

Green ICT Practices for Environmental Sustainability among Library Staff in the Fifth Industrial Revolution: A Study of Selected Libraries in Kaduna State, Nigeria

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Abstract

This study examined Green ICT practices for environmental sustainability among library staff in selected libraries within Kaduna Metropolis, Nigeria, in the context of the Fifth Industrial Revolution (5IR). Four objectives guided the study: to examine the level of awareness, accessibility, utilization, and challenges associated with Green ICT practices among library staff. A descriptive survey research design was adopted. The population comprised 138 library staff members from the National Open University of Nigeria (NOUN) Kaduna Study Centre Library, the Kaduna State University (KASU) Library, the National Library of Nigeria, Kaduna Branch, and the Kaduna Polytechnic Library. A total enumeration technique was employed, and data were collected using a structured questionnaire. Of the 138 questionnaires distributed, 124 were duly completed and returned, representing an 89.9% response rate. Data were analyzed using frequencies, percentages, mean ($\bar{x}$), and standard deviation (SD). The findings revealed a high level of awareness of Green ICT practices among library staff ($\bar{x} = 3.53$, $SD = 1.34$). However, the accessibility ($\bar{x} = 2.85$, $SD = 1.39$) and utilization ($\bar{x} = 3.34$, $SD = 1.44$) of Green ICT tools and practices were only moderate. The study further revealed that lack of training, inadequate ICT infrastructure, insufficient funding, and limited institutional awareness and support were the major challenges affecting the implementation of Green ICT practices ($\bar{x} = 4.36$, $SD = 0.97$). The study concludes that although library staff demonstrate a high level of awareness of Green ICT practices, the accessibility and utilization of these practices remain moderate due to infrastructural, financial, and capacity-related constraints. The study recommends increased investment in Green ICT infrastructure, regular staff training, improved accessibility to Green ICT facilities, and stronger institutional support to enhance the adoption of Green ICT practices and promote environmental sustainability in libraries.

Keywords: Green ICT, Environmental Sustainability, Fifth Industrial Revolution, Library Staff, Kaduna Metropolis, Nigeria.

Introduction

The Fifth Industrial Revolution (5IR) foregrounds a human-centred integration of advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), robotics, and cloud computing with sustainability goals, creating new opportunities and responsibilities for information institutions. According to Adigun (2024), the 5IR era requires libraries not only to adopt smart technologies but also to implement them in ways that minimize environmental impacts and promote sustainable service delivery. Similarly, Oyedokun (2025) observed that Green ICT has gained global prominence as a strategic approach to reducing the environmental footprint of information and communication technologies while supporting the achievement of the Sustainable Development Goals (SDGs). Tariq (2025) described Green ICT in libraries as the adoption of energy-efficient hardware, virtualization and cloud computing, paperless workflows, digital resource sharing, and responsible management of electronic waste (e-waste). These practices contribute to reduced energy consumption, lower paper usage, and prolonged ICT equipment lifespan, thereby enhancing environmental sustainability.

Empirical evidence suggests that Green ICT adoption is gradually gaining attention across African libraries, although implementation remains uneven. Hossain and Rahman (2023) observed that libraries in several African countries are increasingly embracing environmentally sustainable ICT practices, but the extent of adoption differs considerably across institutions. Likewise, Mwanzu (2023) reported that libraries in Kenya and other East African countries have demonstrated strong interest in Green ICT initiatives; however, inadequate funding, weak policy frameworks, and limited technical expertise continue to hinder widespread implementation. In Nigeria, similar trends have been reported: Adeyemi et al. (2024) found that although some libraries have adopted Green ICT practices such as paper reduction, environmental hygiene, and selective ICT upgrades, institutional commitment to Green ICT implementation remains inconsistent. The study further revealed the absence of comprehensive policies to guide Green ICT implementation across many libraries. Furthermore, recent studies on Nigerian academic libraries have documented emerging Green ICT initiatives but reported considerable variations in implementation across institutions and states. For example, an exploratory study of academic libraries in Kwara State found that Green ICT practices were largely fragmented and frequently driven by individual librarians

rather than institutional policies or strategic planning. These findings underscore the need for context-specific empirical studies to identify the factors influencing Green ICT adoption and to provide evidence-based strategies for sustainable library transformation in Nigeria.

