

Strategies for Strengthening Technology-Based Governance of Islamic Boarding School Libraries in the Digital Era

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Abstract

The rapid advancement of information technology requires Islamic boarding schools (pesantren) to modernize their library governance to enhance the quality of information services and students' literacy. This community service program aimed to describe strategies for strengthening technology-based library governance in pesantren in the digital era. The study employed a descriptive qualitative approach using a service-learning model. The participants included pesantren leaders, library administrators, and students from several Islamic boarding schools in Semarang. The findings revealed that most pesantren libraries were still managed conventionally, lacked standardized operating procedures (SOPs), and made limited use of digital technology in collection management and library services. The intervention program consisted of training on shelving and collection classification, the utilization of library management applications, library space arrangement, and the development of a digital catalog. The evaluation results indicated that the program was effective, as evidenced by improved managerial and technical competencies among library administrators, the establishment of a simple digital catalog system, and enhanced accessibility and efficiency of information services for students. The program also generated positive impacts on library administrators through increased technical and managerial skills, while students benefited from more organized, accessible, and literacy-supportive library services. Based on these findings, strategies for strengthening technology-based library governance in pesantren can be implemented through systematic management planning, capacity building for human resources, the provision of technology-supporting facilities, and the sustainable implementation of digital library systems. Therefore, it is recommended that pesantren develop standardized operating procedures, expand integrated digital catalog systems, provide continuous training for library administrators, and strengthen literacy networks among pesantren to ensure the sustainability of the program.

Keywords: Pesantren Library; Governance; Information Technology; Digital Literacy; Service Learning.

Introduction

Libraries occupy a strategic position within the educational ecosystem as centers of information, learning resources, literacy development, and instruments for enhancing the quality of human capital. Beyond providing access to diverse sources of knowledge, libraries play a significant role in fostering reading habits, developing critical thinking skills, and broadening learners' perspectives. Law No. 43 of 2007 concerning Libraries mandates that libraries be managed professionally and organized to support educational, research, and cultural preservation needs (Undang-Undang Republik Indonesia Nomor 43 Tahun 2007 tentang Perpustakaan. Pdf, n.d.). In the context of Islamic boarding schools (pesantren), this strategic role becomes even more crucial, as libraries serve as centers for the development of Islamic scholarship, supporting the study of classical Islamic texts (kitab kuning), Islamic studies, and the strengthening of literacy and intellectual traditions among students (Jaya 2024; Huda 2020; Aulia Normalita 2024). Furthermore, pesantren libraries function as bridges connecting the rich heritage of classical Islamic knowledge with contemporary scientific developments required by students in the modern era. However, the rapid advancement of information technology demands a more adaptive and modern governance system to ensure that pesantren libraries can provide relevant, effective, and efficient information services that meet the needs of the digital age.

Currently, pesantren face significant challenges in maintaining their role as Islamic educational institutions rooted in text-based learning and intellectual traditions. Many pesantren libraries are still managed conventionally, relying on manual cataloging systems, limited collection organization, inadequate service standards, and minimal utilization of information technology. In addition, library management is often carried out without standardized operating procedures and integrated digital systems, resulting in inefficient information retrieval and limited access to learning resources. At the same time, the rapid advancement of information technology and digital transformation has fundamentally changed the way people seek, access, and utilize information. Students increasingly depend on digital resources, online references, and technology-supported learning environments to meet their academic needs. Consequently, pesantren libraries are required to adapt to these developments in order to remain relevant and capable of providing efficient and accessible information services (Saini 2024; Husni 2025; Gatot Krisdiyanto, Muflikha, Elly Elvina Sahara 2019). Without modernization of governance and the integration of digital technologies,

pesantren libraries risk becoming less effective in supporting educational activities and gradually losing their strategic role as centers of knowledge, literacy, and Islamic scholarship in the digital era.

