

Digitizing Sustainability: Exploring the Opportunities and Challenges for Rural Public Libraries Adopting Technology

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ABSTRACT

This paper explores the infusion of digital technologies in the sustainability of rural public libraries, focusing on the opportunities and threats. In rural settings, libraries serve as essential community hubs, providing access to information, education, and cultural resources. Integrating digital technologies offers numerous opportunities, including expanded access to information through online resources, enhanced community engagement via virtual platforms, and more efficient resource management through digital cataloguing systems. Moreover, digital initiatives enable rural libraries to adopt sustainable practices by reducing paper consumption and optimizing resource utilization. However, alongside these opportunities come significant threats, such as the digital divide, financial constraints, data privacy concerns, technological obsolescence, and the risk of diminishing traditional engagement methods. Navigating these challenges requires careful consideration of rural communities' unique needs and constraints, as well as strategic planning to ensure equitable access and effective implementation of digital initiatives. Ultimately, rural public libraries must balance leveraging the benefits of digital technologies and preserving their core mission of serving as inclusive centres of knowledge and community empowerment.

Keywords: digital technologies, sustainability, rural libraries, data privacy

INTRODUCTION

Rural public libraries are often the heart of small communities, offering access to knowledge, entertainment, and community engagement. However, these libraries face unique challenges, including limited resources and access to technology. In recent years, the infusion of digital technologies has presented opportunities and threats to the sustainability of these vital institutions (Febunmi, 2019). The push towards sustainability has become a global imperative, intersecting with the rapidly evolving landscape of technology. As societies strive to mitigate climate change and promote environmental stewardship, the role of digital technologies in achieving these goals is under intense scrutiny. Rural public libraries, often seen as community anchors, are now at a pivotal crossroads where digital innovation and sustainability intersect. Globally, the need for sustainable development is underscored by rising environmental challenges, such as resource depletion and climate change, exacerbated by traditional practices and outdated infrastructure (United Nations, 2023). As such, integrating technology within these rural institutions is not only a matter of modernizing their services but also a step towards contributing to broader sustainability goals. Recent studies emphasize that integrating digital technologies in rural settings can offer transformative benefits, such as improving access to information and supporting local economic development (Smith & Jones, 2023). However, this integration is fraught with challenges, including limited resources, inadequate infrastructure, and digital divides that could further marginalize these communities if not addressed properly (Brown et al., 2024). For rural public libraries, adopting technology offers an opportunity to enhance their role as vital community hubs while simultaneously advancing sustainability practices. This paper explores the opportunities and challenges associated with digitizing sustainability in these contexts, highlighting how technological advancements can be leveraged to support both local needs and global sustainability goals. In Malaysia, the integration of digital technology in rural public libraries presents both significant opportunities and notable challenges. The Malaysian government has recognized the potential of technology to drive sustainable development, as evidenced by the ongoing efforts to bridge the digital divide and promote digital

inclusion. According to the Malaysian Communications and Multimedia Commission (MCMC), as of 2023, internet penetration in rural areas has increased to approximately 73%, up from 67% in 2022, reflecting gradual improvements in connectivity (MCMC, 2023). This progress is crucial for rural libraries, which serve as key access points for information and digital resources in underserved regions. However, the disparities remain pronounced. Despite these improvements, rural areas still face considerable challenges, such as insufficient digital infrastructure and limited access to technological resources. A recent survey by the Malaysian Institute of Microelectronic Systems (MIMOS) found that 40% of rural public libraries lack the necessary equipment to fully leverage digital tools and nearly 55% report inadequate training for staff to manage and utilize these technologies effectively (MIMOS, 2024). Furthermore, while the Malaysian government's Digital Nasional Berhad (DNB) initiative aims to enhance digital infrastructure nationwide, rural libraries often lag in accessing these advancements due to geographical and economic constraints (Digital Nasional Berhad, 2024). Addressing these issues is crucial for ensuring that rural libraries can fully contribute to Malaysia's sustainability goals by utilizing digital technologies to enhance their services and support community development.

