.8)	3.39	0.67	High
3	Natural ventilation is practised as a deliberate energy-saving measure	82 (49.7)	71 (43.0)	10 (6.1)	2 (1.2)	3.41	0.65	High
4	Energy-saving policies documented and implemented	68 (41.2)	73 (44.2)	19 (11.5)	5 (3.0)	3.24	0.74	High
5	Environmental awareness campaigns integrated into library services	62 (37.6)	71 (43.0)	26 (15.8)	6 (3.6)	3.15	0.79	High
6	Paper recycling initiatives are actively practised	55 (33.3)	63 (38.2)	35 (21.2)	12 (7.3)	2.97	0.87	High
7	Tree planting and landscaping are supported by the library management	48 (29.1)	57 (34.5)	41 (24.8)	19 (11.5)	2.81	0.94	High
8	Waste sorting and segregation are practised within the library	39 (23.6)	49 (29.7)	50 (30.3)	27 (16.4)	2.61	0.98	High
9	Solar-powered devices in active use	21 (12.7)	39 (23.6)	55 (33.3)	50 (30.3)	2.19	0.96	Moderate
10	Rainwater harvesting systems are operational	16 (9.7)	33 (20.0)	58 (35.2)	58 (35.2)	2.04	0.92	Moderate

Table 2 shows that the majority of green practices were rated at a high level of adoption by library personnel in the FCT. Digital services integration recorded the highest mean ($M = 3.51$, $SD = 0.57$), followed by the use of natural ventilation ($M = 3.41$, $SD = 0.65$) and energy-efficient lighting ($M = 3.39$, $SD = 0.67$). Energy-saving policies ($M = 3.24$) and environmental awareness campaigns ($M = 3.15$) also returned high ratings. Paper recycling ($M = 2.97$), tree planting ($M = 2.81$), and waste sorting ($M = 2.61$) were equally rated as high, though with wider standard deviations suggesting greater variability among institutions. Only solar-powered devices ($M = 2.19$) and rainwater harvesting ($M = 2.04$) fell below the 2.50 threshold, indicating moderate adoption levels. These results indicate that while most operational green practices are actively pursued, capital-intensive infrastructure-based initiatives continue to lag.

Level of Climate Change Knowledge Among Staff of Academic Libraries in FCT

Objective 3 examined the level of climate change knowledge among library staff in the FCT. Respondents rated ten knowledge items on a four-point Likert scale. Higher mean values indicate greater knowledge. The results are presented in Table 3.

Table 3: Respondents' Climate Change Knowledge Level (N = 165)

S/N	Knowledge Item	SA (f/%)	A (f/%)	D (f/%)	SD (f/%)	Mean	SD	Remark
1	General understanding of climate change causes and effects	98 (59.4)	75 (45.5)	0 (0)	2 (1.2)	3.32	0.64	High
2	Awareness of greenhouse gas emissions and their environmental effects	108 (65.5)	68 (41.2)	0 (0)	2 (1.2)	3.41	0.59	High
3	Knowledge of library-related environmental risks and impacts	87 (52.7)	65 (39.4)	8 (4.8)	5 (3.0)	3.18	0.71	High
4	Understanding of waste management principles in library operations	96 (58.2)	73 (44.2)	5 (3.0)	1 (0.6)	3.27	0.66	High
5	Knowledge of energy conservation strategies in library settings	112 (67.9)	74 (44.8)	0 (0)	0 (0)	3.44	0.58	High
6	Understanding of green library concepts and sustainable operations	78 (47.3)	68 (41.2)	14 (8.5)	5 (3.0)	3.06	0.74	High
7	Awareness of climate change mitigation strategies	95 (57.6)	71 (43.0)	7 (4.2)	2 (1.2)	3.29	0.64	High
8	Awareness of climate change adaptation strategies	88 (53.3)	67 (40.6)	9 (5.5)	1 (0.6)	3.21	0.69	High
9	Knowledge of the SDGs related to climate action (SDG 13)	82 (49.7)	66 (40.0)	13 (7.9)	4 (2.4)	3.11	0.72	High
10	Knowledge of national and institutional environmental policies	74 (44.8)	63 (38.2)	21 (12.7)	7 (4.2)	2.98	0.76	High

