

## **Implementation of Ecological Principles in Higher Education Library Management: A Case Study of the Universitas Muhammadiyah Sinjai Library**

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### **ABSTRACT**

*This study aims to analyze the implementation of ecological principles in the management of the Universitas Muhammadiyah Sinjai of Sinjai Library by referring to Fritjof Capra's five ecological principles: interdependence, recycling, partnership, flexibility, and diversity. The study employed a descriptive qualitative method with data collected through observation, interviews, and documentation. The results show that the library functions as a living system in which each element interacts and depends on one another. The principle of interdependence is reflected in the connection between librarians, users, technology, and institutional policies, although system integration remains limited. Recycling is implemented through collection digitization and efficient resource use. Partnership is realized through collaboration with the National Library and lecturers in developing collections. Flexibility appears in librarians' ability to adapt services to technological dynamics, while diversity is evident in the variety of collections, human resources, and users. Overall, the application of ecological principles at the library of Universitas Muhammadiyah Sinjai has been initiated but still requires strengthening in technology, policy, and collaboration aspects to establish a sustainable and adaptive library management system.*

**Keywords:** Ecological Principles; Library Management; Sustainability

## **1. INTRODUCTION**

Ecological principles refer to a set of guidelines that help us understand the relationships between organisms and their environments (Mudin, Zarkasyi, & Riyadi, 2021). In this context, ecological principles refer to an awareness of the interconnectedness of elements within a living system, including humans, the environment, and resources. These principles are not solely related to the physical environment, such as energy and waste management, but also refer to the harmony between the

sustainability of information resources, the use of technology, community participation, and local cultural dynamics (Pratama et al., 2024). Within this framework, ecological principles can serve as a foundation for building library management that is more sustainable, inclusive, and adaptive to adaptive to rapid technological and social changes (Kamińska, Opaliński, & Wyciślik, 2021). The application of ecological principles in library management is not a foreign concept in modern management literature. Various approaches, such as the Green Library, Sustainable Information Management, and the concept of Eco-literacy, have been developed and adapted across the globe (Cahyani, 2020; Mochammad, Ardika, & Cahyono, 2020). However, the implementation of these principles in Indonesia, particularly at the university library level, remains limited to the architectural realm. Research focusing on the integration of ecological principles and library management is still scarce.

As one of the universities in Indonesia Universitas Muhammadiyah is required to maintain a library that meets established standards for university libraries and fulfills the defined elements, including those related to information and knowledge management through the university library. In facing the challenges of the times, such as climate change, the energy crisis, and technological disruption, libraries are expected to be not only centers of information but also agents of social and environmental change (Kornfeind, 2022).

Ecological principles in the context of library management encompass at least three key aspects. First, resource sustainability, which pertains to how library collections, energy, and infrastructure are managed efficiently and in an environmentally friendly manner (Susanti et al., 2020). This can include the application of digital technology to reduce paper usage, energy-efficient lighting and ventilation management, and the reuse of library materials or equipment that are still in good condition (Mojjada & Kumar, 2025). Second, system interconnectivity, namely how libraries network and interact with other surrounding elements such as schools, communities, cultural institutions, and social organizations (A. Sonny Keraf, 2013). In this approach, the library is positioned as a living information hub within a broader social ecosystem (Webber et al., 2023). Third, adaptation and resilience, which refer to a library's ability to respond to the dynamics of social, technological, and environmental change, as well as ensure service continuity of its services in various situations (Septiani, Handoyo, & Setyowati, 2024).

Library management that adopts ecological principles can also serve as a concrete example of sustainable development practices at the local level (Mishra, 2023). This aligns with national and global development agendas, including the Sustainable Development Goals (SDGs), which emphasize the importance of quality education, reducing inequality, institutional innovation, and action on climate change (Febriyanti & Giantara, 2025). Through libraries, these values can be disseminated to the public in a more structured and contextual manner. Furthermore, an ecological approach to library management is not merely an idealistic discourse but a practical strategy capable of addressing the challenges of our time. Amid rapid digital transformation and technological disruption, libraries must remain adaptive and relevant spaces (Djaenudin & Trianggoro, 2020). By adopting ecological principles, libraries focus not only on collection management but also on how to manage relationships among people, between people and technology, and between people and the physical environment (Permana, Syamsuddin, Harianto, & Ardiansyah, 2025). Ecology-based management encourages the involvement of all stakeholders in decision-making, fosters a sense of ownership, and builds sustainable synergy in the management of information resources.

