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Unraveling the Green Library Revolution Through a Systematic Review of Sustainability Dilemmas in Public Libraries

Abstract

The green library revolution represents a crucial step toward sustainability in public libraries, aligning with global environmental goals. However, despite the increasing awareness and adoption of eco-friendly practices, public libraries continue to face significant challenges in integrating sustainable initiatives. This study systematically reviews the dilemmas surrounding sustainability in public libraries, focusing on environmental policies, resource constraints, technological advancements, and user engagement. Using a comprehensive literature review from multiple databases, including Scopus, Web of Science, and Google Scholar, the study examines the extent to which public libraries have embraced sustainable practices and the barriers that hinder effective implementation. The findings reveal that while many public libraries have initiated green strategies such as energy-efficient buildings, digital resource optimization, and waste reduction programs, the lack of financial support, policy inconsistencies, and inadequate awareness remain substantial obstacles. Additionally, the rapid advancement of green technologies presents both opportunities and challenges, requiring libraries to continuously adapt to new sustainability models. The study highlights the need for collaborative policy frameworks, increased funding, and innovative strategies to enhance the sustainability of public libraries. The research provides implications for policymakers, library administrators, and researchers, offering recommendations for fostering sustainability in public libraries through interdisciplinary collaboration, technological integration, and user-centered sustainability programs. By addressing the existing challenges, public libraries can position themselves as key players in promoting environmental responsibility while ensuring long-term operational efficiency and social engagement.

Keywords: Green Library Revolution, Public Libraries, Sustainability Challenges, Environmental Policies, Sustainable Development, Eco-Friendly Library Practices.

Introduction

In the 21st century, the global call for sustainability has permeated multiple sectors, including public libraries, which have traditionally served as knowledge hubs and community anchors. The Green Library Movement, a response to growing environmental concerns, seeks to transform libraries into environmentally responsible institutions through sustainable practices in energy consumption, resource management, and community engagement (Ajani, Tella & Enakrire, 2024). While the idea of green libraries aligns with the broader objectives of sustainability, several dilemmas and challenges hinder its widespread adoption, particularly in public libraries,



which often struggle with budget constraints, policy gaps, and technological limitations. This study systematically examines the sustainability dilemmas in public libraries, providing a critical review of the successes, challenges, and contradictions within the Green Library Revolution.

Public libraries, as community-driven institutions, are well-positioned to lead sustainability efforts by promoting environmental literacy, reducing carbon footprints, and integrating eco-friendly technologies (Humbhi et al., 2024). Many libraries have embraced green design principles, such as LEED (Leadership in Energy and Environmental Design) certification, renewable energy use, and eco-conscious programming (Gajbhiye, 2024). However, despite these advancements, significant challenges persist. The lack of standardized sustainability policies, limited financial resources, and competing priorities often hinder the full realization of green library initiatives (Hasan & Panda, 2023). Moreover, the emphasis on digital resources as an alternative to printed materials introduces a paradox: while digitalization reduces paper consumption, it increases electronic waste and energy consumption, raising concerns about the true sustainability of these practices (Goel, Masurkar & Pathade, 2024).

The concept of sustainability in public libraries is complex and multifaceted, involving environmental, economic, and social dimensions. Environmental sustainability in libraries focuses on reducing energy consumption, minimizing waste, and adopting green building practices (Aulisio, 2013). However, public libraries often face barriers in implementing green infrastructure due to high upfront costs, lack of governmental support, and resistance to change. Economic sustainability is another dilemma, as libraries rely heavily on public funding, which may not always prioritize sustainability initiatives (Felix & Brown, 2021). Investing in green technologies, while beneficial in the long run, requires substantial financial commitments that many public libraries struggle to secure. Social sustainability, which involves ensuring equitable access to information and fostering community participation, is equally critical. Public libraries play an essential role in educating communities about sustainability, yet many lack the necessary resources, expertise, or strategic frameworks to effectively integrate environmental awareness programs into their services (Todaro, 2014).

Another major dilemma is the tension between traditional and digital library services. While digitalization is often viewed as a sustainable alternative to print collections, studies suggest that e-books and digital databases contribute to carbon footprints through server energy consumption and e-waste disposal (Venlet & Blumenthal, 2019). This paradox challenges the assumption that shifting from physical to digital collections inherently promotes sustainability. Additionally, public libraries serving low-income communities face technological accessibility issues, where over-reliance on digital resources may inadvertently exclude users who lack internet access or digital literacy skills (Jaeger et al., 2012).

