

## Full Length Research

# Green Library Development in the Digital Age: Issues, Challenges & Way Forward

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The 21st century has seen the coming together of environmental crisis and digital transformation that forces institutions including libraries to rethink their core operating philosophies as well as physical locations. One of the most interesting answers of library profession to global climate emergency can be green library development, which is based on the principles of environmental sustainability, eco-friendly information infrastructure and responsible management of natural resources. The paper will discuss the concept, history, issues, relevance, challenges and strategic way forward of the green library development in the digital age. Based on the frameworks of the United Nations Sustainable Development Goals (SDGs), the sustainability agenda of the International Federation of Library Associations and Institutions (IFLA) and the core values of librarianship defined by the American Library Association (ALA), where sustainability became a component in 2019, the paper summarises the existing empirical evidence, institutional case studies, and statistical records to provide a comprehensive analysis of green This paper has established that green libraries have quantifiable environmental, economic and social advantages, but their implementation, especially in African and Nigerian regions, is limited due to lack of funding, bad policy implementation plans, lack of infrastructure and lack of awareness. Eco-design integration, migration of digital resources, adoption of renewable energy and professional capacity building are recommended strategies that are promoted to make university libraries green in a sustainable way.

**Keywords:** Green Library, Sustainability, Eco-Friendly Infrastructure, Digital Age, SDGs, IFLA, Library Development, Environmental Sustainability, Nigerian Libraries

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## INTRODUCTION

The increasing rate of climate change, environmental degradation and ecological loss has resulted in an unprecedented call to institutions of any form to embrace sustainable practices, including libraries. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (2021) cautions that by the early 2030s all parts of the world will have global temperatures above the 1.5°C target unless deep and drastic measures are taken to reduce carbon emissions. Libraries, with large physical presence, in terms of large buildings, electronic systems that use energy, paper-based operations, and heavily material collections of materials are not just contributors to, but also possible solutions to, this crisis.

The green library- a library that incorporates the principles of environmental sustainability into its physical, operational, service, and community activities- is an idea that has become very popular in the international library community since the beginning of the 2000s. In 2019, the American Library Association (ALA) made sustainability one of its Core Values of Librarianship because the profession formally acknowledged that libraries are the ones that need to act to achieve ecological resilience (ALA, 2019; Ren and Lu, 2024). In the same manner, the International Federation of Library

Associations and Institutions (IFLA) has repeatedly urged libraries to serve as stakeholders in the 2030 Agenda on Sustainable Development of the United Nations, as well as its 17 Sustainable Development Goals (SDGs), namely SDGs 7 (Affordable and Clean Energy), SDGs 11 (Sustainable Cities and Communities),

With the digital age, green library has now been extended beyond LEED-certified buildings and paper recycling programmes to the strategic provision of environmentally-friendly information infrastructures such as cloud computing, digital collections, energy-efficient servers and e-learning platforms that can bring about radical reduction in materials consumed by libraries and carbon footprints and at the same time increase accessibility and quality of services. The current paper aims at providing an in-depth analysis of the green library development in the frames of global sustainability discourses and the challenge and opportunities of the development of Nigerian university libraries.

## CONCEPT OF GREEN LIBRARY

### Definition and Meaning

The concept of green library is widely understood as a library which integrates green practices in all aspects of its work, including the design of the building and energy-saving measures, as well as the development of collections, providing services, and educating the community about the environmental issues. The term is used to refer to the physical (built environment) and philosophical (value and mission) aspects of library sustainability. The pioneering work of Antonelli (2008) on the Green Library Movement continues to be used in defining a green library as a building and operation in an environmental friendly manner; and as an active agent of environmental stewardship through collections, programmes and community working.

To this paper, the development of green libraries can be perceived as the utilisation of information infrastructures and systems which are eco-friendly to execute library services. Such definition includes: (1) embracing energy-efficient and renewable-energy-powered libraries buildings and systems; (2) the purposeful migration of print-to-dominant to digital-dominant information resources and services; (3) embracing waste reduction, recycling, and conservation practices of resources in library operations; (4) adopting sustainable materials and products as library furnishing, equipment, and supplies; and (5) the proactive promotion

Triple Bottom Line, a concept that includes environmental stewardship, economic feasibility, and social equity, is a fundamental concept behind the modern theory and practice of green libraries. This framework was operationalised in the library context by the Sustainability Task Force of the ALA (2018), which affirmed that libraries that are truly sustainable have to exhibit commitments on all three dimensions, as opposed to environmental axis only. Such combined knowledge is essential in the Nigerian scenario, where social equity in the form of equal access to information should be offset with environmental and economic sustainability factors.