The results of the needs assessment in several pesantren in Semarang indicate that most libraries are still managed traditionally, both in terms of collection arrangement, circulation services, and supporting facilities. Many libraries do not yet have standardized SOPs, their collections are not organized according to classification systems such as the DDC, and record-keeping is still done manually (Erland, Interview, 11 November 2025). This condition causes delays and inefficiencies in information retrieval, making it difficult for students to access the required reference materials. In addition, the absence of digital catalogs further hinders comprehensive library modernization efforts.

From the perspective of human resources, most pesantren library managers do not have a background in library science. Management is carried out based on experience alone, without sufficient understanding of cataloging techniques, classification, or library automation implementation. This lack of librarian competence results in unsystematic library management and directly affects service quality. Furthermore, the limited training and mentoring opportunities have left many managers unprepared to operate digital catalog applications or modern library management systems required in the digital era (Erland, Interview, 11 November 2025).

Infrastructure conditions also represent a significant issue. Many pesantren libraries still face limitations in reading space, insufficient bookshelves, and inadequate lighting. In addition, information technology facilities such as computers, internet networks, and library automation tools are often very limited (Erland, Interview, 11 November 2025). Yet, these facilities are prerequisites for implementing technology-based library services. Without adequate infrastructure support, efforts toward library digitalization will be difficult to achieve and unable to optimally meet students' information access needs.

The low level of technology utilization in pesantren library management is a major obstacle in the transformation toward modern libraries. Library management systems based on applications such as SLiMS, INLISLite, or other digital platforms have not been widely adopted in pesantren (Erland, Interview, 11 November 2025). As a result, processes such as inventory, literature searching, and borrowing services are still conducted manually. This

not only slows down services but also makes collection management less accurate and difficult to trace. In the context of rapid technological advancement, this digital lag can hinder the effectiveness of libraries as fast and accessible information centers.

Beyond technical issues, literacy culture within pesantren also requires strengthening. Field findings indicate that students' reading interest is relatively good, but it has not been supported by a systematic library management system. The lack of literacy programs, minimal involvement of students in library management, and the absence of scheduled literacy activities have prevented libraries from becoming active learning spaces that foster reading habits (Muhammad Ardhi Khalif, Affa Ardhi Saputri, Kuntoro Adi Juwanda, Agus Sudarmanto 2024). Without structured interventions, libraries will struggle to develop into literacy centers capable of enhancing students' intellectual quality.

Considering these complex challenges, a comprehensive strategy is required to strengthen technology-based governance of pesantren libraries (Nurasikin, Akhmad, Tri Handayani, A Saiful Aziz, Ali Imron, Ubbadul Adzkiya, Aris Abdul Ghoni 2025). This strategy must include improving managerial competencies through training, reorganizing collections according to library science standards, developing digital catalogs, and digitizing library services. In addition, systematic SOPs must be developed so that all aspects of management can operate according to professional standards. Library modernization must also involve students, teachers, and pesantren administrators to create a sustainable literacy ecosystem.

Community service activities involving twenty pesantren in Semarang represent a strategic effort to formulate a model for strengthening technology-based library governance. Through a service learning approach, this program not only provides technical training such as shelving, classification, and operation of digital library applications, but also assists pesantren in building modern and measurable library management systems. This intervention is expected to serve as a best practice model for digital library management in pesantren and can be replicated in other regions.

Several previous studies have examined library management within Islamic boarding school (pesantren) settings. A study published in JIMPI (Solehuiddin 2023) emphasized the implementation of pesantren library management functions through the POSDCORB approach, which includes planning, organizing, staffing, coordinating, reporting, and budgeting.

Meanwhile, (Fatoni 2024) investigated the implementation of pesantren library management in promoting students' reading literacy through programs such as library material acquisition, reading habituation, literacy competitions, and the arrangement of a conducive library environment. Another study conducted by (Mesra 2024) demonstrated that libraries play a significant role in enhancing students' reading interest, academic achievement, and literacy culture. Nevertheless, these studies primarily focus on library management and literacy development, while research on strategies for strengthening technology-based library governance through an integrated mentoring approach remains limited. Therefore, the novelty of this study lies in the development of strategies for strengthening technology-based library governance in pesantren through a service-learning model that integrates capacity building for library administrators, the development of standard operating procedures (SOPs), collection organization, the utilization of library management applications, and digital catalog development. Based on this research gap, the present study aims to describe strategies for strengthening technology-based library governance in pesantren in the digital era as an effort to improve the quality of information services, enhance the effectiveness of library management, and support the sustainable development of students' literacy.

