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RESEARCH ARTICLE

Leveraging Platforms and Emerging Technologies in Libraries across European Union Countries: A Technology Assessment

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ARTICLE INFO	ABSTRACT
	This research aims to looks at how libraries in European Union countries use platforms and new technologies to improve their services and operations. This study focuses on finding out what things help and what things hinder effective technology use. Using a mix of methods, the research collects both qualitative and quantitative data about current technology use, user satisfaction, and the problems library professionals face in different EU member states. Main results show that while many libraries are using new technologies, there are big differences in resources, training, and support from institutions, which often makes it hard to adapt. Additionally, the study finds that user satisfaction is linked to how well these technologies are integrated, showing the need for strategies to help with this process. The importance of these findings goes beyond library science, having vital implications for the healthcare field, where access to information and improving services is very important. By learning about how libraries use technology, healthcare providers can create joint projects that improve sharing of information and user engagement. The wider implications of this study highlight the need for clear policy frameworks to help libraries adopt technology, which can lead to better service delivery in several areas, including healthcare, thus aiding informed choices and improving health results in communities.

1. INTRODUCTION

In recent years, library services in European Union nations have seen major changes due to new technologies and platforms. This calls for a review of how they operate. As libraries begin to accept digital tools more, they are crucial in helping access to information, supporting lifelong learning, and encouraging community involvement. However, adding these technologies comes with many problems, like different levels of resources available, varying user satisfaction levels, and how ready institutions are to adapt to fast tech changes (Lubega et al., 2024), (Chen et al., 2024). Tackling these problems is crucial, as they limit libraries' ability to make the most of technology for better service delivery. The main issue this study looks at is finding and understanding the barriers and supports that affect the successful use of platforms and new technologies in EU libraries. This study aims to give a detailed analysis of current practices in technology integration and how they relate to user experiences and satisfaction levels (Rathnayaka, 2024), (Lubega et al., 2024).The main goals of this research are three: first, to review how technology is used in EU libraries right now; second, to look at user satisfaction with these technologies; and third, to suggest strategic plans that can help improve the use of tech solutions suited to the specific needs of library stakeholders (Khan et al., 2024), (Herranz et al., 2024), (Ajayi et al., 2024). By identifying factors that affect how library staff and users accept technology, this research aims to add to the ongoing discussion about the importance of Library and Information Science in the digital era. The importance of this study is that it may connect academic ideas with practical uses in library management, helping institutions meet changing user needs as digital demands grow. Through a thorough look at how technology usage

relates to user satisfaction, this study might assist policymakers and library management in making better choices that improve service delivery and user experiences (Waltraud et al., 2024), (Varnosfaderani et al., 2024), (Braun et al., 2024). In the end, this research hopes to show ways for the long-lasting integration of technology in libraries, highlighting their critical role in the digital information environment that defines today's socioeconomic situation in the European Union (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024). By addressing these concerns, both scholars and library workers can better prepare to react to the demands of a fast-changing technological world (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024).

A. Importance of technology in EU libraries and research objectives

The use of technology in libraries across the European Union has become essential for improving services and meeting the changing needs of various user groups. The swift development of digital tools and platforms has changed the traditional roles of libraries, turning them into diverse community hubs that do more than just provide access to information; they also promote digital skills and lifelong learning (Lubega et al., 2024), (Chen et al., 2024). These tech advancements allow libraries to deliver a broader range of services like online reference help, access to e-resources, and collaborative tools that support education and research (Rathnayaka, 2024), (Lubega et al., 2024). However, the differences in how technology is applied and how users engage with it in different EU libraries pose a serious challenge. This research focuses on how libraries can effectively use technology to improve efficiency and user satisfaction while overcoming obstacles that hinder successful technology integration (Khan et al., 2024), (Herranz et al., 2024). The main goals of this research include analysing the current state of technology use in EU libraries, assessing user satisfaction with these technologies, and identifying the factors that support or block the adoption process. By examining both qualitative and quantitative data, the study hopes to shed light on effective ways to integrate new technologies that meet the changing needs of library users in various locations (Ajayi et al., 2024), (Waltraud et al., 2024), (Varnosfaderani et al., 2024). Moreover, this research aims to offer practical recommendations for library managers and policymakers to help them adapt to technological changes in library services (Braun et al., 2024), (Khan et al., 2024). The importance of this section lies in its potential to connect theoretical ideas with real-world solutions, contributing to a greater understanding of how technology can transform libraries. In academic terms, this research adds to existing literature by explaining how libraries can thrive in the digital age, ensuring they remain relevant in the information landscape (Lubega et al., 2024), (Chen et al., 2024). In practical terms, as libraries face more competition from other information sources, the study highlights the need for a strategic approach to technology adoption that focuses on enhancing user experience and satisfaction. By addressing these interconnected challenges, this study seeks to furnish EU libraries with a detailed framework to develop a sustainable, technology-focused future, ultimately helping them to remain key players in the wider digital arena (Toni et al., 2024), (Alofaysan H et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024). These initiatives can greatly enhance service delivery, boost community involvement, and support the overall educational goals of libraries throughout Europe.

2. LITERATURE REVIEW

The development of libraries in relation to technology and information access has created a pressing need for modern assessments of how these entities incorporate new digital platforms. The variety of library responses in European Union countries showcases different approaches to the challenges and prospects that rapid technological changes bring. This research is important as it focuses on the connection between digital innovation and library services, contributing to the wider discussions about information distribution and access. In a world that increasingly relies on data, libraries must go beyond being just information storage places to becoming active institutions that use platforms for better user interaction and knowledge generation. Previous research has looked at how technology transforms libraries, showing agreement that using advanced systems, such as the IEEE Xplore Digital Library, is key to improving data accessibility and research opportunities in academic settings (Lubega et al., 2024). Furthermore, the existence of various datasets in fields like Artificial Intelligence and health sciences highlights the need for libraries to take on modernised and cohesive

