Microfilm Preservation in Libraries: A Systematic Literature Review

Preservasi Mikrofilm di Perpustakaan: Tinjauan Literatur Sistematis

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Abstract

Background: *Microfilms are susceptible to damage over time. The lack of guidelines, materials and reference materials on microfilm is also the reason why the use and maintenance of microfilm in libraries is still rare. Many libraries and librarians are not fully aware and prepared to maintain and care for microfilm so that it can be used for a long time.* ***Purpose:*** *To review the literature on microfilm preservation so that through this research, the extent of scientific development and knowledge that has been produced by experts is known.* ***Method:*** *A systematic literature review with a qualitative approach was used to collect literature relevant to the topic. The formulation of research questions used the population, intervention, comparison, outcome, and context (PICOC) framework and the search strategy used Boolean logic. Literature sources came from Google Scholar, which was then tested for quality. The analysis technique used content analysis by describing the research findings.* ***Result:*** *The majority of the literature reviewed came from India and Nigeria with the highest number of publications in 2023. Traditional microfilm preservation techniques are carried out by providing a special place and controlling environmental conditions. Meanwhile, digital preservation techniques are carried out by digitizing through data migration. The constraints of microfilm preservation that are often encountered are financial limitations.* ***Conclusion:*** *From the results of the systematic review, it was found that storage in a separate room and digitization are often done in libraries to preserve microfilms with limited funds as the main obstacle.*

Keywords: *Library; Library Material; Microfilm; Preservation*

Abstrak

Latar Belakang: Mikrofilm rentan mengalami kerusakan seiring berjalannya waktu. Sedikitnya panduan, materi, dan bahan rujukan mengenai mikrofilm juga menjadi alasan mengapa penggunaan dan perawatan mikrofilm di perpustakaan masih jarang dilakukan. Banyak perpustakaan dan pustakawan belum memahami dan siap sepenuhnya untuk menjaga dan merawat mikrofilm supaya dapat digunakan dalam jangka waktu yang panjang. **Tujuan**: Untuk mereview berbagai literatur seputar preservasi mikrofilm sehingga melalui penelitian ini diketahui sejauh mana perkembangan ilmu serta pengetahuan yang telah dihasilkan oleh pakar. **Metode**: *Systematic literature review* dengan pendekjatan kualitatif digunakan untuk mengumpulkan literatur yang relevan dengan topik. Perumusan pertanyaan penelitian menggunakan kerangka *population, intervention, comparison, outcome, and context* (PICOC) dan strategi penelusuran menggunakan *Boolean logic*. Sumber literatur berasal dari Google Scholar yang kemudian dilakukan uji kualitas. Teknik analisis menggunakan analisis konten dengan menjabarkan temuan penelitian. **Hasil**: Literatur yang dikaji mayoritas berasal dari negara India dan Nigeria dengan jumlah publikasi terbanyak pada tahun 2023. Teknik preservasi microfilm secara tradisional dilakukan dengan menyediakan tempat khusus dan mengendalikan kondisi lingkungan. Sedangkan, teknik preservasi secara digital dilakukan dengan proses digitalisasi melalui migrasi data. Kendala preservasi microfilm yang sering dijumpai yaitu keterbatasan finansial. **Kesimpulan**: Dari hasil telaah sistematis ditemukan bahwa penyimpanan pada ruang tepisah dan digitalisasi sering dilakukan pada perpustakaan untuk merawat mikrofilm dengan keterbatasan dana sebagai kendala utama.

Kata kunci: Bahan Pustaka; Mikrofilm; Perpustakaan; Preservasi

I. INTRODUCTION

Background. The development of research related to microfilm preservation in Indonesia has been relatively slow during the period of 2021–2025. This is evident from data obtained using the Publish or Perish tool with Google Scholar, where a search using the keyword "microfilm preservation" revealed that most studies do not specifically examine the topic. Most of the research focuses on the use of microfilm as a form of media conversion for library materials, aiming to protect the information in historical documents or manuscripts from deterioration, rather than discussing the specific techniques of microfilm preservation (Makmur et al., 2024; Wati & Rahmi, 2021). In fact, research that specifically focuses on microfilm preservation in Indonesia is critically needed to support the advancement of preservation science in this field that can serve as a valuable reference for its practical implementation.

