

CHALLENGES OF ICT ADOPTION IN LIBRARIES

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Article Info	Abstract
<p>Keywords:</p> <ul style="list-style-type: none">• <i>ICT adoption</i>• <i>Libraries</i>• <i>Digital divide</i>• <i>Staff training</i>• <i>Budget constraints</i>• <i>Infrastructure</i>• <i>Information systems</i>• <i>Library policy</i>	<p>This paper examines the major challenges encountered when adopting Information and Communication Technologies (ICT) in libraries. It synthesizes the literature and practical experience to identify and analyze barriers such as budgetary constraints, staff training and capacity-building, the digital divide among patrons, infrastructure limitations, policy and governance issues, content and systems interoperability, security and preservation concerns, and user acceptance. The paper proposes evidence-based recommendations and an implementation roadmap to help library managers, policymakers, and stakeholders plan and execute ICT projects successfully.</p>

I. INTRODUCTION

Information and Communication Technologies (ICT) have become one of the most transformative forces in the contemporary knowledge society. Over the last three decades, technological progress in computing, telecommunications, and digital information systems has redefined the ways in which information is created, stored, disseminated, accessed, and preserved. Libraries, as long-standing institutions for knowledge organization and access, have been both challenged and enriched by these developments. Whereas libraries were once primarily defined by their physical collections, reference desks, and reading rooms, today they are increasingly characterized by hybrid and digital services such as online catalogues, digital repositories, remote access to licensed databases, e-learning platforms, and user analytics systems. The integration of ICT has allowed libraries to serve wider audiences, to provide 24/7 services that transcend geography, and to reimagine their role as knowledge hubs in an information-driven economy.

Despite these profound opportunities, ICT adoption in libraries is not simply a technical matter of purchasing hardware or subscribing to new software. Instead, it is a socio-technical process involving financial investment, institutional governance, staff skills, cultural acceptance, and user readiness. The challenges are multifaceted: budgetary constraints limit the ability of libraries—especially in resource-constrained contexts—to procure, implement, and sustain ICT infrastructure; staff often require continuous training to keep pace with rapid technological change; and a “digital divide” persists between different categories of users, thereby undermining equitable access. Moreover, technological adoption must be aligned with broader organizational strategies, national information policies, and ethical commitments to privacy, inclusivity, and digital preservation. This introduction situates ICT adoption in libraries within these broader dynamics and lays the foundation for a critical exploration of the challenges involved.

II. RATIONALE AND SCOPE

This research paper focuses on public, academic, and special libraries in both low-to-middle-income and high-income contexts, highlighting common barriers as well as context-specific challenges. Public libraries, often the most accessible community institutions, struggle with limited budgets, infrastructure deficits, and the need to serve highly diverse user populations. Academic libraries, while typically better resourced, face pressure to adopt cutting-edge technologies to support teaching, research, and global competitiveness, yet they must also grapple with issues such as licensing restrictions, faculty resistance, and rapidly changing student expectations. Special libraries—including those in government,

corporate, medical, and research settings—encounter unique constraints related to confidentiality, sector-specific demands, and the integration of specialized digital tools.

The scope of this paper extends beyond a purely technical discussion to emphasize the social, economic, and cultural dynamics that influence ICT adoption. In low-to-middle-income countries, the digital divide, inconsistent power supply, and inadequate network connectivity present structural barriers. In contrast, high-income contexts often face subtler challenges such as user adaptation, digital fatigue, and the sustainability of rapidly evolving technology ecosystems.

By drawing on cross-disciplinary perspectives from information science, organizational change management, digital inclusion, and even public policy studies, this paper adopts a holistic framework. It recognizes that ICT adoption is not merely about acquiring hardware and software but about transforming organizational culture, building digital skills, securing long-term financial investment, and ensuring equitable access for all patrons. The research also incorporates a global lens, comparing how different economic and cultural environments influence strategies, success rates, and long-term sustainability of ICT projects in libraries.