In the context of this study, awareness refers to the level of knowledge and understanding that library staff possesses regarding Green ICT concepts, practices, and their environmental benefits, while Accessibility denotes the extent to which Green ICT facilities, technologies, and supporting infrastructure are available for library staff to perform their routine professional responsibilities. Utilization applies to the actual application of Green ICT tools and environmentally sustainable ICT practices in library operations and service delivery; institutional challenges are the organizational, financial, technical, infrastructural, and policy-related constraints that hinder the effective adoption and implementation of Green ICT practices in libraries. Examining these dimensions provides a comprehensive understanding of the current state of Green ICT practices among library staff and offers evidence for developing strategies that promote environmentally sustainable library services.

Urban library environments such as Kaduna Metropolis provide an appropriate setting for investigating library staff's awareness, accessibility, utilization, and institutional challenges associated with Green ICT practices. Compared with many rural libraries, urban libraries generally possess better ICT infrastructure and greater exposure to emerging 5IR technologies, making them suitable environments for examining Green ICT implementation Banad, (2024). Evidence generated from such studies can provide practical insights for institutional policy formulation, staff capacity development, ICT investment, and environmentally sustainable library management. In addition, findings from Kaduna Metropolis may provide useful lessons for other urban libraries in Nigeria and similar developing-country contexts.

Despite the growing body of literature on Green ICT adoption, environmental sustainability, and the application of emerging technologies in libraries, important research gaps remain. Existing studies have largely focused on general environmental initiatives, ICT adoption, or isolated Green ICT practices without simultaneously examining the levels of awareness, accessibility, utilization, and institutional challenges among library staff. In addition, relatively few studies have situated Green ICT practices within the framework of the Fifth Industrial Revolution, which emphasizes the integration of technological innovation, environmental sustainability, and human-centred development. More importantly, empirical

evidence on Green ICT practices among library staff in Kaduna State remains limited despite the state's expanding ICT infrastructure and growing investment in higher education and library services.

This study addresses these gaps by investigating the awareness, accessibility, utilization, and challenges of Green ICT practices among library staff in selected libraries in Kaduna Metropolis, namely the National Open University of Nigeria (NOUN) Kaduna Study Centre Library, Kaduna State University (KASU) Library, National Library of Nigeria, Kaduna Branch, and Kaduna Polytechnic Library. The study is expected to provide empirical evidence that will inform institutional policies, strengthen staff capacity-building programmes, promote sustainable ICT procurement and management practices, and contribute to the advancement of environmentally sustainable library services within the context of the Fifth Industrial Revolution.

Statement of the Problem

The Fifth Industrial Revolution (5IR) emphasizes the integration of advanced technologies with human-centred values and environmental sustainability. Within this paradigm, Green ICT practices, including the use of energy-efficient technologies, paperless operations, cloud computing, virtualization, responsible electronic waste (e-waste) management, and sustainable ICT procurement, have become essential strategies for reducing the environmental impact of information and communication technologies. In libraries, these practices support environmental sustainability by minimizing energy consumption, reducing carbon emissions and paper waste, improving resource efficiency, and promoting responsible management of ICT resources while maintaining effective information service delivery.

Despite the growing recognition of Green ICT as a key component of sustainable library development, its implementation in many Nigerian libraries remains uncertain. Existing evidence suggests that although some libraries have introduced environmentally friendly ICT initiatives, their adoption is often inconsistent due to inadequate funding, insufficient staff training, weak institutional policies, and limited technological infrastructure. Consequently, many libraries continue to rely on energy-intensive technologies, excessive paper-based operations, and outdated ICT systems that are inconsistent with the sustainability objectives promoted by the Fifth Industrial Revolution.

In Kaduna Metropolis, academic, public, and special libraries possess relatively better ICT infrastructure than many libraries in other parts of the country. However, there is limited

empirical evidence regarding library staff's awareness, accessibility, utilization, and the institutional challenges associated with Green ICT practices for environmental sustainability. As a result, the extent to which these libraries are leveraging ICT to support environmentally sustainable library operations remains largely unknown. This lack of evidence limits informed policy formulation, strategic planning, investment in sustainable ICT infrastructure, and staff capacity development.

It is against this background that this study investigates Green ICT practices for environmental sustainability among library staff in the Fifth Industrial Revolution, with particular focus on selected libraries in Kaduna Metropolis, Nigeria. The study seeks to generate empirical evidence that will inform institutional policies, strengthen sustainable ICT implementation, and enhance environmentally responsible library service delivery.

