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The Impact of Digital Technologies on Algerian Library Services

Amel Hadef
Faculty of Humanities and Social Sciences, Badji Mokhtar University of Annaba, Algeria
Email: amel.hadef@univ-annaba.dz

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Abstract
The Fourth Industrial Revolution has profoundly transformed Algerian library services and fostered the emergence of a new type of institution: the advanced electronic library. These libraries provide students and researchers with a wide range of intelligent services through technologies such as artificial intelligence, radio-frequency identification (RFID), cloud computing, and data-management systems. Nevertheless, Algerian libraries face several challenges in keeping pace with technological developments. The transition requires substantial technical, organizational, and human resources, and deficiencies in these areas may create gaps in service delivery and compromise the future quality of scientific research.
Keywords: digital technologies; digital libraries; library management systems; databases; technology.

Introduction

Today, the world is experiencing a far-reaching information revolution known as the Fourth Industrial Revolution. Technology permeates every field and institution, with applications in artificial intelligence, robotics, the Internet of Things, and other advanced technologies. No sector, including libraries, has remained untouched. Whereas libraries once served primarily as destinations for students and researchers, they now seek to reach users and deliver services through modern technologies. These technologies have become indispensable, adapting to the digital age as an urgent necessity. Libraries of all types, particularly Algerian libraries, have consequently shifted from traditional functions toward digitally enabled service delivery and administration through advanced technologies such as the Internet of Things, RFID, holography, and cloud computing. This transition has contributed significantly to their development.

Library digitization in Algeria began with early initiatives that lacked continuity. Computers were introduced into libraries during the 1990s, followed by pilot digital projects in the 2000s focused on cultural materials and historical documents. During the same period, Emir Abdelkader University of Islamic Sciences in Constantine launched a digital library project to provide users with networked access to various information resources. Government and academic institutions subsequently intensified their efforts to develop and modernize the library

sector. In recent years, libraries have begun to use electronic databases and provide a range of digital services through advanced technologies.

This study highlights the digital transformations that have enabled Algerian libraries to meet user needs through technological tools and strategies. These transformations have directly affected library functions and service delivery while creating challenges related to adaptation to ongoing developments.

Given the importance of the topic, this study addresses the following questions: What principal transformations have digital technologies introduced into the services provided by Algerian libraries? How have these transformations affected library users?

Hence, the study identifies the principal digital technologies used in Algerian libraries and examines their role in transforming work practices (Section One). It also examines the challenges confronting libraries in terms of technical and financial preparedness and decision-making (Section Two).

Given the nature of the inquiry, the study employs a descriptive approach to examine Algerian libraries and the digital technologies they use. It draws on a range of sources and references, most of which are foreign-language works.

Section One: Digital Technologies Used in Algerian Libraries

Digital transformation technologies, including artificial intelligence and cloud computing, have improved library efficiency. However, many Algerian libraries continue to rely on traditional methods, limiting their capacity to embrace change and innovation.

Because content delivery is a core library function, libraries must modernize their operations and services by providing access to resources through emerging digital technologies, as discussed below.

Administrative and Organizational Technologies

Algerian libraries are affiliated with universities or educational institutions that supervise and finance them to meet user needs. As digital transformation expands, libraries must adopt effective administrative and organizational methods to ensure the successful digitization of their resources and improve service efficiency.[1] Adapting to technological developments in the digital age therefore requires libraries to employ a range of administrative and organizational technologies, summarized below:

1. Integrated Library Management Systems

Algerian libraries use digital systems to automate cataloging, lending, and service management. Some universities, including Souk Ahras University, have adopted the

[1] Joint Ministerial Order of August 24, 2004, determining the administrative organization of the university directorate, faculty, institute, university annex, and shared services, *Official Gazette*, no. 62.

open-source Koha system to support the transition to digital libraries and improve their services.[2]