Methods

This community service research employs a service learning method, an approach that integrates community service activities with academic learning processes conducted directly in the field. This method was chosen to ensure that the interventions provided are aligned with the real needs of pesantren and to enable optimal mentoring processes (Agus Afandi 2022). The activities were carried out in twenty pesantren in the Semarang region, including Pondok Pesantren Al Ihya, Al Khawarizmi, Bina Insani, Al Falah Besongo, Ar-Rois, and several other institutions with varying conditions of library management. Through this method, the team was able to interact directly with caregivers, library managers, and students to gain an in-depth understanding of the dynamics, challenges, and opportunities for strengthening technology-based library governance within pesantren environments.

Data collection was conducted through interviews and documentation, which complemented each other in providing a comprehensive picture of the condition of pesantren libraries. Interviews were carried out with caregivers, library managers, teachers, and students to identify priority needs, management obstacles, and their level of understanding of library technology.

Meanwhile, documentation in the form of activity photographs, shelving records, collection data, and library profile documents was used as empirical evidence to strengthen the analysis. These three techniques provided complete data covering managerial, technical, and cultural aspects that influence library governance in pesantren (Agus Afandi 2022).

The implementation stages of the program consisted of five main steps. First, a needs assessment was conducted to identify the actual condition of the libraries, including librarian competencies, availability of technology, and priority needs requiring immediate intervention. Second, program planning was carried out by developing modules, drafting standard operating procedures (SOPs), preparing materials for digital library application usage, and designing systematic mentoring plans. Third, implementation included training in shelving, classification, cataloging, spatial arrangement, and assistance in operating digital library applications. Fourth, monitoring and evaluation were conducted to assess the level of program success and the managers' ability to independently apply the technology. Fifth, reflection and reporting were conducted as a process of formulating recommendations for the future development of pesantren libraries (Agus Afandi 2022). The service learning method proved to be effective because it enabled direct interaction between academics and pesantren, resulting in interventions that are more precise, contextual, and sustainable.

Result

Findings of the Needs Assessment on Pesantren Library Governance

The results of the needs assessment conducted in twenty pesantren in the Semarang region indicate that the condition of library governance remains far from the professional standards that should be applied in educational institutions. The majority of libraries do not yet have standardized operational guidelines; therefore, all management processes are carried out spontaneously and unsystematically. There are no standard documents regulating procedures for collection processing, user services, spatial arrangement, or circulation mechanisms. This condition results in library management being based on individual habits of administrators rather than on established principles of library management grounded in scientific standards. Consequently, services are often inconsistent and difficult to evaluate.

Another constraint is observed in the collection arrangement, which does not follow library science principles, particularly classification systems such as the Dewey Decimal Classification (DDC). Many pesantren libraries organize

collections based on cover type, book size, or even personal perceptions of managers rather than subject matter and knowledge structure. This leads to ineffective information retrieval. Students struggle to find the required references because there is no systematic storage structure. In addition, the absence of classification labels and call numbers results in collections being mixed or even lost due to poor documentation.

Human resource competency is also a significant finding in the needs assessment process. Most library managers do not have an academic background in library science and lack professional library management experience. They perform their duties based on personal experience or merely follow leadership instructions without clear technical standards. This low level of librarianship literacy is the main factor causing many pesantren libraries to operate traditionally. The lack of technical training such as shelving, cataloging, and collection digitization makes it difficult for libraries to develop and to meet students' information needs optimally.

