Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6, 2690-2706
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i6.8464

From print to planet: Exploring sustainability practices, influencing factors, and challenges in academic libraries

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Abstract: This study aimed to examine the implementation of sustainability practices in academic libraries on negros Island, Philippines, focusing on existing initiatives, influencing factors, and challenges encountered. A descriptive-relational research design was employed using a validated and pilot-tested researcher-developed questionnaire. Stratified random sampling yielded 65 academic librarian respondents from higher education institutions. Descriptive and inferential statistics, including linear regression, were used for data analysis. Results revealed that sustainable practices are evident across key library functions. In collection development, commonly implemented actions include electronic cataloging, book repair, and digital material adoption. Service delivery emphasizes energy-efficient technology, consistent service quality, and digital expansion. Physical and indoor environment improvements feature space optimization and energy-saving designs. Leadership and governance focus on resource conservation and waste management. Significant factors influencing implementation include age, campus location, population served, and budget size. Challenges include limited financial resources, regulatory complexity, and lack of training. Sustainability is emerging as an operational priority in academic libraries, though barriers remain. The findings provide actionable insights for library administrators and policymakers in developing targeted interventions and policies to support a sustainable library system and align academic library operations with broader sustainability goals.

Keywords: *Academic library management, Influencing factors, Negros island, Philippines, Sustainability challenges, Sustainability practices.*

1. Introduction

The imperative of transitioning from traditional print-based library practices to sustainable and eco-conscious operations within academic libraries is increasingly recognized globally [1, 2]. Academic libraries, as vital hubs of education and research, have a profound role in addressing environmental challenges. This role is underscored by the call to action issued by leading international bodies, such as the American Library Association (ALA) and the International Federation of Library Associations and Institutions (IFLA) [3]. ALA and IFLA have emphasized the importance of libraries embracing sustainability to minimize their environmental footprint and serve as catalysts for sustainable practices within their communities and institutions [4, 5].

Negros Island, a region renowned for its cultural richness and natural beauty, also grapples with environmental challenges such as climate change, resource scarcity, and ecological degradation [6, 7]. Within this context, academic libraries on the island have a unique role as knowledge hubs and community leaders. They have the potential to not only support the educational and research needs of their patrons but also serve as exemplars of sustainable practices that align with broader global sustainability goals.

However, this journey towards sustainability is not without its challenges. The transition from print to planet-conscious library practices presents multifaceted obstacles. These challenges

History: Received: 8 April 2025; Revised: 16 June 2025; Accepted: 19 June 2025; Published: 30 June 2025
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encompass collection development, infrastructure, resource management, and leadership [8, 9]. Furthermore, the sustainable transformation must consider the unique local circumstances, cultural dynamics, and available resources on Negros Island.

Despite the urgency and relevance of these challenges, there is a notable research gap in understanding the specific sustainability challenges and key influencers within academic libraries on Negros Island. While international studies provide valuable insights into sustainability in libraries, they may not always account for this region's distinct characteristics and challenges. Thus, this study seeks to bridge this research gap by providing a nuanced understanding of the complex interplay of sustainability dynamics within the local academic library context. Moreover, the findings of this research are expected to contribute not only to the enhancement of academic libraries on Negros Island but also to the broader global discourse on sustainable library operations, offering insights that can be adapted and adopted by institutions facing similar environmental challenges and striving for sustainability.

1.1. Statement of the Problem

This study seeks to determine the sustainable practices, influencing factors, and challenges within academic libraries in Negros Island, Philippines.

Specifically, this study aimed to answer the following questions:

1. What is the demographic profile of the participants in terms of sex and age and the institutional profile considering the academic libraries' geographical location, campus, population size, type of institution, and the average annual library budget?
2. What are the prevailing sustainability practices of academic libraries in the domains of collection management, service delivery, physical infrastructure and indoor environments, and leadership and governance?
3. What are the influencing factors of sustainability practices in these libraries?
4. What challenges do librarians face in their pursuit of sustainable library operations?

1.2. Theoretical Framework

This study is anchored on two theoretical foundations: sustainable development and the innovation diffusion theories. The sustainable development theory emphasizes the need for organizations, including academic libraries, to operate in a way that ensures the balanced integration of environmental, social, and economic dimensions to achieve long-term viability and societal benefit [10, 11]. This theory justifies implementing eco-conscious practices such as energy efficiency, responsible collection development, inclusive service delivery, and environmentally friendly infrastructure. Libraries are increasingly recognized as institutions that can advance the United Nation's Sustainable Development Goals (SDGs), particularly in promoting quality education (SDG 4), sustainable institutions and communities (SDG 11), climate action and sustainability (SDG 13), and access to information (SDG 16) [12, 13].

Moreover, the innovation diffusion theory offers a valuable framework for understanding how sustainable innovations are adopted within institutions [14]. The theory suggests that the adoption and diffusion of innovations are influenced by five key attributes: relative advantage, compatibility with existing systems, complexity, trialability, and observability [15]. In the context of academic libraries, these attributes shape how sustainability practices such as digital transformation, resource conservation, and green technologies are evaluated, accepted, or resisted. Empirical studies further emphasize that diversity in both demographic and institutional profiles significantly affects how sustainability is implemented in libraries [16, 17]. Demographic variables such as age, educational attainment, experience, and position impact librarians' openness to change, technical proficiency, and advocacy for sustainable practices. For example, younger or educated librarians may more readily embrace eco-friendly innovations or digital solutions. Similarly, institutional characteristics such as type (public or private), campus location, population, and

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

annual budget determine the level of resources and structural support available for sustainability efforts. Urban, well-funded institutions are more equipped to trial and scale sustainable innovations, while rural or under-resourced campuses may struggle with complexity and compatibility due to limited capacity.