The lack of comprehensive guidelines, materials, and reference sources on microfilm preservation is the reason for the limited use and maintenance of microfilm in libraries. Many libraries and librarians are not yet fully equipped or knowledgeable enough to properly preserve and care for microfilm so that it can serve as a long-lasting and usable information resource (Elnadi, 2021). Microfilm is highly susceptible to physical deterioration, such as scratches and fading of the film emulsion, which can result in unreadable content (Eyford, 2023). Consequently, microfilm maintenance is particularly challenging as it requires specialized equipment and skilled personnel (Bellido, 2023). Therefore, research on microfilm preservation, studies that address the potential obstacles encountered in the process, is urgently needed.

Problems. The limited resources on microfilm preservation is one of the main factors contributing to the limited use of microfilm in libraries. This lack of information can lead to confusion among librarians in properly maintaining and preserving microfilm (Elnadi, 2021). Therefore, there is a need for research that explores both traditional and digital preservation techniques, as well as the challenges encountered in the microfilm preservation process.

Previous Literature Review.

Based on a review of prior research, the preservation of collections using microfilm has long been a significant topic in the field of library and information science, particularly in relation to safeguarding newspapers and other valuable archives. Previous findings indicate that although digital access to newspapers is becoming increasingly popular, traditional practices such as microfilming, digital image collection, and print rotation remain fundamental pillars of preservation efforts in state libraries across the United States (Pleiss & David, 2025). Historical analyses also show that microfilm has played an important transitional role in the development of preservation knowledge, bridging the gap between early scientific experiments in combating book decay and the massive adoption of digitization technologies in recent decades (Lischer-Katz, 2022).

In the European context, microfilm has been recognized as a technically compatible medium for long-term storage that can serve as an intermediary in digitization projects, as demonstrated in the experiences of the National and University Library in Zagreb (Lebinac & Filipeti, 2017). In Indonesia, microfilm is also regarded as an effective preventive measure against the risk of archive loss due to natural disasters, used alongside microfiche and electronic records as part of broader archival protection strategies (Erliyana & Rozanti, 2019). From a risk management perspective, microfilm preservation has benefited from structured approaches that integrate environmental control, collection rehousing, and

preventive conservation measures, such as those implemented at the British Library (Garside, Bradford, & Hamlyn, 2018).

Previous research has demonstrated that microfilm preservation can be effectively carried out through digitization processes to preserve the information contained within microfilms in case of physical deterioration (Beelen et al., 2023). Other research emphasizes that microfilm storage requires careful temperature control to maintain the health and stability of the microfilm (Plaisance, 2021). Previous studies have focused only on digital preservation techniques for microfilm but did not discuss the procedures involved in applying these techniques. Meanwhile, other research has addressed microfilm maintenance through temperature regulation only without exploring the challenges encountered in the process.

State of The Art. The common thread among these studies lies in the recognition of microfilm's relevance as a durable preservation medium, even amid the rise of digitization, as well as the importance of integrating preventive and curative strategies. The differences, however, are evident in the focus on specific types of collections (e.g., newspapers), specific geographical contexts, or particular managerial approaches. In contrast, the present study—Microfilm Preservation in Libraries: A Systematic Literature Review—synthesizes both global and local experiences, evaluates technical compatibility and long-term sustainability, and assesses the relevance of microfilm within the contemporary preservation ecosystem. The scientific novelty of this research lies in its systematic, cross-contextual approach, combining historical, technical, managerial, and risk mitigation perspectives, thereby providing a comprehensive guide for libraries in designing adaptive microfilm preservation strategies that are responsive to technological developments and future challenges.

Purpose. The main objective of this study is to review various literature on microfilm preservation in order to evaluate the extent of knowledge and advancements made by experts in the field.

