Implementation of the Green Library as an Effort to Strengthen Library Support for UI GreenMetric

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Abstract
The Green Library has emerged as a key strategy in promoting environmental sustainability within higher education institutions. This study explores the implementation and impact of Green Library practices at the Library of Universitas Sebelas Maret (UNS) and their contribution to the university's performance in the UI GreenMetric ranking. A qualitative descriptive approach was employed, with data collected through observation, document analysis, and informal interviews involving four groups of informants: librarians, faculty members, students, and representatives from the Sub-directorate of Green Campus and SDGs at UNS. The library's sustainability initiatives include paperless digital services, waste segregation, energy-efficient lighting, and user-centered environmental education. Informants acknowledged the library's positive role but also pointed out existing gaps, such as the absence of a formal roadmap and a systematic reporting mechanism. This study affirms the library's strategic role in driving sustainable campus transformation and recommends enhancing institutional collaboration, adopting data-driven reporting, and developing long-term sustainability policies.

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Abstrak
Green Library telah muncul sebagai strategi utama dalam mendorong keberlanjutan lingkungan di institusi pendidikan tinggi. Penelitian ini mengeksplorasi implementasi dan dampak praktik Green Library di UPT Perpustakaan Universitas Sebelas Maret (UNS) serta kontribusinya terhadap kinerja universitas dalam pemeringkatan UI GreenMetric. Pendekatan deskriptif kualitatif digunakan dengan teknik pengumpulan data melalui observasi, studi dokumentasi, dan wawancara informal dengan empat kelompok informan: pustakawan, dosen, mahasiswa, dan perwakilan Subdirektorat Green Campus dan SDGs UNS. Inisiatif keberlanjutan perpustakaan meliputi layanan digital tanpa kertas, pemilahan sampah, pencahayaan hemat energi, dan edukasi lingkungan yang berfokus pada pengguna. Para informan mengakui peran positif perpustakaan, namun menyoroti adanya kekurangan seperti belum adanya roadmap formal dan sistem pelaporan yang sistematis. Penelitian ini menegaskan peran strategis perpustakaan dalam mendorong transformasi kampus berkelanjutan, serta merekomendasikan penguatan kolaborasi kelembagaan, pelaporan berbasis data, dan pengembangan kebijakan keberlanjutan jangka panjang.

I. INTRODUCTION

Climate change, resource depletion, and growing waste generation are pressing global challenges that demand responses from all societal sectors, including higher education institutions (Drahein, De Lima and Da Costa, 2019; Fausey et al., 2024). As hubs of knowledge production and future leadership, universities play a strategic role in advancing sustainability (Soltani & Nikou, 2020). One expression of this role is their participation in global sustainability rankings such as the UI GreenMetric, which assesses campus performance across six indicators: infrastructure, energy and climate change, waste and water management, transportation, and education and research (Atici et al., 2021).

UI GreenMetric acts both as a benchmarking tool and a catalyst for embedding sustainability into institutional strategies and operations. It urges every academic unit, including university libraries, to contribute meaningfully to sustainability goals. While environmental sustainability is well-documented in research, specific studies on campus-level data and implementation remain limited (Petratos and Damaskou, 2015). Academic libraries today are evolving beyond their traditional roles as information repositories into dynamic spaces for learning, literacy, and social engagement (Fedorowicz-Kruszewska, 2020; Cox, 2021; Ashiq, Jabeen and Mahmood, 2022). The Green Library concept operationalizes libraries' contribution to sustainability through eco-

friendly design, energy conservation, service digitalization, and educational initiatives that promote sustainable values (Afacan, 2017; Mwanzu et al., 2023).

Aligned with these principles, the UPT Library of Universitas Sebelas Maret (UNS) has adopted several eco-oriented practices. These include transitioning to LED lighting, offering e-journals and e-books, maintaining a digital repository, implementing digital signage for information delivery, and initiating paper reduction campaigns (Chalfoun, 2014). Additionally, the library incorporates SDG themes into its literacy services and collaborates with campus stakeholders on environmental programs.