Previous research by Carol and Imanda Utami Rangkuty (2023), titled "*Efektivitas Penerapan Arsitektur Ekologi dan Hi-Technology pada Perpustakaan Taiwan sebagai Referensi Arsitektur Eco-Technology*", found that library buildings can be designed by combining the principles of ecological

architecture and high technology—a concept known as eco-technology architecture. This study examines two case studies: the Taoyuan Public Library Longgang Branch and the National Taipei University Library in Taiwan. At the Taoyuan Public Library, the application of ecological principles is reflected in the building's orientation, which adapts to the local climate; the use of solar panels; the selection of environmentally friendly materials such as wood and wood wool cement board; and the presence of vegetation that supports the balance of the surrounding ecosystem. Meanwhile, the National Taipei University Library applies high-technology architectural principles through exposed structural design, the use of glass symbolizing transparency, natural lighting, and a dynamic and futuristic building form. Both libraries demonstrate the integration of environmental sustainability and technological advancement in library architecture. This study contributes to the understanding of how sustainability principles can be integrated into modern architecture, particularly in library buildings. However, the study does not examine managerial dimensions or stakeholder participation in library management comprehensively (Carol & Rangkuty, 2023).

Furthermore, research conducted by Rezka Adi (2017) titled "*Kajian Konsep Ekologis pada Gedung Perpustakaan Pusat UGM*". The findings indicate that ecological architectural concepts can be implemented in library building design through the application of Sim Van der Ryn's ecological design principles, such as ecological accounting, design with nature, and making nature visible. This study assessed the level of ecological design in the UGM Central Library building using parameters from the GBCI Greenship program, tropical architectural principles, and building accessibility regulations. Key findings indicate that the UGM Library has adopted various ecological design strategies, such as the utilization of green open spaces (30.56% of the total land area), the use of green roofs, energy efficiency of 39.17%, natural lighting of 300 lux in 60.67% of the floor area, and an Overall Thermal Transfer Value (OTTV) of 19.85 W/m<sup>2</sup>, which is considered good. The building was designed with a slender massing form and oriented north–south to minimize solar radiation exposure. The opening systems, shading, and wall and roof elements were also designed with a tropical approach and thermal efficiency in mind. This study also indicates that the building adheres to the principle of "making nature visible" through accessibility features for people with disabilities, such as ramps, elevators with Braille buttons, accessible restrooms, and tactile maps. However, there are still shortcomings, such as leaks in the ceiling due to a suboptimal flat roof drainage system and a green roof that is not yet fully implemented across the entire roof. The study recommends improving roofing materials and expanding the green roof system in future developments (Rezka, 2017).

Next, a study conducted by Prasetyo (2019) titled "*Dampak Era Digital Terhadap Perpustakaan Sebagai Upaya Menarik Generasi Milenial*". The results of the study indicate that the Fourth Industrial Revolution presents both challenges and significant opportunities for libraries in maintaining their relevance amid the dominance of information digitization. This study emphasizes the need for libraries to undergo technology-based transformation to remain a place of interest for the millennial generation. This article employs a qualitative descriptive method with a literature review approach. The author highlights three key aspects in the development of digital libraries: the increasingly demanding user experience regarding speed, convenience, and interactivity; data-driven collection management (library data, big data, and digital analytics); and the importance of collaborative innovation among stakeholders in addressing technological disruption. In this context, libraries no longer serve merely as information providers but as digitally connected social ecosystems capable of adapting to community needs. A strength of this study is its comprehensive examination of the digital revolution's impact on library service dynamics and its relevance to the needs of the millennial generation. The study also highlights

the new roles of librarians in the digital era as data curators and information strategists. However, a limitation of this study is the lack of empirical data or field studies, as well as the absence of a managerial evaluation framework based on sustainability or ecological principles. Environmental aspects are only generally mentioned through the term “eco-friendly,” without a systematic discussion of their impact on library management (Prasetyo, 2019).