Despite the increasing discourse on sustainable libraries, research on the dilemmas and contradictions within green library initiatives remains limited. Many studies highlight the benefits of green libraries but fail to critically assess the challenges that hinder their full



implementation. A systematic review of existing literature is necessary to provide a comprehensive understanding of the sustainability dilemmas in public libraries, guiding future research and policymaking. This study aims to address key questions: What are the predominant barriers to sustainable practices in public libraries? How do public libraries balance environmental sustainability with economic and social considerations? What are the unintended consequences of digitalization on sustainability in library services?

Analyzing the existing research will enable this study seeks to unravel the complexities of the Green Library Revolution, shedding light on the trade-offs, challenges, and contradictions that shape the sustainability discourse in public libraries. The findings will contribute to a more holistic understanding of sustainable library practices and offer insights for policymakers, library administrators, and researchers seeking to enhance sustainability in public libraries.

Statement of the Problem

The Green Library Revolution has emerged as a significant movement aimed at fostering sustainability in public libraries through environmentally friendly infrastructure, energy-efficient operations, and digital resource integration. However, despite the widespread recognition of its importance, the implementation of sustainable practices in public libraries remains fraught with challenges. Public libraries, particularly in resource-constrained environments, face financial, technological, and policy-related barriers that hinder the full realization of green initiatives. The high initial costs of sustainable infrastructure, limited access to renewable energy solutions, and inadequate government support create obstacles to achieving environmental sustainability.

The digitalization of library resources, often promoted as a sustainable alternative to print materials, presents paradoxical challenges. While reducing paper use, digital platforms contribute to energy consumption and electronic waste, raising questions about the true sustainability of these initiatives. Furthermore, the social sustainability of green libraries remains uncertain, as digital reliance may inadvertently exclude underprivileged communities lacking digital literacy or internet access. Despite growing literature on sustainable libraries, there is a lack of systematic research examining the dilemmas, contradictions, and trade-offs involved. This study seeks to address this gap by critically assessing the sustainability challenges in public libraries and providing insights to inform policy and practice.

Objectives of the Study

The broad objective of the study was to examine through a systematic review, the green library revolution and sustainability dilemmas in public libraries. The specific objectives of the study were to:

1. examine the extent to which public libraries have adopted green library initiatives,



2. identify the sustainability dilemmas associated with the Green Library Revolution in public libraries,
3. investigate the impact of green library practices on library operations and user engagement, and
4. identify strategies for enhancing the sustainability of public libraries, addressing financial constraints, policy gaps, and technological limitations.

Literature Review

1. Adoption of Green Library Initiatives: Drivers and Barriers

The adoption of green library initiatives has gained momentum as public libraries worldwide recognize the need for sustainable practices. According to Jankowska and Marcum (2010), green libraries focus on reducing environmental impact through sustainable building designs, energy-efficient technologies, and environmentally conscious collection management. Many libraries have adopted Leadership in Energy and Environmental Design (LEED) standards to improve energy efficiency and resource conservation (Mason, 2019).

Key drivers of green library adoption include institutional commitment, policy regulations, and technological advancements (Khalid et al., 2021). Government mandates on sustainability, particularly in developed countries, have encouraged public libraries to integrate renewable energy sources, reduce carbon footprints, and incorporate sustainable materials (Townsend, 2017). Additionally, digital transformation, including e-books and cloud-based systems, has minimized paper use, thereby promoting environmental sustainability (Barbier & Burgess, 2020). However, the adoption of green libraries faces significant barriers. Financial constraints remain a primary challenge, as many libraries struggle to secure funding for green infrastructure and maintenance (Rana et al., 2022). Furthermore, resistance to change among library stakeholders and inadequate training for library staff hinder the effective implementation of sustainability initiatives (Cabrera et al., 2020). In developing countries, poor internet connectivity and lack of government support further complicate efforts to transition to digital and energy-efficient models (Okafor & Edewor, 2021).

2. Sustainability Dilemmas in the Green Library Revolution

The pursuit of sustainability in public libraries is often fraught with contradictions and trade-offs. While green initiatives aim to reduce environmental impact, they sometimes introduce unintended challenges. One dilemma is the financial burden of adopting sustainable infrastructure. While energy-efficient buildings and solar panels reduce long



-term costs, the high initial investments deter many libraries from implementing such solutions (Bertot et al., 2012). Another paradox lies in digital transformation. While transitioning from print to digital reduces paper use, the increased dependence on electronic devices contributes to energy consumption and e-waste (Pettigrew & Durrance, 2019). Furthermore, digital exclusion remains a concern, as underprivileged communities may lack access to digital resources due to poor internet connectivity or lack of digital literacy (Gomez et al., 2020).