II. METHODS

This study employs Systematic Literature Review (SLR) method with a qualitative approach to map relevant studies on microfilm preservation using the most recent sources (Wati & Rahmi, 2021). The SLR is conducted by collecting relevant literature that meets the eligibility criteria to effectively answer the research questions (Nurhayati, 2023).

Formulating Research Questions. The formulation of research questions refers to the Population, Intervention, Comparison, Outcomes, and Context (PICOC) framework to determine the scope and boundaries of the study. This study focuses on microfilm preservation within library settings, with particular attention to both traditional and digital preservation techniques, as well as the challenges faced during the preservation process. The analysis compares the similarities and differences between these techniques and the obstacles encountered, highlighting how various approaches address common preservation issues. The intended outcome is to identify and describe the techniques currently employed, along with the key challenges that impact their effectiveness. This investigation is grounded in a review of findings from recent studies conducted over the past five years, providing a contemporary perspective on the state of microfilm preservation practices in libraries.

Based on the identification the following research questions (RQs) are proposed:

RQ1: What are the traditional techniques used in microfilm preservation?
RQ2: What are the digital techniques used in microfilm preservation?
RQ3: What are the common challenges encountered in microfilm preservation?

The Strategy of Literature Review. The literature review strategy was conducted by selecting relevant databases and determining appropriate keywords. The database used in

this study was Google Scholar, with the assistance of the was conducted to broaden the scope of literature retrieval. Google Scholar was chosen for its wide range of scholarly sources and its openness criteria.

Keywords were formulated in English to increase both the quantity and relevance of the search results, using Boolean logic to refine the search process. The literature search using the keywords (microfilm preservation OR microfilm conservation) AND (library materials OR archival materials) was conducted on March 14, 2025, resulted in a total of 89 sources.

Literature Selection. The selection of literature was conducted by applying inclusion and exclusion criteria to ensure the relevance and accessibility of sources that offer complete content and comprehensible language. Based on the inclusion and exclusion criteria outlined, a total of 23 articles were identified as potential sources for quality assessment.

The selection of articles for this study was based on several inclusion and exclusion criteria. Only articles published in scientific journals, as well as those derived from conference proceedings, seminars, and final academic projects such as theses or dissertations, were considered. Priority was given to articles with open access and full-text availability, written in language that is easily understandable, and specifically focusing on techniques for microfilm preservation. Furthermore, the time frame was limited to works published within the last five years to ensure the relevance and currency of the findings. Articles were excluded if they had restricted access or incomplete content, used overly complex or unclear language, addressed topics unrelated to microfilm preservation techniques, or were published more than five years ago.

Quality Assessment of Search Results. The final step in the systematic literature review is to assess the quality of the literature to ensure that the selected sources are relevant and capable of answering the research questions. The quality assessment applies the following criteria (C):

C1: Does the article discuss traditional microfilm preservation techniques?

C2: Does the article discuss digital microfilm preservation techniques?

C3: Does the article address common challenges encountered in microfilm preservation?

Each question is answered with YES/NO, scored as YES = 1 and NO = 0. Literature included in this reserach must achieve a minimum total score of 2. Based on these criteria, 21 articles were selected for use in this research.

III. RESULTS AND DISCUSSION

Result. The findings of this study present several tables summarizing the Overview of Microfilm Preservation Research. The results show that microfilm preservation remains a relevant and widely discussed topic in library and archival science. The research reviewed covers various aspects, including its role in preserving newspapers, archival documents, and other valuable collections.

Table 1.
Publication Year

No	Year	Number of Studies
1.	2025	0
2.	2024	3
3.	2023	6
4.	2022	8
5.	2021	4

Source: Research findings, 2025

Table 1 shows how research on microfilm preservation has evolved over the past five years. Interestingly, the most active period was in 2022, when eight studies were published. This surge could reflect a renewed awareness of the importance of long-term preservation strategies, especially as libraries and archives around the world adapted to the disruptions of the COVID-19 era. In contrast, 2021 had only four studies, while 2023 saw a moderate rise to six publications. By 2024, interest had dropped again to just three studies, and in 2025 no new publications were found at the time this review was conducted.