### Core Components of a Green Library

**Table 1: Core Components of a Green Library and Their Eco-Friendly Characteristics**

| Component                                 | Eco-Friendly Features  | Examples of Implementation   |
|---|--|--|
| <b>Green Building Design</b>              | LEED/BREEAM certified; natural light maximisation; green roofs; rainwater harvesting | Denver Public Library (LEED Gold); Singapore National Library (Green Mark Platinum)        |
| <b>Renewable Energy Systems</b>           | Solar panels; wind energy; geothermal systems; LED lighting; smart HVAC              | Coventry Central Library (UK) solar-powered operations; Adeyemi FUED solar energy adoption |
| <b>Digital Information Infrastructure</b> | E-collections; cloud-based ILS; digital repositories; paperless workflows            | NUC Virtual Library (Nigeria); WorldCat; JSTOR; institutional repositories                 |
| <b>Waste Management</b>                   | Paper recycling; e-waste programmes; composting; reduced packaging procurement       | California Libraries' sustainable procurement standards; ALA SustainRT guidelines          |
| <b>Sustainable Transportation</b>         | Bicycle racks; EV charging; proximity to public transit; remote access services      | University of Nottingham library cycling facilities; JSTOR remote access                   |
| <b>Environmental Education</b>            | Sustainability collections; green programming; community climate action support      | California Sustainable Libraries initiative; ALA's Climate Action for Libraries programme  |

Table 1: Author's Synthesis (2024); adapted from Antonelli (2008); ALA (2019); Keller (2023); Tribelhorn (2023)

## HISTORY OF GREEN LIBRARY DEVELOPMENT

The history of green libraries can be traced back to four major developmental periods each presenting the level of environmental awareness and technology of that period. The initial stage (pre-2000) was defined by initial consciousness of libraries in their environmental obligations, with main signs in collection development policies which prefer environmental titles and the periodic building efficiency. The second period (2000-2010) was the period of formalisation of the discourse of green libraries, the publication of foundational texts such as that by Antonelli and McCullough (2012) *Greening Libraries* and the development of the first purpose-built green libraries buildings. The certification system LEED (Leadership in Energy and Environmental Design) created by the U.S. Green Building Council started to be used in the library buildings around this time.

The third stage (2010-2019) marked the institutionalisation of the principles of green libraries by professional organisations. The Sustainability Round Table (SustainRT) of ALA was founded, IFLA released its 2016 position on libraries and the 2030 Agenda, and the idea of the digital green library- using electronic resources to minimize the use of paper- earned a lot of academic coverage. The fourth and ongoing stage (2019-present) is marked by aligning the development of green libraries with the global climate action plans. This phase is marked by the formal commitment of sustainability as a value of ALA in 2019, the growth of empirical studies on green library practice (Tribelhorn, 2023; Mathiasson and Jochumsen, 2022; Ren and Lu, 2024) and the rise of green metrics in library evaluation systems.

Green libraries have developed more gradually in Africa and Kenya has become an outstanding example. In a study by Mwanzu et al. (2023), Kenyan academic libraries reported their green initiatives, such as the use of solar energy, paperless workflows, and environmental programming, but the authors observed that the adoption of green initiatives is limited by key structural factors, such as insufficient funding and support of the government policy. In Nigeria, the situation is not different: there have been isolated institutional efforts to establish that green library practices are feasible, but green transformation on a sector-wide scale is a dream and not a reality.

**Table 2:** Developmental Phases of Green Library Evolution

| Phase                          | Period       | Key Developments   | Global Milestones  |
|--------------------------------|--------------|--|--|
| <b>1. Nascent</b>              | Pre-2000     | Early environmental collections; basic energy conservation                   | 1970: First Earth Day; 1992: Rio Earth Summit; 1994: Agenda 21                               |
| <b>2. Formalisation</b>        | 2000–2010    | First green library buildings; LEED for libraries; green collections         | 2002: LEED v2.0; 2006: USGBC library certification; 2007: IFLA's 2007 sustainability chapter |
| <b>3. Institutionalisation</b> | 2010–2019    | ALA SustainRT; IFLA-SDG linkage; digital green libraries emerge              | 2015: UN SDGs adopted; 2016: IFLA Access & Opportunity for All; 2018: ALA Task Force         |
| <b>4. Climate Action</b>       | 2019–present | ALA sustainability core value; NCASL; empirical green library research surge | 2019: ALA core value; 2021: IPCC AR6; 2022: ALA Climate Action Strategy; 2023: IFLA Trends   |