These two theories provide a comprehensive lens through which this study examines the implementation of sustainability practices in academic libraries. While the sustainable development theory highlights the why, emphasizing the responsibility of libraries to contribute to environmental, social, and economic well-being, the innovation diffusion theory explains how and to what extent these practices are adopted within varied institutional settings. This dual-theoretical approach enables the study to evaluate the presence and scope of sustainable initiatives and understand the dynamic factors, such as demographic diversity and institutional characteristics, that influence their adoption and integration. In the context of Negros Island, this framework supports a more nuanced analysis of both opportunities and barriers, offering valuable insights into the diffusion and institutionalization of sustainability in academic libraries.

1.3. Conceptual Framework

This study is guided by a variable-centered conceptual framework that explores the relationship among independent, dependent, and moderating variables to understand better the dynamics of sustainability practices within academic libraries on Negros Island. The independent variables consist of the demographic profile of the respondents, specifically their sex and age, alongside the institutional profile of the academic libraries. The institutional profile includes essential characteristics such as geographical location, campus affiliation, population size served, type of institution (public or private), and the average annual library budget. These demographic and institutional factors influence how academic libraries perceive, prioritize, and implement sustainability. The dependent variable is the extent of sustainability practices adopted by the libraries, categorized into four main domains: collection management, service delivery, physical infrastructure and indoor environmental quality, and leadership and governance. These domains collectively reflect the operational and strategic measures undertaken to embed environmentally responsible and socially conscious actions into library systems and services.

Additionally, the framework identifies the challenges librarians and academic libraries encounter as a moderating variable. Such challenges may involve resource limitations, infrastructure issues, resistance to change, insufficient training or awareness, and lack of administrative support. These obstacles can either hinder or facilitate the relationship between the demographic and institutional factors and the adoption of sustainable practices. Even when favorable demographic and institutional conditions exist, significant challenges can impede progress toward sustainability. By articulating these variables and their interactions, the conceptual framework provides a foundation for examining the factors that shape sustainability efforts in academic libraries and assesses how encountered challenges influence successful implementation. This framework, therefore, guides data collection and analysis and supports the development of evidence-based recommendations to enhance sustainable operations in academic libraries.

2. Methodology

2.1. Research Design

This study employed a descriptive-relational research design to investigate sustainability practices, influencing factors, and challenges in academic libraries. This design is suited for identifying existing trends and relationships between variables without manipulation, making it appropriate for studies aiming to examine conditions as they naturally occur [18].

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Vol. 9, No. 6: 2690-2706, 2025
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2.2. Participants of the Study

The target population consisted of 87 academic librarians from various higher education institutions across Negros Island, all of whom are active members of the Philippine Librarians Association, Incorporated–Negros Island Region Librarians Council (PLAI-NIRLC). Stratified random sampling was employed to ensure representative participation and reduce sampling bias. The population was first divided into strata based on geographical location (e.g., northern, central, and southern areas of Negros Island) to ensure that each subgroup was proportionately represented in the sample. Participants were randomly selected within each stratum, allowing each librarian an equal chance of inclusion. This method enhanced the sample's representativeness by reflecting the population's diversity while controlling for potential location-based biases. The final sample size was computed using [19] with a 5% margin of error, resulting in a required sample of 71 respondents. Out of those selected, 65 librarians completed the survey, yielding a high response rate of 91.5%, which further supports the reliability and generalizability of the study's findings.

2.3. Research Instruments

The research instrument was a structured questionnaire to gather comprehensive data from academic librarians. Part I focused on the profile of the participants, which was divided into two sections: Demographic Profile and Institutional Profile. The Demographic Profile included items such as sex and age. At the same time, the Institutional Profile gathered information on the institution's location, campus type, population size, institution type, and library budget. Part II assessed the sustainability practices implemented by academic librarians across four key domains: Collection Management, Service Delivery, Physical Infrastructure and Indoor Environment, and Leadership and Governance. Each domain comprised specific items rated on a 5-point Likert scale ranging from 1 (Never) to 5 (Always), allowing for both numerical scoring and verbal interpretation of the extent to which sustainable practices were observed. Part III explored librarians' challenges in implementing these sustainability initiatives, addressing budget limitations, institutional support, staff training, and operational difficulties.

To ensure content validity, the questionnaire was reviewed by six library directors holding doctoral degrees. The Content Validity Ratio (CVR) method developed by Lawshe [20] was used, with 95% of the items rated as essential. Items in the questionnaire not meeting the minimum CVR threshold of 0.636 were omitted to enhance validity and relevance. Reliability was confirmed through a pilot test involving 30 head librarians from higher education institutions in Panay Island, yielding a Cronbach's Alpha coefficient of 0.952, indicating excellent internal consistency and overall reliability of the instrument.

2.4. Data Collection Procedures

Data were gathered through both face-to-face distribution and email-based surveys. This dual approach was used to enhance reach and accommodate participants' accessibility and preferences, particularly in geographically dispersed locations across Negros Island. Responses were compiled and processed systematically in preparation for statistical analysis.