III. LITERATURE REVIEW

Studies of ICT adoption in libraries consistently identify several recurring themes that cut across geographic, economic, and institutional boundaries. Among the most prominent challenges are constrained budgets, which limit the ability of libraries to invest in modern hardware, software, and subscription-based digital resources. Financial barriers also restrict staff recruitment, maintenance of digital infrastructure, and the provision of continuous training programs.

Another critical issue is the limited skillset of library staff, many of whom were trained in traditional cataloguing and reference services but may lack competencies in database management, cloud-based platforms, metadata standards, or digital preservation. Without systematic professional development opportunities, the gap between staff capabilities and technological requirements widens, hampering the smooth integration of ICT.

Infrastructure remains a persistent concern, particularly in low-to-middle-income contexts. Connectivity challenges, unreliable electricity, and inadequate hardware reduce the reliability and efficiency of digital services. Even when infrastructure exists, disparities in system compatibility often hinder progress. Lack of interoperable systems creates silos, where different platforms cannot communicate with one another, preventing the seamless exchange of bibliographic data or user records across institutions.

Equally significant is the digital divide among users, which manifests in terms of unequal access to devices, varying levels of digital literacy, and social or cultural barriers to technology adoption. For example, rural or marginalized populations may struggle to benefit from digital services due to lack of internet access, while even in highly developed environments, older adults or first-generation learners may find digital platforms intimidating.

From a theoretical standpoint, the Technology Acceptance Model (TAM) provides a useful lens for examining user adoption of ICT in libraries. TAM emphasizes two primary determinants: perceived usefulness (the degree to which a person believes that using a particular system will enhance their performance) and perceived ease of use (the belief that the system will be free of effort). Both factors strongly influence user attitudes and behavioral intentions toward adopting new technologies in a library setting.

Similarly, Diffusion of Innovations theory, developed by Everett Rogers, explains ICT adoption as a social process influenced by communication channels, time, and social systems. It categorizes users into innovators, early adopters, early majority, late majority, and laggards, highlighting the varying rates at which different groups embrace change. In library contexts, innovators may be proactive librarians who champion digital transformation, while laggards may include staff or patrons resistant to altering traditional practices. The theory underscores the importance of social influence, trust in change agents, and supportive conditions in accelerating adoption.

Recent literature also extends these frameworks to consider organizational change management and digital inclusion perspectives, stressing that ICT adoption requires not just technological upgrades but also institutional leadership, clear governance policies, and sustained investments in equity-focused initiatives. The convergence of these perspectives reveals that ICT adoption is a complex socio-technical phenomenon shaped by financial, cultural, organizational, and human factors.

IV. RESEARCH METHODOLOGY

This paper adopts a theoretical and applied approach that draws upon existing literature, conceptual models, and practical case examples. The methodology is primarily qualitative and interpretive, focusing on a thematic analysis of scholarly research, policy documents, and professional reports related to ICT adoption in libraries. To strengthen theoretical grounding, the study integrates frameworks such as the Technology Acceptance Model (TAM), Diffusion of Innovations theory, and principles of organizational change management.

At the same time, the paper maintains an applied orientation by synthesizing practical frameworks and implementation recommendations tailored to the needs of library managers, policymakers, and stakeholders. The methodological design emphasizes not only the identification of barriers but also the translation of conceptual insights into actionable strategies. By combining theoretical perspectives with applied practices, this approach ensures that the findings remain both academically rigorous and directly relevant to decision-making in diverse library contexts.

V. HISTORICAL BACKGROUND OF ICT IN LIBRARIES

In the knowledge society, access to information has become both an enabler of social inclusion and a driver of economic competitiveness. Governments and international agencies such as UNESCO and IFLA frequently underscore the role of libraries as key institutions for supporting lifelong learning, research, innovation, and civic participation. ICT plays a central role in enabling libraries to fulfill these functions. For instance, online catalogues allow users to discover resources remotely, while digital repositories ensure that theses, research articles, and cultural heritage materials can be accessed worldwide. In academic libraries, ICT supports e-learning by integrating with learning management systems (LMS), while in public libraries, ICT enables community members to access e-government services, job portals, and digital literacy programs.