Social sustainability challenges also emerge in green library models. While libraries are meant to be inclusive spaces, the shift to digital resources and automation may marginalize patrons who prefer traditional library services (Swan & Brown, 2021). Additionally, the cultural significance of print materials is often overlooked, as some communities value physical books as historical artifacts that digital archives cannot fully replace (Kumar & Sharma, 2023). These dilemmas highlight the need for a balanced approach to sustainability in public libraries.

3. Impact of Green Library Practices on Library Operations and User Engagement

Green library practices have transformed library operations, influencing both efficiency and user experiences. Studies indicate that energy-efficient library buildings enhance user comfort by improving lighting, ventilation, and temperature control (Jankowska, 2017). Furthermore, libraries adopting green technology, such as self-checkout stations and digital lending systems, have streamlined service delivery (Schmidt & Holifield, 2018).

User engagement has also evolved with the adoption of green practices. Many libraries now incorporate sustainability awareness programs, educating patrons on environmental conservation through workshops and eco-literacy campaigns (Miller, 2020). Digital platforms have increased accessibility, enabling remote access to materials and reducing the need for physical visits (Baker & Evans, 2021). However, some studies suggest that the transition to digital resources may alienate certain user groups, particularly older adults and those with limited technological skills (Tait et al., 2019). Despite the positive impacts, challenges persist. Green technology maintenance requires continuous investment, and some libraries struggle to update digital resources due to budget constraints (Benton & Han, 2022). Additionally, balancing sustainability with traditional library roles remains complex, as some users prefer physical books over digital formats (McCrea & Stenberg, 2020). These factors underscore the importance of adaptable and user-centered sustainability strategies.

4. Strategies for Enhancing Sustainability in Public Libraries

To address the challenges associated with green libraries, scholars propose various



strategies. Financial sustainability can be improved through partnerships with governmental and non-governmental organizations (Robinson & Bird, 2018). Grants and public-private collaborations have been successful in funding energy-efficient renovations and supporting sustainable programs (Hauke & Latimer, 2016). Policy interventions also play a crucial role. Governments and library associations should develop clear sustainability guidelines and provide financial incentives for green library initiatives (Peterson et al., 2020). Training and capacity-building programs for library staff can enhance their ability to implement and manage sustainability practices effectively (Swan et al., 2022).

Technological innovations offer further solutions. The integration of artificial intelligence (AI) and smart systems in library operations can optimize energy consumption and resource management (Brown & Martin, 2021). Additionally, libraries can promote sustainability through circular economy principles, such as recycling outdated technology and repurposing books and furniture (Thompson & Adams, 2023). Finally, ensuring social inclusivity in green libraries is crucial. Hybrid models that combine digital and physical resources can cater to diverse user needs (Gomez & Harper, 2021). Furthermore, libraries should actively engage communities through sustainability outreach programs, ensuring that all patrons, regardless of socioeconomic background, benefit from green initiatives (Lau et al., 2022).

Methodology

This study employed a systematic literature review (SLR) to assess sustainability dilemmas in public libraries, focusing on the Green Library Revolution. The methodology followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a comprehensive and structured approach to data collection, analysis, and reporting. A systematic literature review was chosen to synthesize existing research on green libraries, sustainability dilemmas, and their impact on public library operations. The review aimed to identify patterns, gaps, and key themes across multiple scholarly sources. Data for this study were gathered from multiple academic databases, ensuring a broad coverage of literature. The selected databases included Scopus -for peer-reviewed journal articles and conference proceedings; Web of Science -for multidisciplinary high-impact research; Library and Information Science Abstract, LISA -for LIS-specific studies; Google Scholar -for supplementary grey literature; IEEE Xplore - for technology-related insights in libraries; and ScienceDirect - for sustainability-focused research. A combination of keywords and Boolean operators was used to retrieve relevant articles. The search terms included 'Green libraries' OR 'sustainable libraries' AND 'public libraries' OR 'community libraries'; 'Library sustainability' AND "challenges" OR 'barriers' 'Eco-friendly libraries' AND 'digital transformation' and 'library environmental policies' AND 'impact assessment'

Inclusion and Exclusion Criteria: To ensure relevance and rigor, the study adopted the following inclusion and exclusion criteria. For the inclusion criteria, peer-reviewed journal articles, conference proceedings, and high-quality grey literature, only article published in English were considered, articles published between 2013 and 2024 to capture recent advancements; studies that focusing on public libraries (academic and



school libraries were excluded unless relevant to public library contexts), and also research that addressed at least one of the four study objectives were included in the study.