Historical studies have highlighted the critical role of public libraries in bridging the digital divide and promoting sustainability, yet they also reveal persistent gaps in resource allocation and technology adoption in rural areas. Research by Ahmad and Ismail (2021) underscores that rural public libraries in Malaysia face significant barriers, including limited funding and inadequate infrastructure, which hinder their ability to implement and sustain digital technologies effectively. Their study found that while libraries in urban areas have benefited from technological advancements, rural counterparts struggle with outdated facilities and insufficient support, exacerbating regional disparities in access to digital resources. Further analysis by Lee et al. (2022) emphasizes that despite government initiatives aimed at improving digital infrastructure, rural libraries often lack the necessary training and technical support to utilize new technologies effectively. Their research indicates that while internet connectivity is improving, the gap in digital literacy and technological skills among library staff remains a substantial obstacle. Additionally, a study by Lim and Tan (2023) highlights the crucial role that public libraries play in fostering digital inclusion and environmental sustainability. They argue that libraries equipped with modern technologies can act as catalysts for community development and environmental awareness but also caution that without targeted interventions, these benefits will be unevenly distributed, particularly affecting rural areas. These past studies collectively illustrate that while progress is being made, substantial challenges persist in equipping rural public libraries with the resources and skills needed to fully leverage digital technologies for sustainable development. Addressing these issues is essential for ensuring that rural libraries can effectively contribute to Malaysia's broader sustainability goals and support equitable access to digital resources.

The objective of this study is to comprehensively examine the integration of digital technologies in the sustainability of rural public libraries, with a focus on identifying the opportunities and threats associated with this infusion. Through an exploration of the current landscape of rural public libraries, the study aims to : 1. Assess the extent to which digital technologies have been integrated into the operations and services of rural public libraries, 2. Identify the specific opportunities that digital technologies present for enhancing the sustainability of rural public libraries, including expanded access to information, community engagement, and resource management, and 3. Analyze the potential threats and challenges posed by the infusion of digital technologies, such as the digital divide, financial constraints, data privacy concerns, technological obsolescence, and the risk of diminishing traditional engagement methods. By fulfilling these objectives, the study aims to contribute to the existing body of knowledge on the role of digital technologies in rural library sustainability and inform future initiatives aimed at fostering the development of inclusive and resilient library systems in rural communities. Despite the growing recognition of the importance of digital technologies in advancing sustainability, significant research gaps remain in understanding how these technologies can be effectively integrated into rural public libraries. Several key areas of research require further exploration to address these gaps. **Resource Allocation and Infrastructure Development:** While studies have documented the challenges faced by rural libraries in adopting digital technologies, there is limited research on the effectiveness of various funding models and infrastructure development strategies specific to these contexts. Understanding which approaches work best for different rural settings could provide valuable insights into how to allocate resources more efficiently and promote sustainable digital infrastructure (Ahmad & Ismail, 2021). **Training and Capacity Building:** Another critical gap is the evaluation of training programs for library staff in rural areas. Existing

literature often highlights the lack of technical skills and digital literacy among staff but falls short of providing detailed analyses of successful training initiatives or capacity-building programs. Research that assesses the impact of different training methodologies on library operations and staff competency could help in designing more effective training interventions (Lee et al., 2022). **Community Impact and Engagement:** There is also a need for more comprehensive studies on how digital technologies in rural libraries affect local communities. While some research touches on the benefits of digital access, there is insufficient data on how these technologies influence community engagement, economic development, and environmental sustainability at a granular level. Investigating the specific outcomes of digital initiatives on community well-being and sustainability could offer a deeper understanding of their effectiveness and guide future initiatives (Lim & Tan, 2023). **Policy and Implementation Strategies:** The role of policy in supporting digital sustainability in rural libraries remains underexplored. Research often focuses on general policies related to digital inclusion but lacks an in-depth analysis of how specific policies impact rural library settings. Examining the role of national and local policies in facilitating or hindering digital advancements in these libraries could provide critical insights for policymakers and stakeholders. **Comparative Studies:** There is a scarcity of comparative studies that analyze the experiences of rural libraries across different countries or regions. Such studies could reveal diverse approaches to overcoming common challenges and adopting successful practices. Comparative research would help in identifying best practices and adaptable solutions that could be tailored to the needs of rural libraries in various contexts. Addressing these research gaps is essential for developing a more comprehensive understanding of how digital sustainability can be effectively integrated into rural public libraries. By focusing on these areas, researchers can contribute to more informed policy decisions, improved library practices, and enhanced community outcomes.