However, these roles also bring new responsibilities. The library of the 21st century is no longer confined to managing shelves and lending books; it must manage digital licenses, negotiate with vendors, ensure digital accessibility, and protect user data. The shift requires organizational change and a new culture of service that blends traditional librarianship with information technology skills.

The adoption of ICT in libraries has been incremental. Early developments in the 1960s and 1970s involved the automation of cataloguing and circulation systems, with the introduction of Machine-Readable Cataloguing (MARC) formats and Integrated Library Systems (ILS). The 1980s saw the emergence of CD-ROM databases, while the 1990s marked a turning point with the internet, enabling online public access catalogues (OPACs) and the first wave of digital libraries. By the 2000s, subscription to electronic journals and e-books had become mainstream, and many academic libraries shifted significant portions of their acquisition budgets from print to digital. In the 2010s and 2020s, cloud computing, mobile applications, discovery layers, and institutional repositories became central, while artificial intelligence and data analytics began to influence search, recommendation, and collection management.

This historical trajectory highlights that ICT adoption is not a one-time event but an ongoing process of adaptation to technological evolution. Each stage introduced both new opportunities and new challenges, from licensing costs to metadata standards, from training needs to infrastructure upgrades.

VI. OPPORTUNITIES CREATED BY ICT IN LIBRARIES

The adoption of ICT in libraries has opened up a spectrum of opportunities that were previously unimaginable within traditional service models. One of the most significant benefits is enhanced access, as users can now consult resources from virtually anywhere and at any time, thereby eliminating the physical and geographical limitations that once defined library use. This has been particularly transformative for distance learners, researchers working across continents, and members of marginalized communities who may not be able to travel to physical branches regularly.

Closely tied to this is improved discovery, where advanced search engines, discovery layers, and federated search platforms empower patrons to navigate seamlessly across diverse catalogues, digital repositories, and databases. Such tools save time, reduce frustration, and democratize access by making complex collections more transparent and user-friendly.

ICT also facilitates resource sharing, enabling interlibrary loans, consortial purchasing, and collaborative repositories that reduce duplication of effort and distribute costs more efficiently. By pooling resources, libraries can provide their patrons with access to a much wider range of materials than they could acquire individually.

Another critical advancement is user empowerment. Through ICT, patrons can manage their own accounts, renew or reserve materials online, and customize their information experiences. Personalized services, such as recommendation systems or user dashboards, allow individuals to engage with the library in more meaningful and efficient ways.

Equally important is preservation and digitization. ICT tools allow rare manuscripts, archives, and cultural heritage artifacts to be digitized, thereby safeguarding them against physical decay while also broadening access to previously restricted or fragile materials. This not only supports research but also contributes to cultural memory and intergenerational knowledge sharing.

Libraries are also increasingly leveraging ICT for data-driven decision-making. Analytics and digital dashboards provide insights into user behavior, resource demand, and collection performance. Such information helps librarians allocate budgets wisely, streamline services, and demonstrate impact to stakeholders.

In addition, ICT offers robust support for research and learning. Integration with citation management software, plagiarism detection tools, and learning management systems enhances the academic environment by streamlining workflows for both students and faculty. Libraries can thus position themselves as essential partners in teaching and research rather than mere repositories of materials.

Beyond these benefits, ICT adoption introduces greater inclusivity through assistive technologies such as screen readers, text-to-speech tools, and captioning services, ensuring that users with disabilities can access resources equitably. Mobile applications further expand reach by enabling access through smartphones, which are often the primary devices for users in developing contexts. Moreover, ICT fosters community engagement by enabling libraries to host online workshops, webinars, and virtual exhibitions that draw in wider audiences and diversify participation.

Finally, ICT adoption contributes to institutional reputation and visibility. Libraries that maintain well-developed digital repositories not only serve local users but also project their academic or cultural contributions globally, enhancing the institution's recognition and fostering international collaboration.