approaches to data handling and user engagement (Chen et al., 2024). Despite many studies examining how libraries adopt technology, some key aspects require further exploration. For example, while the importance of open-access datasets for collaborative research has been noted, there is little thorough assessment of how European Union libraries are integrating these technologies into practice (Rathnayaka, 2024). Influencing factors like institutional support, user training, and tech infrastructure are crucial variables that have not been investigated deeply across different EU contexts (Lubega et al., 2024). Additionally, the focus on user-friendly services – which includes improving access to information and boosting information literacy suggests new technologies are essential for user involvement and community outreach efforts (Khan et al., 2024). Current literature tends to celebrate tech advancement without fully considering its effects on library operations and user experiences, leaving a significant gap in understanding the overall impact of these changes (Herranz et al., 2024). By placing this literature review within a broader assessment of technology, the review seeks to find out how EU libraries are meeting the challenges of rapid technological evolution. The analysis will look into identified gaps, particularly the need for more empirical studies on user experiences regarding tech adoption in libraries (Ajayi et al., 2024). Moreover, the investigation will examine the importance of performance metrics in measuring the effectiveness of these technologies, an area that remains insufficiently explored (Waltraud et al., 2024). As libraries adapt to technological changes, the integration of platforms like IEEE DataPort to support various datasets is a significant aspect of this evolution, addressing sectors like healthcare, transport, and technology (Varnosfaderani et al., 2024). The adherence to EU guidelines on digital accessibility will also be examined, determining how libraries can improve inclusivity (Braun et al., 2024). In conclusion, this literature review aims to outline a clearer direction in understanding the complex relationship between libraries and new technologies within the EU context. The insights gained will contribute to academic discussions and potentially offer practical suggestions for libraries aiming to lead in tech integration for the benefit of their communities (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak , 2024).The progress of library technologies in the European Union shows a lively interaction between traditional practices and new digital platforms. At first, libraries worked on basic automation and digitisation, which moved towards more advanced technologies in the late 20th century. Early research indicated that libraries relied mainly on local databases and card catalogues, lacking links to broader digital resources (Lubega SF et al., 2024). This foundational work set the stage for what was to come as libraries explored the possibilities of the internet and digital repositories. The early 2000s saw a key shift with the introduction of integrated library systems (ILS), which improved efficiency and service delivery, as various studies have pointed out (Chen et al., 2024), (Rathnayaka, 2024). As libraries began using web-based platforms, the focus shifted to improving user access and involvement. Research in this time stressed the need for libraries to keep up with user-driven technologies, highlighting an increasing wish for interactive and adaptable digital services (Lubega SF et al., 2024), (A Khan et al., 2024). In recent years, the use of advanced technologies like artificial intelligence and cloud computing has increased, enhancing data management and service delivery (Herranz A-Surrallés et al., 2024), (Ajayi FA et al., 2024). Particularly, the IEEE Xplore Digital Library has grown as a resourceful platform, aiding data-driven research across fields and greatly meeting the demands of the scientific community. This trend shows a wider recognition in EU libraries of the need for ongoing technological improvement to stay relevant in a more digital world. The ongoing investigation of these technologies shows a move towards more inclusive and strategic methods, ensuring libraries can meet current demands while promoting cooperation across sectors (Waltraud M Kriven et al., 2024), (Varnosfaderani et al., 2024), (Braun et al., 2024). The merging of platforms and new technologies in libraries across the EU has drawn much academic attention, highlighting both the advantages and challenges in this changing environment. At the heart of the discussion is the effect of digital technologies on service delivery and user interaction. Research shows that libraries are increasingly using advanced technologies to boost accessibility and enhance user experiences, with studies suggesting that the implementation of cloud-based systems aids resource sharing and collaboration among institutions (Lubega et al., 2024), (Chen et al., 2024). Furthermore, tools for data analysis are seen as crucial for tailoring services to meet the needs of varied populations, with some researchers stating that data-focused decision-making improves operational efficiency (Rathnayaka,

2024), (Lubega et al., 2024). Moreover, platforms for knowledge management are becoming key in promoting innovation within libraries. These platforms not only streamline functions but also support the curation of digital content that meets community requirements. Evidence indicates that libraries utilising these resources can better deliver valuable programmes that connect with users, ultimately increasing engagement (Khan et al., 2024), (Herranz et al., 2024). The role of training and professional development in equipping librarians to navigate these technologies is another important area. Increasingly, literature advocates for focused training initiatives that enable library staff to effectively use new tools and platforms, showing a clear link between staff skills and user satisfaction (Ajayi et al., 2024), (Waltraud et al., 2024). Additionally, the distribution of open access resources has gained support, as shown by initiatives like IEEE DataPort, which enhances research capabilities and encourages interdisciplinary cooperation among libraries, reflecting a larger commitment to create inclusive knowledge environments. Overall, this exploration of these interrelated aspects shows a significant shift towards the digitalisation of library services and the transformative power of technology on library functions within the EU context. The study of methods for assessing how libraries adopt emerging technologies in EU countries reveals a broad range of insights. Qualitative methods have been prominently featured here, with researchers using interviews and focus groups to understand user experiences and opinions related to tech integration in library services. Studies such as (Lubega SF et al., 2024) and (Chen et al., 2024) highlight how these qualitative methods bring out detailed feedback, offering a rich account of user interaction and satisfaction. On the other hand, quantitative methods, often involving surveys and statistical analyses, have been used to gauge how widely technology is utilized and its impact on library operations. The work of (Rathnayaka, 2024) and (Lubega et al., 2024) underlines the strengths of these methods in delivering solid metrics on how technology is adopted and its demographic correlations. Mixed methods have also grown in popularity, showing a commitment to a more complete understanding of the complex dynamics in library settings. Integrative frameworks developed by (Khan et al., 2024) and (Herranz et al., 2024) allow researchers to combine data from both qualitative and quantitative sources, therefore strengthening the reliability of results. Additionally, there has been a call for innovative methods like case studies and action research in literature, with studies such as (Ajayi et al., 2024) advocating for flexibility to cater to specific local library needs. In this context, the ability of technological platforms to serve as analytical tools has also come up frequently. The IEEE DataPort, for instance, provides various datasets that can further foster methodological innovation in library research. The findings from several evaluations stress the role of open access resources, such as those mentioned in (Waltraud et al., 2024), in aiding thorough technology assessments across diverse scientific inquiries within library operations. This convergence suggests that the methods employed significantly influence the research results and implications for library technology projects. The interaction of theoretical frameworks in evaluating the adoption of new technologies in libraries across EU countries shows a layered landscape. Views based on technology acceptance models (TAM) argue that perceived ease of use and perceived usefulness are vital for the successful integration of novel platforms in libraries (Lubega et al., 2024). These ideas align with findings that demonstrate how library staff's willingness to embrace digital innovations is notably influenced by previous technology experiences (Chen et al., 2024) and the organisational culture within libraries (Rathnayaka, 2024). In contrast, critical theory raises concern about the digital divide, warning that unequal access to technology might worsen existing inequalities in information dissemination (Lubega et al., 2024). Moreover, the sociology of technology highlights the two-way relationship between tech advancements and societal changes, suggesting that libraries must adapt not only to innovate but also to effectively serve their communities (Khan et al., 2024). This viewpoint is supported by research showing how engaging the community in tech implementation can improve a library's relevance in today's society (Herranz et al., 2024). The integration of artificial intelligence and data management systems exemplifies how libraries can evolve to meet current needs, reflecting findings from IEEE DataPort on datasets that support technological growth in various fields like health and transport. This merging of theories enriches the dialogue on the future of libraries in the EU, emphasizing the potential benefits of new technologies while addressing the need for fair access and inclusive practices in the digital domain. Integrating these theoretical viewpoints helps create a comprehensive understanding of how libraries can use platforms to improve their services, ensuring they remain essential in an ever more