The findings in Table 3 indicate that library personnel in the FCT demonstrated a high level of climate change knowledge across all ten items, with all means exceeding 2.50 (the threshold for “High” on the four-point scale employed). The aggregate mean was 3.23 (SD = 0.67), confirming a collectively high knowledge level. Respondents were most knowledgeable about energy conservation strategies (M = 3.44, SD = 0.58) and greenhouse gas emissions (M = 3.41, SD = 0.59), reflecting strong awareness of core climate science concepts. Moderately high ratings were recorded for climate mitigation strategies (M = 3.29), waste management principles (M = 3.27), and general climate understanding (M = 3.32). Comparatively lower, though still high, scores were obtained for knowledge of national environmental policies (M = 2.98) and understanding of green library concepts (M = 3.06), suggesting that while librarians possess solid general environmental knowledge, familiarity with specific policy frameworks and professionally applied sustainability concepts requires further development. These findings are consistent with the pattern reported by Orewa (2024) and Igbo et al. (2022), who observed that Nigerian librarians demonstrate strong conceptual climate awareness but weaker technical and policy-specific knowledge.

Challenges Faced in the Adoption of Green Practices for Sustainability in FCT

Objective 4 identified the challenges faced by academic libraries in the FCT in adopting green practices for sustainability. Respondents rated ten challenge items on a four-point Likert scale. Higher mean values indicate more severe challenges. Results are presented in Table 4.

Table 4: Challenges Affecting Green Practice Adoption in Academic Libraries in FCT, Nigeria (N = 165)

S/N	Challenge Item	SA (f/%)	A (f/%)	D (f/%)	SD (f/%)	Mean	SD	Remark
1	Inadequate funding for sustainability initiatives and infrastructure	112 (67.9)	71 (43.0)	2 (1.2)	0 (0)	3.44	0.58	High
2	Unstable power supply is disrupting the use of energy-efficient technologies	108 (65.5)	70 (42.4)	6 (3.6)	1 (0.6)	3.41	0.59	High
3	Insufficient technology availability and outdated equipment	96 (58.2)	74 (44.8)	4 (2.4)	1 (0.6)	3.29	0.62	High
4	Lack of infrastructural support for green operations	97 (58.8)	73 (44.2)	5 (3.0)	0 (0)	3.38	0.61	High
5	Lack of clear institutional management policies on sustainability	85 (51.5)	72 (43.6)	7 (4.2)	1 (0.6)	3.16	0.69	High
6	Poor staff training opportunities in sustainability and green practices	80 (48.5)	75 (45.5)	9 (5.5)	1 (0.6)	3.21	0.67	High
7	Poor collaboration with environmental agencies and sustainability bodies	72 (43.6)	68 (41.2)	20 (12.1)	5 (3.0)	3.07	0.70	High
8	Lack of professional guidelines on green library operations	68 (41.2)	66 (40.0)	26 (15.8)	5 (3.0)	2.97	0.74	High
9	Limited awareness of green practices among library staff	62 (37.6)	65 (39.4)	31 (18.8)	7 (4.2)	2.88	0.74	High
10	Resistance to change among library staff and management	57 (34.5)	61 (37.0)	36 (21.8)	11 (6.7)	2.74	0.84	High

The results in Table 4 indicate that all ten challenge items were rated as high barriers to green practice adoption, with all means exceeding the 2.50 threshold. The most severe challenges were inadequate funding ($M = 3.44$, $SD = 0.58$), unstable power supply ($M = 3.41$, $SD = 0.59$), lack of infrastructural support ($M = 3.38$, $SD = 0.61$), and insufficient technology availability ($M = 3.29$, $SD = 0.62$). These findings highlight structural and resource-based barriers as the primary constraints on sustainability adoption. Institutional challenges such as the lack of management policies ($M = 3.16$), poor staff training ($M = 3.21$), and weak collaboration with environmental agencies ($M = 3.07$) also rated highly, confirming that organisational readiness is a significant limiting factor. Behavioural challenges, including limited staff awareness ($M = 2.88$) and resistance to change ($M = 2.74$), were rated as high, though with greater standard deviations, indicating variability in their perceived severity across institutions. Collectively, the findings confirm that financial, infrastructural, institutional, and human capacity challenges constitute a complex, interconnected barrier system constraining green practice adoption in FCT academic libraries.