2.5. Data Analysis

The data were analyzed using descriptive and inferential statistical methods to understand academic librarians' sustainability practices and challenges comprehensively. Descriptive statistics were used to summarize and describe participants' responses, including frequency, percentage distribution, mean, and standard deviation. The mean scores were interpreted using the following scale:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
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Table 1.
Descriptive Scale and Interpretation for the Implementation of Sustainability Practices in Libraries.

Mean Scale	Verbal Description	Interpretation
4.51–5.00	Very Highly Practiced	The practice is consistently implemented across most areas of library operations
3.51–4.50	Highly Practiced	The practice is regularly implemented and integrated into library activities
2.51–3.50	Moderately Practiced	The practice is occasionally implemented but not yet consistent
1.51–2.50	Less Practiced	The practice is seldom observed or implemented sporadically
1.00–1.50	Least Practiced	The practice is rarely or never implemented.

This interpretation indicated the extent to which sustainable practices were carried out across the four domains of library operations.

To analyze Part III of the instrument, which focused on the challenges encountered by academic librarians, frequency and percentage were used to determine the most prevalent issues faced in implementing sustainability practices.

Inferential statistics, specifically linear regression analysis, were also applied to examine the relationships among sustainability practices and institutional and demographic factors. It allowed for deeper insights into how various factors influenced the extent of implementing sustainability practices.

2.6. Ethical Considerations

The study was carried out in strict accordance with established ethical standards to safeguard all participants' rights, dignity, and welfare. Participation was entirely voluntary, with no coercion or obligation involved. Before data collection commenced, participants were fully informed of the study's objectives, procedures, potential risks and benefits, and their right to withdraw without penalty. The informed consent was formally obtained through signed consent forms following a clear explanation of the study protocol. The research procedures, including the survey instrument and consent process, were reviewed and approved by the university's research office, and the study was deemed to involve minimal to no physical or psychological risk. Participants were also assured that their contributions would support academic advancement, particularly in sustainable library practices.

To ensure the highest standards of privacy and confidentiality, no identifying information was collected or linked to individual responses. Data access was restricted solely to the researchers, and all findings were presented in aggregated form to prevent the identification of any participant. Collected data were securely stored in password-protected digital formats and were disposed of responsibly upon the study's conclusion, following institutional data protection guidelines. These ethical measures reflect the study's commitment to integrity, transparency, and respect for participant autonomy throughout the research process.

3. Results

3.1. On the Profile of the Participants

Table 2 presents the demographic and institutional characteristics of the academic librarians who participated in the study. A total of 65 librarians from various higher education institutions (HEIs) across Negros Island were surveyed to capture diverse perspectives relevant to sustainable library practices.

The demographic profile shows that the participant group was predominantly female, accounting for 78.5% of the respondents, while male participants comprised 21.5%. This gender imbalance reflects the longstanding trend of female dominance in the library profession, locally and globally [21]. Despite facing certain stereotypes and expectations based on appearance or roles, female librarians display resilience and professionalism in the workplace [22].

Regarding age, 60.0% of the respondents were 31 and above, while 40.0% were 30 and below.

This distribution suggests a workforce of experienced librarians and younger professionals who may bring innovative ideas and digital competencies to sustainability efforts. As noted in previous studies, older librarians, particularly those with advanced degrees, often demonstrate stronger professional competencies and leadership skills and are inclined to environmental care [23].

In terms of institutional location, the majority of respondents were affiliated with institutions in Negros Occidental (73.8%), while 26.2% came from Negros Oriental. The result reflects the concentration of HEIs in the western part of the island, which may influence access to resources and institutional support for sustainable practices [24].

As for campus assignments, 63.1% of librarians were based in main campuses, and 36.9% were working in external or satellite campuses. Librarians in main campuses often benefit from better infrastructure and administrative support, enabling broader implementation of sustainability programs compared to their counterparts in satellite campuses [23].

Concerning the institutional population size, 67.7% of the respondents were from smaller institutions with 14,000 or fewer students, while 32.3% served in larger institutions. Librarians in smaller academic settings may face resource limitations, yet they adopt creative, cost-effective strategies to promote sustainability in library services [24].

About institutional classification, 70.8% of the librarians were employed in public HEIs, and 29.2% were in private institutions. Lastly, regarding the annual library budget, 60.0% of respondents reported working with budgets below ₱3 million, while 40.0% managed budgets of ₱3 million and above. These figures suggest financial variability across institutions, which can impact the availability of green technologies, staff training, and long-term sustainability planning [23].

Table 2.
Profile of the Participants.

Variable		f	%
A. Demographic			
Sex			
	Male	14	21.5
	Female	51	78.5
Age			
	30 years old and below	26	40.0
	31 years old and above	39	60.0
B. Institutional			
Geographical Location			
	Occidental	48	73.8
	Oriental	17	26.2
Campus			
	Main	41	63.1
	External	24	36.9
Population Size			
	Small (14,000 & below)	44	67.7
	Medium (Above 14,000)	21	32.3
Type of the Institution			
	Private	19	29.2
	Public	46	70.8
Average Annual Library Budget			
	Below 3 million	39	60
	3 million and above	26	40.0

3.2. On Sustainability Practices

The study assessed the integration of sustainability practices in academic libraries across five key areas of library management, as reflected in Tables 3 to 6: Collection Development and Management, Service Delivery, Physical Set-up and Indoor Environment, and Leadership and Governance. Each area

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

highlights how libraries adopt sustainable practices in their operations, facilities, services, and organizational culture.