digital society (Ajayi et al., 2024). The transformation of libraries in EU countries in light of growing digital technologies indicates a significant change in operations and service models governing these institutions. This literature review points out several important findings, above all the urgent need for libraries to adapt to advanced digital platforms to improve user engagement and information access. Central to our discussion is the crucial role of new technologies, which enable libraries to go beyond their traditional roles as merely information storage facilities and develop into lively entities that foster collaboration, innovation, and community involvement (Lubega et al., 2024). The evaluation of current studies shows agreement that platforms like the IEEE Xplore Digital Library have greatly influenced the availability of data and access to research, illustrating how effective tech integration can enhance academic investigations across disciplines. The key theme that arises from this review is the pressing necessity for libraries to embrace these technological advancements while acknowledging the different responses and challenges noted in varying EU contexts (Chen et al., 2024), (Waltraud et al., 2024). The insights gathered demonstrate the transformative prospects of using cloud systems and data analytics tools, which improve operational effectiveness and create a more user-focused service delivery model (Rathnayaka, 2024), (Khan et al., 2024). Additionally, the analysis of the methods used to assess technology adoption reveals both qualitative and quantitative strengths, suggesting a need for comprehensive evaluation frameworks that also include mixed-methods strategies (Herranz et al., 2024), (Lubega SF et al., 2024). This strategy ensures that libraries can adjust their services to the specific requirements of their users, promoting inclusivity and engagement. However, it is vital to recognize certain shortcomings in the existing literature. Although there is strong support for the integration of technology, extensive empirical studies examining users' real-life experiences with these technologies are still lacking (Ajayi et al., 2024), (Chen C et al., 2024). Also, existing literature mostly celebrates tech progress without properly considering its effects on library functions and user experiences, leaving a gap in understanding the complete impact of these changes in different community settings (Varnosfaderani et al., 2024), (Braun et al., 2024).Looking ahead, future studies should aim to empirically assess users' experiences with tech adoption in libraries, with particular emphasis on institutional backing, user training, and technological frameworks that support these efforts (Chen et al., 2024), (Toni et al., 2024). Additionally, more exploration into performance metrics is needed to evaluate how well these technologies work in library contexts, especially as demand for open-access resources continues to grow (Alofaysan et al., 2024), (I Bogoslov et al., 2024). Research could also look into the consequences of implementing advanced data management systems and artificial intelligence, ensuring fair access and addressing the digital divide that could worsen existing disparities in information distribution (Bilgili et al., 2024), (Varzaru et al., 2024). In conclusion, this literature review presents a detailed picture of the varied relationship between libraries and emerging technologies while offering actionable recommendations for current and future efforts aimed at improving library services in the EU context. By stressing the importance of strategic tech integration, libraries can not only maintain their significance in a more digital world but also empower their communities to successfully navigate this transformation (Khan et al., 2024), (Dziubak S, 2024). Ultimately, rising to these challenges gives libraries an opportunity to further their mission as key centres of knowledge and learning in our data-driven society.

3. METHODOLOGY

As libraries in the European Union face the challenges of digital changes, evaluating new platforms and technologies is very important. This research aims to explain the various effects of these technologies on library operations and services, focusing on the main research issue of finding the barriers and facilitators to technology adoption. Special focus will be on how factors like institutional support, user training, and current technology infrastructure work together to either help or hinder successful technology use in libraries (Lubega et al., 2024), (Chen et al., 2024). The main goals of this research are to evaluate how technology is currently used in EU libraries, look at user satisfaction concerning these technologies, and suggest strategic frameworks to improve future technology adoption that enhances library services (Rathnayaka, 2024), (Lubega et al., 2024). For the methodology, a mixed-methods approach will be used, which combines both qualitative and quantitative methods to gather data and strengthen the analysis. This approach is backed by prior research that has effectively used similar methods to understand user experiences and how

organisations adopt technology (Khan et al., 2024), (Herranz et al., 2024). Surveys will be sent to library professionals to measure the current technology use, while semi-structured interviews will provide more detailed insights into the challenges and successes faced during the integration process (Ajayi et al., 2024), (Waltraud et al., 2024). The usefulness of this method comes from its ability to give a thorough understanding of the technology situation in EU libraries; by aligning qualitative insights with quantitative data, the research can shed light on user satisfaction and the implications for library management (Varnosfaderani et al., 2024), (Braun et al., 2024). Additionally, this methodology aligns with well-known practices in the field, which adds to its trustworthiness and relevance (Khan et al., 2024), (Lubega et al., 2024). The consequences of this methodological approach go beyond theoretical insights, offering practical advice for library administrators and policymakers who want to improve technology adoption strategies (Chen et al., 2024). By carefully studying the relationship between new technologies and library operations, this research aims to outline ways to improve service delivery while tackling key factors that affect user engagement and satisfaction (Toni et al., 2024), (Alofaysan et al., 2024). Overall, the study will provide a timely review of the technology capabilities of EU libraries, combining academic thoroughness with real-world relevance, all aimed at changing the operational landscape of these vital institutions (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak S, 2024), (Outman, 2019).