These ups and downs suggest that microfilm preservation is not always at the center of preservation research conversations. The spotlight often shifts toward newer digital technologies, but microfilm continues to quietly serve as a reliable, time-tested safeguard for cultural and historical records.

For our study, Microfilm Preservation in Libraries: A Systematic Literature Review, this trend sends a clear message: there is a need to bring microfilm preservation back into the discussion, not as a nostalgic practice, but as a relevant and adaptable strategy in today's hybrid preservation landscape. By weaving together insights from various years and contexts, our research aims to refresh the conversation and show that microfilm still has a place in modern library and archival work.

Table 2.
Country of Research

No	Country	Number of Studies
1.	Nigeria	5
2.	India	5
3.	Tanzania	2
4.	Canada	2
5.	Inggris	2
6.	Zambia	1
7.	Georgia	1
8	Germany	1
10.	Uzbekistan	1
11.	Indonesia	1

Source: Research Findings, 2025

Table 2 reveals the geographical spread of microfilm preservation research included in this systematic literature review. The largest contributions come from Nigeria and India, each producing five studies. This strong representation suggests that microfilm preservation remains a practical and relevant concern in regions where access to robust digital preservation infrastructure may still be developing, making microfilm an affordable and sustainable option for safeguarding library and archival materials.

Tanzania, Canada, and the United Kingdom follow with two studies each, indicating a more moderate but still noteworthy engagement with the topic. These contexts may represent either targeted case studies in specific institutions or ongoing interest in integrating microfilm into hybrid preservation strategies. Countries such as Zambia, Georgia, Germany, Uzbekistan, and Indonesia each contributed one study, highlighting emerging interest or specialized projects in those regions.

This distribution shows that microfilm preservation is a truly global concern, crossing economic, technological, and cultural boundaries. However, the concentration of studies in a handful of countries also signals a gap in research from other parts of the world, particularly regions with rich cultural heritage collections but limited documentation of preservation practices.

Traditional Microfilm Preservation Techniques. The following are some of the most commonly mentioned traditional microfilm preservation techniques in research:

Table 3.
Traditional Microfilm Preservation Techniques

No	Traditional Microfilm Preservation Techniques
1.	Environmental control of storage areas
2.	Dust cleaning
3.	Binding
4.	Pest control
5.	Storage in a designated area
6.	Restricted access
7.	Preparing a disaster recovery plan
8.	Consultation with professional librarians on microfilm preservation

Source: Research Findings, 2025

Table 3 outlines the traditional techniques commonly employed to preserve microfilm collections. The findings show that environmental control of storage areas remains a foundational strategy, as temperature and humidity stability are critical to preventing chemical degradation of microfilm. Routine dust cleaning and pest control are equally important, as both dust accumulation and biological threats can cause irreversible damage over time.

Binding and storage in designated areas serve dual purposes—protecting microfilm physically while also maintaining order for easy retrieval. Restricted access functions as a security measure, reducing the risk of mishandling or accidental exposure to damaging conditions. Preparing a disaster recovery plan demonstrates that even traditional preservation frameworks recognize the importance of proactive risk management, ensuring that collections can be salvaged in the event of emergencies such as floods or fires.

Notably, the inclusion of consultation with professional librarians highlights the human expertise required in effective microfilm preservation. Technical measures alone cannot guarantee long-term survival without the informed oversight and decision-making provided by trained professionals.

From the perspective of this research, these techniques reflect a preservation philosophy rooted in prevention and care, rather than reactive repair. While they may seem basic compared to modern digital preservation tools, their continued relevance lies in their cost-effectiveness, proven efficacy, and adaptability across different library contexts. This suggests that even as hybrid preservation strategies evolve, traditional microfilm preservation methods remain an essential component of a sustainable archival ecosystem.