Library management systems allow researchers to search electronic catalogs, verify the availability of books, reserve materials, and monitor loans electronically. Efficient operation requires adequate funding and high-speed internet access to keep systems and equipment up to date.[3]

2. Electronic Database Technologies

Electronic databases are fundamental to digital library management. They enable libraries to organize and index theses and other research outputs and facilitate access to international scholarly journals and periodicals through databases such as Scopus, ScienceDirect, and JSTOR, thereby enhancing researchers' access to information during the digital transformation.[4]

3. Web 2.0 Technologies

Some Algerian libraries use Web 2.0 technologies to digitize their services, enabling users to interact with library services, participate, and access information. These technologies have contributed to the development of library services in accordance with the requirements of the digital age and the needs of researchers and students, as summarized in the following figure.[5]

Library → Web 2.0 → Library 2.0

Figure 1. Transition to Library 2.0

Algerian libraries use second-generation web applications primarily in higher education institutions. The University of Algiers 1 Library, for example, uses a content management system (CMS).[6] These applications strengthen communication with users, collect feedback, manage lending, and distribute updates and alerts by email through technologies such as RSS and Library Elf, thereby supporting the development of interactive digital libraries. Nevertheless, Algerian libraries have yet to adopt Web 3.0 and Web 4.0 technologies, limiting service development and their ability to keep pace with digital advances.[7]

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[2] Mohamed Cherif Messaadia University of Souk Ahras, "How to Use the New Digital Library Platform (Koha)," accessed March 7, 2025, https://www.univ-soukahras.dz/ar/faculte/snv/a/81318.

[3] Francis Élie and Odile Quesnel, "Collaborative, documentaliste," *Science de l'Information* 44, no. 1 (2007): 54.

[4] Martin Kleppmann, *Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems*, 1st ed., 98.

[5] Blount Lindahl, "Weblogs: Simplified Web Publishing," *Computer* 36 (2003): 13.

[6] University of Algiers 1, "Digital Library Portal," accessed March 7, 2025, https://www.pdoc-dz.com/.

[7] A. Saxena and D. T. Dubey, "Impact of Digital Technology on Academic Libraries of India: Problems and Prospects," *International Journal of Application or Innovation in Engineering & Management (IJAIEM)* 3, no. 3 (2014): 308–25, https://www.academia.edu/download/33565536/IJAIEM-2014-03-26-095.pdf.

4. Radio-Frequency Identification (RFID) Technology

Some Algerian libraries have adopted technologies such as RFID and QR codes to streamline lending and inventory procedures, improve services, and reduce book theft. Libraries in Batna, Constantine, and Oran are among the institutions that have implemented these technologies as part of initiatives overseen by the Ministry of Higher Education and Scientific Research to advance library digitization and integrate information and communication technologies. The bodies involved are listed below:

National Committee for Documentary Information Systems	Center for Scientific and Technical Information CERIST	National Copyright Office ONDA
• Provide opinions on projects to develop information systems in higher education and scientific research. • Integrate technology into documentary information systems. • Provide opinions on virtual library projects. • Establish the legal framework governing libraries' right to digitize their collections.	• Establish digitization policies. • Create and develop a national scientific and technical information system. • Coordinate scientific and technical information programs in cooperation with other bodies.[8]	• Establish policies for library digitization projects. • Monitor activities related to literary and artistic works. • Resolve problems concerning the deposit of works. • Establish contracts granting digitization rights for works in return for financial compensation.

Source: Prepared by the author.

User Identification and Communication Technologies

Algerian libraries have used digital transformation to develop their services and strengthen interaction with users through modern technologies that have improved operational efficiency and service quality.[9] These technologies include:

[8] The CERIST Library is not a university library and is excluded from the RIBU network. It is a digital library and a research center for scientific and technical information in Algeria. It was established under Law No. 85-56 of March 16, 1985, and operates under the supervision of the Minister of Higher Education and Scientific Research pursuant to Decree No. 03-454 of December 1, 2003.