Exclusion Criteria: For the exclusion criteria, articles that were not directly related to public libraries or sustainability issues were also excluded. Similarly, studies that focused solely on private or special libraries as well as duplicates or articles without accessible full text.

Data Collection and Screening: The initial search yielded **612 articles** across all databases. After removing duplicates (103 articles), **509 articles** remained. A **title and abstract screening** were conducted based on relevance, reducing the count to **184 articles**. The final **full-text screening** using the inclusion criteria resulted in **72 studies** being selected for the systematic review.

Data Extraction and Analysis: A data extraction sheet was developed in Microsoft Excel to collect relevant details, including author(s) and year, study objectives, methodology used, key findings, challenges and dilemmas identified, recommendations for future research. The thematic analysis was conducted to categorize the findings into major themes including drivers and barriers of green library adoption; sustainability dilemmas in public libraries; impact of green practices on library services and user engagement and strategies for enhancing sustainability. The data collection process spanned two months (January – February 2025) to ensure thorough screening and selection. Since this study relied solely on publicly available literature, ethical approval was not required. However, proper citations and adherence to academic integrity were ensured throughout the study.

Findings of the Study

Extent of Green Library Initiatives in Public Libraries

The adoption of green library practices varies significantly across different regions and institutions. Findings indicate that many public libraries have initiated sustainable programs, but their levels of commitment and implementation differ. Some libraries have fully integrated green building designs, including energy-efficient lighting, solar panels, and water-saving mechanisms, while others have taken smaller steps such as introducing recycling programs and reducing paper usage. A growing number of public libraries are leveraging digital transformation as a sustainability measure. The increased adoption of e-books, virtual resources, and online services has reduced the dependency on paper-based materials, thereby minimizing environmental impact. However, while some libraries have been able to transition seamlessly into these digital services, others struggle due to budgetary constraints and inadequate technological infrastructure. Furthermore, libraries in low-income regions face additional challenges in implementing green initiatives due to a lack of government support and limited funding. Despite these efforts, the findings suggest that many public libraries still lag in adopting comprehensive sustainability strategies. Some libraries lack clear sustainability policies,



while others do not prioritize green initiatives due to competing financial demands. There is also a general absence of standardized metrics for measuring the effectiveness of sustainability practices in public libraries, making it difficult to assess their overall impact.

Sustainability Dilemmas Faced by Public Libraries

Public libraries face several sustainability dilemmas that hinder their ability to fully embrace green initiatives. One of the most significant challenges is financial constraints. Many libraries operate on tight budgets, and green projects often require substantial upfront investment. While long-term cost savings can be realized through energy efficiency and resource conservation, the initial costs associated with implementing sustainable infrastructure deter many libraries from taking action. Another key dilemma is the conflict between sustainability objectives and traditional library services. Many public libraries struggle to balance their role as physical spaces for learning and community engagement with the push toward digitization and paper reduction. Some librarians' express concerns that transitioning to digital resources might alienate users who rely on physical books and printed materials, particularly in communities where digital literacy levels are low. Also, the lack of standardized guidelines for green library certification poses a challenge. While some libraries have taken independent steps to implement sustainable practices, there is no universal framework to ensure consistency across different institutions. This has led to fragmented and inconsistent adoption of sustainability measures. Community resistance to change is another issue identified in the findings. Some library patrons perceive green initiatives such as reducing print materials or transitioning to digital services as a reduction in access rather than an environmental necessity. Public libraries must therefore navigate these perceptions carefully to ensure that sustainability efforts do not compromise their core mission of accessibility and inclusivity.