Table 4.
Challenges in Microfilm Preservation

No	Challenges in Microfilm Preservation
1.	Financial Limitations
2.	Insufficient librarian skills or knowledge
3.	Inadequate environmental conditions
4.	Difficulty in reading microfilm reels
5.	Challenges in maintaining microfilm quality, including color, size, and legibility
6.	Legal Constraints
7.	Reconstruction of classification system
8.	Lack of standardized written guidelines

Source: Research Findings, 2025

Table 4 shows that there are several common challenges encountered in microfilm preservation including classic issues such as financial limitations or lack of funding, insufficient skills or knowledge among librarians in maintaining microfilm, and inadequate environmental conditions, usually related to temperature or lighting that cannot be properly controlled. Other challenges, though less frequently mentioned, but still have a significant impact include difficulties in reading microfilm reels, maintaining the quality, size, and legibility of microfilm, legal issues (often related to copyright, sensitive information, and intellectual property), reconstruction of classification systems, and the absence of written guidelines for microfilm preservation.

Table 5.
Results of Literature Review

Title	Writer, Year, Jurnal Vol (No)	Findings
Preservation of audio-visual archives in Zambia	Mulauzi et al, 2021, ESARBICA Journal: Journal of the Eastern an Southern Africa Regional Branch of the International Council on Archives, 40(1)	Audio-visual collections (including microfilm) need to be preserved by storing them on open shelves and in specialized cabinets. It is also essential to digitize and migrate at-risk archival recordings, fumigate storage areas, and regulate temperature and humidity within storage environments. The main challenges in preserving audio-visual collections include lack of funding, technology, playback equipment, training, backup systems, and inadequate storage facilities.
Preservation and Conservation o Library Resources in Nigerian Libraries: A Review	Usiedo et al, 2022, Communicate: Journal of Library and Information Science, 24(2)	Preservation efforts for library collections (including microfilm) include digitization, dust cleaning, arranging materials to ensure proper air circulation, using insecticides to deter pests, and installing air conditioning systems to regulate storage temperature.

Preservation and Conservation o Manuscripts at Oriental Researcl Institute Library in Karnataka: A Case Study	Nirmala & Tadasad, 2022 Journal of Library Development, 8(1)	Preservation efforts for library collections (including microfilm) involve the use of lemongrass oil as a natural pesticide to repel insects and digital scanning. The main challenges faced include the need for adequate funding and the involvement of a trained professional to properly preserve the collection.
Ancient Manuscript Preservatior of Museum Ranggawarsita Library Collection Semarang Central Java	Khafidlin, 2021, Daluang: Journal of Library and Information Science, 1(1)	The maintenance of library collection (including microfilm) can be carried out through preventive and curative measures such as controlling temperature and humidity, dust cleaning, protection against pollutant gases and insects, as well as restoration efforts. A common obstacle in collection maintenance is the lack of funding."
Preservation of Digital Information Resources in Selected University Libraries in Delta State, Nigeria	Rhima, 2023, Communicate: Journal of Library and Information Science, 25(2)	Libraries often use external hard drives CD-ROMs/DVDs, and computer hard disks as storage media for collection preservation purposes. In addition, libraries regulate air humidity to maintain a cool environment by using air conditioners.
Preservation of Cultural Heritag at University Libraries: a Case Study of Storage, Conservation & Presentation of Manuscripts at Bharat Ratna Dr BR Ambedkar Memorial Library of Osmania University, Hyderabad, Telangan State	Munigal, 2022, International Journal of Information, Library and Society, 11(2)	Microfilm is converted into digital format to facilitate easier reading and storage, while also being cleaned of dus and fumigated. A key challenge faced is the lack of knowledge and skills among librarians in properly maintaining microfilm.
Between Online and Offline: Doing Archival Research in the Digital Age	Zaagsma, 2024, ARCHIV. theorie & praxis, 77(1)	Collection digitization is carried out to facilitate user access to library materials. However, challenges often arise in the digitization process and must be carefully considered, such as legal issues, copyright restrictions, and information sensitivity.
Transferred, Preserved, and Destroyed: The Dominion Lands Branch's Manitoba Files 1	Eyford, 2023, Archivaria, (95)	Preservation is carried out by digitizing microfilm library materials and providing bibliographic descriptions for each item. A common issue with microfilm materials is the difficulty in reading the film reels.
Bias and representativeness in digitized newspaper collections: Introducing the environmental scan	Beelen et al, 2023, Digital Scholarship in the Humanities, 38(1)	Preservation can be carried out through the digitization and scanning of historical archives in microfilm format. A major challenge faced is the reconstruction of the classification system to be used.