Test of Hypothesis

The null hypothesis was tested at the 0.05 level of significance using Pearson Product-Moment Correlation (PPMC). The hypothesis states: H_0 : There is no significant relationship between climate change knowledge and the adoption of green practices for sustainability among academic libraries in FCT, Nigeria. Results are presented in Table 5.

Table 5: Pearson Product-Moment Correlation between Climate Change Knowledge and Green Practice Adoption (N = 165)

1. Climate Change Knowledge	<i>Pearson r</i>	1.000		165	.002
	<i>Sig. (2-tailed)</i>			.002	165
	<i>r²</i>			.130	
2. Green Practice Adoption	<i>Pearson r</i>	.360**	1.000	165	.002
	<i>Sig. (2-tailed)</i>	.002		165	
	<i>r²</i>	.130			

Note: Correlation is significant at the 0.01 level (2-tailed). r^2 = coefficient of determination.

The results in Table 5 reveal a statistically significant moderate positive correlation between climate change knowledge and green practice adoption ($r = .360$, $p = .002$). Since the obtained p-value (.002) is less than the significance level of .05, the null hypothesis is rejected. The coefficient of determination ($r^2 = .130$) indicates that climate change knowledge accounts for approximately 13% of the variance in green practice adoption among academic libraries in the FCT. This finding confirms that higher levels of climate change knowledge among library personnel are significantly associated with greater adoption of green practices, while the remaining 87% of variance is attributable to other factors, most notably the structural, financial, and institutional barriers identified in Table 4.

Discussion of Findings

The findings of this study reveal that academic libraries in the FCT primarily adopt green practices that are low-cost and operationally accessible, such as digital service integration, natural ventilation, energy-efficient lighting, and environmental awareness campaigns. This pattern is consistent with Emmanuel and Okojie (2022), who noted that digital services and resource digitisation are the most accessible sustainability approaches in Nigerian academic libraries. The widespread adoption of e-resources aligns with the broader trend of digitalisation in Nigerian library services and reflects the comparatively low marginal cost of transitioning from print to electronic resources once the necessary digital infrastructure is in place. The use of natural ventilation and energy-efficient lighting also reflects rational, cost-effective responses to Nigeria's unreliable electricity supply and high energy costs. These findings support Igbo et al. (2022), who observed that naturally ventilated buildings reduce energy consumption in Nigerian institutions, and Kolawole and Oladokun (2024), who identified energy conservation as the most consistently adopted green practice among Nigerian librarians.

The comparatively low adoption of capital-intensive practices such as solar energy (35.2%) and rainwater harvesting (29.7%) is particularly noteworthy and reflects the investment barriers documented extensively in the literature. Adeyemi et al. (2024) confirmed that financial constraints and limited government support are primary inhibitors of infrastructure-based sustainability in Nigerian academic libraries. The data from Table 2 corroborate this interpretation: while the level of adoption for operational green practices was uniformly high (all means ≥ 2.61), solar and rainwater systems returned means below 2.50, the only items in the study to fall in the moderate range. This divergence between operational and infrastructural

adoption provides empirical precision to the general finding and suggests that sustainability programming in FCT libraries should prioritise funding mechanisms that specifically address capital expenditure gaps. With respect to climate change knowledge, the aggregate mean of 3.23 (out of 4.00) confirms that library personnel in the FCT possess a high level of climate change awareness.

This finding extends the work of Orewa (2024) and Igbo et al. (2022), both of which reported moderate-to-high knowledge levels among Nigerian librarians. The particularly strong scores for energy conservation knowledge ($M = 3.44$) and greenhouse gas awareness ($M = 3.41$) suggest that librarians have internalised foundational climate science concepts that directly relate to their operational responsibilities. The comparatively lower scores for knowledge of national environmental policies ($M = 2.98$) and green library concepts ($M = 3.06$), while still falling in the “high” range on the four-point scale, indicate that there is meaningful scope for targeted professional development that bridges the gap between general climate awareness and its specific application to library sustainability practice. Amirulkamar et al. (2025) made a similar observation in the Indian university context, noting that general climate literacy does not automatically translate into knowledge of institutionally applied sustainability strategies.