LITERATURE REVIEWS

This literature review created in this study was implemented by using systematic literature where the content of different research studies/articles was critiqued about the chosen topic of this study. The literature review covers the following different areas, and they are the infusion of digital technologies in the sustainability of rural public libraries, threats to the uses of digital technologies to sustain rural public libraries, and opportunities that can enhance the infusion of digital technologies in the sustainability of rural public libraries. As organizations like libraries strive to keep up with the ever-shifting technological scene, research into the intersection of digital technology and sustainable practices has grown in importance. For rural libraries in particular, digital sustainability—defined as the capacity to sustain digital resources and services over time in a way that is socially, economically, and environmentally responsible—is crucial. In remote locations, these establishments frequently act as vital centres for community involvement, education, and information. Particular opportunities and difficulties arise for rural libraries in the context of digital sustainability. Demographics, infrastructure limitations, and resource scarcity may prevent them from utilizing digital technology to their greatest potential. Simultaneously, these libraries possess the capacity to assume a crucial function in mitigating the digital gap, advancing digital literacy, and cultivating sustainable practices in their local communities. Thus, the relationship between digital sustainability and rural libraries calls for a careful analysis of the body of research to pinpoint issues, creative solutions, and best practices that might direct further research in this area. Studies such as Bertot, Jaeger, & McClure (2011) emphasize how public libraries, particularly in rural areas, have integrated digital resources to provide essential services like e-books, internet access, and educational programs. These resources improve library offerings and accessibility for underserved populations. Information technology (IT) adoption, provision of internet access, e-government services, and mobile library services have been crucial for enhancing operations in rural libraries. Moniarou-Papaconstantinou et al. (2014) highlight the impact of IT on library staff's professional development and how new technologies reshape the role of rural librarians, moving from book lending to broader information facilitation roles. Technology's Role in Expanding Access: Murray & Trosow (2013) and Luo & Weak (2013) provide insight into how rural libraries have embraced new technologies, such as providing access to digital content platforms and online databases, thereby enabling remote access to resources that were previously available only in physical form. According to Perryman & Sterkel (2018), digital technologies help rural libraries achieve long-term sustainability by allowing them to offer diversified services like online education, distance learning platforms, and digital archives, which increase their relevance in the community. Goulding, Spacey & Faulder (2020) discuss how digital tools help rural libraries engage their communities through social media, virtual programs, and digital literacy training. These methods broaden