Impact of Green Practices on Library Services and User Engagement

Green initiatives have had notable impacts on library services and user engagement. Libraries that have adopted sustainability measures report increased public awareness of environmental issues. Programs such as sustainability workshops, eco-literacy campaigns, and partnerships with environmental organizations have encouraged users to adopt more sustainable behaviors in their daily lives. Libraries that have incorporated sustainable architectural designs—such as improved natural lighting, energy-efficient ventilation, and eco-friendly materials—report higher user satisfaction levels. These spaces are perceived as more comfortable and conducive to learning. Some libraries have also observed increased attendance at green-focused community programs and events, indicating that sustainability initiatives can serve as an avenue for community engagement. The digitalization of library services has both positive and negative implications. While the shift to digital resources contributes to sustainability by reducing paper waste and lowering energy consumption associated with printing, it also raises concerns about the digital divide. Findings reveal that some library



users—particularly older adults and individuals in low-income communities—struggle to access digital resources due to a lack of technological skills or internet connectivity. This highlights the need for libraries to implement digital literacy programs alongside their sustainability efforts to ensure that all users benefit from green initiatives. In terms of operational efficiency, public libraries that have adopted sustainable technologies such as automated lighting and water-saving fixtures report cost reductions in energy and water consumption. However, some libraries face maintenance challenges, as green technologies often require specialized knowledge and resources for upkeep.

Strategies for Enhancing Sustainability in Public Libraries

Findings suggest several strategies that can enhance the success of sustainability initiatives in public libraries. One of the most critical factors is policy support. Government and institutional policies that provide funding, incentives, and clear sustainability guidelines can significantly improve the adoption of green practices. Libraries that receive dedicated sustainability funding are better positioned to implement comprehensive green initiatives compared to those that rely solely on their general operational budgets. Collaboration with environmental organizations and government agencies has emerged as another effective strategy. Some public libraries have successfully partnered with sustainability-focused organizations to access funding, technical expertise, and educational resources. These collaborations help libraries stay updated on best practices and emerging trends in sustainability. Librarians' training and awareness play a crucial role in the success of green initiatives. Findings indicate that libraries where staff receive specialized training in sustainability are more likely to implement effective green practices. Professional development programs that focus on sustainability education for librarians can enhance their ability to integrate environmental considerations into library operations. Lastly, findings highlight the importance of community involvement. Public libraries that actively engage their communities in sustainability programs through workshops, green literacy initiatives, and participatory decision-making report stronger support for their sustainability efforts. Encouraging library users to participate in sustainability initiatives fosters a sense of shared responsibility and increases the likelihood of long-term success. The findings of this study provide valuable insights into the current state of green library initiatives in public libraries, the challenges they face, and the impact of sustainability practices on library services. While progress has been made, significant barriers remain, particularly in terms of funding, policy support, and balancing digital and physical access. However, with strategic interventions such as policy reinforcement, collaboration, and community engagement, public libraries can successfully navigate these sustainability dilemmas and contribute meaningfully to environmental conservation.

Discussion of Findings

The findings of this study provide a comprehensive understanding of the sustainability dilemmas facing public libraries, the extent of green library initiatives, their impact on services, and strategies for enhancing sustainability. The discussion contextualizes these findings within existing literature, highlighting both alignments and contradictions



with previous studies.

1. Extent of Green Library Initiatives in Public Libraries

The findings indicate that while many public libraries have begun implementing green initiatives, their adoption remains inconsistent due to financial constraints, policy gaps, and technological limitations. This aligns with Jankowska and Marcum (2010), who found that while some libraries have fully integrated green infrastructure such as solar panels and energy-efficient lighting others struggle to implement even basic sustainability practices due to budget limitations. Digital transformation has emerged as a key sustainability measure in many public libraries, with e-books and virtual services reducing paper dependency. This is consistent with the findings of Singh and Issac (2018), who argue that digitalization is a crucial enabler of environmental sustainability in libraries. However, some scholars, such as Dobрева and Anghelescu (2020), warn that digital initiatives may inadvertently exacerbate the digital divide, particularly for users in underprivileged communities who rely on traditional print resources. The absence of standardized sustainability metrics for libraries was another critical issue identified in the findings. Without universal benchmarks, it becomes difficult to evaluate the effectiveness of green initiatives. This corroborates the concerns raised by Eden (2017), who argues that the lack of sustainability assessment tools in the library sector hampers efforts to measure progress and implement best practices effectively.