However, a lack of systematic documentation on the implementation, evaluation, and alignment of Green Library practices with UI GreenMetric indicators remains a challenge. Key obstacles include the absence of a strategic development roadmap, limited reporting of measurable outcomes, and insufficient cross-unit coordination (Puertas, Guaita-Martinez and Marti, 2023). This study explores the implementation and impact of Green Library practices at the UNS Library and evaluates their contribution to the university's performance in the UI GreenMetric ranking.

This study draws on the Sustainable Campus and Green Library frameworks developed by the American Library Association (ALA) and the International Federation of Library Associations and Institutions (IFLA), which advocate for integrating environmental, social, and economic dimensions into library management. These include energy efficiency, inclusive practices, waste reduction, and sustainability literacy, allowing libraries to act as institutional agents of sustainability and academic culture transformation (Afacan, 2017; Fedorowicz-Kruszewska, 2020; Vijesh et al., 2024).

A qualitative descriptive approach was employed, using direct observation, internal document analysis, and informal interviews with four informant groups: librarians, faculty members, students, and representatives from the Sub-directorate of Green Campus and SDGs at UNS. Thematic analysis was used to identify correlations between Green Library practices and UI GreenMetric indicators, as well as future development opportunities.

This research contributes to the contextual development of a Green Library model for Indonesian universities and supports strategic efforts to enhance sustainability rankings. A Green Library is not limited to green-certified infrastructure but encompasses services and practices that foster a culture of sustainability. The term itself remains fluid, with some interpretations focusing solely on environmental design, while others emphasize broader organizational and behavioral transformation (Jones and Wong, 2016).

This research contributes to the contextual development of a Green Library model for Indonesian universities and supports strategic efforts to improve sustainability ranking performance. A Green Library is not limited to environmentally certified buildings but also includes libraries that promote sustainability through operational practices, services, and organizational culture (Jones and Wong, 2016). The term "Green Library" does not yet have a universally agreed-upon definition. Some sources equate it with a sustainable library, while others confine it solely to environmental sustainability (ES) aspects (Mwanzu, Bosire-Ogechi and Odero, 2023).

II. METHOD

This study employs a qualitative descriptive approach to explore and describe the implementation of Green Library practices at the Library Unit (UPT) of Universitas Sebelas Maret (UNS). This approach is appropriate for investigating context-bound institutional practices and policy implementation related to sustainability.

The research was conducted in five sequential stages to ensure methodological rigor and data credibility: (1) problem identification and objective formulation, (2) literature review and analysis of institutional sustainability documents, (3) direct observation of library infrastructure and activities, (4) informal interviews with key informants, and (5) data analysis and reporting.

Informants were selected using purposive sampling and categorized into four groups: librarians (as technical implementers), faculty members (as service users and academic collaborators), students (as primary users of library services), and representatives from the Sub-directorate of Green Campus and SDGs UNS (as institutional policymakers). These groups were chosen based on their relevance and direct involvement in Green Library activities.

The study was conducted at the UPT Library of Universitas Sebelas Maret, Surakarta serving as the central academic and literacy hub on campus between February to April 2025.

Data were analyzed thematically to identify patterns, categories, and relationships between

sustainability practices and institutional strategies.

III. RESULT AND DISCUSSION

A. Result

The findings of the study indicate that the Library Unit (UPT) of Universitas Sebelas Maret has implemented various programs and initiatives aligned with the principles of a Green Library. These implementations cover aspects of infrastructure, digital services, waste management, and environmental literacy education. The findings are classified into four main areas.

These findings reflect four core dimensions of Green Library implementation at the UPT Library of Universitas Sebelas Maret. First, the aspect of environmentally friendly infrastructure includes improvements in spatial layout, the use of energy-efficient lighting such as LED, incorporation of natural ventilation, and the adoption of eco-conscious materials throughout the library environment. Second, service digitalization and paper consumption reduction are demonstrated through various innovations such as online clearance systems, mandatory soft-file submission of academic works, and RFID-based circulation services, all of which minimize paper use and enhance operational efficiency. Third, waste management and environmental education are addressed through the provision of waste segregation facilities, the promotion of reusable drink containers, and educational campaigns aimed at cultivating ecological awareness and responsible behavior among library users. Lastly, active engagement with the Green Campus and UNS SDGs Subdirectorate reflects the library's institutional collaboration to support sustainability reporting and to position itself as a strategic partner in advancing the university's environmental goals.