3.2.1. Sustainability Practices on Collection Development and Management

Table 3 provides a comprehensive overview of sustainable library practices within the context of collection development and management. Notably, the dataset reveals a strong commitment to sustainability, with several practices receiving high mean scores and demonstrating alignment with eco-conscious objectives.

The top-ranked practices, such as "use electronic systems for quicker and more efficient cataloging and management of collections" (M = 4.42, SD = 0.95), "repair damaged books instead of replacing them" (M = 4.37, SD = 0.84), and "acquire e-books and other digital resources to reduce paper usage and the need for physical storage space" (M = 4.12, SD = 1.05), indicate a robust dedication to sustainable practices.

Conversely, "joining in resource sharing through collaborative collection development and consortia purchasing" receives a moderately practiced rating, with a mean score of 3.06 and a standard deviation of 1.09. The result suggests that while the library is engaged in resource sharing to some extent, an opportunity exists to further enhance collaborative collection development efforts. While it may not be at its highest level of practice, this score still reflects a noteworthy level of engagement in resource-sharing initiatives.

The data reflect a positive path toward sustainability within the library's collection development and management practices. While a strong foundation is in place, the findings also underscore the potential for further refinement and alignment with sustainable initiatives, particularly in areas where mean scores are slightly lower. Ultimately, the library's commitment to these sustainable practices benefits the environment and holds the potential for cost savings, improved accessibility, and more effective resource management, further enhancing its impact and relevance within the community. These initiatives support the findings that libraries strongly commit to reducing waste, streamlining cataloging processes, and embracing digital resources, ultimately contributing to enhanced environmental sustainability and operational efficiency [25, 26]. Likewise, studies have noted that libraries have long been active participants in resource-sharing initiatives, recognizing the benefits of cooperative efforts in expanding access to information resources and optimizing collection development [13].

Table 3.
Sustainability Practices on Collection Development and Management.

Rank	Indicators	*M*	*SD*	Interpretation
1	Use electronic systems for quicker and more efficient cataloging and management of collections.	4.42	0.95	Highly Practiced
2	Repair damaged books instead of replacing them, as this reduces waste and extends the book's lifespan.	4.37	0.84	Highly Practiced
3	Acquire e-books and other digital resources to reduce paper usage and the need for physical storage space.	4.12	1.05	Highly Practiced
4	Digitize collections to reduce physical storage space, reduce printing, and provide remote access to materials.	3.83	1.28	Highly Practiced
5	Establish a "Green Collection Development" policy as one of the sustainable initiatives.	3.77	1.18	Highly Practiced
6	Facilitate the donation of no longer needed materials, like books, magazines, & other collections like CDs, DVS, etc.	3.73	1.14	Highly Practiced
7	Carry out preservation practices such as archiving & digitizing fragile materials for longevity of collections.	3.66	1.25	Highly Practiced
8	Join in resource sharing through collaborative collection development and consortia purchasing.	3.06	1.09	Moderately Practiced
	Area Mean	**3.87**	**0.79**	Moderately Practiced

Note: Mean Scale: 4.51-5.0 (Very Highly Practiced), 3.51-4.50 (Highly Practiced, 2.51-3.50 (Moderately Practiced), 1.51-2.50 (Less Practiced), 1.0-1.50 (Least Practiced).

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

3.2.2. Sustainability Practices on Service Delivery

Table 4 highlights the extent to which sustainability practices are integrated into the library's service delivery. The data revealed a strong institutional commitment to environmental responsibility while maintaining user-centered services. With an overall area mean of $M = 4.20$ ($SD = 0.76$), all listed practices fall within the "Highly Practiced" to "Very Highly Practiced" range, demonstrating a deliberate effort to align operational strategies with sustainable development goals.

The highest-rated practice—maintaining quality, efficient, and user-friendly online and onsite services ($M = 4.51$, $SD = 0.75$)—reflects the library's emphasis on user satisfaction and operational excellence. This result underscores the library's dual focus on service quality and sustainability, as efficient systems reduce resource waste and user frustration. Library sustainability involves reducing carbon footprints and enhancing access and service quality through innovative, low-impact approaches [27].

Closely following are practices related to providing energy-efficient laptops and computers ($M = 4.31$, $SD = 1.00$) and offering diverse digital services such as digitization and e-circulation ($M = 4.30$, $SD = 0.90$). These initiatives are practical responses to environmental challenges and reflect the library's adaptive capacity to address the digital divide and expand reach through technology. The availability of financial resources influences the ability of libraries to adopt eco-friendly technologies, suggesting that high ratings also indicate sound institutional investment in sustainable ICT infrastructure [28].

Table 4.
Sustainability Practices on Service Delivery.