VII. CONCEPTUALIZING ICT ADOPTION AS A SOCIO-TECHNICAL PROCESS

Understanding ICT adoption in libraries requires a socio-technical perspective. Technologies do not operate in a vacuum; they are embedded in organizational structures, human skills, and cultural practices. Several theoretical frameworks illustrate this:

- Diffusion of Innovations (Rogers, 2003): emphasizes how innovations spread through social systems, depending on factors like relative advantage, compatibility, complexity, trialability, and observability.
- Technology Acceptance Model (Davis, 1989): highlights the role of perceived usefulness and ease of use in shaping adoption behavior.
- Institutional Theory: draws attention to the organizational and regulatory environments that shape decision-making in public institutions.

From these perspectives, the introduction of an online catalogue, a digital repository, or an RFID-based circulation system is not simply a technical installation but a process involving perception, training, organizational buy-in, and policy compliance. Failure to acknowledge this socio-technical complexity often results in underutilized systems or unsuccessful projects.

VIII. CORE CHALLENGES

i. Budgetary Constraints

Libraries frequently operate under tight and unpredictable budgets that prioritize essential services such as staffing, acquisition of core materials, and maintenance of physical spaces over technological upgrades. ICT adoption demands both capital investments—such as servers, computers, networking equipment, and security systems—and recurring costs, including software licenses, digital subscriptions, technical support, and bandwidth fees. These long-term obligations create financial strain, especially in institutions dependent on annual grants or government allocations.

In many cases, budget limitations force libraries to defer upgrades, rely on outdated systems, or compromise on quality by adopting suboptimal platforms. For example, libraries in developing regions often rely on donated or second-hand equipment, which increases the risk of system failures. To mitigate these issues, libraries can adopt multi-year budgeting models to spread costs, participate in consortial purchasing agreements that leverage collective bargaining, and prioritize open-source software to reduce licensing fees. Additionally, international funding programs and research grants can provide supplementary financial support, though they require strategic proposal writing and alignment with donor priorities.

ii. Staff Training and Capacity Building

The success of ICT implementation hinges on the ability of staff to operate, maintain, and promote new systems. Many libraries struggle with staff skill gaps in areas such as system administration, metadata standards, digital curation, cybersecurity, and user support. Without adequate training, service quality declines, leading to low user satisfaction and wasted investments.

To address these challenges, libraries should invest in continuous professional development that goes beyond one-time workshops. This may include vendor-led training sessions, certification courses in information technologies, Massive Open Online Courses (MOOCs), and peer-to-peer mentoring programs. Identifying and empowering ICT champions within the library can also drive internal knowledge sharing and motivate other staff members to adopt digital practices. Furthermore, embedding ICT competencies into job descriptions and performance evaluations ensures that technology adoption becomes a core organizational priority rather than an optional skill.

iii. The Digital Divide and User Readiness

ICT adoption in libraries is complicated by unequal user readiness. Patrons differ in their levels of digital literacy, access to personal devices, and confidence in navigating online resources. Vulnerable populations—including the elderly, rural residents, low-income groups, and persons with disabilities—face systemic barriers in accessing ICT-based services. If left unaddressed, these disparities risk exacerbating social inequalities and undermining the library's mission of inclusivity.

Libraries can respond by designing digital literacy programs that cover basic computer use, internet safety, and research skills. Device loan schemes (e.g., lending tablets, laptops, or Wi-Fi hotspots) can help bridge access gaps. Moreover, the adoption of universal design principles—such as accessible interfaces, multilingual platforms, and assistive technologies like screen readers—ensures that ICT services remain inclusive. Partnering with community organizations, schools, and NGOs extends outreach and builds trust with marginalized groups, making ICT adoption socially sustainable.

iv. Infrastructure and Connectivity

Robust infrastructure is the backbone of ICT-driven libraries. Reliable electricity, sufficient bandwidth, modern hardware, climate-controlled server rooms, and secure storage systems are essential for digital services. Yet, many rural and low-resource libraries face frequent downtime, hardware failures, and network bottlenecks, which disrupt access and erode user trust.