Research Questions

The study was guided by the following research questions:

1. What is the level of awareness of Green ICT practices among library staff in selected libraries within Kaduna Metropolis?
2. To what extent are Green ICT tools and facilities accessible in libraries within Kaduna Metropolis?
3. To what extent do library staff utilize Green ICT tools and applications to promote environmental sustainability?
4. What challenges hinder the effective adoption and implementation of Green ICT practices in libraries within Kaduna Metropolis?

Literature Review

Awareness of Green ICT Practices among Library Staff

Awareness of Green ICT practices is essential for promoting environmentally sustainable library services. Studies indicate that librarians generally possess a good understanding of Green ICT concepts and environmental sustainability. For example, Adeyemi et al. (2024) reported that librarians in Kwara State, Nigeria, were aware of Green ICT practices such as paper reduction and selective ICT upgrades, although institutional policies to support implementation were inadequate. Similarly, David-West and Wali (2024) found that librarians in South-South Nigeria recognised the importance of Green ICT but reported limited

institutional support. Outside Nigeria, Bincy and Vasudevan (2023) found a high level of environmental sustainability awareness among library professionals at the University of Calicut, India. These studies suggest that awareness is increasing, although greater institutional commitment is required to translate awareness into practice.

Accessibility of Green ICT Tools and Facilities

Accessibility to Green ICT facilities is a prerequisite for effective implementation. Evidence from Kwara State (Adeyemi et al., 2024), South-South Nigeria (David-West & Wali, 2024), and Kenya (Mwanzu, 2023) indicates that access to Green ICT infrastructure remains constrained by inadequate funding, limited technological resources, and weak institutional investment. These limitations continue to hinder the adoption of environmentally sustainable ICT practices in libraries.

Utilization of Green ICT Practices

The utilization of Green ICT practices in libraries remains moderate despite increasing awareness. Adeyemi et al. (2024) found that Green ICT implementation in Kwara State was largely fragmented and dependent on individual initiatives rather than institutional strategies. Likewise, Kolawole and Oladokun (2025) observed that Nigerian libraries are gradually embracing Green ICT, but utilization remains constrained by infrastructural and financial challenges. Hossain and Rahman (2023) similarly reported uneven implementation of Green ICT practices across academic institutions in developing countries.

Challenges Affecting Green ICT Adoption

The literature consistently identifies inadequate funding, insufficient ICT infrastructure, weak institutional policies, limited staff training, and poor management support as the major barriers to Green ICT implementation. These challenges were reported in studies conducted in South-South Nigeria (David-West & Wali, 2024), Kwara State (Adeyemi et al., 2024), Kenya (Mwanzu, 2023), and in Tariq's (2025) systematic review of Green ICT adoption.

The reviewed literature indicates that while awareness of Green ICT practices is relatively high, accessibility and utilization remain constrained by institutional, financial, and infrastructural barriers. Furthermore, few studies have simultaneously examined awareness, accessibility, utilization, and implementation challenges within the framework of the Fifth Industrial Revolution. More importantly, empirical evidence on these dimensions remains limited in Kaduna State, Nigeria, thereby providing the rationale for the present study.

Methodology

This study adopted a descriptive survey research design because it was suitable for assessing Green ICT practices for environmental sustainability among library staff without manipulating the study variables. Creswell and Creswell (2018) maintained that survey research is appropriate for describing the characteristics, attitudes, behaviours, and practices of a population through the collection and statistical analysis of data obtained using standardized instruments such as questionnaires. The study was conducted in four selected libraries in Kaduna Metropolis: The National Open University of Nigeria (NOUN) Kaduna Regional Library, Kaduna State University (KASU) Library, National Library of Nigeria, Kaduna Branch, and Kaduna Polytechnic Library. The population comprised 138 librarians. A total enumeration (census) technique was adopted because the population was small and manageable, allowing all librarians to participate in the study.

Data were collected using a researcher-developed structured questionnaire based on the study objectives and relevant literature. The instrument was validated by experts in Library and Information Science and research methodology. A pilot study involving 15 librarians at Kashim Ibrahim Library, Ahmadu Bello University, Zaria, was conducted to determine the reliability of the instrument, yielding a Cronbach's Alpha coefficient of 0.86. The questionnaire was administered physically by the researcher with the assistance of designated library representatives in the selected libraries. Of the 138 questionnaires distributed, 124 were completed and returned, representing an 89.9% response rate. Data were analysed using descriptive statistics, including frequency counts, percentages, mean ($\bar{x}$), and standard deviation.

Findings and discussions

Response Rate

A total of 138 questionnaires were administered to librarians in the selected libraries within Kaduna Metropolis. Out of these, 124 questionnaires were duly completed and returned, representing a response rate of 89.9%. The returned questionnaires formed the basis for data analysis.