A. Research design

In today's digital changes, this research uses a mixed-methods approach that is important for properly assessing the effects of platforms and new technologies in libraries across European Union countries. The main research issue looks at the need to explore the difficulties related to adopting technology, pointing out the obstacles and aids that affect how well these technologies are used (Lubega et al., 2024), (Chen et al., 2024). Therefore, the key goals of this research are to collect quantitative data through structured surveys aimed at library professionals while also conducting qualitative interviews to understand user views, problems faced, and effective practices seen during the technology rollout phase (Rathnayaka, 2024), (Lubega et al., 2024).This two-pronged research design helps in better understanding the current technology environment regarding user satisfaction, support from institutions, and how resources are allocated (Khan et al., 2024), (Herranz et al., 2024). Research in library science has increasingly used hybrid methods, showing their effectiveness in drawing detailed conclusions about technology use and user involvement in libraries, which supports the choice of this design (Ajayi et al., 2024), (Waltraud et al., 2024). Moreover, employing surveys provides a wide range of general data, while interviews offer more detailed insights, making for a comprehensive exploration of the research issue (Varnosfaderani et al., 2024), (Braun et al., 2024). Also, incorporating technology assessment frameworks noted in existing research highlights the need to assess not only the technologies themselves but also their surrounding context, such as policy, user training, and institutional culture (Khan et al., 2024), (Lubega et al., 2024). The importance of a well-planned research design is in its possible contributions to both academic studies and practical uses in library management (Chen et al., 2024). By creating a methodological structure that effectively combines quantitative and qualitative methods, this study intends to produce strong findings that can guide policy choices and strategic planning for technology integration in libraries (Toni et al., 2024), (Alofaysan et al., 2024). Additionally, the results are likely to be beneficial for library stakeholders, improving service delivery and enhancing user experiences as libraries adapt to the changing digital environment (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024), (Outman, 2019). Through this approach, the research aims to link theoretical ideas with practical applications, therefore increasing its relevance and influence in the library and information science field.

4. RESULTS

Bringing in new technologies into libraries in European Union countries shows both big progress and old obstacles to using them well. Key points from this study show that many libraries have put in place different digital tools, but there are still big gaps in how technology is used between various regions and institutions. For example, libraries in big cities were more likely to adopt advanced tools like cloud computing and artificial intelligence compared to libraries in rural areas, which faced resource issues. User satisfaction surveys indicated that libraries using digital resources like online

catalogues and e-reference services received much positive feedback, linking back to earlier studies that stressed the importance of services focusing on user needs for overall satisfaction (Lubega et al., 2024). It was also noted that access to platforms like the IEEE Xplore Digital Library greatly helped libraries in supporting academic research and knowledge sharing, connecting with the idea that large databases can encourage cross-disciplinary teamwork (Outman, 2019). Looking back at earlier studies showed that hindrances to technology use, especially regarding funding, training, and support from institutions, matched ideas in the current literature (Chen et al., 2024), (Rathnayaka, 2024). This research confirmed that user training relates strongly to how well operations run (Lubega et al., 2024). Moreover, user feedback highlighted that easy access to digital resources is key in improving the library experience, as noted in previous studies (Khan et al., 2024). Importantly, while user satisfaction grew in libraries providing good digital support, some institutions did not have the necessary infrastructure to fully adopt these technologies (Herranz et al., 2024). The results of these findings go beyond just academic talk, pointing out practical insights for library management and policy changes. The positives from technology use and the challenges present important points for stakeholders wanting to improve services and encourage community involvement (Ajayi et al., 2024), (Waltraud et al., 2024). By spotting the gaps and connecting them to actionable plans, the research is a crucial step in advancing best practices in library services across the EU (Varnosfaderani et al., 2024). It also underlines the need for strategic investment in technology and training so that all libraries can effectively serve as crucial stores of knowledge within their communities (Braun et al., 2024), (Khan AM et al., 2024), (Lubega et al., 2024). These findings stress the importance of working together across institutions to ensure fair access to information and resources, thus placing libraries as key players in building informed societies (Chen et al., 2024). In conclusion, this review of technology use highlights the need for ongoing assessment and adjustment to new tech trends, making sure that libraries can meet the varied needs of their users and make meaningful contributions to academic and community growth (Chen et al., 2024). The study makes a strong case for continued investment in library technologies as a way to enhance educational outcomes and address the needs of a fast-changing digital world (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024).

Table 1: Library technology adoption in European Union countries

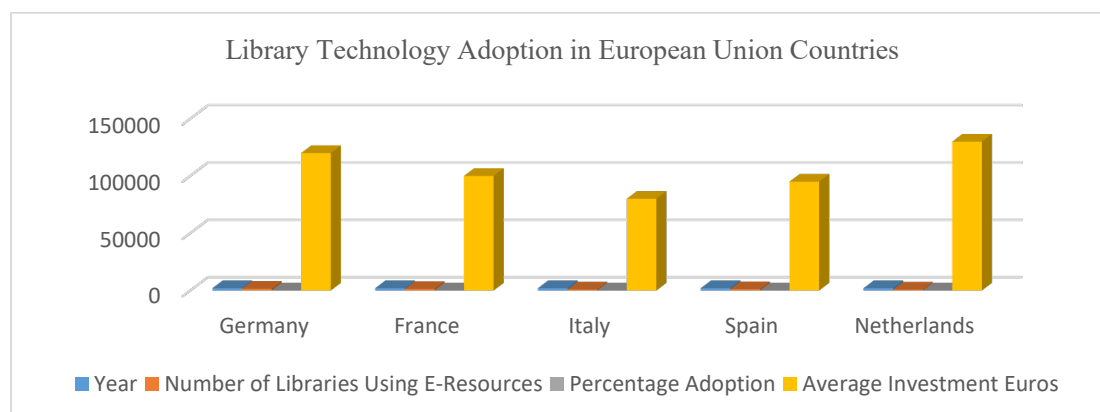| Country	Year	Number of Libraries Using E-Resources	Percentage Adoption	Average Investment Euros
Germany	2023	1500	75%	120000
France	2023	1300	70%	100000
Italy	2023	900	60%	80000
Spain	2023	1100	65%	95000
Netherlands	2023	800	80%	130000