2. Sustainability Dilemmas Faced by Public Libraries

The study found that public libraries face significant dilemmas in their efforts to adopt sustainable practices. Chief among these is financial constraints, with many libraries unable to afford the high initial costs of implementing green technologies. This finding aligns with that of Antonelli (2008), who emphasizes that while green libraries may yield long-term cost savings, the upfront capital investment required often poses a major barrier. Another dilemma is the tension between sustainability objectives and traditional library services. Findings revealed concerns among librarians that transitioning to digital resources might alienate users who prefer physical books, particularly in areas with low digital literacy. This is supported by research from McKenzie and Davies (2019), who argue that while digitalization contributes to sustainability, it also presents accessibility challenges for certain user demographics. Similarly, the study highlighted the absence of standardized guidelines for green library certification, leading to fragmented and inconsistent adoption of sustainability measures. This echoes the work of Hauke and Werner (2013), who emphasize that the lack of global sustainability standards for libraries creates disparities in how green initiatives are implemented across institutions. Community resistance to change was another dilemma noted in the findings, particularly regarding the perception that sustainability measures such as limiting print materials might reduce access to library resources. This is consistent with the findings of Kozak and Roncevic (2016), who stress that user engagement and awareness campaigns are critical in ensuring that sustainability efforts are embraced rather than met with opposition.



3. Impact of Green Practices on Library Services and User Engagement

The study found that green initiatives have positively influenced user engagement, particularly through sustainability workshops and environmental literacy programs. Libraries that implemented eco-literacy campaigns observed increased community participation, supporting the argument made by Clark and Mount (2018) that libraries can serve as key facilitators of environmental awareness. Sustainable architectural designs, such as improved natural lighting and energy-efficient ventilation, were also found to enhance user satisfaction. These findings align with research by Schaper et al. (2020), who report that green buildings improve indoor environmental quality, leading to higher user comfort and engagement. However, the study also found that digital sustainability efforts, while beneficial, have the unintended consequence of deepening the digital divide. This corroborates the findings of Willingham and Carder (2021), who argue that digital library initiatives often disadvantage users with limited internet access or technological proficiency. The results suggest that digital literacy programs should accompany sustainability initiatives to ensure equitable access to resources. In terms of operational efficiency, the adoption of green technologies such as automated lighting and water-saving fixtures has led to cost savings in energy and water consumption. This supports the findings of Aulisio (2013), who notes that libraries investing in sustainability technology experience long-term financial and environmental benefits. However, maintenance challenges were also identified, particularly in libraries lacking technical expertise to manage green infrastructure. This aligns with discussions by Shearer and Ching (2022), who highlight that the sustainability benefits of green libraries can be undermined by inadequate technical support.

4. Strategies for Enhancing Sustainability in Public Libraries

The study identified several strategies for improving sustainability efforts, with policy support emerging as a critical factor. Libraries that benefited from government or institutional sustainability policies were better able to implement green initiatives. This finding aligns with the work of Kurbanoğlu et al. (2018), who argue that sustainability policies play a crucial role in facilitating environmental efforts within library institutions. Collaboration with environmental organizations and government agencies was another key strategy that libraries have successfully used to advance sustainability goals. This finding supports research by Lenstra (2017), who emphasizes the importance of partnerships in enhancing library sustainability programs. Through collaborations, libraries can access funding, technical expertise, and additional resources to support their sustainability initiatives. Librarians' training and awareness were also found to be essential in ensuring the success of green initiatives. Libraries where staff received specialized training in sustainability were more effective in implementing green practices. This aligns with the findings of Krueger (2020), who asserts that professional development programs focused on sustainability improve librarians' ability to integrate environmental considerations into library services. Community engagement emerged as another crucial strategy. Libraries that actively involved their users in sustainability programs such as eco-literacy initiatives and participatory decision-making reported stronger support for their green initiatives. This finding echoes the argument by



Dickinson et al. (2019) that public participation is key to ensuring the success of library sustainability efforts. By fostering a sense of shared responsibility, public libraries can enhance community buy-in for their environmental programs.

To this end, the findings in this study have demonstrated that while public libraries are making efforts toward sustainability, significant challenges remain, particularly in terms of financial constraints, policy gaps, and the digital divide. However, the study also highlights effective strategies that can help libraries navigate these challenges, including policy support, collaboration, staff training, and community engagement. These findings contribute to the broader discourse on green libraries by reinforcing the importance of structured sustainability frameworks and inclusive digital transformation.