outreach and foster sustainable relationships with patrons. Aabo (2017) explores how adopting cloud-based systems, digital cataloging, and resource-sharing platforms reduces operating costs and resource wastage in rural libraries, improving their financial sustainability. Digital technologies also enable libraries to share resources across networks, providing a wider range of materials without increasing physical inventory. Haggerty (2020) explores how digital technologies offer opportunities for libraries to reach underserved communities, such as elderly users or those with disabilities, enhancing access to information and resources that previously required physical presence. Analyze the potential threats and challenges posed by the infusion of digital technologies, such as the digital divide, financial constraints, data privacy concerns, technological obsolescence, and the risk of diminishing traditional engagement methods. Bertot, McDermott & Lincoln (2012) examine the persistent digital divide in rural communities, where access to high-speed internet and digital literacy remains a significant challenge. Libraries often bear the burden of bridging this divide by providing free internet and digital literacy programs, but they struggle with limited funding and infrastructure. Studies such as Jaeger et al. (2011) highlight that rural libraries face severe budget cuts, limiting their ability to maintain and upgrade digital infrastructure. The high costs of adopting new technologies, combined with ongoing maintenance and staff training, create significant financial challenges for small rural libraries. Zimmerman & Ng (2016) discuss data privacy issues in libraries, emphasizing the ethical challenges of collecting, storing, and managing user data. As rural libraries adopt more digital services, they become more vulnerable to data breaches, especially with limited resources to implement robust cybersecurity measures. Selwyn (2016) addresses the issue of rapid technological change, where rural libraries often struggle to keep up with hardware and software upgrades, leading to obsolescence. This issue is particularly acute in rural areas where financial resources are scarce, and technology is quickly outdated. Powell, Bryson, & Hollingsworth (2015) explore how the digital shift risks alienating patrons who rely on traditional, face-to-face services. They argue that rural libraries must strike a balance between maintaining personal engagement methods and integrating digital technologies to avoid alienating key demographics, such as older adults or individuals with limited technological skills. The purpose of this review of the literature is to investigate the major ideas and conclusions found in the corpus of research on rural libraries and digital sustainability. This review will provide a thorough understanding of how rural libraries can successfully incorporate digital sustainability into their operations, guaranteeing that they continue to serve as essential community resources in a rapidly changing digital world, by synthesizing research from various perspectives.

RESEARCH METHODOLOGY

The literature review for this study was meticulously conducted using a variety of reputable online academic databases and platforms, including ResearchGate, Google Scholar, and others. These platforms were selected due to their extensive repositories of peer-reviewed articles and research papers, which are essential for conducting a comprehensive literature review. The methodology employed in gathering the literature was rooted in **interpretive content analysis**, a qualitative approach that involves the detailed examination and interpretation of text data to identify key themes, patterns, and insights.

To ensure the literature was relevant and focused, the research was guided by specific sub-themes related to the **opportunities and challenges** associated with introducing sustainable digital technology into rural public libraries. These sub-themes acted as a lens through which the literature was selected, ensuring that only the most pertinent studies were included in the review. Gathering and analyzing the literature was completed within less than two weeks, reflecting the efficiency and targeted nature of the research approach. Throughout the study, approximately **11 research papers and articles** were critically reviewed. Each piece of literature was scrutinized not only for its content but also for its relevance to the broader discussion on digital sustainability in rural libraries. The interpretive content analysis employed revealed both **commonalities and differences** across the studies, providing a nuanced understanding of the subject matter.

This process of examining the substance of each research paper involved a careful reading of the methodologies, findings, and conclusions presented by the authors. By comparing and contrasting these elements, the study was able to identify trends, gaps, and emerging issues in the literature. The insights gained from this analysis are intended to contribute meaningfully to the ongoing discourse on the integration of digital technologies in rural public libraries, particularly in terms of sustaining their operations in the face of technological advancements.

Infusion of Digital technologies in the sustainability of rural public libraries.

Rural public libraries have transformed significantly as a result of the extensive use of digital technology, although these changes in the methods for carrying out library functions have evolved the jobs themselves, as well as the aim of rural public libraries (Mierzeka, 2021). Some rural public libraries have shown tremendous adaptability in meeting the needs of a larger and more diverse and services are now much more user-tailored in response to the needs of 24/7 access to resources across a variety of platforms, all thanks to the introduction of modern technology. Rural public libraries have also tried to play their part in the implementation and regulation of open access mandates, allowing researchers to expand the reach of their research by managing institutional repositories and data management (Alexandra, Chripausha, and Kunya, 2020). Technology innovations such as computers, portable devices, and the internet have had a great impact on institutions and people's lives. It affects their relationship with information, knowledge, and working methods (Sweykyn, 2018). In a quickly changing from traditional to modern environment, it provides a new clearance for people to adapt. However, it's not that simple, especially when technology advances at an ever-increasing rate (Anuardha, 2021). Digital technology equality is identified as a critical concern in the 2019 EDUCAUSE Horizon Report for higher education. It highlights not only equal access to information but also equal opportunity to generate content and cooperate in remote settings (Alexander, 2019). Rural public libraries play an important role in addressing these concerns by offering services that focus on the development of skills for material creation, open access to publication, and other research outputs, which all types of libraries have long advocated for. So, the infusion of digital technology sustainability must be tided and notice their opportunities and threats to the community.