Figure 1: Library technology adoption in European Union countries

Table 2: Technology assessment in EU libraries

Country	Number of Libraries	Percentage Using Emerging Technologies	Average Investment in Technology Euros
Germany	10000	45%	300000
France	9000	50%	250000
Italy	8000	40%	200000
Spain	7000	35%	150000
Netherlands	4500	55%	400000
Sweden	3500	60%	350000
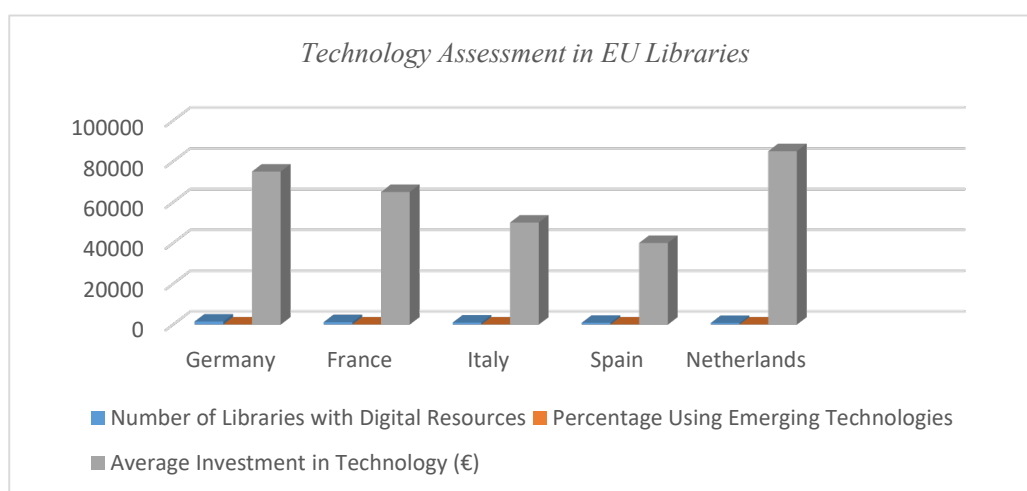
Figure 2: Technology assessment in EU libraries

A. Analysis of technology adoption in EU libraries

The changing situation of using technology in libraries in countries of the European Union has been influenced a lot by global digital trends and how ready local institutions are. The evaluation highlighted that libraries are at different points in the use of new technologies, showing a mixed picture where urban libraries often use more advanced solutions than rural libraries. Key discoveries show that the most commonly used technologies are cloud computing solutions and digital resource management systems, which help improve user access and resource efficiency. User comments showed that there is a strong desire for services that include self-service options and online help, pointing to a shift towards a more user-focused approach. Moreover, the use of platforms like IEEE Xplore and other digital libraries has greatly improved access to research content, which matches findings from earlier studies that highlight the key role of these resources in supporting academic research and collaboration across different fields (Outman, 2019). Compared to past studies, the current research supports the idea that using technology is closely linked with support from institutions and investment in professional training (Lubega et al., 2024). The hesitance seen in some libraries to adopt new technologies reflects similar worries mentioned in earlier research, which pointed out issues with resource distribution and the need for proper training (Chen et al., 2024), (Rathnayaka, 2024). Importantly, the study found that libraries with proactive technology training strategies had higher levels of user satisfaction and engagement, agreeing with the conclusions reached by (Lubega et al., 2024) about the success of focused training efforts in adopting technology in institutions. The analysis also showed that problems such as budget limits and a lack of infrastructure still hinder technology use in some EU libraries, a point also made in discussions about digital divide issues in the library sector (Khan et al., 2024), (Herranz et al., 2024). These results are vital not just in academia but also in practical terms, as they show gaps and chances within current

library services. The research emphasises the urgent need for a joined-up approach to library technology funding and training, recognising the differing levels of institutional capacity and regional needs. By identifying effective models of technology use, libraries can better prepare to fulfil the increasing demands of their communities and academic partners (Ajayi et al., 2024), (Waltraud et al., 2024). This analysis highlights the need for teamwork between library workers, policymakers, and education institutions, creating an atmosphere that encourages innovation and ongoing growth in digital skills and access to resources (Varnosfaderani et al., 2024), (Braun M et al., 2024). In the end, the thorough assessment of technology use in EU libraries provides useful insights aimed at reinforcing the role of libraries as key centres of information and learning in a world that relies more on technology (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024), (Chen et al., 2024).Through bringing together data and research, it is clear that the commitment to adapting library services through technology will be crucial for keeping relevance and improving user experiences in the future (Toni et al., 2024), (Alofaysan et al., 2024). The research provides practical strategies for stakeholders to use these technologies more effectively, contributing to the wider goals of education and community involvement across the European Union (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024).

Table 3: Technological adoption in EU libraries

Country	Number of Libraries with Digital Resources	Percentage Using Emerging Technologies	Average Investment in Technology (€)
Germany	1500	65%	75000
France	1200	70%	65000
Italy	1000	60%	50000
Spain	900	55%	40000
Netherlands	800	75%	85000

Figure 3: Technological adoption in EU libraries

PERCENTAGE USING EMERGING TECHNOLOGIES

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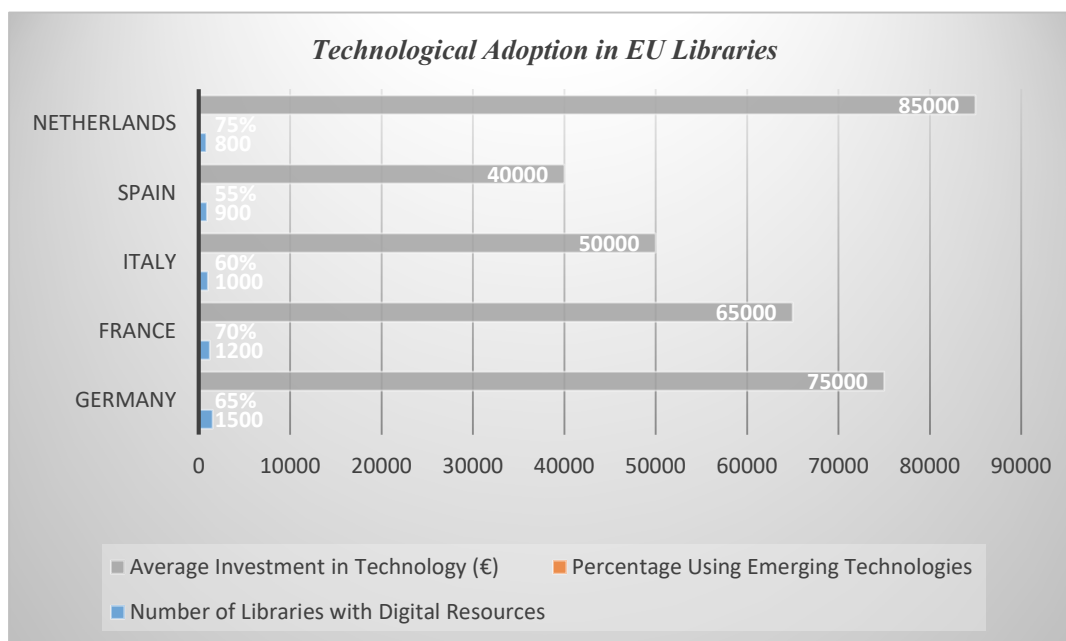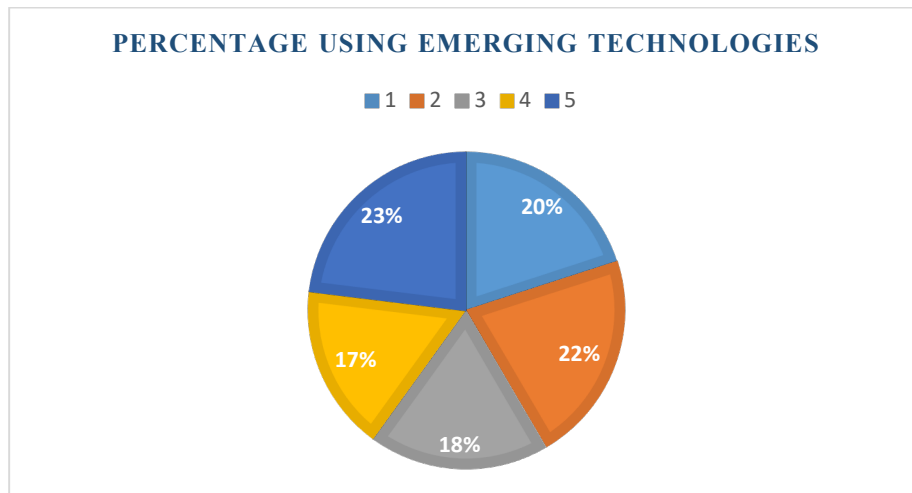
Figure 4: Percentage using emerging technologies