Digitization and Digital Preservation of Library Resources in the Contemporary Era: A Study with Reference to the Selected Special Libraries in Mizoram	Boro & Fanai, 2023, Annals of Library and Information Studies, 70(4	Digitization is an effective preservation technique for ensuring the long-term storage of library materials (including microfilm). A common challenge is that many librarians still lack sufficient skills and understanding of the digitization process.
Preservation and Accessibility to Private Collection of Islamic Scholars in Kano Metropolis	Habibu, 2021, Jewel Journal of Librarianship, 16(1)	Special library collections, such as microfilm, are stored in separate rooms with restricted access for certain users only. Libraries also consult with professional librarians to seek advice on preservation, provide staff training, hire preservation specialists, and equip the facility with modern preservation infrastructure.
The Importance of Electronic Documentation of Photo-Microfilming Example of the Microfirs (Tapes) Depository at the National Manuscript Center	Megeneishvili & Tavadze, 2023, Scientia-Scholarly Journal, (4)	Microfilm and microfiche must be stored in alkaline-buffered neutral boxes, preferably inside closed stainless steel cabinets, with controlled conditions of 17˚C temperature and 50% ±5% relative humidity, along with regular dust cleaning. Additionally, each microfilm must be accompanied by a bibliographic attachment containing images and complete information to facilitate retrieval.
Information Preservation and Security Practices for Livestock Traceability by Market Officials i Katsina State Livestock Markets, Nigeria	Mannir et al, 2024, Nasarawa Journal of Library and Information Science (NAJLIS), 8(1)	Commonly used methods for preserving library materials include dust cleaning and making copies. Additionally, disaster recovery planning is developed, along with the implementation of modern preservation techniques such as digital scanning and acid-free storage to protect library materials in the long term.
Seeing, Saving, and Rememberin Barnardo's Children: Technologies of Access and Preservation in Historical Research	Vestberg, 2022, Scientia Canadensis, 44(1)	Scanning library materials in microfilm format is carried out to create digital copies and protect them from damage by storing them in a designated secure location.
Digitised historic newspapers as a primary source for marketing historians	Hawkins, 2022, Journal o Historical Research in Marketing, 14(2)	Digital scanning of microfilm can be used as a preservation method. The challenges faced include maintaining the quality of the microfilm in terms of color, size, and readability
Preservation Practices fc Information Resources in Publ University Libraries in Tanzania	Mubofu et al, 202 International Journal fc the Preservation Library and Archiva Material, 43(3)	Digitization, dust cleaning on shelves and library areas, as well as bookbinding. Additionally, migration and emergency preparedness are frequently carried out by libraries.

Digitisation of Archival Records at National Archives of India and Department of Delhi Archives: A detailed study of methods, standards and protocols	Ahmad & Sharma, 2021, Nveo-Natural Volatiles & Essential Oils, 8(5)	Damage prevention for microfilm is carried out by restricting user access to microfilm containing historical archives Additionally, digitization with the addition of metadata and annotations for each copy can also be implemented
Indigenous Knowledge Preservation in Nigeria, An Outlook of Public Libraries' Efforts in Kwara State	Mahmud et al., 2022, UMYU Journal of Library and Information Science, 1(1)	Digitization serves as a means to preserve microfilm-based library materials that contain traditional knowledge. However, this effort faces challenges related to collection development policies and the intellectual property rights of information.
Regarding Digitization of Archiv Institutions	Nazarov, 2022, Current Research Journal of History, 3(11)	Microfilm needs to be stored in aluminum cabinets and digitized to facilitate storage, retrieval, and use of the collection. This not only reduces costs but also maximizes its use.
Preservation and conservation practices of library information resources in Tanzania: Perspectives from librarians	Malekani & Wema, 2024, The Journal of Informatics, 4(1)	The preservation of library materials, including microfilm, is carried out through data refreshing, migration, digitization, data backup, proper organization, environmental control, and CCTV monitoring. However, preservation efforts face several challenges, such as a lack of librarian expertise, unfavorable environmental conditions, particularly inadequate temperature control, and the absence o written guidelines
Preservation and Conservation o Library Materials as Reflected Through Library and Informatio Science Abstract (1971–2009): A Review Work	Mukherjee & Das, 2023, International Journal for Multidisciplinary Research, 1(2)	Microfilm preservation is carried out through digitization, which includes enhancing faded or difficult to read images and adding watermarks for security. In addition, storage conditions such as temperature and lighting, must also be carefully maintained.