Based on the previous studies described, this article presents a scientific innovation by shifting the focus of applying ecological principles from the realm of building architectural design into the context of library institutional management. While ecological principles were previously applied primarily to the physical structure of buildings through concepts like green architecture and eco-technology, this article offers a new perspective by positioning the library as a living system comprising the integrated interaction of people, policies, technology, and the environment. The ecological principles that will serve as the foundation for the field study are cited from Fritjof Capra in (A. Sonny Keraf, 2013); these principles include: (1) interdependence; (2) recycling; (3) partnership; (4) flexibility; and (5) diversity.

This study aims to address how ecological principles are implemented in university library management, specifically at Universitas Muhammadiyah Sinjai. The results of this study are expected to provide a comprehensive overview of how ecological concepts can enhance library performance, expand their impact, and strengthen their role within the framework of sustainability. Based on the above, it is important to conduct a study that specifically examines the implementation of ecological principles in the management of the Universitas Muhammadiyah Sinjai Library. This study is expected to provide a theoretical contribution to the development of an ecology-based library management concept, as well as a practical contribution in the form of relevant policy recommendations and library management strategies. This study is also expected to serve as a model for sustainable library development that can be replicated at other universities.

## **2. RESEARCH METHOD**

This study employs a qualitative descriptive approach to gain an in-depth understanding of the implementation of ecological principles in the management of the Universitas Muhammadiyah Sinjai Library. The descriptive approach is used to depict the phenomena, conditions, and managerial processes occurring in the field based on data obtained naturally, without the aim of making broad generalizations. Qualitative research methods are grounded in postpositivist philosophy, in which research is conducted under natural conditions and the researcher serves as the key instrument in the processes of data collection and analysis (Sugiyono, 2013). This approach was chosen because it provides a more comprehensive understanding of the relationship between human, technological, policy, and environmental aspects in library management based on ecological principles.

Research data were obtained through triangulation techniques, including in-depth interviews, observations, and document analysis. In-depth interviews were conducted with informants directly involved in library management to obtain information regarding the application of the principles of interdependence, recycling, partnership, flexibility, and diversity in library management practices. Observations were conducted to directly observe service conditions, technology utilization, and resource management activities within the library environment. Additionally, this study utilized secondary data obtained through literature reviews, including books, scientific journals, policy documents, and relevant prior research, to strengthen the theoretical foundation and support the interpretation of research findings.

The data analysis process was conducted inductively and proceeded continuously from the

data collection stage to the conclusion-drawing stage. Interview data was first transcribed by replaying the interview recordings and systematically writing down the entire content of the conversation. Subsequently, the researcher performed data reduction through an abstraction process by selecting data relevant to the research focus and grouping information based on themes aligned with the ecological principles used in the study. The reduced data were then presented in a descriptive narrative form to facilitate interpretation and the derivation of meaning. The final stage involves drawing conclusions based on the interrelationships among the data, thereby providing a comprehensive overview of the implementation of ecological principles in sustainability-oriented library management.

### **3. RESULTS AND DISCUSSION**

#### **Implementation of Ecological Principles in Library Management at Universitas Muhammadiyah Sinjai**

An ecological approach adapted from the ideas of Fritjof Capra is employed to examine the library as a socio-informational system that functions as a living ecosystem, in which each element interacts, adapts, and contributes to sustainability. This approach is based on five main ecological principles: interdependence, recycling, partnership, flexibility, and diversity (A. Sonny Keraf, 2013). Each principle is analyzed to explore how these ecological values are reflected in library policies, systems, and managerial practices.

##### **a. Interdependence**

The principle of interdependence emphasizes that every element within a system is mutually dependent on one another to maintain balance and sustainability. In the context of library management, interdependence encompasses the relationships between librarians, users, information technology systems, institutional policies, and the academic environment in which the library operates. At the Universitas Muhammadiyah Sinjai Library, this principle is evident in the interconnection between human resources, technology, and policies, although in practice these relationships have not yet been optimally integrated.