Rank	Indicators	M	SD	Interpretation
1	Maintain quality, efficient, and user-friendly online and onsite services through a high satisfaction rating.	4.51	0.75	Very Highly Practiced
2	Provide energy-efficient laptops and computers, increasing access to technology for individuals without devices.	4.31	1.00	Highly Practiced
3	Offer diverse digital and electronic library services like digitization, e-circulation, etc. to minimize carbon footprints.	4.30	0.90	Highly Practiced
4	Use an automated library system improves the speed and accuracy routine tasks, like checking out & returning books.	4.28	1.10	Highly Practiced
5	Promote remote access services like searching OPAC, book reservations, loan requests, loan renewals, etc.	4.28	0.86	Highly Practiced
6	Conduct library instruction on the use and advantages of digital media.	4.20	0.86	Highly Practiced
7	Carry out digitization services through document/book content scanning and online delivery.	4.19	1.05	Highly Practiced
8	Provide signage, education programs, and outreach efforts, encouraging users to adopt eco-friendly practices daily.	4.17	1.04	Highly Practiced
9	Adopt a service philosophy or a green motto to improve its image.	3.98	1.11	Highly Practiced
10	Implement a book exchange program that allows users to borrow and exchange books with each other.	3.78	1.23	Highly Practiced
	Area Mean	4.20	0.76	Highly Practiced

Note: Mean Score: 4.51-5.0 (Very Highly Practiced), 3.51-4.50 (Highly Practiced, 2.51-3.50 (Moderately Practiced), 1.51-2.50 (Less Practiced), 1.0-1.50 (Least Practiced)

Further, the library's use of automated systems ($M = 4.28$) and promotion of remote services ($M = 4.28$) illustrates its strategy to minimize physical transactions and encourage digital interaction strategies that streamline services and reduce the ecological impact of library operations. These practices align with findings that Philippine academic libraries have begun reorienting traditional services toward greener, technology-driven models to meet sustainability demands [29].

While the lowest-rated practice implementing a book exchange program ($M = 3.78$, $SD = 1.23$) still falls within the "Highly Practiced" category, the higher standard deviation suggests greater implementation or user perception variability. This could point to inconsistencies across campuses or

logistical challenges in sustaining such programs. Nevertheless, the result still indicates a conscious effort to support resource sharing and reuse, core tenets of a circular economy.

The spread of standard deviations across all practices (ranging from 0.75 to 1.23) indicates differing experiences or perceptions among respondents, possibly due to differences in library size, available funding, or user demographics. These findings suggest that while the institution's strategic direction is clear, further standardization and inclusive training may be necessary to ensure consistent sustainability practices across all library branches.

Overall, the findings of the study highlight a transformative shift in academic library operations on Negros Island, where service delivery is increasingly characterized by inclusivity, digital innovation, and ecological responsibility [30, 31]. This evolution reflects a growing alignment with broader global movements, particularly the United Nations Sustainable Development Goals (SDGs), with libraries actively supporting it through practices such as digital resource integration and sustainable service models [32]. Incorporating the SDGs into library planning provides a structured approach for setting measurable objectives, assessing impact, and ensuring accountability enabling academic libraries to transition from isolated initiatives to systematized sustainability frameworks [31]. In the context of Negros Island, this alignment enhances both operational efficiency and institutional relevance, positioning academic libraries as agents of sustainable innovation within their communities [33].

3.2.3. Sustainability Practices on Physical Set-up and Indoor Environments

Table 4 presents the extent to which sustainable practices are implemented in the physical setup and indoor environments of academic libraries. The area mean score of $M = 3.96$ ($SD = 0.75$) suggests that, overall, these practices are "Highly Practiced," with strengths in spatial design and environmental elements, though some areas still present opportunities for development.

Table 5.
Sustainability Practices on Physical Set-up and Indoor Environment.

Rank	Indicators	*M*	*SD*	Interpretation
1	Design effective space arrangement by considering physical resources and user movement flow.	4.51	0.64	Very Highly Practiced
2	Incorporate plants and greenery in spaces to promote healthy air quality and reduce stress and anxiety.	4.35	0.91	Highly Practiced
3	Install energy-efficient LED lighting to reduce energy consumption.	4.20	1.02	Highly Practiced
4	Provide ergonomic and locally made furniture to promote a comfortable indoor environment for users and staff.	4.17	0.94	Highly Practiced
5	Provide interior space with access to daylight and natural ventilation.	4.17	0.96	Highly Practiced
6	Provide occupants with a connection between indoor spaces and outdoor views using glass walls/windows.	4.14	1.10	Highly Practiced
7	Ensure that ventilation and air conditioning systems were maintained & optimized to help reduce energy consumption.	4.11	0.99	Highly Practiced
8	Undergo construction or remodeling of buildings to carry the message of sustainable design into the community.	4.09	1.13	Highly Practiced
9	Adopt measures to reduce noise levels, such as soundproofing and white noise machines.	3.40	1.34	Moderately Practiced
10	Use sensors to illuminate places in the library when in use.	2.45	1.37	Less Practiced
	Area Mean	3.96	0.75	Highly Practiced

Note: Mean Score: 4.51-5.0 (Very Highly Practiced), 3.51-4.50 (Highly Practiced, 2.51-3.50 (Moderately Practiced), 1.51-2.50 (Less Practiced), 1.0-1.50 (Least Practiced).

Among the highest-rated practices is "designing effective space arrangements" ($M = 4.51$, $SD = 0.64$), classified as "Very Highly Practiced." The low standard deviation reveals a strong consensus among respondents, affirming that academic libraries are effective in structuring user-friendly, accessible, and functional environments. Spatial quality in academic environments enhances cognitive engagement and learning outcomes [34]. Similarly, practices such as "incorporating plants and greenery" ($M = 4.35$, $SD = 0.91$) and "using energy-efficient LED lighting" ($M = 4.20$, $SD = 1.02$) also

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Vol. 9, No. 6: 2690-2706, 2025
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received high ratings, indicating a strong institutional commitment to eco-friendly design and indoor air quality improvements. Integrating greenery improves indoor air quality and users' psychological well-being by reducing stress and creating more welcoming spaces [35]. Likewise, the widespread implementation of LED lighting indicates a commitment to energy conservation and cost efficiency, reflecting the energy-saving initiatives in library operations [36]. Other commendable practices include providing ergonomic furniture and maximizing daylight access, contributing to library user comfort [37].