Source: Research Findings, 2025

Table 5 show that microfilm preservation practices in libraries and archival institutions are dominated by two broad approaches: traditional preservation methods and digital preservation techniques. Traditional methods include environmental control (temperature and humidity regulation), dust cleaning, pest control, the use of specialized cabinets or storage rooms, restricted access policies, and disaster recovery planning. Some institutions adopt natural solutions, such as lemongrass oil as a pesticide, while others use acid-free storage materials and alkaline-buffered boxes to prolong microfilm lifespan.

Digital preservation is a strong recurring theme, with many studies emphasizing digitization, migration, and the creation of digital surrogates to ensure accessibility and protect the original microfilm. Digitization is often complemented by the addition of metadata, annotations, bibliographic descriptions, and digital enhancements (e.g., improving faded images, adding watermarks). In some contexts, digitization also serves as a safeguard against the obsolescence of playback equipment and to support user convenience.

The main challenges identified across studies are resource-related constraints—notably lack of funding, inadequate storage facilities, limited access to modern technology, shortage of skilled preservation staff, and insufficient training. Additionally, environmental issues (e.g., poor temperature and humidity control), copyright restrictions, and the absence of formal guidelines also hinder preservation efforts.

Overall, the findings suggest that while digital methods are increasingly adopted, traditional techniques remain critical for ensuring the physical stability of microfilm. Effective microfilm preservation in libraries often requires a hybrid strategy—integrating preventive physical care with digitization and metadata management—supported by adequate resources, staff expertise, and clear institutional policies.

Discussion of Research Findings. The research findings show that traditional microfilm preservation techniques can be implemented through various methods, including controlling the storage environment, removing dust, pest control, storing in designated areas, restricted access, preparing disaster recovery plans, and consulting with professional librarians regarding microfilm preservation. Temperature and light control in the storage room can be managed by operating the air conditioner for 24 hours a day to maintain a stable temperature, as well as curtains and lighting system to control light exposure (Mukherjee & Das, 2023; Rhima, 2023; Usiedo et al., 2022). Furthermore, maintaining the cleanliness of the storage area is essential, including routine cleaning of air filters and proper binding materials to prevent dust accumulation, which can cause scratches on microfilm (Khafidlin, 2021; Mubofu et al., 2022; Usiedo et al., 2022). The storage area must also be protected from pests or insects to avoid damage to library materials (Khafidlin, 2021). Preventive measures can involve the use of natural substances, such as citronella oil as a natural pesticide (Nirmala & Tadasad, 2022), and insecticides to repel insects (Usiedo et al., 2022). Microfilm should be stored in a separate room, placed in aluminum cabinets or in neutral-alkaline buffered boxes, with environmental conditions maintained at a temperature of 17°C and relative humidity of 50% ±5%, to ensure the stability and preservation of the microfilm (Megeneishvili & Tavadze, 2023; Mulauzi et al., 2021; Nazarov, 2022)." Moreover, restricting user access to microfilm can help prevent damage caused by improper handling (Habibu, 2021). Microfilm preservation efforts should also include the development of a disaster recovery plan to prepare for potential damage resulting from natural disasters, such as floods or fires (Mannir et al., 2024). Finally, consultation with professional librarians is essential for obtaining expert advice on preservation strategies and for participating in training programs focused on appropriate microfilm preservation techniques (Habibu, 2021; Mubofu et al., 2022).