The limited utilization of information technology is another major challenge in strengthening pesantren library governance. The assessment shows that most pesantren are not yet familiar with digital library applications such as SLiMS, INLISLite, or similar software that can facilitate recording and information retrieval. Collections are still recorded manually in registration books, making them vulnerable to data loss or duplication. Moreover, the absence of digital catalogs prevents students from quickly identifying book availability. The use of technology has not yet become a culture in many pesantren due to limited facilities and insufficient training for managers.

Physical infrastructure constraints are also a significant finding. Many libraries have limited space, inadequate lighting, insufficient bookshelves, and lack comfortable reading tables or seating. Room layouts do not follow library spatial principles, making the space less functional and unattractive to students. Some libraries even stack collections due to insufficient shelving. These conditions affect user comfort and reduce students' motivation to visit the library regularly.

In addition to physical space, limitations in technological infrastructure such as computers, barcode scanners, and stable internet access, also hinder library digitalization. Many libraries do not have computers for data entry, forcing all work to be done manually. The lack of stable internet connectivity makes it difficult to implement web-based applications. In fact, technological infrastructure is a fundamental component in implementing technology-based

libraries. This condition shows that library digitalization requires infrastructural support that has not yet been fully provided in many pesantren.

The assessment also shows that students' literacy culture has not been fully supported by well-structured library management. Although some students have a reading interest, there are no scheduled literacy activities such as literacy classes, reading habits programs, or regular borrowing activities. Reading activities remain sporadic and are not integrated into pesantren programs. This indicates that the library has not yet been positioned as a strategic learning center. Without structured library services, literacy culture is difficult to develop optimally within pesantren environments.



Figure 1. Documentation of the needs assessment with representatives of the Islamic boarding school management

Overall, the needs assessment indicates that strengthening pesantren library governance requires a comprehensive approach, including improving managerial competencies, providing technological infrastructure, reorganizing collections according to standards, and developing a strong literacy culture. These findings serve as the basis for designing a more targeted assistance program aligned with field conditions. The intervention focuses not only on technical librarianship aspects but also on empowering managers and integrating libraries into the pesantren learning process.

Implementation of the Technology-Based Pesantren Library Governance Strengthening Program

The implementation of the technology-based library governance strengthening program was carried out on Sunday, November 23, 2025, at Pondok Pesantren Al-Amanah Semarang. The activity was attended by representatives from 20 pesantren in Semarang committed to improving student literacy. The event was officially opened by the leadership of LPPM

UIN Raden Mas Said Surakarta and the caretaker of Pondok Pesantren Al-Amanah, emphasizing the importance of transforming pesantren libraries in the digital era. The presence of various pesantren with diverse backgrounds made the activity a collaborative forum that strengthened inter-pesantren literacy networks.



Figure 2. Group photo of the speakers and training participants.

The main materials were delivered by two keynote speakers: Suwondo, S.Hum., M.Kom., Head of the Library of Diponegoro University, and Awalinda Dyah Pungky Ramadhani, S.Hum., Librarian at the Semarang City Archives and Library Office. Suwondo emphasized that modern libraries are knowledge centers rather than mere book storage facilities. He highlighted the importance of information technology, open access resources, and inter-library networks in supporting effective services. Meanwhile, Awalinda stressed the importance of professional governance, SOP implementation, and the necessity of transforming library services into digital-based systems.



Figure 3. The speaker explains the training material

One of the core activities was shelving training, which introduced participants to the proper arrangement of collections according to library science standards. Participants were introduced to the Dewey Decimal Classification (DDC) system and call number techniques. This training aimed to equip managers with basic skills to systematically organize collections, thereby improving information retrieval efficiency. Participants directly practiced rearranging existing collections in their pesantren libraries, enabling them to understand technical procedures practically.

Collection processing was the second key topic. In this session, participants learned data entry, cataloging, labeling, bibliographic description, and catalog card preparation. They were also trained to create book labels, determine subject classifications using DDC, and organize call numbers according to bibliographic standards. Through hands-on practice, participants gained a clear understanding of modern library workflows from processing to making collections ready for users.