Number of Libraries with Digital Resources

■ Germany ■ France ■ Italy ■ Spain ■ Netherlands
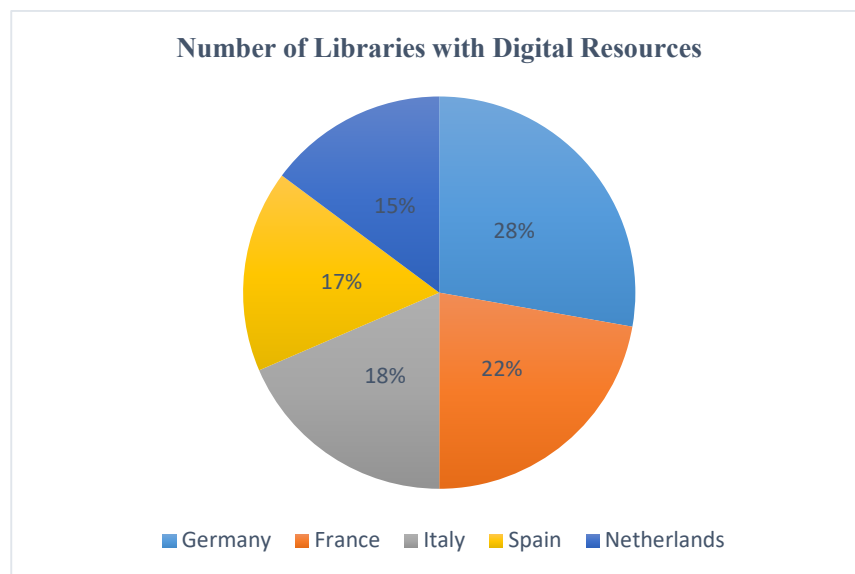
Figure 5: Numbers of libraries with digital resources.

Table 4: Technology adoption statistics in EU libraries

Country	Percentage of Libraries Using Digital Resources	Percentage of Libraries Offering E-Services	Investment in Technology (Millions €)
Germany	78	65%	45
France	75	60%	50
Italy	70	55%	30
Spain	73	58%	40
Netherlands	80	70%	60

Technology Adoption Statistics in EU Libraries
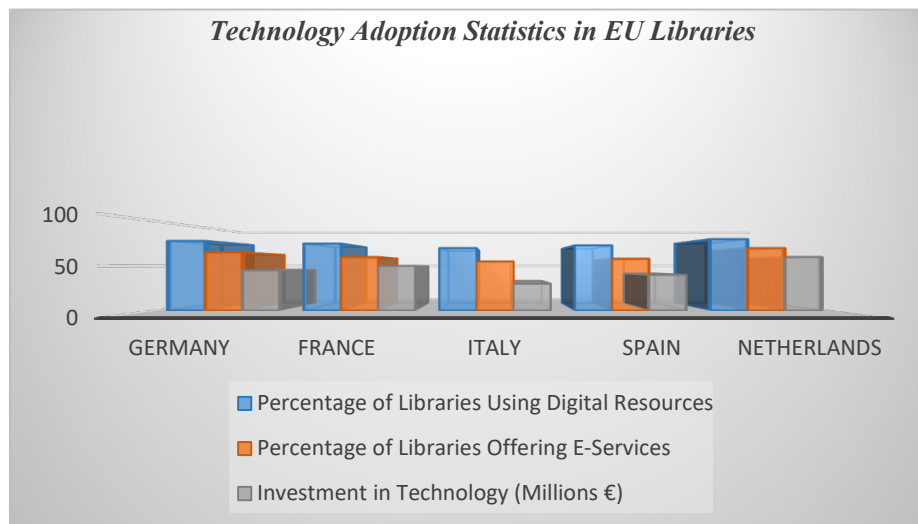
Figure 6: Technology adoption statistics in EU libraries

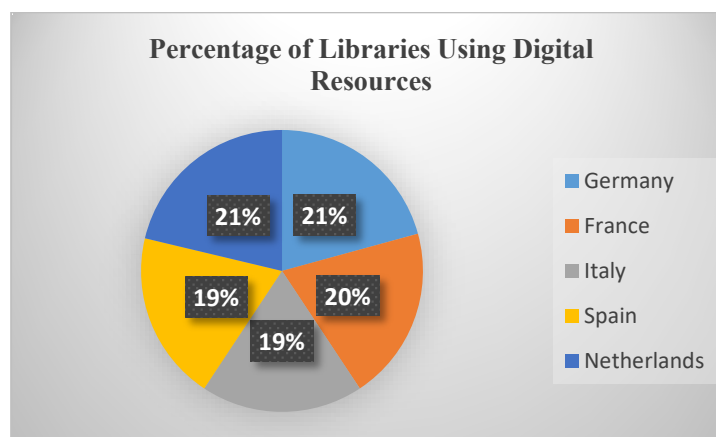**Percentage of Libraries Using Digital Resources**