Table 1*Questionnaire Distribution and Response Rate*

Library	Questionnaires Distributed (n)	Questionnaires Returned (n)	Response Rate (%)
National Open University of Nigeria (NOUN) Kaduna Regional Library	4	4	100.0
Kaduna State University (KASU) Library	69	64	92.8
National Library of Nigeria, Kaduna Branch	38	32	84.2
Kaduna Polytechnic Library	27	24	88.9
Total	138	124	89.9

Note. Response rate = (Questionnaires returned ÷ Questionnaires distributed) × 100.

Table 1 shows that all four copies of the questionnaire administered to librarians at the National Open University of Nigeria (NOUN) Kaduna Regional Library were completed and returned, representing a 100.0% response rate. Kaduna State University (KASU) Library recorded a response rate of 92.8%, while the National Library of Nigeria, Kaduna Branch and Kaduna Polytechnic Library recorded response rates of 84.2% and 88.9%, respectively. 124 of the 138 questionnaires administered were completed and returned, yielding a response rate of 89.9%. This response rate was considered adequate for the analysis and interpretation of the study data.

Demographic Characteristics of Respondents**Table 2:***Distribution of Respondents by Gender and Professional Status*

Variable	Category	Frequency	Percentage (%)
Gender	Male	48	38.7
	Female	76	61.3
	Total	124	100.0
Professional Status	Professional	95	76.6

	Librarian		
	Para-professional Librarian	29	23.4
	Total	124	100.0

Table 2 shows that out of the 124 respondents, 76 (61.3%) were female, while 48 (38.7%) were male, indicating that female librarians constituted many of the respondents. Regarding professional status, 95 (76.6%) were professional librarians, whereas 29 (23.4%) were para-professional librarians. This suggests that most of the respondents possessed professional qualifications and were therefore well-positioned to provide informed responses on Green ICT practices for environmental sustainability in libraries.

Table 3:

Awareness of Green ICT Practices among Library Staff

/N Item		SA + A Percentage (n) (%)	Mean ($\bar{x}$)	SD
1	I am aware of the concept of Green ICT.	78 62.9	3.52	1.40
2	I am aware of energy-saving ICT practices in libraries.	60 48.4	3.32	1.39
3	I am aware of environmentally friendly disposal of ICT equipment.	94 75.8	3.91	1.22
4	I am aware of the role of Green ICT in environmental sustainability.	90 72.6	3.68	1.33
Total		— —	3.53	1.34

Note. SA = Strongly Agree; A = Agree; $\bar{x}$ = Mean; SD = Standard Deviation. **Decision rule:** Mean scores of **3.50–5.00 = High**, **2.50–3.49 = Moderate**, and **1.00–2.49 = Low**.

The findings presented in Table 3 indicate that library staff possess a high level of awareness of Green ICT practices ($\bar{x}$ = 3.53, SD = 1.34). The highest level of awareness was recorded for environmentally friendly disposal of ICT equipment (75.8%, $\bar{x}$ = 3.91, SD = 1.22), followed by awareness of the role of Green ICT in environmental sustainability (72.6%, $\bar{x}$ = 3.68, SD = 1.33). Awareness of the concept of Green ICT was also high (62.9%, $\bar{x}$ = 3.52, SD = 1.40). However, awareness of energy-saving ICT practices was comparatively moderate (48.4%, $\bar{x}$ = 3.32, SD = 1.39). Overall, the findings suggest that librarians in the selected

libraries possess a good understanding of Green ICT and its relevance to environmental sustainability.

This finding is consistent with the study by Adeyemi et al. (2024), who reported that librarians in academic libraries in Kwara State, Nigeria, demonstrated considerable awareness of Green ICT practices, including environmentally friendly ICT initiatives, although institutional support for implementation was inadequate. Similarly, Bincy and Vasudevan (2023) found a high level of environmental sustainability awareness among library professionals at the University of Calicut, India, suggesting that awareness is becoming widespread among librarians. The findings also agree with David-West and Wali (2024), who observed that librarians in South-South Nigeria recognised the importance of Green ICT despite limitations in institutional support and policy implementation. Nevertheless, the comparatively lower awareness of energy-saving ICT practices observed in this study indicates that additional staff training and continuous professional development are needed to strengthen librarians' practical knowledge and application of Green ICT. The findings therefore suggest that, although awareness is relatively high, sustained institutional efforts are required to translate this awareness into effective Green ICT implementation in line with the sustainability objectives of the Fifth Industrial Revolution.