Training on library technology utilization was an essential part of the program. Speakers introduced applications such as SLiMS, INLISLite, and digital repository platforms. Participants were also taught how to access e-books, academic journals, and open-access resources for student learning enrichment. This training is expected to serve as an entry point for pesantren to begin digitalizing their services and improving access to digital information resources.

Library spatial arrangement and collection zoning were also included in the program agenda. Participants were guided on how to design more comfortable, functional, and standards-based library spaces. This included shelving zoning, subject-based collection placement, reading space arrangement, and lighting optimization. Participants also discussed creative ways to utilize limited space while maintaining functional library design standards.

In addition to technical aspects, human resource development was a key focus. Participants were introduced to the roles and responsibilities of pesantren librarians in developing literacy culture. This training emphasized professional motivation and awareness to improve service quality. It also highlighted the importance of librarian leadership in fostering literacy programs such as book discussions, reading clubs, and information literacy activities.

Overall, the program ran with active participation and high enthusiasm. Interactive discussions between participants and speakers provided new insights into the opportunities and challenges of library digitalization in pesantren. The activity not only provided technical training but also built collective commitment to strengthening library governance as an integral part of pesantren education. The results of the program serve as a strong foundation for further monitoring and follow-up in developing digital libraries in partner pesantren.

Field Findings on the Actual Conditions of Pesantren Library Management

Field findings indicate that several pesantren have independently initiated digital library management. One of the best examples is Pesantren Besongo, which has implemented a web-based library automation system. The Besongo library already has an online catalog, a digital circulation system, and computerized inventory management. This digitalization enables students and teachers to access information quickly and efficiently. This best practice demonstrates that digital library transformation is highly feasible in pesantren when supported by strong managerial commitment and capacity.

In contrast, findings show that Pesantren Ar-Rois has a different condition. Although its students have a high interest in reading, the pesantren does not yet have a centralized library. Book collections are dispersed across various rooms such as classrooms, teachers' offices, and informal reading corners, but there is no dedicated library space to accommodate all literacy needs. This condition results in suboptimal access for students to reference materials. This finding indicates that a high reading interest is not always accompanied by adequate facilities, making infrastructure improvement an urgent necessity.

Other findings reveal that many pesantren face challenges in understanding classification, cataloging, and collection management techniques. Many library managers are not familiar with the basic principles of the Dewey Decimal Classification (DDC), subject determination, or bibliographic description. As a result, library collections are difficult to retrieve and not ready for user services. This condition significantly affects library effectiveness, as circulation services and information retrieval are core components of modern library management.

Infrastructure limitations are a dominant issue found in almost all surveyed pesantren. Many libraries lack sufficient bookshelves, causing collections to be stacked or stored improperly. Reading rooms are often cramped and lack adequate seating. In some cases, libraries do not even have proper lighting, discouraging students from reading in the library. These findings highlight the need for physical facility support as a foundational step in transforming pesantren libraries.

Most pesantren also do not have computers or other devices required for library automation. This prevents the implementation of digital cataloging and library management applications, even when managers are willing to begin the process. This limitation is further exacerbated by the lack of stable internet access. In the context of digital libraries, technological infrastructure is an essential component that cannot be overlooked, making facility development a key priority.

Literacy programs in pesantren also remain limited. Most pesantren do not yet have structured literacy classes, reading habituation programs, or supporting activities such as literacy competitions or reading clubs. The lack of such programs causes libraries to lose their social function as centers of learning and knowledge development. This finding confirms that library transformation must be accompanied by sustainable literacy programs so that libraries can play a broader role in shaping students' intellectual character.

Many pesantren expressed the need for standardized guidelines for library management, particularly regarding SOPs, collection processing modules, and digitalization manuals. The absence of such guidelines results in unstructured management practices and difficulties in maintaining service consistency. With written standards in place, library management can be carried out more systematically, even when administrative staff changes occur. This finding highlights the urgency of developing standard documents to support sustainable library governance in pesantren.