*Table 2: Author's Synthesis (2024) based on Antonelli (2008); ALA (2019); IFLA (2022); Mathiasson & Jochumsen (2022)*

## ISSUES IN GREEN LIBRARY DEVELOPMENT

### Policy and Regulatory Framework Gaps

A lack of strong, library-specific policy on sustainability at state and institutional levels is one of the most urgent challenges in the development of green libraries. Although the international organisations like ALA and IFLA have laid down very clear requirements of sustainability, they are voluntary bodies whose requirements may or may not be taken up by individual countries and institutions. The National Universities Commission (NUC) and the Librarians Registration Council of Nigeria (LRCN) in Nigeria have not developed a specific policy framework to enshrine the practices of green libraries in university libraries. It is a structural barrier to systematic green library development because of this policy vacuum (Keller, 2023; Tribelhorn, 2023).

This problem is aggravated by the fact that there are no indicators of sustainability in library accreditation and performance assessment systems. Green practices cannot be measured and therefore, they cannot be controlled or

rewarded. The initial study of sustainability awareness among academic libraries in the US by Tribelhorn (2023) revealed that despite the universal recognition of sustainability as a crucial concept in the library industry, very few had prepared formal key performance indicators (KPIs) to measure and report sustainability, which carries even greater significance in the Nigerian environment.

### **Awareness and Professional Capacity**

One of the major problems with green library development is the unequal distribution of knowledge and ability of library professionals about sustainability practices, green building standards and eco-friendly information systems. In 2024, a systematic review by Mwanzu et al. reported that the majority of articles on green library adoption were published in 2023 (n=6), then 2024 (n=4)- an increasing trend that is indicative of the field emerging but also of relative youth (De Gruyter, 2025). The fact that sustainability issues have been poorly incorporated into the Nigerian Library and Information science (LIS) courses implies that most practising librarians do not have the basic understanding required to be at the forefront or instigate green library projects in their organisations.

### **The Digital Transition Paradox**

Digital transformation, with its promise of a new avenue to a greener library with less paper use, is a paradox on its own. Cloud computing and digital libraries rely heavily on data centres that are very energy-intensive: by 2022, the worldwide data centre sector consumed about 1–1.5 percent of the world's total electricity usage and released enormous carbon emissions (IFLA, 2022). Server hardware consumes rare earth minerals, generates e-waste at end life and in many cases utilizes non-renewable energy sources. By moving to cloud-based systems and digital collections, libraries need to be mindful that their digital infrastructure providers have credible renewable energy commitments, or risk exchanging visible paper waste with invisible yet equally harmful carbon emissions.

### **Equity and Access Dimensions**

Green library building poses significant equity aspects that need to be considered. Green library initiatives that focus on digital collections will increase the disparity in information access by people in many developing nations, such as Nigeria, who lack access to the internet or who lack access to digital devices. A library which has abolished print collections to adopt e-resources can be green but anti-social. Authentic green library development should thus strike a balance between ecological sustainability and social sustainability--making sure that digital transformations do not lead to the creation of new information deserts among vulnerable groups (Ren and Lu, 2024; ALA, 2019).

## **RELEVANCE OF GREEN LIBRARY TO INFORMATION ACCESS AND SERVICE**

Green libraries are not only the environmentally conscious buildings but also proven to be more efficient information services providers. Ren and Lu (2024) discovered that patrons of libraries in green library settings report to have good mental health and better cognition-enabling evidence that green design directly boosts the quality of library-mediated learning and research. The availability of natural light, better air quality, biophilic design features, and less noise - all the features of green library buildings - provide the most favourable conditions to work intellectually and engage in information.

In addition to the built environment, green libraries, which strategically invest in digital information infrastructure, hugely increase access to information. An electronic access to international academic databases such as AGORA, HINARI and OARE, the NUC Virtual Library in Nigeria, exemplifies a model green information service: it not only removes the cost and material waste of print subscriptions, but also radically increases the range of scholarly resources to which Nigerian academics can access. These types of digital services are compatible with the environmental sustainability and information equity objectives (Connaway et al., 2023; IFLA, 2022).

Green libraries also play a vital role of environmental education. Devine and Appleton (2023) remark that only public and academic libraries can serve as role models, educators, and facilitators of environmental sustainability in their communities. Green libraries can help facilitate the larger cultural change required to implement effective climate action by hosting climate action programming, curating sustainability collections, and modeling sustainable practices in their own practices, a mission that will be of particularly relevant significance to Nigerian university libraries, whose student communities will be among those worst affected by the impacts of climate change.