In addition to traditional methods, microfilm preservation can also be carried out digitally through the use of technology. Digital preservation of microfilm involves several processes, including digitization or data refreshing, migration or digital scanning of microfilm records, archiving digital copies onto appropriate digital storage media, and adding metadata or bibliographic descriptions. These preservation efforts help ensure long-term access and facilitate user access to information and improve the storage management of library materials (Hawkins, 2022; Melekani & Wema, 2024; Zaagsma, 2024). Using digitization as a preservation technique is considered an effective and appropriate approach for the long-term storage of library materials (Beelen et al., 2023; Boro & Fanai, 2023; Mulauzi et al., 2021; Vestberg, 2022). The digitization process involves migrating recordings or performing digital scans to convert microfilm formats into digital formats (PDF, JPG, PNG), marked with watermarks to enhance readability and storage (Mukherjee & Das, 2023; Mulauzi et al., 2021; Munigal, 2022). Digitized library materials are then archived in storage media such as external hard drives, CD-ROMs/DVDs, and computer hard disks (Rhima, 2023). The storage of each digitally formatted library material is equipped with metadata

containing bibliographic descriptions and images. (Ahmad & Sharma, 2021; Eyford, 2023; Megeneishvili & Tavadze, 2023).

Common challenges encountered in microfilm preservation include financial constraints, lack of librarian skills or knowledge, unsuitable environmental conditions, unreadable film reels, issues with color quality, size and readability of the microfilm, legal considerations, the need to reconstruct classification systems, and the absence of written guidelines. Among these, a lack of funding or financial difficulties is the common obstacle in preservation efforts. (Khafidlin, 2021; Nirmala & Tadasad, 2022). This issue is further worsened by the lack of librarian skills or knowledge in microfilm preservation practices. (Munigal, 2022). More preservation training needs to be conducted to improve librarians' knowledge (Habibu, 2021). Unstable environmental conditions can affect temperature and lighting, which contribute to deterioration of microfilm (Melekani & Wema, 2024). Humid storage areas can degrade film reels, making them difficult to read and hindering preservation efforts. (Eyford, 2023). This can be caused by deteriorating color quality, reduced microfilm size, and difficulties in maintaining the readability of the microfilm (Hawkins, 2022). Legal reasons such as copyright, intellectual property rights, collection development policies, and information sensitivity can hinder the digitization process aimed at protecting information contained in microfilm (Mahmud et al., 2022; Zaagsma, 2024). The ongoing reconstruction of classification systems can also cause challenges in microfilm storage (Beelen et al., 2023). Finally, the absence of written guidelines regarding microfilm preservation causes confusion among many librarians (Malekani & Wema, 2024).

Research Limitation. The literature review only used the Google Scholar database and did not include international databases such as Scopus

IV. CONCLUTION

Based on the results of the research through a Systematic Literature Review (SLR), it was found that there are 21 articles from various countries within the last five years discussing microfilm preservation in libraries. The highest number of article publications occurred in 2022 and 2023, with the number reaching 6 articles. Most microfilm preservation research has been conducted in Nigeria and India, each publishing five articles, while Indonesia is in the last rank with only one published article. Based on the results of the SLR, it can be concluded that traditional microfilm preservation techniques involve controlling the storage environment, cleaning from dust and pests, storing in designated areas with restricted access, preparing disaster recovery plans, and consulting with professional librarians regarding microfilm preservation. Meanwhile, digital preservation techniques primarily include digitizing microfilm or refreshing data through recording migration or digital scanning of microfilm. Preservation processes often face common challenges in libraries, those are financial constraints and a lack of librarian skills or knowledge.

Future Work. Future research can focus on the use and maintenance of other types of micro library materials, such as microfiche or microslides, as studies on these topics remain limited. Further research could also explore the long-term impacts of microfilm digitization. Additionally, studies addressing the balance of library costs in preservation needs are necessary.

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