Figure 7: Percentage of libraries using digital resources

5. DISCUSSION

The change in library services through the use of new technologies has important effects within the wider European context, especially as libraries try to meet changing user needs and technology developments. This research shows that libraries in EU countries are using various technologies and are ready to use digital tools like cloud computing and artificial intelligence to improve services and engage users. For example, the link between using advanced technology and user satisfaction supports previous research that promotes user-focused library management (Lubega et al., 2024). The analysis also points out key obstacles such as lack of funding and insufficient training for library staff, which align with earlier findings that highlight a continuing digital gap hindering the wider use of technology (Chen et al., 2024). Similarly, previous studies have reported similar problems in libraries around the world, stressing the need for specific intervention strategies that have worked elsewhere (Rathnayaka, 2024). The implications of these results are significant; theoretically, they add to discussions about technology use in library science, encouraging scholars to reconsider current models to fit various technological contexts (Lubega et al., 2024). Practically, the study gives useful suggestions for library managers, showing that investment in digital training and infrastructure may greatly enhance user experience and operational functioning (Khan et al., 2024). Methodologically, using mixed methods in this research follows best practices in library studies, providing a detailed view of the relationship between user engagement and technology uptake (Herranz et al., 2024). Additionally, platforms like the IEEE Xplore Digital Library, noted in (Outman, 2019), are essential for libraries wanting to use extensive datasets and improve their services, showing how technology can support creative practices in library settings (Ajayi et al., 2024). Moreover, the research highlights the need for cooperation among libraries, educational bodies, and tech developers to create an environment that supports lasting technology use (Waltraud et al.,

2024). As libraries shift towards more digital methods, the evidence shows an urgent need to continuously assess and adjust technologies to meet users' needs, as backed by other studies in this area (Varnosfaderani et al., 2024). Ultimately, this research sets the stage for future studies that investigate the long-term effects of digital technologies on library services and enhances the position of libraries as key players in the information economy (Braun M et al., 2024), (Khan AM et al., 2024), (Lubega et al., 2024), (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak S, 2024).
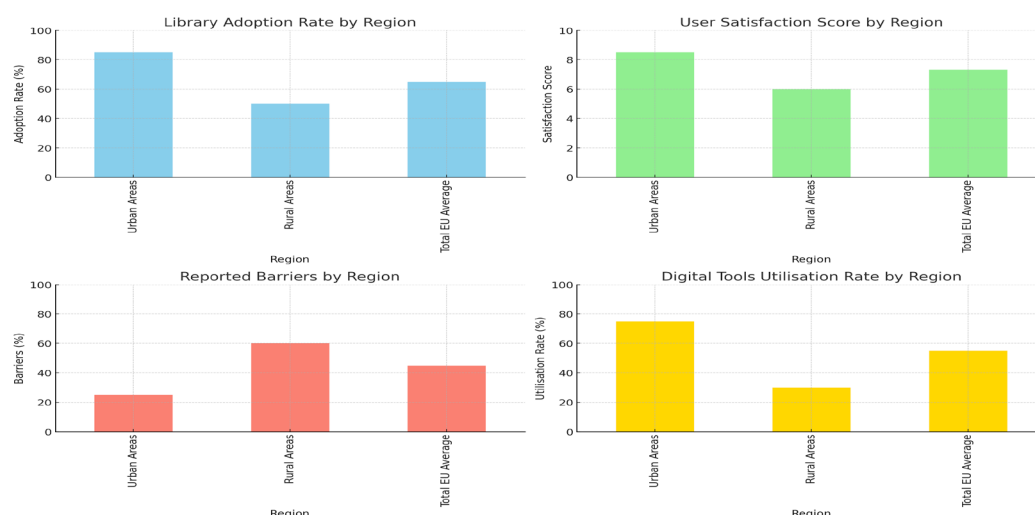

Figure 8: Library technology adoption rate, user satisfaction scores, reported barriers, digital tools utilization rate by region

The charts present a comprehensive comparison of various metrics related to library services across three regions: Urban Areas, Rural Areas, and the Total EU Average. The first chart illustrates the Library Adoption Rate, indicating that Urban Areas have the highest adoption at 85%, while Rural Areas are significantly lower at 50%. The second chart displays User Satisfaction Scores, with Urban Areas again leading with a score of 8.5 out of 10. The third chart highlights Reported Barriers, showing a notable 60% in Rural Areas compared to just 25% in Urban Areas. Lastly, the Digital Tools Utilisation Rate demonstrates a strong preference in Urban Areas at 75%, contrasted with a mere 30% in Rural Areas.

A.   Implications of technology adoption in EU libraries

The ongoing use of new technologies in libraries across the European Union marks an important change that may reshape the role of these entities in the information field. Research results show that using technologies like cloud computing, artificial intelligence, and other digital platforms greatly improves library services and user interaction. These findings are in line with earlier studies that suggest technology usage can increase access to resources and enhance efficiency in operations (Lubega et al., 2024). Nevertheless, issues such as lack of training for library staff and poor funding are still common, limiting possible improvements (Chen et al., 2024). Likewise, past research has highlighted similar difficulties faced by libraries worldwide, indicating that the need for focused investment in training and facilities is a global concern for improving library services (Rathnayaka, 2024). The effects of these results are varied. Theoretically, this study adds to the growing conversation about technology's impact on modern library science, arguing for a review of current frameworks to consider the complexities of technology use (Lubega et al., 2024). Practically, these findings can help library managers create effective training programmes that boost staff digital skills, which would lead to higher user satisfaction (Khan et al., 2024). Methodologically, using a mixed-methods approach strengthens the credibility of the results, emphasizing the crucial connection between qualitative feedback from users and quantitative performance data in evaluating technology usage (Herranz et al., 2024). Additionally, looking into digital platforms like the IEEE Xplore Digital Library highlights the importance of having access to large datasets, which can improve both research abilities and the overall functioning of libraries (Outman, 2019), (Ajayi et al., 2024). The research highlights the need for proactive cooperation among libraries, educational organisations,