Table 4:

Accessibility of Green ICT Tools and Facilities among Library Staff

S/N	Item	SA + A (n)	Percentage (%)	Mean ($\bar{x}$)	SD
1	Energy-efficient computers are available in my library.	57	46.0	3.05	1.48
2	Power-saving features are enabled on ICT devices in my library.	41	33.1	2.80	1.38
3	Facilities for electronic document management are available in my library.	42	33.9	3.00	1.29
4	Green ICT resources are accessible to library staff.	36	29.0	2.54	1.42
Total		—	—	2.85	1.39

Note. SA = Strongly Agree; A = Agree; $\bar{x}$ = Mean; SD = Standard Deviation. Decision rule: Mean scores of 3.50–5.00 = High, 2.50–3.49 = Moderate, and 1.00–2.49 = Low.

The findings presented in Table 4 indicate a moderate level of accessibility of Green ICT tools and facilities among library staff ($\bar{x}$ = 2.85, SD = 1.39). Energy-efficient computers were the most accessible resource (46.0%, $\bar{x}$ = 3.05, SD = 1.48), whereas Green ICT resources generally were the least accessible (29.0%, $\bar{x}$ = 2.54, SD = 1.42). Overall, the findings suggest that although some Green ICT facilities are available in the selected

libraries, accessibility remains insufficient to support widespread implementation of environmentally sustainable ICT practices.

This finding corroborates Adeyemi et al. (2024), who reported that academic libraries in Kwara State, Nigeria, had initiated Green ICT practices but faced limited access to sustainable ICT facilities due to inadequate institutional support. It also agrees with David-West and Wali (2024), who found that inadequate funding and ICT infrastructure constrained Green ICT accessibility in academic libraries in South-South Nigeria. The findings therefore suggest the need for increased investment in Green ICT infrastructure and institutional support to enhance environmentally sustainable library services in the Fifth Industrial Revolution.

Table 5

Utilization of Green ICT Practices among Library Staff (N = 124)

S/N	Item	SA + A (n)	Percentage (%)	Mean ($\bar{x}$)	SD
1	I regularly use electronic documents instead of printed copies.	50	40.3	2.94	1.41
2	I switch off ICT devices when they are not in use.	75	60.5	3.52	1.42
3	I support paperless services in my library.	85	68.5	3.65	1.44
Total		—	—	3.34	1.44

Note. SA = Strongly Agree; A = Agree; $\bar{x}$ = Mean; SD = Standard Deviation. Decision rule: Mean scores of 3.50–5.00 = High, 2.50–3.49 = Moderate, and 1.00–2.49 = Low.

The findings presented in Table 5 indicate a moderate level of utilization of Green ICT practices among library staff ($\bar{x}$ = 3.34, SD = 1.44). Support for paperless library services recorded the highest level of utilization (68.5%, $\bar{x}$ = 3.65, SD = 1.44), followed by switching off ICT devices when they were not in use (60.5%, $\bar{x}$ = 3.52, SD = 1.42). However, the regular use of electronic documents instead of printed copies recorded a moderate level of utilization (40.3%, $\bar{x}$ = 2.94, SD = 1.41). Overall, the findings suggest that although library staff practices some Green ICT initiatives, the overall utilization of Green ICT remains moderate.

This finding agrees with Kolawole and Oladokun (2025), who reported that Nigerian libraries are increasingly adopting environmentally sustainable practices, although the level of implementation remains moderate due to infrastructural and financial constraints. The finding is also consistent with Adeyemi et al. (2024), who found that Green ICT practices in academic libraries in Kwara State, Nigeria, were implemented on a limited scale and were largely dependent on individual initiatives rather than institutional strategies. Similarly, Hossain and Rahman (2023) observed that the practical implementation of Green ICT in

academic institutions remains uneven despite growing awareness. These findings suggest that strengthening institutional support, staff capacity development, and investment in Green ICT infrastructure would enhance the utilization of environmentally sustainable ICT practices in libraries within the framework of the Fifth Industrial Revolution.

Table 6

Challenges Affecting Green ICT Implementation among Library Staff (N = 124)

S/N	Item	SA + A (n)	Percentage (%)	Mean ($\bar{x}$)	SD
1	Lack of funding affects the adoption of Green ICT practices.	109	87.9	4.31	0.96
2	Inadequate awareness hinders Green ICT implementation.	103	83.1	4.22	1.10
3	Lack of training limits the use of Green ICT practices.	117	94.4	4.51	0.79
4	Inadequate ICT infrastructure affects Green ICT adoption.	110	88.7	4.41	1.01
Total		—	—	4.36	0.97

Note. SA = Strongly Agree; A = Agree; $\bar{x}$ = Mean; SD = Standard Deviation. Decision rule: Mean scores of 3.50–5.00 = High, 2.50–3.49 = Moderate, and 1.00–2.49 = Low.