Observations indicate that the automation system in use, the Senayan Library Management System (SLIMS), remains a local system, accessible only via the campus's internal network. This situation limits interaction between librarians and users to the physical library space. Students and faculty cannot search the collection catalog from off-campus, making the process of searching for and borrowing information less efficient. This situation demonstrates that the alignment between technological infrastructure and user needs is not yet fully harmonious. In the context of ecological principles, a local system indicates a high dependence on the internal network without support for inter-unit interconnectivity across the university. Consequently, the potential for collaboration with other institutions such as the Research and Community Service Office (LPPM), the Academic Affairs Office, and the faculties has not been fully realized.

Furthermore, the institutional repository currently being developed by the library is still in the prototype stage and has not been officially published. Yet the repository should serve as the central hub connecting faculty research activities, metadata management by librarians, and the university's policies on open access scholarly publishing. As long as the repository is not publicly operational, the flow of academic information cannot circulate fully among librarians, faculty, and students. As a result, scholarly works produced by the academic

community are not yet widely accessible to the public, and the potential for enhancing the university's scholarly visibility has not been fully realized.

This situation indicates that the library management system at Universitas Muhammadiyah Sinjai is still in the early stages of interconnectivity. Relationships among the system's elements, whether human, technological, or policy-based, remain fragmented and have not yet formed a mutually supportive network. However, according to ecological principles, the success of a system is determined by the strength of the reciprocal relationships within it. Weak integration of the automation system and the repository hinders the creation of a dynamic and adaptive information ecosystem.

To strengthen the principle of interdependence, the library needs to integrate the SLiMS system into the university's online network so that the catalog and services can be accessed by the entire academic community without limitations of time or place. This step not only improves service efficiency but also strengthens the interaction between librarians and users. Additionally, the repository must be officially published and linked to the university's academic system so that faculty and student scholarly works can be properly documented and disseminated. These efforts must be accompanied by the formation of an inter-unit coordination team involving the library, the Research and Community Service Office (LPPM), and academic programs to establish mechanisms for uploading works, managing metadata, and implementing copyright policies.

Overall, the implementation of the principle of interdependence at the Universitas Muhammadiyah Sinjai Library still faces challenges in both technological and institutional aspects. Although the existing system has shown progress toward connectivity, integration among its elements has not yet been fully realized. By strengthening cross-unit synergy, optimizing digital infrastructure, and expanding access to information, the library has the potential to become a vibrant information ecosystem hub where every component is interdependent, interacts, and supports the sustainability of knowledge within the university's academic environment.

b. Recycling

The principle of recycling in an ecological context emphasizes the importance of reusing resources to maintain productivity within a sustainable cycle. In library management, this concept involves not only the recycling of physical materials but also the efficient use of information resources, infrastructure, and energy. The application of the recycling principle is crucial because libraries serve as centers for knowledge management that continuously generate, store, and distribute information. Therefore, the ability to manage resources efficiently and sustainably reflects the institution's ecological responsibility.

At the Universitas Muhammadiyah Sinjai Library, the application of the recycling principle is beginning to manifest through several simple yet meaningful initiatives. The library has begun shifting its document management policies toward digital formats. The digitization process is being carried out on several collections of student theses. The goal is to ensure these documents can be accessed again without relying on physical copies. This digitization effort also serves as a step toward information recycling, as older academic works take on a new form that is more adaptable to the needs of today's users. Although the UMSi repository is still in the prototype stage and has not yet been published, this initiative marks an initial awareness of the importance of a sustainable information cycle within the university environment. From

an operational perspective, the library is also applying the principle of efficient use of material and energy resources. For example, statistical reporting is now being conducted digitally, thereby reducing reliance on paper. This simple practice aligns with the spirit of green management, which emphasizes the minimal use of resources for maximum results.

However, the implementation of recycling principles at the Universitas Muhammadiyah Sinjai Library still faces several limitations. The absence of a fully functional online repository system means that digitized materials cannot yet be widely utilized by users. Additionally, the lack of specific policies regarding sustainable collection management means that recycling practices remain ad hoc rather than systematic. Recycling activities and energy efficiency have also not yet been incorporated into the library's performance indicators or strategic plans.

To strengthen the implementation of these principles, institutional policies are needed that clearly regulate mechanisms for collection and resource management based on recycling. Digitization must be followed by official publication through an institutional repository so that the results truly benefit the academic community and the public. Furthermore, the library can implement a reuse policy system that covers the management of paper waste, electronic equipment, and the use of eco-friendly materials in workspaces. The implementation of paperless administration and energy-saving policies can also serve as concrete steps toward strengthening a culture of sustainability within the library environment.