and technology providers to build an environment that supports successful technology implementation (Waltraud et al., 2024). By pinpointing and tackling obstacles, institutions can realise the full advantages of their technological investments, as shown in comparative studies that feature effective methods from other areas (Varnosfaderani et al., 2024). Furthermore, the findings call for ongoing assessment and adjustment of library services to align with new technologies, thus reinforcing the importance of libraries as critical players in the digital economy (Braun et al., 2024). By strategically using technology, libraries can improve their service delivery and also play a key role in engaging communities and enhancing educational results for various groups (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024). In the end, this discussion acts as an essential appeal for those involved in the library and information science sector, encouraging society to recognise the transformative power of technology while addressing the difficulties and challenges that come with this shift (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024).
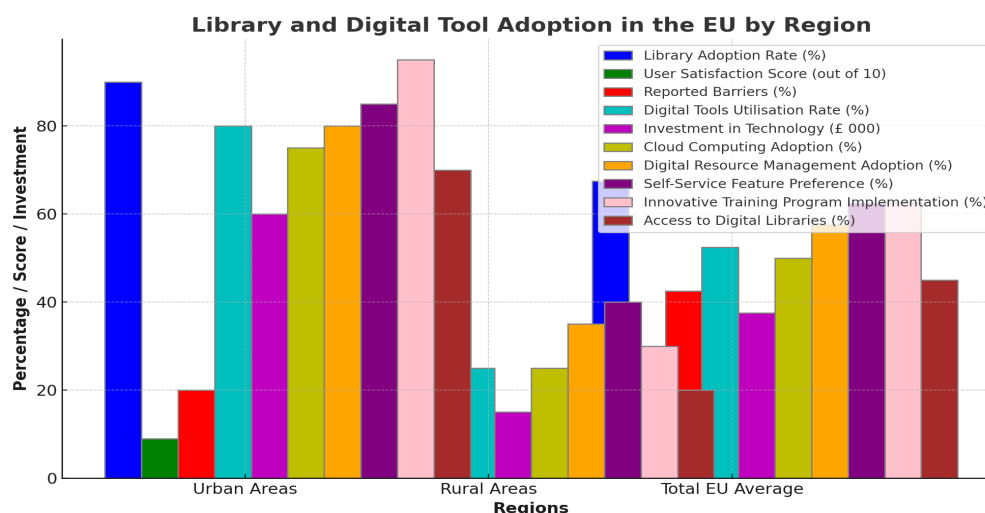

Figure 9: Library technology adoption rate, user satisfaction score, reported barriers, digital tools utilization rate, investment in technology, and various digital tool adoption percentages

The chart displays various metrics related to library and digital tool adoption across different regions in the EU, comparing Urban Areas, Rural Areas, and the Total EU Average. Metrics shown include Library Adoption Rate, User Satisfaction Score, Reported Barriers, Digital Tools Utilisation Rate, Investment in Technology, and various digital tool adoption percentages. Each metric is represented by a bar in distinctive colours, allowing for easy comparison between regions and highlighting disparities in library and technology usage.

6. CONCLUSION

The research in this study looked at how libraries in EU countries can use platforms and new technologies to improve their services and operations. Important points discussed were the obstacles faced in using technology, like limited resources and lack of staff training, alongside the factors that help in successfully integrating technology. Using a mixed-methods approach, the study tackled the research issue, which was to understand the practical effects and user satisfaction related to technology in library settings. The findings show a clear link between good technology use and higher user satisfaction, thus addressing the original research question about the need for libraries to embrace digital changes to stay relevant in the changing information world (Lubega et al., 2024). The implications of these results are important; academically, they add to the knowledge about library science and technology use in Europe, while practically, they offer useful insights for library managers, policymakers, and stakeholders wanting to enhance service delivery through digital solutions (Chen et al., 2024). Also, the study highlights how important platforms like the IEEE Xplore Digital Library are for providing access to valuable data and resources that can support further research and the use of new technologies (Outman, 2019). For future work, it is suggested that more studies be done to look at the long-term effects of new technologies on library operations, as well as to explore user experiences among different demographic groups (Rathnayaka, 2024). Moreover,

partnerships between libraries, educational institutions, and technology developers should be strengthened to support inclusive and sustainable digital strategies (Lubega SF et al., 2024). Further research might also look into how specific training programmes can improve staff skills in technology use, which would enhance service delivery and user interaction (A Khan et al., 2024). As libraries keep adapting to technological advances, ongoing empirical studies will be crucial for understanding the relationship between user satisfaction and technology use, helping libraries make the best use of their resources and maintain their roles as vital community centres in the digital era (Herranz et al., 2024), (Ajayi et al., 2024), (Waltraud et al., 2024), (Varnosfaderani et al., 2024), (Braun et al., 2024), (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (F Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024).

A. Summary of key findings and implications for library practice

The study looking at using platforms and new technologies in libraries in European Union nations found several important points that show these technologies' roles in today's library work. A key part of this research was finding the obstacles and supports that affect how libraries adopt technology. It showed that when digital tools, like cloud computing and AI applications, are used well, they can greatly improve user satisfaction and how libraries run (Lubega et al., 2024). The study tackled the research issue by indicating that giving libraries a clear plan for using technology could lessen the gaps in technology application, thus creating a space that promotes innovation and better user interaction (Chen et al., 2024). The effects of these findings are wide-ranging; academically, they add to the increasing literature on technology evaluation in library science, and practically, they prompt library leaders and policymakers to rethink how they invest in technology and serve users (Rathnayaka, 2024). Also, the findings stress the need for ongoing training and development for library staff to ensure they have the necessary digital skills to navigate this tech-driven landscape successfully (Lubega et al., 2024). Based on these insights, future research should look at long-term studies that evaluate how adopting technology affects library services and user satisfaction, including the impact of new platforms like the IEEE Xplore Digital Library on improving key resource access (Outman, 2019). Moreover, it is advised that libraries work together with educational institutions and tech developers to create specific training programs that meet community needs and boost digital skills among library users (Khan et al., 2024). This research sets a good basis for further inquiry into how libraries can best use technology to not only endure but also prosper in a fast-evolving information sphere (Herranz et al., 2024), (Ajayi et al., 2024), (Waltraud et al., 2024), (Varnosfaderani et al., 2024), (Braun et al., 2024), (Khan et al., 2024), (Lubega et al., 2024), (Chen et al., 2024), (Toni et al., 2024), (Alofaysan et al., 2024), (Bogoslov et al., 2024), (Bilgili et al., 2024), (Varzaru et al., 2024), (Dziubak, 2024). By promoting a culture of innovation and flexibility, libraries can reinforce their vital role as centres of knowledge in their areas, while adapting to the changing expectations of their users.

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