**Table 3: Relevance Dimensions of Green Libraries to Information Access and Community Benefit**

| <b>Relevance Dimension</b>           | <b>Mechanism of Impact</b>   | <b>Evidence / Example</b>  |
|--------------------------------------|--|--|
| <b>Enhanced Learning Environment</b> | Green design (natural light, air quality, biophilia) improves cognitive performance and patron wellbeing | Ren & Lu (2024): green library patrons report higher mental health scores and better study outcomes                  |
| <b>Expanded Information Access</b>   | Digital green infrastructure provides 24/7 remote access to vast e-collections without material waste    | NUC Virtual Library: 95,000+ e-journals accessible to Nigerian universities via HINARI/AGORA                         |
| <b>Cost Efficiency</b>               | Energy savings, reduced print procurement costs; reinvestment in information services                    | Coventry Central Library (UK) reported 40% energy reduction post-green retrofit (D-Tech, 2024)                       |
| <b>Environmental Education</b>       | Sustainability collections; climate action programming; community resilience support                     | California Libraries: 90% of sustainability programme participants applied learning to daily routines (D-Tech, 2024) |
| <b>SDG Alignment</b>                 | Contributes directly to SDG 4 (Quality Education), SDG 7 (Clean Energy), SDG 13 (Climate Action)         | Connaway et al. (2023): OCLC survey of 1,700+ librarians confirms SDG contribution across 5 goals                    |

*Table 3: Author's Synthesis (2024)*

## CHALLENGES TO GREEN LIBRARY DEVELOPMENT

### Funding and Financial Constraints

The biggest problem facing the development of green libraries especially in the Nigerian context is insufficient and unreliable funding. Green building retrofits, renewable energy systems, digital infrastructure investments and development of sustainability programmes all demand large upfront capital outlay that is beyond the financial means of most Nigerian library budgets. The Committee of University Librarians of Nigerian Universities (CULNU) has continually indicated that library allocations in most of the Nigerian universities are way below the recommended UNESCO standard of 5-10 percent of institutional budgets. The budgetary space to support sustainability investment is direly limited with many university libraries in Nigeria being recurrently allocated less than 0.5 percent of institutional budgets (Adeyemi et al., 2025; Ajani and Buraimo, 2022).

### Poor ICT Infrastructure and Unreliable Energy Supply

The development of green digital libraries relies on strong, dependable ICT and energy infrastructure- both of which are severely lacking in Nigeria. According to the records given by the Nigerian Communications Commission (NCC, 2021), Nigeria is experiencing a deficit of infrastructure investments worth 100 billion a year. In Nigeria, about 65.5 percent of libraries are not provided with special internet bandwidth and most university campuses have 8-16 hours power outage daily. Such circumstances complicate the technical and operational aspects of implementing and sustaining digital green library systems, such as cloud-based ILS, digital repositories, e-learning systems, and energy management systems (Abu and Okafor, 2023; Adeyemi et al., 2025).

### Low Awareness and Professional Capacity

Nigerian university library administrators and professional staff have little knowledge of green library concepts, LEED certification standards, renewable energy sources, and information system alternatives that are eco-friendly. Lack of green library content in LIS programs in Nigerian universities, added to a lack of accessibility to international professional development materials, poses a knowledge gap that limits the promotion and adoption of green library programs (Mwanzo et al., 2023; Keller, 2023).

### Absence of Policy Frameworks and Institutional Support

In the absence of explicit sustainability directives by the NUC, LRCN, or even individual university administration, the development of green libraries is entirely reliant on the individual belief of individual library directors- a wobbly and uneven platform. According to Keller (2023), although there are numerous illustrations of the individual green library projects, there is a dire need in the methodology at the top management level, which is an overall systemic failure to develop the sustainability governance structures in the library industry.