Overall, the principle of recycling at the Universitas Muhammadiyah Sinjai Library has begun to be implemented, though it remains limited to the operational level. Efforts in collection digitization, the reuse of library materials, and the efficient use of resources indicate a growing ecological awareness among librarians. With strengthened policies and adequate technological support, this library has the potential to serve as a model for the implementation of ecological management in higher education, where every information resource can continue to circulate, be updated, and be utilized sustainably to support a dynamic and environmentally friendly academic life.

c. Partnership

The principle of partnership in ecology asserts that the balance of a system can only be achieved through mutually supportive, reciprocal relationships among its components. In the context of library management, partnerships are a key element in expanding resource networks, strengthening institutional capacity, and enhancing the relevance of services for the academic community. Libraries capable of building and maintaining collaborative relationships with various parties will be more adaptable in facing change and more empowered in fulfilling their role as centers of knowledge.

One concrete form of ongoing collaboration is the receipt of book grants from the National Library of the Republic of Indonesia (Perpusnas). This grant program makes a significant contribution to enriching the collection. Through this collaboration, the library can expand the scope of its collection without placing an excessive burden on the university's budget. On the other hand, good relations with faculty members at UMSi also constitute a form of partnership that strengthens the foundation of the local collection. Many faculty members voluntarily donate books they have authored to enrich the library's collection. This practice reflects academic awareness and a spirit of cooperation in building a literacy ecosystem on campus.

However, the established partnership still faces several challenges. Limited human resources and the absence of formal policies governing the management of the collaboration often result in partnership programs stalling at the ceremonial stage. Additionally, the lack of integration between the SLiMS system and the repository into the online network remains a major obstacle to digital-based collaboration, particularly regarding data exchange and remote access. Consequently, the potential for broader synergy among institutions has not been fully realized.

To strengthen the implementation of partnership principles, the Universitas Muhammadiyah Sinjai Library needs to design a more systematic and sustainable collaboration strategy. A clear memorandum of understanding (MoU) is needed between the library and its partners, both internal and external so that every form of collaboration has a legal basis and measurable development goals. Additionally, a regular communication forum among partners should be established to evaluate activities and expand collaboration potential in the areas of collection development, information literacy, and library research. Librarians also need collaborative training to enhance their ability to build networks, draft partnership proposals, and manage project-based collaborations.

Overall, the implementation of partnership principles at the Universitas Muhammadiyah Sinjai Library demonstrates that cooperation and collaboration are the primary drivers in building a sustainable management system. Through grant support from the National Library of Indonesia and faculty contributions to the collection, the library has successfully positioned itself as a vibrant hub of knowledge among various academic entities. If reinforced with more robust policy frameworks and digital infrastructure, this partnership model has the potential to become an effective and inclusive model for managing the information ecosystem within the higher education environment.

d. Flexibility

The principle of flexibility in ecology refers to a system's ability to adapt to environmental changes without losing its balance. In library management, flexibility is key to maintaining the sustainability of services amid social and technological changes and dynamic user needs. A flexible library is not only capable of responding to change but also anticipating it through innovation and adaptive strategies relevant to the current context.

At the Universitas Muhammadiyah Sinjai Library, the principle of flexibility is beginning to be reflected in various efforts to adapt services to the needs of the academic community. One notable form of adaptation is the shift in service delivery from a conventional system toward a more digital one. Although the Senayan Library Management System (SLiMS) remains a local system, librarians have optimized its use as a tool for managing collections, loans, and internal inventory of library materials. This situation demonstrates that despite technological limitations posing challenges, librarians continue to strive to maximize the use of available resources. These efforts reflect the ability to adapt amidst infrastructure limitations.

Beyond service aspects, flexibility is also evident in the evolving roles of librarians, which adapt to the dynamics of academic needs. Librarians now function not merely as collection managers but also as information facilitators and supporters of digital-based academic services. This role transformation indicates that library staff have aligned themselves with the new paradigm of modern librarianship, which is oriented toward technological competencies and data-driven services.