Overall, the field findings reveal a significant gap between the ideal conditions of pesantren libraries and their actual conditions in practice. Although some pesantren have demonstrated positive initiatives, the majority still require assistance, further training, and infrastructure provision. These findings serve as an important foundation for formulating strategies to strengthen technology-based library governance so that it can be implemented optimally across partner pesantren.

Main Output of the Community Service Program: Technology-Based Pesantren Library Management Module

The main output of this community service program is the development of a Technology-Based Pesantren Library Management Module, a comprehensive instructional and technical guide designed to assist pesantren in transforming their libraries toward more modern, professional, and standards-based governance. This module was developed based on the needs assessment results, field findings, and inputs from partner library managers in pesantren. Therefore, its content is not only theoretical but also contextual and relevant to the real conditions of library management in pesantren, which often face limitations in facilities, human resources, and understanding of information technology.

The module is divided into several core chapters covering all aspects of technology-based library management. A key section of this module is the library digitalization guide, which includes step-by-step instructions for installing and using digital library applications such as SLiMS, managing online catalogs, creating user accounts, and utilizing open-access resources to enrich students' references. In addition to explaining technical aspects, the module also provides strategies for developing sustainable digital libraries, including database maintenance, data protection, and the integration of digital services with learning activities in pesantren. This guide is designed in a practical manner and supported with illustrations so that it can be used by managers without a background in library science.

As a final output of the program, this module serves as a standardized reference document that can be used by all partner pesantren as well as other institutions seeking to strengthen their library governance. It is also designed to be continuously developed in line with advances in information technology and the future needs of pesantren. The presence of this module is expected to become an important foundation in fostering well-organized, professional, and competitive pesantren libraries in the digital era, while also supporting the improvement of literacy quality and educational outcomes for students in a sustainable manner.

Recommendations for the use of digital library applications constitute another strategic output of this program. Pesantren are encouraged to adopt applications such as SLiMS, INLISLite, or other library management systems that suit their institutional needs. The community service team also guided on selecting appropriate applications, basic installation procedures, and the use

of online catalogs to improve information access. This recommendation is expected to serve as an initial step for pesantren in transitioning from manual systems to more efficient and modern library automation.

As part of follow-up mentoring activities, recommendations for the development of digital-based libraries were also formulated. These recommendations are based on field findings indicating that technology is a crucial factor in strengthening library governance. With these recommendations, pesantren are expected to have a long-term roadmap for modernizing their library services.

A sustainable literacy program for students is another important output of this community service activity. This program includes reading habituation, literacy classes, information retrieval training, and other supporting activities. The objective of this output is to strengthen the literacy culture within pesantren so that libraries function not only as book providers but also as centers of academic activity. Through this program, students are expected to become more active in utilizing library facilities and developing their literacy skills.

Documentation of activities and the final community service report were also prepared as part of academic accountability. The report contains field findings, training processes, collection arrangement outcomes, and evaluations of program effectiveness. This documentation is not only useful for the community service team but also serves as a reference for other pesantren seeking to develop technology-based libraries. It also functions as an important instrument for strengthening literacy networks between pesantren and higher education institutions.

Overall, the outputs of this community service program demonstrate a tangible contribution to strengthening pesantren library governance. From module development to sustainable literacy programs, all outputs are designed to support the transformation of pesantren libraries into more modern, professional, and technology-based institutions. These outputs are expected to serve as a replicable model for other pesantren in Indonesia that aim to improve the quality of their libraries in a gradual but sustainable manner.

Discussion

Strengthening human resources (HR) is a fundamental foundation in the modernization of pesantren libraries based on technology. The findings of the program indicate that HR competence is a key prerequisite for ensuring that

all aspects of library management can function effectively, ranging from collection processing, user services, to the use of digital applications (Amaliah 2024). However, most library managers do not have an academic background in library science and have never received adequate technical training. This condition results in library services that remain traditional and lack standardized management systems, thereby slowing down the transformation toward a modern system.