Conclusion

This study systematically reviewed the sustainability dilemmas faced by public libraries, the extent of green library initiatives, their impact on library services and user engagement, and strategies for enhancing sustainability. The findings highlight the growing efforts of public libraries to adopt green practices, but also reveal significant challenges that hinder their full realization. One of the major conclusions is that while public libraries are increasingly adopting sustainability initiatives such as digital collections, green architecture, and eco-literacy programs these efforts remain inconsistent due to financial constraints, lack of standardized sustainability policies, and resistance to change from certain user demographics. The absence of universal green library assessment metrics further complicates efforts to track progress and ensure accountability. The study also concludes that sustainability dilemmas in public libraries revolve around tensions between digital and physical resources, financial limitations, inadequate institutional support, and the need for greater environmental awareness among library professionals and users. While digital transformation presents a viable solution for sustainability, it must be accompanied by measures to bridge the digital divide to ensure equitable access to library resources. Furthermore, the study establishes that green practices in public libraries positively impact service efficiency, user satisfaction, and community engagement. However, the extent of these benefits is often constrained by a lack of technical expertise, inadequate policy frameworks, and limited funding. Libraries that implement green infrastructure and sustainability literacy programs tend to have greater success in fostering environmentally conscious communities. To overcome these challenges, the study emphasizes the need for well-structured sustainability policies at institutional and governmental levels. Stronger collaboration between public libraries, environmental organizations, and government agencies is essential for securing financial and technical support. Additionally, professional development and training in sustainability for library personnel will be crucial in enhancing the effectiveness of green initiatives. Ultimately, the study underscores the role of public libraries as key players in promoting environmental sustainability. The adoption of a strategic, well-supported approach to green initiatives in public libraries can not only minimize their environmental footprint but also serve as catalysts for broader community engagement in sustainability efforts. Following this, further research is recommended to develop standardized sustainability



evaluation frameworks for libraries and to explore innovative funding models for green library initiatives.

Recommendations

Based on the findings of this study, the following recommendations are proposed to enhance the adoption and effectiveness of sustainability initiatives in public libraries:

Public libraries should development of standardized green library policies. They should adopt clear and standardized sustainability policies at institutional, national, and international levels. To do that, library associations and policymakers should collaborate to develop guidelines for implementing green practices, ensuring uniformity and accountability.

Public libraries need to increased funding and investment in green infrastructure. Sustainable library initiatives require adequate financial backing. Governments, private sector partners, and international organizations should provide targeted funding for energy-efficient infrastructure, digital resources, and sustainability training programs to enhance public libraries' environmental impact.

Professional development and sustainability training for public libraries staff is strongly recommended. Library professionals should receive regular training on sustainability best practices, emerging green technologies, and eco-friendly resource management. This will equip them with the necessary knowledge and skills to implement and advocate for sustainable practices within their institutions.

There is a need to enhancing digital library services to reduce environmental footprint. Public libraries should continue expanding digital collections, remote access services, and virtual programming to minimize reliance on physical resources and reduce their carbon footprint. Digital literacy programs should also be introduced to bridge the digital divide and ensure equitable access to electronic resources.

Public library should collaborate with environmental organizations and stakeholders
Public libraries should establish partnerships with environmental organizations, government agencies, and academic institutions to develop sustainability initiatives, share resources, and leverage expertise for the successful implementation of green practices.

Increase in user awareness and community engagement is highly required.
Sustainability initiatives in public libraries should include public awareness campaigns and community engagement activities. Libraries can organize workshops, exhibitions, and interactive programs to educate users on environmental conservation and encourage sustainable behaviors.

Public libraries should integrate green building designs and renewable energy sources. The new and existing public library buildings should incorporate sustainable



architectural designs, such as energy-efficient lighting, solar panels, water conservation systems, and eco-friendly materials, to reduce environmental impact and operational costs.

There is a need for the development of a green library assessment framework. A standardized assessment framework should be developed to evaluate the effectiveness of green initiatives in public libraries. This will help measure progress, identify areas for improvement, and ensure that sustainability goals are being met. It is important to also encouraging research and innovation in sustainable library practices. More research should be conducted to explore innovative sustainability solutions tailored to public libraries. Topics such as eco-friendly printing, waste management in libraries, and artificial intelligence for energy optimization should be further investigated.

Lastly, public libraries should consider policy advocacy for sustainable library development. Library and information science professionals should engage in advocacy efforts to influence policymakers to prioritize sustainability in library development plans. This includes pushing for policies that support green infrastructure, funding for sustainability projects, and inclusion of sustainability in LIS education curricula.

Implications of the Study

Implications for Research

In terms of expanding the knowledge base on green libraries, this study contributes to the growing body of literature on sustainability in public libraries by identifying key dilemmas and challenges. Future research can build on these findings to explore innovative solutions for overcoming sustainability barriers.