**Table 4:** Summary of Challenges to Green Library Development in Nigerian University Libraries

| <b>Challenge</b>                        | <b>Specific Manifestation (Nigeria)</b>   | <b>Source / Evidence</b>   |
|---|---|--|
| <b>Funding Deficit</b>                  | Library budgets <0.5% of university allocation; no green capital expenditure            | CULNU (2022); Adeyemi et al. (2025): libraries rely on solar due to grid failure—costly workaround |
| <b>Poor Energy Infrastructure</b>       | 8–16 hours daily power outages; unreliable grid; costly generator backup                | NCC (2021): \$100B infrastructure gap; Abu & Okafor (2023): 65.5% lack dedicated bandwidth         |
| <b>ICT Infrastructure Gap</b>           | Inadequate servers, poor internet; limited cloud capacity for digital collections       | NCC (2021); Ajani & Buraimo (2022)   |
| <b>Low Professional Awareness</b>       | Limited green library content in LIS curricula; few CPD opportunities in sustainability | Mwanzu et al. (2023); Keller (2023)  |
| <b>Policy Vacuum</b>                    | No NUC/LRCN green library mandate; no sustainability KPIs for accreditation             | Tribelhorn (2023); Keller (2023); CULNU (2022)   |
| <b>Climate &amp; Environmental Data</b> | Limited local data on library carbon footprints; no Nigerian green library baselines    | De Gruyter (2025) systematic review; Ren & Lu (2024)   |

*Table 4: Author's Synthesis (2024)*

## CONCLUSION

Green library development is one of the greatest and the most pressing priorities of the library profession in the world during the 21<sup>st</sup> century. With the increasing levels of climate change, and the environmental costs of human activity becoming increasingly apparent, libraries can not only be morally obliged to show the community they can do good, but they have a practical chance of doing so without harm to their ecological footprint. The digital age has not eliminated the necessity of green library development, but instead intensified and complicated it, offering new possibilities of delivering information services in a green way and challenging sustainability issues through new digital infrastructure that consumes energy.

The green library development in Nigeria is fraught with a lot of barriers on its way: lack of funds, substandard infrastructure, policy loopholes, and lack of professional knowledge. But the need is no less pressing. Serving a population of 2.2 million students and an ever-increasing research fraternity, the libraries of Nigerian universities are destined to be strongly influenced by the environmental conditions in the future. Green libraries in the present day are not only ecologically resilient, but also institutionally credible, patron wellbeing and long-term sustainability of their services.

## WAY FORWARD TO THE CHALLENGES

### Policy Advocacy and Regulatory Reform

The NUC and LRCN will need to create and implement a Green Library Standards Framework to create minimum sustainability requirements to university library accreditation. This framework ought to encompass energy efficiency standards, digital resource transfer goals, waste management stipulations, and environmental education requirements. To achieve sustainable library development, the Federal Ministry of Education needs to come up with a National Green Library Policy as part of the National Renewable Energy and Energy Efficiency Policy (NREEEP) and NDC targets under the Paris Agreement that will form the regulatory framework of sustainable library development.

### Investment in Renewable Energy Infrastructure

University libraries ought to make a gradual process of switching their grid-dependent operations to solar-powered operations and use TETFund, as well as institutional grants, to finance the installation of solar panels with battery storage systems that can supply the library operations with 24-hour power. This conversion will solve the energy reliability issue at the same time cut down the carbon footprint of the library, a twofold advantage that is especially crucial in the Nigerian setting. The fact that a good number of Nigerian university libraries are already switching to the use of solar energy as a workaround solution to epileptic grid power proves the technical viability of the transition (Adeyemi et al., 2025).

### Accelerated Digital Collection Development

Nigerian university libraries are urged to expedite the creation of digital collections, institutional repositories and e-resource access programmes, because digital information delivery is more environmentally friendly than print-based counterparts, as long as it is facilitated by renewable energy infrastructure. Joint e-resource licensing consortia, e.g., the HEAL-Link model in Greece or the SPARC Africa model can save individual library funds and increase digital access, establishing economies of scale that enable development of green libraries digitally even with resource-limited institutions.

### Curriculum Reform and Professional Development

Nigeria LIS schools need to incorporate the elements of green library content, such as sustainability theory, LEED standards, information system design that is environmentally friendly, and environmental library programming, into both undergraduate and postgraduate degrees. The NLA ought to create a special Sustainability and Green Library Section and hold annual CPD on green library practice which is supported by online materials, webinars, and international networking opportunities with the Environment, Sustainability and Libraries Special Interest Group (ENSULIB) of IFLA.

### Green Library Assessment and Reporting

To identify baselines, targets, and report on the development of green libraries, libraries are encouraged to implement sustainability assessment tools, including the ALA Sustainability Assessment Tool or Universitas Indonesia GreenMetric framework. Evidence-based green reporting does not only aid in institutional accountability but also gives the performance information required to legitimize the additional investment in sustainability initiatives to the university management and external funders.