On the other hand, "adopting noise reduction measures" (M = 3.40, SD = 1.34) and "using sensors for lighting" (M = 2.45, SD = 1.37) were rated lower and exhibited higher standard deviations, suggesting inconsistency in their implementation. These results reflect existing limitations in adopting more advanced green technologies due to resource and infrastructure constraints [38]. While there is evident progress in implementing sustainable features that are both functional and financially viable, more sophisticated innovations like sensor-based lighting remain underutilized due to technical and financial barriers [39].

Generally, these findings indicate that academic libraries in Negros Island are actively engaging in sustainable design principles, particularly in areas that are both cost-effective and immediately impactful, such as space optimization, natural lighting, and greenery. However, more advanced green technologies, like sensor lighting and noise-reducing infrastructure, remain underutilized. These gaps suggest the need for strategic investments and policy support to help academic libraries evolve into fully sustainable institutions. The trend mirrors broader observations that although libraries firmly intend for sustainability, fully realizing green design and energy efficiency often requires substantial policy backing and investment [40].

3.2.4. Sustainability Practices on Leadership and Governance

Table 6 presents the data on sustainability practices under the domain of leadership and governance in academic libraries. The overall mean score of 4.13 (SD = 0.74) falls under the "Highly Practiced" category, indicating that sustainability is significantly embedded in leadership structures and operational strategies. The relatively low standard deviation reflects a strong consensus among respondents, suggesting uniform implementation of these practices across institutions. This finding confirms the increasing importance placed on environmental responsibility in library governance, aligning with studies that emphasize the strategic role of library leaders in integrating sustainability into institutional operations and planning [40].

Among the specific indicators, the most highly practiced item is "Observe the Conservation of Paper, Water, and Energy Usage" (M = 4.51, SD = 0.73). This very high mean score implies a strong institutional commitment to resource conservation, and the low standard deviation reflects consistency in this practice among academic libraries. This result underscores the proactive steps taken by libraries to reduce their environmental footprint, particularly in energy and utility consumption [41].

The second most practiced item is "Embrace Sustainability Initiatives like 5Ss and 3Rs in All Library Operations" (M = 4.42, SD = 0.58). The adoption of operational frameworks such as 5S (Sort, Set in order, Shine, Standardize, Sustain) and 3Rs (Reduce, Reuse, Recycle) reflects the integration of sustainability principles into daily routines. The low standard deviation also suggests a strong consensus, indicating consistent application across institutions [41].

Following this is "Observe Proper Waste Segregation and Disposal" (M = 4.35, SD = 0.86), which also falls within the "Highly Practiced" range. The result suggests that libraries are actively implementing proper waste management protocols, although the higher standard deviation points to some differences in execution or perception. Nonetheless, it highlights libraries' efforts to minimize environmental impact through responsible waste handling [40].

At the lower end of the ranking is "Create a Greening Committee to Provide Awareness and Assistance" (M = 3.52, SD = 1.42). While it is still categorized as "Highly Practiced," the high standard deviation reveals considerable variability in implementation. This suggests that while the idea is valued,

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

its actual adoption may be hindered by differing institutional priorities, resource limitations, or lack of expertise. It reflects earlier findings that, although library staff often hold favorable attitudes toward sustainability, their understanding and application of structured eco-friendly programs may be limited [42].

In sum, the findings in Table 6 affirm that academic libraries are actively pursuing sustainability initiatives under the purview of leadership and governance. Core practices such as conserving resources, integrating sustainability into daily operations, and managing waste are widely practiced and consistently implemented. However, initiatives requiring structural or policy-level commitments like greening committees or formal environmental policies appear less consistently adopted. These findings reiterate academic libraries' pivotal role in promoting sustainability within higher education institutions.

Table 6.
Sustainability Practices on Leadership and Governance.

Rank	Indicators	*M*	*SD*	Interpretation
1	Observe the conservation of paper, water, and energy usage.	4.51	0.73	Very HighlyPracticed
2	Embrace sustainability initiatives like 5Ss and 3Rs in operations.	4.42	0.58	Highly Practiced
3	Observe proper waste segregation and disposal.	4.35	0.86	Highly Practiced
4	Conduct periodic assessments and maintenance audits of the facility.	4.23	0.81	Highly Practiced
5	Integrate sustainable constructs into library planning and decision-making.	4.14	0.98	Highly Practiced
6	Procure and use eco-friendly and non-toxic cleaning products to promote a healthy indoor environment for library users and staff.	4.15	0.83	Highly Practiced
7	Participate in training on environmentally and sustainability-related topics.	4.06	1.06	Highly Practiced
8	Take part in certification systems or community-driven sustainability initiatives.	3.95	1.14	Highly Practiced
9	Establish a written policy that addresses environmental sustainability.	3.92	1.24	Highly Practiced
10	Create a greening committee to provide awareness and assistance.	3.52	1.42	Highly Practiced
	Area Mean	**4.13**	**0.74**	**Highly Practiced**

Note: Mean Scale: 4.51-5.0 (Very Highly Practiced), 3.51-4.50 (Highly Practiced, 2.51-3.50 (Moderately Practiced), 1.51-2.50 (Less Practiced), 1.0-1.50 (Least Practiced)

3.3. On the Influencing Factors of Sustainability Practices

Table 7 presents the results of a multiple linear regression analysis to identify the predictors of sustainability practices in academic libraries. The model incorporated seven independent variables—sex, age, geographical location, campus, population size, type of institution, and average annual budget—with overall sustainability practices as the dependent variable.