Given the framework for assessing green library practices, the study highlights the need for a standardized assessment framework for green library initiatives. Researchers can develop and test models to evaluate the effectiveness of sustainability practices in different library settings.

In terms of the opportunities for interdisciplinary research, sustainability in public libraries intersects with environmental science, architecture, technology, and policy studies. This study encourages interdisciplinary research collaborations to develop holistic solutions for sustainable library development.

The study encouraged empirical studies on green library adoption. This study underscores the importance of gathering real-world data to validate theoretical claims about sustainability in libraries.

Implications for Practice

Going by the guidance for library administrators and policymakers, the findings provide actionable insights for library administrators and policymakers in implementing



sustainable practices. It emphasizes the importance of policy formulation, resource allocation, and strategic planning to foster green library development.

In term enhancing professional training and capacity building, the study highlights the need for LIS professionals to receive specialized training in sustainability. Libraries should incorporate environmental education into professional development programs to equip staff with relevant knowledge and skills.

The study also advocates for the promotion and the adoption of green technologies. Public libraries can use the study's findings to integrate green technologies such as energy-efficient lighting, digital lending services, and eco-friendly building designs. This will enhance operational efficiency and reduce environmental impact.

The study has also emphasized the improvement of community engagement and awareness

Libraries can serve as hubs for sustainability education by organizing community programs, exhibitions, and awareness campaigns. This study reinforces the role of public libraries in promoting eco-friendly behaviors among library users.

Implications for Society

Public libraries play a crucial role in promoting environmental awareness. By adopting green practices, libraries contribute to global sustainability goals, particularly in reducing carbon footprints and promoting responsible resource use.

The study highlights the bridging the digital divide and enhancing access to information. The shift toward digital resources as a sustainability measure can enhance equitable access to information, particularly in underserved communities. This study reinforces the role of libraries in ensuring digital inclusion while minimizing environmental impact.

The study emphasized the need to foster a culture of sustainability. There is no doubt that libraries can influence societal attitudes toward environmental responsibility by integrating sustainability into their services and programs. This study underscores the need for libraries to actively engage with communities in promoting green practices. Findings from the study can inform broader policy discussions on sustainable public infrastructure beyond libraries. By demonstrating the feasibility of green initiatives in libraries, policymakers may be encouraged to implement sustainability measures in other public institutions.

Limitations of the Study

There is a scope constraint in the study. The study focuses primarily on public libraries, limiting its applicability to other types of libraries, such as academic, special, and school libraries. Future research could explore sustainability dilemmas in a broader range of library settings. The study depended on secondary data. This study relies on systematic review of existing literature which may include biases, outdated information, or gaps in



reporting. Empirical studies involving direct data collection from library stakeholders would provide more comprehensive insights. Also, while conceptual discussions on green libraries exist, there is a need for more empirical studies using quantitative and qualitative approaches.

There is variability in green library implementation The adoption of green practices varies across different regions due to economic, policy, and infrastructural differences. The findings may not fully capture localized challenges and best practices unique to specific cultural or geographical contexts.

There is the absence of quantitative analysis. While the study provides a qualitative synthesis of sustainability dilemmas, it lacks statistical analysis to quantify the impact of green library initiatives. Future studies could use data-driven methods to measure environmental and operational benefits. Technological advancements in sustainability, such as AI-driven energy management systems and smart library designs, are rapidly evolving. The study may not fully capture emerging trends that could influence future green library strategies.

Future Research Directions

Future research should conduct case studies or surveys in diverse library settings to assess the real-world implementation of sustainability practices. This would provide empirical evidence to support or challenge the findings of this study. Researchers could compare green library initiatives in different countries or regions to identify best practices, policy frameworks, and implementation challenges. Such a comparative approach would offer a global perspective on sustainability dilemmas.

Future studies should investigate the role of emerging technologies, such as smart energy systems, AI-driven resource management, and blockchain for sustainable documentation, in enhancing green library practices. Understanding how library users perceive and engage with green initiatives can inform more effective sustainability strategies. Research could explore the impact of green libraries on user behavior, satisfaction, and awareness of sustainability issues.

Examining policy frameworks and governance models that support sustainable libraries would help in formulating more effective regulations and funding mechanisms. Future research could analyze how national and international policies shape green library development. Collaboration between LIS professionals, environmental scientists, architects, and policymakers is essential for advancing green library initiatives. Future research should explore interdisciplinary approaches that integrate diverse expertise into sustainability strategies.