To better understand the scope and relevance of the Green Library practices implemented at the UPT Library of Universitas Sebelas Maret, this study classified the findings into four key thematic areas: environmentally friendly infrastructure, service digitalization and paper reduction, waste management and environmental education, and institutional engagement. Each practice was then mapped against the corresponding indicators of the UI GreenMetric ranking system, which serves as a framework for evaluating campus sustainability performance across multiple dimensions.

The table below summarizes these practices and their alignment with the relevant UI GreenMetric indicators. It illustrates how each initiative contributes to measurable sustainability goals through reductions in energy consumption, waste generation, and increased awareness of environmental responsibility within the academic community.

Table 1. Green Library Practices and Their Alignment with UI GreenMetric Indicators

No	Green Library Practice	Related UI GreenMetric Indicator	Brief Description
1	Use of LED lights and inverter AC	Energy and Climate Change	Reduces energy consumption and carbon emissions
2	Service digitalization (online clearance, RFID, e-books) / Paperless	Waste; Education	Reduces paper use and supports digital learning
3	Digital repository of scientific works	Education	Promotes open access, paperless environment, and knowledge dissemination
4	Waste management education and waste bank programs	Waste; Education	Instills environmental awareness among the academic community
5	Campaign for using reusable drink tumblers	Waste	Reduces single-use plastics through user behavior change

Source: Research findings based on field observation and alignment with UI GreenMetric indicators (Atici et al., 2021).

The classification presented in Table 1 provides a structured overview of how the UPT Library of Universitas Sebelas Maret contributes to various dimensions of sustainability as defined by the UI GreenMetric indicators. By aligning specific library practices with measurable sustainability categories such as energy efficiency, waste reduction, and environmental education the table serves as an analytical framework for understanding the scope and impact of Green Library initiatives.

Each of these practices will be elaborated in the following sub-sections below, which

detail the library's efforts in infrastructure transformation, service innovation, environmental engagement, and institutional collaboration. Together, these initiatives illustrate the library's multifaceted role in supporting a sustainable academic ecosystem and enhancing the university's overall performance in global sustainability rankings.

1. Environmentally Friendly Infrastructure

   The UPT Library of UNS has undertaken substantial improvements in infrastructure and spatial design. The use of LED lights for energy efficiency, natural air circulation in certain areas, placement of indoor plants, and utilization of natural lighting are part of the strategies to reduce energy consumption. The library also uses energy-efficient inverter air conditioners and has replaced some furniture with items made from recycled materials. Based on direct observation, the study rooms appear bright, comfortable, and conducive to users' focus and learning.

2. Service Digitalization and Paper Consumption Reductiondan

   One of the concrete contributions of the UPT Library of Universitas Sebelas Maret in supporting sustainability principles is the adoption of policies and services that directly reduce paper usage on campus. This strategy is implemented through several innovations in digital and automated services.

   First, the library has implemented an online clearance system, allowing students to complete administrative library procedures online without having to print and submit physical documents. This procedure not only simplifies user access but also significantly reduces paper consumption previously used for forms, certificates, and other administrative documents (Srirahayu, Harisanty and Anugrah, 2023).

   Secondly, in the submission process of academic works such as undergraduate theses, master's theses, and dissertations, the library has implemented a policy requiring submissions in soft file format through an online upload system to the institutional repository. As a result, students are no longer required to submit multiple printed copies, which previously contributed to significant paper consumption. This policy also accelerates the integration of academic works into the UNS academic information system and digital repository, while expanding public access to scientific reference materials.

   Thirdly, the RFID-based lending and return system has reduced the need for printed loan slips and has expedited circulation services. Users simply use their library membership cards or an integrated mobile application to carry out self-service transactions via RFID machines. This enhances operational efficiency and supports the transition toward a paperless library service (Shi, Tang and Lu, 2020; Abcouwer and Van Loon, 2021; Obsanga and Enierga, 2021).

   Overall, the policies and systems implemented by the UNS Library in the context of service digitalization demonstrate a strong commitment to reducing paper consumption as part of its Green Library strategy and its contribution to the *Waste* and *Education* indicators of the UI GreenMetric.