However, the implementation of flexibility principles at the Universitas Muhammadiyah Sinjai Library still faces several challenges. Limited network connectivity prevents digital services from being widely accessible to users off-campus. Additionally, the absence of a public repository system hinders the management and dissemination of scholarly works. Regarding human resources, not all librarians possess the same technical skills, necessitating a continuous training strategy to ensure adaptation occurs evenly. Another challenge lies in the lack of formal policy support for service innovation, meaning changes remain individual initiatives rather than systemic ones.

To strengthen the implementation of the principle of flexibility, libraries need to take several strategic steps. First, the development of online-based automation systems should be a priority so that information services can be accessed anytime and anywhere. Second, internal policies on service innovation need to be established to provide space for librarians to experiment and develop new programs without bureaucratic obstacles. Third, it is crucial to provide ongoing training for librarians in information technology, digital literacy, and academic data management to ensure their adaptability continues to improve. Fourth, the library can adopt the principle of user-centered design when developing new services, by directly involving users in the evaluation and design processes.

Overall, the application of flexibility principles the Universitas Muhammadiyah Sinjai Library demonstrates a continuously evolving capacity for adaptation despite resource constraints. Librarians play an active role in ensuring service sustainability and seeking innovative solutions to technical challenges. By strengthening digital capacity, building open systems, and fostering a culture of innovation in the workplace, the library can move toward a management model that is more responsive, adaptive, and relevant to the challenges of the times. The principle of flexibility ultimately serves as a vital foundation for the library to remain a dynamic, sustainability-oriented information ecosystem.

e. Diversity

The principle of diversity in ecology highlights the importance of diversity in maintaining the balance and resilience of a living system. The more diverse the elements within an ecosystem, the greater the system's ability to withstand external changes and disturbances. In the context of library management, diversity can be understood as variety in collections, services, users, human resources, and management strategies. This diversity serves as the foundation for creating an inclusive, adaptive, and sustainable academic environment.

At the Universitas Muhammadiyah Sinjai Library, the principle of diversity is reflected in efforts to provide a collection that spans various fields of study and includes a wide range of reference sources. The available collection encompasses Islamic literature, social sciences, education, health, economics, and technology, in both print and digital formats. This diversity of academic fields demonstrates the library's commitment to supporting interdisciplinary learning processes, a hallmark of modern higher education institutions.

In addition to regular purchases and subscriptions, the library's collection is also acquired through book grants from the National Library of the Republic of Indonesia (Perpusnas) as well as donations from faculty members and local authors within the UMSi community. Donated books from Perpusnas enhance the variety of general reading materials and broaden users' perspectives beyond the university's core academic fields, while faculty members' contributions of scholarly works enrich the local intellectual landscape with

contextually relevant academic perspectives. Through this diversity of collection acquisition sources, the library functions not only as an information provider but also as a space representing the intellectual life of the campus and the surrounding community.

In terms of human resources, the diversity of librarians' backgrounds is a strength in itself. Librarians at Universitas Muhammadiyah Sinjai possess diverse expertise, ranging from management to public service administration. This diversity of competencies enables the library to perform multiple functions simultaneously: managing data and educating users. However, sustained efforts are needed to enhance competencies so that each librarian can perform optimally within their respective fields of expertise.

Nevertheless, the implementation of diversity principles at the Universitas Muhammadiyah Sinjai Library is not yet fully optimized. The main challenge lies in the limitations of digital infrastructure, which hinder access to online collections and open-access resources. Digital collections remain limited, while unpublished repositories reduce the potential for disseminating the diverse scholarly works of the academic community. To strengthen the principle of diversity, the library needs to develop more inclusive strategies for collection management and services. First, a mapping of information needs among users from diverse backgrounds is necessary to ensure collection development is more targeted and representative. Second, the strengthening of the institutional repository must be accelerated so that scholarly works across various disciplines can be openly accessed and serve as a source of inspiration across fields. Third, information literacy activities need to be expanded not only for students but also for faculty members so that the value of information diversity is truly felt equitably.

Overall, the application of the principle of diversity at the Universitas Muhammadiyah Sinjai Library demonstrates a tangible effort to create an inclusive and diverse information environment. Through the acquisition of collections from various sources, services that reach many user groups, and the diversity of librarians' competencies, the library has successfully affirmed its role as a center of knowledge open to all. By strengthening the aspects of digitization, collaboration, and equitable service delivery, this principle of diversity will become a crucial foundation for the development of a library that is adaptive, sustainable, and competitive within the higher education ecosystem.