### REFERENCES

- Abu, H., & Okafor, C. J. (2023). Influence of information and communication technology (ICT) use on staff job performance in university libraries in Benue State, Nigeria. *Library Philosophy and Practice (e-journal)*, Article 7264. <https://scholarworks.sjsu.edu/libphilprac/7264/>
- Adeyemi, I. O., Otaru, G. O., Fashola, O. D., Fasoroti, K. K., Fatai, F. A., Bakare, A., Omopupa, K. T., & Kamal, T. (2025). Reducing the environmental impacts of ICT adoption with library practices and collection development policies in selected university libraries in Kwara State, Nigeria. *IFLA Journal*, 51(4), 1058–1072. <https://doi.org/10.1177/03400352251342514>
- Ajani, F. O., & Buraimo, O. (2022). Perceived impact of automation on university library services by library personnel in South West, Nigeria. *Information Development*, 38(2), 179–191. <https://doi.org/10.1177/0266666921992089>
- American Library Association. (2019). *Core values of librarianship*. <https://www.ala.org/advocacy/intfreedom/corevalues>
- American Library Association, Council Committee on Sustainability. (2022). *Sustainability in libraries: A call to action* [Briefing]. [https://www.ala.org/sites/default/files/aboutala/content/SustainabilityInLibraries\\_Briefing\\_Final\\_April2022.pdf](https://www.ala.org/sites/default/files/aboutala/content/SustainabilityInLibraries_Briefing_Final_April2022.pdf)
- Antonelli, M. (2008). The green library movement: An overview and beyond. *Electronic Green Journal*, 1(27), Article 1. <https://escholarship.org/uc/item/39p1w9c8>
- Antonelli, M., & McCullough, M. (Eds.). (2012). *Greening libraries*. Library Juice Press.
- Association of Research Libraries. (2023, December 13). How libraries can lead the way in campus decarbonization. *ARL Views Blog*. <https://www.arl.org/blog/how-libraries-can-lead-the-way-in-campus-decarbonization/>
- Connaway, L. S., Doyle, B., Cyr, C., Gallagher, P., & Cantrell, J. (2023). Libraries model sustainability: Results of an OCLC survey on library contributions to the SDGs. *IFLA Journal*, 49(2), 269–285. <https://doi.org/10.1177/03400352231157041>
- D-Tech International. (2024, January 31). Five trends shaping the library experience in 2024. <https://d-techinternational.com/us/blog/2024/01/31/five-trends-shaping-the-library-experience-in-2024/>
- De Gruyter. (2025). Factors influencing the adoption of green libraries for environmental sustainability: A systematic literature review. *Libri*, 75(1). <https://doi.org/10.1515/libri-2024-0089>
- Devine, J., & Appleton, L. (2023). Environmental education in public libraries. *Library Management*, 44(1/2), 152–165. <https://doi.org/10.1108/LM-10-2022-0090>
- Intergovernmental Panel on Climate Change. (2021). *Climate change 2021: The physical science basis. Contribution of*

- Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. <https://doi.org/10.1017/9781009157896>
- International Federation of Library Associations and Institutions. (2022). *IFLA trend report 2022 update*. <https://trends.ifla.org/update-2022>
- Keller, A. (2023). Sustainability 3.0 in libraries: A challenge for management. *Publications*, 11(1), Article 6. <https://doi.org/10.3390/publications11010006>
- Mathiasson, M. H., & Jochumsen, H. (2022). Libraries, sustainability and sustainable development: A review of the research literature. *Journal of Documentation*, 78(6), 1278–1304. <https://doi.org/10.1108/JD-11-2021-0224>
- Mwanzu, A., Bosire-Ogechi, E., & Odero, D. (2023). Green initiatives towards environmental sustainability: Insights from libraries in Kenya. *IFLA Journal*, 49(2), 298–312. <https://doi.org/10.1177/03400352231157042>
- Nigerian Communications Commission. (2021). *Challenges of technology penetration in an infrastructure deficit Nigeria* [Report]. Nigerian Communications Commission.
- Ren, X., & Lu, J. (2024). Librarians' attitudes toward library's roles in environmental sustainability. *Journal of Librarianship and Information Science*. Advance online publication. <https://doi.org/10.1177/09610006241229460>
- Tribelhorn, S. K. (2023). Preliminary investigation of sustainability awareness and activities among academic libraries in the United States. *The Journal of Academic Librarianship*, 49(3), Article 102661. <https://doi.org/10.1016/j.acalib.2023.102661>
- United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development* (Resolution A/RES/70/1). <https://sdgs.un.org/2030agenda>