The result revealed that age was a significant negative predictor ($\beta = -0.387$, $p = .003$), indicating that younger academic librarians demonstrate greater engagement with sustainability practices than their older counterparts. The result implies that institutions should consider empowering younger staff through leadership roles in sustainability-focused projects or committees to leverage their enthusiasm and innovative thinking. This finding aligns with generational research, highlighting that Generation Z and Millennials are notably more environmentally aware and proactive in green initiatives than previous generations [43, 44].

The campus variable ($\beta = 0.359$, $p = .018$) and population size ($\beta = 0.296$, $p = .032$) were also positively associated with sustainability practices. These findings imply that libraries on main campuses and those serving larger academic populations are more likely to adopt and institutionalize sustainability measures. It could be due to greater access to resources, visibility, or administrative support in larger or centrally located campuses. Hence, decentralized or smaller campuses may require targeted interventions and resource allocation to encourage equal participation in sustainability programs. These findings support the assertion that institutional size and physical scope directly affect the success of green initiatives, as larger institutions face greater resource demands and often have more infrastructure and administrative mechanisms to manage and support such efforts [45].

Edelweiss Applied Science and Technology
ISSN: 2576-8484
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The average annual budget was another strong and statistically significant predictor ($\beta = 0.391$, $p = .004$), highlighting the critical role of financial capacity in enabling sustainability practices. Libraries with higher budget allocations are more likely to invest in sustainable infrastructure, professional development, and green technologies, enhancing their ability to implement environmentally responsible programs [28, 46].

In contrast, the variables sex, geographical location, and type of institution were not statistically significant predictors of sustainability practices ($p > .05$). This suggests that gender identity, urban-rural campus setting, and whether the institution is public or private do not substantially influence the degree to which sustainability is practiced. These findings imply a more uniform recognition of sustainability across different institutional profiles, though institutional resources and organizational priorities may still shape variation in implementation.

The result implies that higher education institutions should focus on strategic budget allocations, inclusive campus-wide policies, and targeted support for younger professionals to serve as sustainability champions. Moreover, smaller or less-resourced campuses may require tailored support mechanisms to foster equity in sustainability implementation across academic libraries. These results offer valuable insights for policymakers, educational leaders, and library administrators seeking to mainstream sustainability into academic library operations.

Table 7.
Regression Coefficients Predicting Sustainability Practices.

Model	Unstandardized Coefficients		Standardized Coefficients	*t*	*p*
	B	Std. Error	β		
1 (Constant)	3.506	0.678	—	5.174	< 0.001
Sex	0.073	0.196	0.044	0.370	0.713
Age	-0.543	0.173	-0.387	-3.148	0.003*
Geographical Location	-0.169	0.202	-0.106	-0.836	0.407
Campus	0.511	0.209	0.359	2.446	0.018*
Population	0.440	0.199	0.296	2.205	0.032*
Type of Institution	-0.301	0.198	-0.196	-1.523	0.133
Average Annual Budget	0.552	0.181	0.391	3.047	0.004*

Note: *$p < .05$ indicates statistical significance.*

3.4. Challenges in Implementing Sustainability Practices

Librarians face several notable challenges in implementing environmentally sustainable practices within their institutions. As shown in Figure 1, the most frequently cited obstacle identified by 70.8% of respondents is the limited availability of financial resources necessary for transitioning from print to electronic resources in an eco-responsible manner. This financial constraint is a widely recognized barrier in libraries, particularly in developing countries [47]. Similarly, inadequate funding continues to hinder library modernization efforts [48] while budgetary constraints also pose challenges to adopting green technologies [49, 50].

Additionally, 69.2% of respondents express the need for better awareness of regulatory requirements related to sustainability initiatives, highlighting the complexity of navigating legal frameworks. Non-compliance or inefficient efforts can hinder progress toward greener library operations [51].

Furthermore, half of the respondents (50.8%) face the challenge of inadequate training and education on sustainability practices for both library personnel and users. While less prevalent than the top two challenges, this issue underscores the necessity of comprehensive training programs to equip library staff and users with the essential knowledge and skills for sustainable operations [52]. The lack of understanding among consumers and library staff is a significant challenge in adopting green practices [5, 53].

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

The data also shows that 49.2% of respondents regard the rapid change in digital technology as a significant challenge. It highlights the fast-paced nature of technological advancements and the ongoing demand for libraries to adapt accordingly. Libraries must stay current with emerging technologies while ensuring that these innovations support eco-friendly practices. Libraries are particularly vulnerable to the swift evolution of technical and digital tools as they strive to adopt green practices [5, 50, 51]. This vulnerability emphasizes the need for libraries to integrate environmentally responsible technologies and approaches into their daily operations proactively.