The challenge analysis confirms that the barriers to green practice adoption in FCT academic libraries are predominantly structural and financial rather than attitudinal. Inadequate funding ($M = 3.44$), unstable power supply ($M = 3.41$), lack of infrastructural support ($M = 3.38$), and insufficient technology availability ($M = 3.29$) emerged as the four highest-rated challenges. These findings are consistent with Adeyemi et al. (2024), Ivwighrehweta and Adjogri (2025), and Singh and Mishra (2023), all of whom identified financial constraints and infrastructural deficiencies as the foremost barriers to sustainability in African and Asian academic libraries. The high ratings assigned to institutional barriers, including weak management policies ($M = 3.16$) and poor staff training ($M = 3.21$), further suggest that even where financial resources exist, the absence of formal sustainability governance frameworks limits their effective deployment. These institutional barriers are particularly amenable to policy intervention and should form the focus of near-term institutional action. Although behavioural challenges such as resistance to change ($M = 2.74$) were rated as the least severe, they nonetheless remain high and should not be dismissed; institutional culture change is typically a precondition for the sustained implementation of any systemic initiative.

The central finding of this study, a statistically significant moderate positive correlation between climate change knowledge and green practice adoption ($r = .360$, $p = .002$, $r^2 = .130$), provides the first correlational evidence linking these two variables within the specific context of academic libraries in the FCT. This finding is theoretically congruent with the Theory of Planned Behaviour (Ajzen, 1991), which predicts that knowledge-based attitudes will influence behavioural intentions and eventual action. It is also empirically consistent with Pan et al. (2023), who demonstrated that climate literacy predicted pro-environmental behavioural intention among Chinese citizens, and with Amirulkamar et al. (2025), who found that climate knowledge significantly influenced sustainable practices among academic staff. Critically, however, the coefficient of determination ($r^2 = .130$) indicates that climate knowledge accounts

for only 13% of the variance in green practice adoption. This finding is theoretically important: it validates the role of knowledge as a significant predictor while simultaneously affirming that knowledge alone is insufficient. The remaining 87% of variance attributable to structural, institutional, and environmental factors captured in the challenges data reinforces the argument that the TPB's perceived behavioural control component is equally important in this context. Sustainability adoption requires not only knowledgeable individuals but also enabling institutional conditions.

Conclusion

This study examined climate change knowledge as a predictor of green practice adoption for sustainability among academic libraries in the FCT, Nigeria. The findings reveal that academic libraries in the FCT predominantly implement low-cost, operationally accessible green practices such as e-resource integration, natural ventilation, and energy-efficient lighting, while capital-intensive sustainability measures, including solar energy systems and rainwater harvesting, remain largely unadopted. Library personnel demonstrated a high level of climate change knowledge, with particular strength in energy conservation awareness and greenhouse gas knowledge, and comparatively lower scores in knowledge of environmental policies and green library concepts. The primary barriers to green practice adoption were identified as inadequate funding, unstable power supply, insufficient technology, and lack of institutional policy frameworks, all of which were rated as high challenges across the sample. Pearson correlation analysis confirmed a statistically significant, moderate positive relationship between climate change knowledge and green practice adoption, leading to the rejection of the null hypothesis. While climate change knowledge is a significant predictor of green practice adoption, it accounts for only 13% of the variance, underscoring the critical role of structural, financial, and institutional enablers. These findings carry clear implications for practice. For academic libraries in the FCT to move beyond low-cost operational sustainability measures towards comprehensive, institution-wide green transformation, strategic interventions are required at both individual and organisational levels. Targeted climate literacy programmes can strengthen the knowledge base of library personnel, while the development of formal sustainability policies, allocation of dedicated budgets, and engagement of institutional leadership can create the enabling conditions necessary for translating knowledge into sustained action. By addressing these interconnected dimensions simultaneously, academic libraries in the FCT can position themselves as genuine contributors to Nigeria's sustainability agenda and to the achievement of the United Nations Sustainable Development Goals.