The findings presented in Table 6 indicate that library staff perceived high levels of challenges affecting the implementation of Green ICT practices ($\bar{x}$ = 4.36, SD = 0.97). Lack of training emerged as the most significant challenge (94.4%, $\bar{x}$ = 4.51, SD = 0.79), followed by inadequate ICT infrastructure (88.7%, $\bar{x}$ = 4.41, SD = 1.01), lack of funding (87.9%, $\bar{x}$ = 4.31, SD = 0.96), and inadequate awareness (83.1%, $\bar{x}$ = 4.22, SD = 1.10). These findings indicate that financial, infrastructural, and human capacity constraints remain major barriers to the effective implementation of Green ICT practices in the selected libraries.

The findings are consistent with David-West and Wali (2024), who identified inadequate funding, weak institutional support, and limited ICT infrastructure as major barriers to Green ICT initiatives in academic libraries in South-South Nigeria. Similarly, Adeyemi et al. (2024) reported that although libraries in Kwara State, Nigeria, had begun implementing Green ICT practices, inadequate funding, limited institutional commitment, and the absence of comprehensive sustainability policies constrained wider adoption. The findings also agree with Hossain and Rahman (2023) and Tariq (2025), who observed that inadequate staff training, insufficient infrastructure, and financial constraints continue to hinder Green ICT implementation in academic institutions. Addressing these challenges through increased investment, continuous staff capacity development, and stronger institutional support will

enhance Green ICT adoption and contribute to environmentally sustainable library services in line with the objectives of the Fifth Industrial Revolution.

Summary of Findings

The study assessed Green ICT practices for environmental sustainability among library staff in selected libraries within Kaduna Metropolis, Nigeria. The findings revealed that library staff demonstrated a high level of awareness of Green ICT practices ($\bar{x} = 3.53$, $SD = 1.34$), particularly regarding environmentally friendly disposal of ICT equipment and the role of Green ICT in promoting environmental sustainability. However, the accessibility ($\bar{x} = 2.85$, $SD = 1.39$) and utilization ($\bar{x} = 3.34$, $SD = 1.44$) of Green ICT tools and practices were found to be moderate, indicating that environmentally sustainable technologies have not yet been fully integrated into library operations. The study further revealed that lack of training, inadequate ICT infrastructure, insufficient funding, and inadequate awareness were the major challenges affecting the implementation of Green ICT practices ($\bar{x} = 4.36$, $SD = 0.97$). Overall, the findings suggest that although library staff possess adequate awareness of Green ICT practices, greater institutional support, investment in Green ICT infrastructure, and continuous staff capacity development are required to enhance their accessibility, utilization, and effective implementation in libraries.

Conclusion

The study concludes that library staff in the selected libraries within Kaduna Metropolis demonstrated a high level of awareness of Green ICT practices. Nevertheless, the accessibility and utilization of Green ICT tools and facilities remain only moderate, indicating that awareness has not yet translated into widespread implementation. The study further established that inadequate funding, insufficient staff training, and inadequate ICT infrastructure are the major challenges limiting the effective adoption of Green ICT practices. Therefore, increased investment in Green ICT infrastructure, continuous staff capacity development, and stronger institutional support are essential to enhance the implementation of Green ICT practices and promote environmental sustainability in libraries within the context of the Fifth Industrial Revolution (5IR).

Recommendations

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

1. Library management in Kaduna metropolis should organize regular awareness programmes, workshops, and seminars to further strengthen library staff's knowledge and understanding of Green ICT practices and their role in promoting environmental sustainability.
2. Libraries in Kaduna metropolis should improve the availability and accessibility of Green ICT tools and facilities by investing in energy-efficient computers, electronic document management systems, and other environmentally friendly technologies.

3. Library staff should be encouraged and supported to utilize Green ICT practices through continuous training, institutional policies promoting paperless services, and the adoption of energy-saving measures in daily library operations.
4. Government agencies, library management, and relevant stakeholders should provide adequate funding, training opportunities, and ICT infrastructure to address the challenges hindering the effective adoption and implementation of Green ICT practices in libraries.

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