[9] Reda Mohamed Ghalem and Nadhir Ghanem, "Digital Transformation of University Libraries amid Emerging Technology: Between Reality and Aspiration: A Field Study of the Libraries of the University of Batna 1," *Journal of Human and Social Sciences* 13, no. 4 (2024): 87.

1. Electronic Library Cards

Electronic library cards facilitate the borrowing and return of books and the tracking of reference materials. They encode subscriber data in barcodes and use RFID technology, thereby improving the efficiency of library operations and facilitating user services.[10]

2. Digital Libraries

Algerian libraries have advanced digital-library development by digitizing books and periodicals and making them available online, with support from the government and research institutions. Major initiatives include the digital library of Emir Abdelkader University, the Virtual Library for the Social Sciences and Humanities, and the My Digital Library application.[11]

Algeria has several digital library systems, most notably the Algerian Digital Libraries Portal (PBA), the Online Documentation System (SDC) for documenting university research, and the Scientific and Technical Data Bank (BDST), which provides researchers with scientific and technical resources and data.[12]

The Importance of Digital Technologies in Improving Library Services

Digital technologies have improved library services and facilitated access to knowledge for researchers and readers without temporal or spatial constraints. Through digital systems and networks, they have transformed library operations and advanced digitization in Algeria.[13]

Digital technologies have enhanced library services by digitizing content, facilitating access to resources, improving cataloging and lending operations, and supporting communication and distance-learning activities. Nevertheless, Algerian libraries continue to struggle to keep pace with digital developments. This lag has created a gap between available services and users' expectations, reduced library use, and prompted users to seek alternatives.

Section Two: Challenges Facing Algerian Libraries in Adopting Digital Technologies

Digital developments have transformed Algerian libraries into digital centers for knowledge and learning, broadened access to information, and reduced the digital divide. As Michael Stern Hart observed, "Digital libraries are the future of information."[14] Despite progress in digitization, Algerian libraries continue to struggle to keep pace with Fourth Industrial

[10] Wissam Ben Zekka, "The Information Specialist in the Web 2.0 Environment: Readiness and Feasibility: A Field Study of the Libraries of the Universities of Jijel and Bejaia" (PhD diss., Library Science, University of Constantine 2, 2015), 89.

[11] National Office for School Publications, "My Digital Library," https://onps.com.dz/.

[12] Naglaa Ahmed, *Digitization and Its Technologies in Arab Libraries*, 1st ed. (Egypt: Al-Arabi Publishing and Distribution, 2013), 34.

[13] Faleh Al-Sulami, "Technical Competencies Required of University Library Staff amid the Shift toward Digital Transformation," *Arab Journal of Media and Communication Research* 2020, no. 28 (2020): 590.

[14] Michael Stern Hart, *Project Gutenberg*, https://www.gutenberg.org/.

Revolution technologies and artificial intelligence due to inadequate infrastructure, the absence of standards for evaluating service quality, and the predominance of foreign-language digital content, which limits access for some users. This section addresses the technical challenges facing digital libraries, followed by financial and administrative challenges and, finally, the principal human and cultural challenges.

Technical Challenges

Technical capacity is fundamental to the success of digital libraries. It requires advanced infrastructure, modern equipment, robust networks, and cybersecurity systems to ensure efficient service delivery. Although Algerian libraries have adopted some digital technologies, they still face obstacles to comprehensive digital transformation, particularly in deploying artificial intelligence applications that meet user needs.[15] The principal technical challenges are as follows:

- Digital libraries face limited technical infrastructure and unreliable internet connectivity, which reduce the efficiency of access to information and electronic services. Limited familiarity with Web 2.0 applications among staff and users presents an additional obstacle to the development of digital services.
- Digital libraries require safeguards against cyberthreats. Denial-of-service (DoS) attacks can disrupt access to digital content.[16] Malware may also compromise sensitive information. Government authorities have therefore sought to implement security measures that provide adequate protection, including antivirus software and network firewalls that prevent unauthorized access to library networks.[17]
- Successful digital libraries require adequate funding and technical expertise to update and maintain systems and to manage networks and information security. However, insufficient financial resources and a shortage of specialized personnel impede service development and slow access to digital content.[18]

[15] Most Algerian university libraries lack a unified portal for digital services, except for RIBU libraries. Moreover, email services available in some libraries are not used effectively to provide reference services. *Journal of Library Science* 7, no. 2 (2015): 201.