This condition is then addressed through technical training in collection management, which has proven to have a significant impact on improving the competence of library managers. Materials such as shelving, Dewey Decimal Classification (DDC), cataloging, and labeling not only enhance knowledge but also provide practical skills that are directly applied in the field. Practice-based mentoring has proven to be more effective than purely theoretical training. With sufficient basic skills, managers become more confident in performing technical tasks independently and are able to continuously improve the collection arrangement system within pesantren libraries.

The improvement of skills does not only stop at technical aspects but also extends to professionalism and changes in managerial mindset. Through training and mentoring, awareness has emerged that libraries serve as strategic centers of knowledge within pesantren education (Arkana 2019; Handoko 2016; Siagian 1978; Harold Koontz 1990; Supratikno 2003; George R. Terry 2019). In addition, the ability to adapt to technology is a crucial factor in library transformation. Strengthening HR is not only about skills, but also about building work attitudes, commitment, and institutional awareness so that libraries can function optimally and sustainably (Zulfatun Sofiyani, Faisal Fahmi, Meinia Prasyesti Kurniasari, Mega Putri Mahadewi, Arly Maya Berlyanti 2025).

This awareness is further strengthened through the implementation of information technology as the core of digital transformation in pesantren libraries. The use of applications such as SLiMS enables collection management, circulation services, and information retrieval to be carried out more efficiently and accurately (Saepul Burhan 2022). Pesantren that have begun adopting this system show high enthusiasm from both managers and students. The digital catalog system also enhances information accessibility, allowing users to independently search for materials more quickly, reducing reliance on slow and error-prone manual systems.

This efficiency is further evident in the information retrieval system, which becomes significantly faster and more accurate. With an online catalog, searching for collections can be done within seconds without manually checking inventory records (Rifqi 2021). This improves service efficiency and reduces the risk of data loss. In addition, digitalization enables integration with open-access learning resources such as journals, e-books, and digital encyclopedias, thereby enriching students' literacy without relying heavily on limited physical collections (Tuty Maryati, Made Mas Hariprawani 2022).

However, the implementation of information technology faces several challenges, including limited devices, low digital literacy, and unstable internet access. Therefore, digital transformation must be carried out gradually and adaptively. The development of a technology-based library management module becomes an essential solution, as it provides technical guidance ranging from installation to data management. Furthermore, integrating libraries with the pesantren education system expands their role as part of the learning process (Mudiarto 2025), rather than merely a supporting unit.

This transformation cannot be optimally achieved without adequate facilities and infrastructure as essential components in the development of pesantren libraries. Many libraries still face limitations in space, bookshelves, and inadequate lighting, which reduce user comfort (Sesep Ahmad Rustandi 2023). Poor physical conditions also make collections difficult to access and maintain. Therefore, infrastructure improvement becomes a crucial part of library modernization to support more optimal services.

The improvement of infrastructure is reflected in better and more comfortable reading room arrangements for students. Simple improvements such as proper lighting, organized seating arrangements, and adequate ventilation can create a more conducive learning environment (Ja'far Shodiq, Abu Yazid Adnan Quthy 2023). Well-organized bookshelves and collection zoning systems also improve accessibility and reflect professional library management (Amanda, 2024). This demonstrates that physical comfort directly affects the effectiveness of library services (Amanda 2024).

In addition to spatial and comfort aspects, the availability of technological equipment such as computers, internet access, and barcode scanners is essential for digital library implementation. However, many pesantren still experience shortages in equipment and internet connectivity. These conditions hinder the optimal implementation of digital systems. Therefore, infrastructure development must include the provision of technological

facilities, improved internet connectivity, and proper maintenance of spaces and collections to ensure sustainability.

Infrastructure strengthening cannot be separated from the development of a literacy culture as the core of pesantren library advancement. Libraries are not only storage spaces for books but also centers of literacy activities (Fatoni 2024; Beti Malia Rahma Hidayati 2023). Findings show that literacy activities are still passive and not systematically structured. Therefore, a transformation toward active libraries is needed to stimulate students' reading interest through sustainable programs.