### **Integration of Ecological Principles in the Academic Information Ecosystem**

The implementation of ecological principles in the management of the Universitas Muhammadiyah Sinjai Library demonstrates that the library functions as a living system composed of interconnected components that influence one another and operate dynamically to achieve balance. Each principle: interdependence, recycling, partnership, flexibility, and diversity, forms an integrated and complementary framework in building a sustainable information ecosystem within the academic environment.

The principle of interdependence serves as the primary foundation, emphasizing that successful library management cannot be achieved independently, but rather through the interconnectedness of human resources, technology, and institutional policies. The reciprocal relationships among librarians, lecturers, students, and academic support institutions create a collaborative network that sustains the circulation of information. However, the limitations of the locally based SLiMS system and the unpublished institutional repository indicate that this interdependence is

still in the process of being strengthened.

The principle of recycling further reinforces the dimension of sustainability in management practices. Efforts to reuse information resources and library materials, both through collection digitization and the improvement of physical facilities, represent tangible forms of ecological awareness within the library environment. Although still relatively simple, these information recycling practices reflect a commitment to efficiency and responsibility toward resource sustainability.

Meanwhile, the principle of partnership highlights the importance of cross-sector collaboration in developing a strong library system. Collaboration with the Research and Community Service Office (LPPM), academic faculties, the National Library of Indonesia, and lecturers demonstrates that the library has become an open knowledge hub connected to multiple stakeholders. Support in the form of book grants and faculty contributions to collection development represents a concrete example of synergy between academic and social ecosystems.

The principle of flexibility plays an important role in maintaining the library's adaptability to changing times. The transformation of services toward digital systems indicates the library's efforts to adjust to technological developments and evolving user needs. Although still facing limitations in network infrastructure and formal policy support, this adaptive spirit reflects the resilience and continuous growth of the system.

In addition, the principle of diversity complements the previous four principles by positioning diversity as a source of strength. The diversity of collections, services, and librarians' competencies enables the library to function as an inclusive space that reflects the plurality of knowledge and academic culture. Collection acquisitions from various sources, including national grants and local contributions, indicate a balance between global orientation and commitment to local values.

When integrated, these five principles create a working pattern that resembles a natural ecosystem in which each element has a unique role while remaining interconnected with others. Interdependence creates connectivity; recycling sustains the circulation of resources; partnership expands the network of the system; flexibility enables adaptation to change; and diversity strengthens resilience against external challenges. The combination of these principles positions the Muhammadiyah University of Sinjai Library not merely as a place for storing information, but as a living social organism that continues to grow, adapt, and contribute to the academic community and the wider society.

Therefore, the implementation of ecological principles in library management is not solely concerned with efficiency and service innovation, but also with fostering ecological awareness in knowledge management practices. Libraries that adopt this approach are capable of creating a balance between resource sustainability, technological advancement, and humanistic values, which constitute the core of future-oriented higher education.

#### **4. CONCLUSION**

The implementation of ecological principles in the management of the Universitas Muhammadiyah Sinjai Library demonstrates that the library functions as an interconnected and sustainability-oriented information ecosystem. Through five main principles; interdependence, recycling, partnership, flexibility, and diversity, the library has begun to develop a management system that is efficient, adaptive, and inclusive. The principle of interdependence is reflected in the relationship among librarians, technology, and institutional policies, although system integration remains limited. Recycling is implemented through collection digitization and resource efficiency, although it has not yet been

carried out systematically. Partnership is realized through collaboration with the National Library of the Republic of Indonesia and faculty members in collection development, while flexibility is reflected in librarians' ability to adapt to changes in services and user needs. Meanwhile, diversity is evident in the variety of collections and librarians' competencies that support interdisciplinary learning.

Overall, ecological principles have begun to be implemented, although further strengthening is still needed in terms of policy, technology, and institutional collaboration. These findings indicate that an ecological approach is not only relevant as a conceptual framework but can also serve as an alternative strategy for developing sustainable, adaptive, and ecosystem-oriented library management within higher education institutions.

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