Additionally, 47.7% of respondents report the lack of sustainable policies as a barrier to adopting a consistent and comprehensive sustainability strategy. Developing and implementing context-specific policies are essential to effectively embed sustainability within library management and operations [54, 55]. The result paints a complex picture of libraries' obstacles when striving for sustainable practices. Overcoming these challenges requires a multifaceted approach that combines financial support, regulatory guidance, training programs, and the development of sustainable policies to drive meaningful progress toward greener libraries.

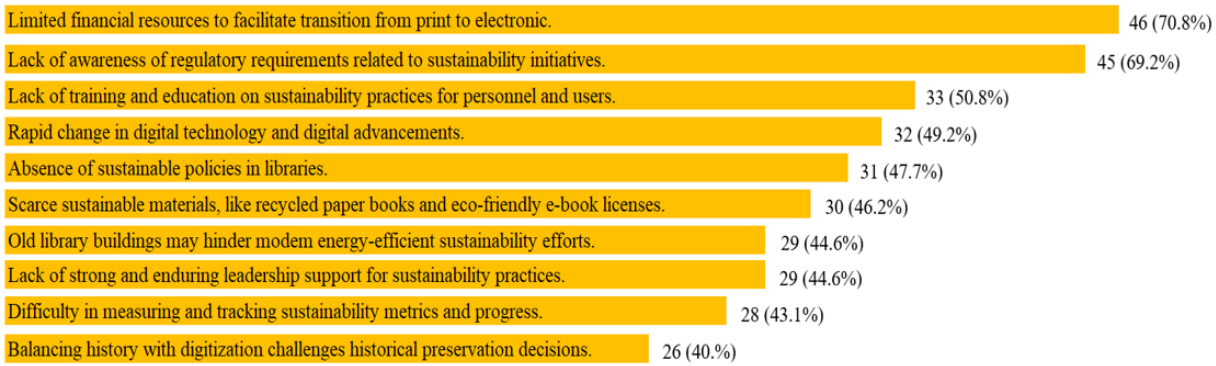

Figure 1.
Challenges in implementing sustainable practices.

4. Conclusion and Recommendations

In the journey towards sustainability, academic libraries on Negros Island, Philippines, have demonstrated a growing commitment to eco-friendly practices across core areas of librarianship, particularly in collection management, service delivery, and green infrastructure. This evolution reflects a broader shift, highlighting the libraries' transformation from traditional print-centered operations to a more environmentally responsible model.

Despite facing challenges such as limited resources, complex regulatory frameworks, and institutional constraints, the path forward for advancing sustainability in academic libraries is both urgent and actionable. Library administrators and leaders must prioritize investment in continuous staff training, allocate funding for specialized sustainability programs, and embed green initiatives into institutional planning and governance. It includes integrating sustainability priorities into annual budgeting and establishing measurable indicators to track progress.

Library personnel are encouraged to participate actively in professional development activities, collaborate with colleagues and external networks, and take initiative in leading green practices within their institutions. At the same time, campus administrators must acknowledge libraries as strategic partners in institutional sustainability, providing support in terms of policy alignment, infrastructure upgrades, and funding. Regulatory authorities are also urged to provide more consistent, more consistent, and supportive guidelines that will empower academic libraries to comply with national and global sustainability frameworks.

Academic institutions offering Library and Information Science (LIS) programs should integrate green library practices into their curricula to equip future information professionals with specific

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464

competencies in areas such as eco-friendly collection development, energy-efficient library design, sustainable service models, digital resource management, and policy advocacy for environmental sustainability.

Furthermore, regional professional organization councils, such as the Philippine Librarians Association, Inc. – Negros Island Region Librarians Council (PLAI-NIRLC), are strongly encouraged to lead by example by organizing sustainability-focused seminars, training workshops, and collaborative projects. They can serve as catalysts in fostering region-wide awareness, sharing best practices, and developing sustainability guidelines tailored to local library contexts. Such councils are in a unique position to influence professional standards, promote advocacy, and build a culture of environmental stewardship across member institutions.

Finally, sustainability advocates within the academic library community must continue to champion efforts that minimize the ecological footprint of library operations. Through the united commitment of institutional leaders, professional bodies, educators, and practitioners, the vision of transitioning "From Print to Planet" can be achieved—redefining libraries not only as knowledge hubs but also as responsible agents of environmental change.

5. Implication

The overall findings of this study have significant implications for the library and information science landscape. They affirm that academic librarians are key drivers of sustainability within higher education institutions, particularly through their strong practices in service delivery and collection management. However, the persistence of challenges such as inadequate infrastructure, limited funding, and weak governance structures suggests that sustainable practices cannot be fully realized without robust institutional support. These findings highlight the need for systemic changes such as strategic planning, targeted investments, and leadership-driven initiatives to embed sustainability into the core functions of academic libraries. Furthermore, the variation in sustainability practices across different types of institutions and campuses underscores the importance of tailoring strategies to local contexts. As such, this study encourages library leaders, policymakers, and educators to view sustainability not as an optional enhancement but as an essential, long-term commitment vital to the relevance, resilience, and impact of academic libraries in the 21st century.

Funding:
The APC and other publication cost was financed by the Research and Development Services Office of Carlos Hilado memorial State University.

Transparency:
The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Acknowledgements:
The authors would like to thank Higher Educational Institutions in Negros Island, the Philippine Librarian's Association, Incorporated – Negros Island Region Librarian's Council, and Carlos Hilado Memorial State University for the support.

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 6: 2690-2706, 2025
DOI: 10.55214/25768484.v9i6.8464