Implications of the Study

This study has important implications for academic libraries, policymakers, and institutional leaders in the FCT. First, the finding that libraries primarily rely on low-cost green practices demonstrates a clear willingness to engage with sustainability when financial demands are manageable. However, bridging the gap between operational and infrastructural adoption requires dedicated funding mechanisms, including competitive grant programmes, public-private partnerships, and national sustainability funds specifically targeted at tertiary institution libraries. Second, the high levels of climate change knowledge among librarians, combined with

comparatively weaker knowledge of environmental policies and green library concepts, indicate that professional development programmes should be redesigned to move beyond general climate awareness towards practically applied sustainability competencies. Third, the dominance of structural barriers in the challenges data implies that knowledge-based interventions alone will have a limited impact unless accompanied by institutional reforms that address funding constraints, strengthen sustainability governance, and improve access to appropriate technologies. Finally, the moderate correlation ($r = .360$) between knowledge and adoption, while statistically significant, highlights the critical importance of the enabling environment. Policymakers should therefore invest simultaneously in both climate literacy programming and the institutional infrastructure that transforms individual knowledge into collective organisational action.

Limitations of the Study

This study has several limitations that should be acknowledged. First, the study was geographically bounded to academic libraries within the FCT, and the findings may not be fully generalisable to libraries in other Nigerian regions, where differences in funding structures, infrastructure, and institutional priorities may produce different patterns. Second, the cross-sectional design captures a snapshot of knowledge and practice at a single point in time. Given that sustainability adoption is dynamic and evolves with policy changes, funding availability, and technological development, a longitudinal design would provide richer insights into how green practices evolve. Third, the study relied on self-reported data, which may be subject to social desirability bias; respondents may overstate their green practice adoption or knowledge levels. Future studies should complement self-report data with direct observation or institutional record analysis. Fourth, while the study examines climate change knowledge and institutional challenges as predictors of green practice adoption, other potentially relevant variables, including organisational culture, leadership style, personal values, and peer influence, were not assessed. Incorporating these variables into future models would improve explanatory power beyond the 13% of variance accounted for in the present study.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Academic libraries should implement structured climate literacy training programmes and workshops designed to strengthen librarians' understanding of environmental policies, green library concepts, and practical sustainability strategies. The current knowledge gap in policy-related and professionally applied areas indicates that general environmental awareness must be supplemented with vocationally specific training.
2. Library management and university administrations should prioritise the development of formal institutional sustainability policies, allocate dedicated green operations budgets, and establish measurable performance indicators for sustainability outcomes. Organisational commitment and governance frameworks are essential for converting individual knowledge into sustained institutional practice.

3. Academic libraries should continue to expand accessible and cost-effective sustainability measures, including digital services, energy-efficient lighting, and waste reduction initiatives, as a foundation for building a culture of sustainability while simultaneously advocating for the infrastructural investments needed for capital-intensive green practices.
4. Academic libraries should pursue strategic partnerships with government agencies, non-governmental environmental organisations, and private sector sponsors to access funding, technical expertise, and equipment necessary for adopting solar energy systems, rainwater harvesting, and other infrastructure-based green initiatives.
5. National professional associations, particularly the Nigerian Library Association and the Nigerian Association of Library and Information Science Educators, should develop and disseminate formal guidelines and standards for green library operations, providing librarians with the professional framework needed to implement and assess sustainability practices systematically.

Suggestions for Further Studies

1. Future studies should replicate this research across other geopolitical zones in Nigeria and in other African countries to generate comparative evidence on how regional variations in infrastructure, funding, and institutional culture influence green practice adoption in academic libraries.
2. Longitudinal research designs should be employed to track changes in green practice adoption over time, allowing scholars to assess the long-term impact of training programmes, policy interventions, and funding investments on sustainability outcomes in academic libraries.
3. Future studies should employ multivariate analytical approaches, including multiple regression and structural equation modelling, to simultaneously assess the relative contributions of climate change knowledge, institutional policy, funding availability, and organisational culture to green practice adoption, providing a more comprehensive explanatory model.
4. Research should investigate the role of digital library automation and technology adoption in advancing sustainability goals, examining whether libraries that have invested more substantially in digital infrastructure achieve higher levels of green practice adoption.
5. Future studies should evaluate the outcomes of specifically designed climate literacy and green library training programmes, measuring how targeted professional development translates into measurable improvements in sustainable practice adoption among library personnel.

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