Opportunities that can enhance the infusion of digital technologies and sustainability of rural public libraries

Rural Public libraries have been advised to reinvent the delivery of their programs and services as technology advances. "The library principal's aim has always been to serve the curriculum; the notion has significantly enhanced in light of today's staff and visitors' requirements and expectations" (Anuardha, 2021). The topic of training came up at the same time as utilizing electronic resources. Digital technology has significantly increased the possibility of offering many types of instruction at the library, from new student orientation to specialized training. (Hebrews, 2020). The presence of technology has given staff and visitors opportunities to learn how to use multimedia tools, which are divided among staff and others for visitors. Knowing how to use technology is the first step in creating situations where people and AI can collaborate. Librarians should set aside their conservatism as AI enters libraries because these technologies may eventually replace the slothful and conservative information professionals (Tella, 2020). Digital technology solutions offer the potential to increase information access, lower prices, and improve quality (Egbo & Titua, 2022). According to Moya (2011), employing digital technologies improves teaching, working methods and learning quality. The importance of digital technology in enhancing mixed, online and mobile usage cannot be understated.

Here are some opportunities for the infusion of digital technology sustainability in rural public libraries:

Access to Information: Digital technologies enable rural libraries to expand their collections beyond physical books. E-books, audiobooks, and online databases provide patrons with a broader range of resources, regardless of location.

Community Engagement: Social media, virtual events, and online forums allow rural libraries to engage with their communities in new ways. Virtual book clubs, author talks, and educational workshops can reach a broader audience and foster a sense of belonging.

Resource Sharing: Digital platforms facilitate resource sharing among libraries, allowing rural institutions to access materials and expertise that may not be available locally. Inter-library loan systems and digital repositories enhance the breadth and depth of resources available to patrons.

Education and Lifelong Learning: Online courses, tutorials, and educational apps empower rural library patrons to pursue lifelong learning opportunities. Digital literacy programs can also help bridge the digital divide and empower community members with essential technology skills.

Sustainability Initiatives: Digital technologies offer rural libraries opportunities to adopt sustainable practices. By transitioning to digital formats, libraries can reduce their environmental footprint by saving paper and energy.

In conclusion, integrating digital technology sustainability in rural public libraries presents many opportunities for enhancing access, engagement, education, and resource management. By leveraging these opportunities and implementing strategic initiatives, rural libraries can continue to evolve as inclusive centers of learning, culture, and community empowerment. Policymakers, library administrators, and stakeholders must prioritize investments in digital infrastructure, staff training, and community outreach to maximize the benefits of digital integration and ensure the long-term sustainability of rural libraries in the digital age.