Mitigation strategies include conducting infrastructure audits to identify weak points, investing in backup power solutions (generators, solar power), adopting virtualization and cloud hosting to reduce local hardware dependence, and negotiating bulk bandwidth deals with service providers. Furthermore, libraries should plan for scalability, ensuring that systems can accommodate growing user demands without frequent overhauls. In contexts where full-scale infrastructure investment is not feasible, hybrid models—combining local servers with cloud-based services can provide balance between reliability and affordability.

v. Policy, Governance, and Strategic Alignment

Even when funding, staff, and infrastructure are available, ICT initiatives often fail due to weak governance and lack of alignment with institutional strategies. Common pitfalls include duplication of efforts, poor project management, unclear data ownership, and absence of policies for security and privacy. Without strategic direction, ICT projects risk becoming short-term experiments rather than sustainable services.

Effective solutions include establishing ICT steering committees that bring together librarians, IT professionals, administrators, and external stakeholders. Libraries should also develop comprehensive ICT policies that cover data protection, intellectual property rights, user privacy, and ethical use of information. Furthermore, ICT strategies must be aligned with the library's mission and institutional goals, ensuring that technology supports—not distracts from—the core objectives of access, education, and research. Periodic impact assessments and feedback mechanisms should be incorporated to refine governance structures and maintain accountability.

IX. RECOMMENDATIONS

To make ICT adoption more successful and sustainable, libraries can follow these key practices:

- Plan with purpose – Link every ICT initiative to the library's mission and the real needs of its users. A clear roadmap prevents wasted effort and keeps projects focused.
- Secure sustainable funding – Move beyond year-to-year budgeting by exploring grants, consortial purchasing, partnerships, and even small revenue models where appropriate. Diverse funding makes projects more resilient.
- Invest in people, not just technology – Continuous staff training, mentoring, and appointing ICT “champions” ensure that new systems are not only installed but also effectively used and supported.
- Design for everyone – Platforms should be inclusive and accessible, taking into account users with disabilities, different literacy levels, and varying levels of digital confidence.
- Follow standards and best practices – Using international metadata and interoperability standards makes systems more reliable, sharable, and future-proof.
- Strengthen governance – Establish ICT steering groups, draft clear policies on privacy and data management, and ensure accountability at all levels.
- Protect users and systems – Implement cybersecurity basics like strong authentication, data backups, and regular security audits to safeguard both collections and community trust.
- Adopt a step-by-step approach – Start small, pilot new services, gather feedback, and then scale gradually. This reduces risk and allows for timely adjustments.
- Build resilience – Prepare for challenges like power outages, system crashes, or funding cuts through cloud hosting, redundancy planning, and regular monitoring.

By approaching ICT adoption in this practical, people-centered way, libraries can build systems that are not only technologically advanced but also socially inclusive, sustainable, and trusted by their communities.

X. CONCLUSION

Adopting ICT in libraries is far more than a technical upgrade; it is a transformative journey that reshapes how communities access, share, and preserve knowledge. Yet this journey is not without obstacles. Financial limitations, skill gaps among staff, inadequate infrastructure, and unclear policy frameworks often slow progress or create uneven outcomes. These challenges are real, but they are not insurmountable.

What matters most is that libraries approach ICT adoption with a vision rooted in people, inclusion, and sustainability. Technology is only as powerful as the community it serves. By securing sustainable funding, investing in continuous capacity building, and embedding inclusive design into every service, libraries can ensure that no user is left behind—whether they are students in urban universities, villagers in remote areas, or lifelong learners seeking self-improvement.

Strong governance and clear policies provide the backbone for resilience, while phased implementation allows libraries to learn, adapt, and grow without being overwhelmed. Above all, ICT adoption must be seen as a collective effort that involves librarians, policymakers, funders, and communities working hand in hand.

When embraced thoughtfully, ICT has the power to bridge digital divides, preserve cultural heritage, empower users, and transform libraries into vibrant digital gateways. In doing so, libraries not only remain relevant in the 21st century but also reaffirm their timeless role as guardians of knowledge and enablers of opportunity for all.