Active literacy programs can take the form of book discussions, reading classes, and review clinics that encourage students not only to read but also to understand and critically analyze information. In addition, involving students as library volunteers increases their sense of ownership of the library (Fatoni 2024). Integrating libraries into pesantren learning activities also strengthens their educational function as part of the broader education system.

The strengthening of literacy culture becomes more effective when supported by comfortable facilities and strong institutional backing. A supportive environment and leadership commitment from pesantren authorities play a crucial role in the success of literacy programs (Aceng Badruzzaman 2023). Furthermore, aligning collections with students' interests is an important factor in increasing participation. With a holistic approach, libraries can develop into dynamic and sustainable literacy centers (Qulloh 2021).

These efforts are further reinforced through collaboration between pesantren and higher education institutions as a strategic factor in strengthening technology-based library management. Pesantren require academic and technical support from universities to accelerate the digital transformation process (Solehuddin 2023). Through this collaboration, knowledge transfer occurs in the form of training, mentoring, and the development of systematic management modules.

This collaboration is further expanded through networks among pesantren that share best practices in library management. More advanced pesantren can serve as models for others in implementing digital systems. The exchange of experiences and best practices accelerates collective technological adoption. In addition, collaboration with universities opens opportunities for field-based research that enriches studies on pesantren literacy and produces data-driven solutions.

Moreover, this collaboration expands access to digital resources such as academic repositories and online libraries. Continuous training through seminars, workshops, and inter-institutional visits strengthens the capacity of library managers. However, the success of collaboration depends heavily on the readiness of each institution. With an adaptive and contextual approach, this collaboration becomes a key factor in building a modern, sustainable, and digitally literate pesantren library ecosystem.

The implementation of strategies for strengthening technology-based governance of pesantren libraries has generated tangible benefits for both library managers and the broader pesantren community. For library managers, the program has enhanced technical and managerial competencies in collection organization, cataloging, classification, and the operation of digital library systems. The availability of standard operating procedures (SOPs), digital catalogs, and technology-assisted management systems has simplified administrative tasks, improved work efficiency, and reduced errors in collection management and circulation services. As a result, library managers are better equipped to provide professional, systematic, and sustainable library services.

For the pesantren community, particularly students and teachers, the strengthening of library governance has improved access to information and learning resources. The implementation of digital catalogs and better-organized collections enables users to locate materials more quickly and efficiently, thereby supporting learning activities, religious studies, and independent research. Improved library facilities and literacy programs have also contributed to the development of a more conducive learning environment and a stronger reading culture among students. Furthermore, the integration of technology into library services has fostered digital literacy skills, encouraged more active engagement with knowledge resources, and reinforced the role of the library as a center of learning and literacy within the pesantren ecosystem. These impacts demonstrate that strengthening technology-based library governance not only improves managerial performance but also contributes to enhancing the quality of education and literacy culture in pesantren.

Conclusion and Suggestion

This community service program demonstrates that strengthening technology-based library governance in pesantren requires a comprehensive

and integrated strategy encompassing human resource development, the implementation of information technology, infrastructure improvement, literacy culture enhancement, and institutional collaboration. Human resource strengthening through technical training and mentoring is essential to improve managerial and technical competencies in library management. The adoption of digital technologies, including library management applications, digital catalogs, and standardized operating procedures, contributes significantly to improving service efficiency and information accessibility. Furthermore, adequate facilities and infrastructure, supported by sustainable literacy programs, play an important role in optimizing library functions as centers of learning and knowledge development within pesantren.

The findings also indicate that collaboration between pesantren and higher education institutions serves as a strategic mechanism for accelerating digital transformation through knowledge transfer, technical assistance, and capacity building. The integration of these strategies not only strengthens library governance but also enhances the role of libraries in supporting learning activities, literacy development, and digital literacy among students. Therefore, technology-based library governance can serve as an effective approach to transforming pesantren libraries into modern, sustainable, and adaptive learning centers capable of meeting the challenges of the digital era.

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