   Information literacy activities are also conducted online, such as training on the use of e-resources and the introduction of tools like Grammarly. Both faculty members and students have stated that these digital services are efficient, support distance learning, and reduce reliance on printed materials (Drahein, De Lima and Da Costa, 2019; Ali and Anufriev, 2020).

3. Waste Management and Environmental Education

   As part of its commitment to sustainability, the UNS Library (UPT Perpustakaan Universitas Sebelas Maret) also runs waste management and environmental education programs aimed not only at internal users but also at the surrounding campus community. One notable initiative is the organization of waste management education activities based on the "waste bank" concept. In this program, the library collaborates with relevant units to raise awareness among local residents about the importance of waste separation and the principles of the circular economy. This activity represents the library's expanded role as an agent of social change and community empowerment.

   The library provides separate waste bins, such as organic, inorganic, and paper

waste. These bins are strategically placed in high-traffic areas such as reading rooms and the main lobby, and are equipped with educational labels and visual designs. This effort aims not only to improve waste management but also to consistently instill environmentally friendly behavior among library users.

In addition, the library actively encourages the academic community to reduce the use of single-use plastics, particularly bottled drinks. Through visual campaigns, users are invited to bring and use their own reusable tumblers as an eco-friendly alternative. This campaign promotes sustainable habits as part of a behavioral change strategy.

These initiatives align with the principles of *environmental literacy* or *Green Information Literacy*, which expands the scope of information literacy with a sustainability perspective(Fedorowicz-Kruszewska, 2023). Within the Green Library framework, the focus is not only on infrastructure changes but also on trans-forming user culture through educational approaches (Mwanzu, Bosire-Ogechi, and Odero, 2023). This contribution supports the *Waste* and *Education* indicators of the UI GreenMetric, while strengthening the library's role as an environmental education hub within the green campus ecosystem of UNS.

4. Engagement with the Green Campus and UNS SDGs Subdirectorate

The Green Campus and UNS SDGs Subdirectorate confirmed that the library is a strategic unit that can support campus sustainability reporting, particularly in relation to UI GreenMetric indicators. In an informal interview, a representative from the Subdirectorate stated that the library holds a strategic position in contributing to the achievement of UI GreenMetric indicators. This is due to its role as a public academic space that is widely used by students, faculty members, researchers, and the general public. As a convergence point for academic activities across faculties, the library is an ideal space to embed sustainability values through both infrastructure and educational activities.

Moreover, the library also has flexible and multifunctional physical spaces such as reading rooms, discussion areas, literacy corners, and indoor gardens that can be managed and developed in line with the principles of a green university. These spaces hold the potential to become venues for environmental education, green literacy exhibitions, and even pilot projects for micro-scale green technology implementation on campus.

The Green Campus and UNS SDGs Subdirectorate views the library's contribution not only as technical such as in waste reduction or energy efficiency but also as strategic and symbolic, demonstrating to the public that sustainability practices are embedded within the university's academic culture. Therefore, the existence and systematic management of a Green Library will greatly support UNS's reporting and achievements in the UI GreenMetric, particularly in the areas of Education, Setting and Infrastructure, and Waste.

Nevertheless, to ensure that these contributions are properly recorded and optimally integrated, a more structured reporting system and clear quantitative indicators are needed to ensure alignment between library initiatives and measurable sustainability targets at the institutional level. The library is expected to work closely with the Green Campus Subdirectorate to develop a Green Library roadmap and design internal evaluation instruments that support the university's sustainability goals in a comprehensive manner.

In general, all informants stated that the Green Library program has made a tangible contribution to behavioral change and increased environmental awareness among the academic community. However, consistent implementation, regular evaluation, and strengthened cross-unit synergy remain urgent needs to ensure that these efforts have a broader and more measurable impact.

B. Discussion

The study demonstrates that UPT Perpustakaan Universitas Sebelas Maret has systematically implemented sustainability-oriented practices in line with the Green Library and Sustainable Campus frameworks (Jones and Wong, 2016; Afacan, 2017; Vijesh et al., 2024). These efforts reflect a deliberate shift from traditional library functions toward

a more strategic role in advancing environmental and institutional sustainability (Fedorowicz-Kruszewska, 2020).