Opportunities that can enhance the infusion of digital technologies and sustainability of rural public libraries

Rural Public Libraries are clearly under significant pressure. The importance of a library and its priority in budget allocation can no longer be assumed. Rural public libraries must justify their value regarding where to invest scarce resources (Ateka, 2022). In relation to libraries, a report from the United Kingdom identifies “intensified contextual pressures” when it comes to rural public libraries to find digital resources - a myriad of political, economic and other pressures (Pintfield, 2021), including funding problems, outstanding geographical surroundings, poor maintenance and many other problems. Without knowing how much money is available, how much the project will cost and where the money will come from. Another potential limiting element is when financial resources are related to donor expectations that may or may not be in line. With library core instructions and mission (Anduardha, 2018). As a result of these issues, most rural public libraries naturally seek other options outside of their beliefs. Integrating digital technologies in rural public libraries has ushered in transformation opportunities for expanding access to information, enhancing community engagement, and optimizing resource management (Tella, 2019). However, alongside these opportunities come significant threats and challenges that must be addressed to ensure the sustainability of digital initiatives in rural library settings. This literature review examines existing research from a threat perspective, focusing on the challenges and risks associated with implementing digital technology sustainability in rural public libraries.

These are the possible threats to infusing digital technology sustainability of rural public libraries:

Digital Divide: While digital technologies offer many benefits, not all rural communities have equal access. The digital divide, exacerbated by limited Internet infrastructure and socioeconomic disparities, can widen existing inequalities and exclude specific population segments.

Financial Constraints: Implementing and maintaining digital technologies requires financial investment, which can be challenging for rural libraries with limited budgets. Subscription fees, equipment costs, and ongoing training expenses may strain already-strained resources.

Privacy and Security Concern: As libraries collect and store more digital data, they must prioritize privacy and security to protect patron information. Cyber-security threats like data breaches and malware attacks pose risks to the library and its users.

Loss of Traditional Services: While digital technologies offer many advantages, there is a risk of neglecting traditional services such as physical book lending and face-to-face interactions. Balancing digital offerings with traditional services is essential to meet the diverse needs of rural communities.

Technological Obsolescence: Rapid technological advancements can quickly render hardware and software obsolete, necessitating frequent upgrades and replacements. Rural libraries may need help to keep pace with these changes, leading to outdated or ineffective systems.

From the threat perspective, the infusion of digital technology sustainability in rural public libraries presents significant challenges that must be addressed to ensure long-term viability and effectiveness. The digital divide, financial constraints, privacy and security concerns, and technological obsolescence all pose threats to the sustainability of digital initiatives in rural library settings (Chuaka, 2022). By recognizing these threats and

implementing targeted interventions, policymakers, library administrators, and stakeholders can mitigate risks and ensure that rural libraries continue to serve as inclusive centers of knowledge, culture, and community empowerment in the digital age.

The Synergy between Digital Sustainability and Rural Libraries: Opportunities and Threats in Digitization

Digital sustainability and rural libraries are deeply intertwined, influencing the other's development. **Digital sustainability** refers to the practices that ensure the long-term availability, accessibility, and usability of digital resources in an environmentally responsible manner. For **rural libraries**, which often serve as critical access points to information and digital services in underserved areas, the principles of digital sustainability are not just relevant—they are essential.

The digitization of rural libraries offers significant **opportunities**. These include increased access to information, improved educational resources, and enhanced community engagement. Digitization can bridge the digital divide, providing rural populations with the tools needed for personal and economic development.

However, there are also **threats** associated with digitization in rural libraries. The primary concerns revolve around the sustainability of digital infrastructure, digital literacy among staff and patrons, and the potential for social exclusion. For rural libraries, maintaining the balance between advancing digital services and ensuring they are sustainable and accessible to all community members is a critical challenge.

RESEARCH GAPS AND CONCLUSION

Despite the growing body of literature on digital sustainability and rural libraries, several research gaps still need to be addressed. One of the most significant gaps is the need for empirical studies examining the long-term impact of digitization on rural communities. There is also a need for more research on the specific strategies that rural libraries can adopt to overcome the challenges associated with digital sustainability.

In conclusion, while digitization offers numerous opportunities for rural libraries, it also presents significant challenges that must be carefully managed. By adopting a strategic approach to digital sustainability, rural libraries can ensure that they continue to serve their communities effectively in the digital age. Further research is needed to explore the best practices for achieving digital sustainability in rural libraries and to address the gaps identified in the existing literature.

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