Within the Green Library framework as outlined by the American Library Association (ALA) and the International Federation of Library Associations (IFLA), libraries contribute across three domains: (1) environmentally responsible infrastructure, (2) transformation of services through paperless and energy-efficient systems, and (3) sustainability-focused educational programming (Mwanzu, Bosire-Ogechi and Odero, 2023). All three domains are clearly evident in the case of the UPT Library of UNS.

First, in terms of infrastructure and spatial layout, the library has implemented energy-saving initiatives such as LED lighting, natural ventilation, increased use of natural lighting, and the integration of green open spaces. These infrastructure strategies not only reduce energy consumption but also redefine how libraries contribute to institutional climate goals. These actions are strongly aligned with the Energy and Climate Change as well as the Setting and Infrastructure indicators of the UI GreenMetric (Chalfoun, 2014; Atici et al., 2021).

Second, in the realm of services and digital transformation, initiatives such as online clearance, digital thesis submission, and RFID-based lending systems reflect a clear alignment with paperless service principles. These practices not only increase operational efficiency but also support resource conservation and service inclusivity (Abcouwer and Van Loon, 2021; Obsanga and Enierga, 2021). From a sustainability standpoint, such digitalization embodies the principle of eco-efficiency—achieving maximum output with minimal environmental cost (Ali and Anufriev, 2020; Shi, Tang and Lu, 2020). These efforts reinforce the library's relevance within both the Waste and Education categories of the UI GreenMetric.

Third, in waste management and user education, the library provides waste separation infrastructure and organizes educational programs, including waste bank campaigns and plastic reduction initiatives. The use of recycling corners and visual campaigns promoting reusable drink containers represents an experiential environmental education strategy (Fedorowicz-Kruszewska, 2020). These initiatives serve to strengthen the library's identity as a hub for environmental literacy and cultural transformation (Mwanzu, Bosire-Ogechi and Odero, 2023).

Fourth, the library actively collaborates with the Green Campus and SDGs Subdirectorate at UNS. As a multifunctional public space used by students, faculty, and researchers, the library is well-positioned to serve as a platform for implementing university-wide sustainability agendas. This institutional engagement underscores the library's symbolic and operational role in aligning academic functions with global sustainability commitments (Puertas, Guaita-Martinez and Marti, 2023). Such collaboration is essential for bridging technical practice with strategic policy integration.

Despite these positive developments, several institutional challenges remain. The absence of a comprehensive Green Library roadmap, limited quantitative metrics, and the lack of a formal reporting system hinder the library's contributions from being fully institutionalized and recognized within the UI GreenMetric framework (Petratos and Damaskou, 2015). These gaps indicate that while the technical implementation is underway, further integration into strategic evaluation systems is required.

This discussion underscores the importance of embedding the Green Library initiative within a structured, theory-informed, and data-driven approach (Drahein, De Lima and Da Costa, 2019). The library must not only act as a service provider but also evolve into an evidence-based contributor to institutional sustainability reporting and performance improvement.

In conclusion, the interplay between Green Library practices, campus sustainability frameworks, and the UI GreenMetric ranking system forms a mutually reinforcing cycle (Soltani and Nikou, 2020; Jabeen et al., 2024). Together, these components are driving the transformation of the academic library into a structured, measurable, and high-impact catalyst for sustainable institutional change.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

This study concludes that the Green Library at the UPT Library of Universitas Sebelas Maret has been implemented through diverse sustainability initiatives. These include the use of eco-friendly infrastructure, digital service innovations, waste

management programs, and environmental literacy education. These practices align with and contribute to the achievement of UI GreenMetric indicators, particularly in the areas of energy and climate change, waste management, and education.

Informants recognized the library's positive role in fostering a culture of sustainability across the campus. However, the absence of a structured development roadmap and a data-driven reporting mechanism poses a key challenge to ensuring that these contributions are systematically tracked and institutionally leveraged for greater impact.

B. Suggestion

The UPT Library of Universitas Sebelas Maret should develop a strategic and measurable roadmap for long-term Green Library development. In parallel, a data-driven reporting framework must be established and integrated with the Green Campus and SDGs Subdirectorate to ensure that the library's sustainability contributions are systematically recorded and institutionally aligned.

Furthermore, strengthening inter-unit collaboration, providing continuous professional development for librarians in environmental literacy, and formulating internal evaluation indicators will reinforce the library's strategic role in institutional sustainability transformation.

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