[16] Denial-of-service (DoS) attacks are cyberattacks that target digital libraries, disrupt their services, and prevent access to online databases and digital resources.

[17] The University of Algiers 1 Library uses firewalls and intrusion detection systems (IDS) to monitor suspicious activity and cyberattacks and to alert administrators to take the measures necessary to protect the system.

[18] M. Asif and K. Singh, "Emerging Trends and Technologies for Digital Transformation of Libraries," *IP Indian Journal of Library Science and Information Technology* (2019): 44, https://doi.org/10.18231/j.ijlsit.2019.011.

Financial and Administrative Challenges

Digital libraries face inadequate financial and administrative planning, a shortage of personnel capable of implementing digital transformation strategies, insufficient coordination among departments, and limited government support. These conditions restrict the development of digital services and the ability to meet user needs.[19]

Protecting digital content and intellectual property rights is among the most significant challenges facing digital libraries. Clear legislation and procedures are therefore required to regulate the use of digital rights management (DRM) technologies and protect authors' rights, particularly given the shortcomings of Algerian legislation in this area.[20]

The absence of legislation regulating the use of digital technologies in libraries constitutes a legal obstacle to service development and necessitates laws that support digital transformation. Successful digitization also requires appropriate organizational structures, clear strategies, stronger legal protections, a culture of innovation, and the professional development of library staff.

Human and Cultural Challenges

Qualified human resources are essential to successful digital transformation in libraries. Using modern technologies requires personnel with digital skills and information literacy, while a shortage of specialized personnel hinders efficient digitization.[21] Digital libraries require staff capable of managing digital systems, databases, and archives; organizing information; developing research services; and planning digital projects. However, shortages in these competencies and limited staff technical skills constrain the benefits of digital technologies, reduce service quality, and increase operating and maintenance costs.[22]

Digital libraries face human and cultural challenges, particularly the continued reliance on traditional lending practices that are incompatible with the digital environment and restrict flexible access to resources. Modern solutions, including electronic lending, digital lending platforms, and open-access models, must therefore be adopted to meet user needs in the digital age.[23]

Algerian libraries consequently face numerous challenges related to an institutional work culture that must evolve. Adopting digital technologies requires administrators and employees to

[19] Nabil Aknouche, "The Digital Library at the Algerian University: Its Design and Establishment: The Emir Abdelkader University Library as a Model" (PhD diss., Library Science, University of Constantine, Algeria, 2010), 300.

[20] Alain Labruffe, *Management des compétences: Construire votre référentiel* (Saint-Denis: Afnor, 2005), 66.

[21] Jean-Marie Peretti, *Dictionnaire des ressources humaines* (Paris: Librairie Vuibert, 2005).

[22] Mabrouk Ibrahim El-Said, *Human Resource Management in University Libraries in the Knowledge Age* (Alexandria, Egypt: Dar Al-Wafaa for Printing and Publishing, 2014), 98.

[23] Abdelghani Kouasmiya, "Trends among Arab Bloggers Specializing in Library Science: An Analytical and Evaluative Study" (master's thesis, Library Science, University of Oran, Algeria, 2015), 77.

embrace new working methods. Algerian libraries also lack sufficient awareness of the importance of digital technologies: many researchers still prefer traditional research methods and remain unaware of the benefits that digital services can provide.[24]

Conclusion

Recent changes in Algerian libraries have accelerated digitization and the adoption of advanced technologies. Libraries now interact dynamically with researchers, staff, and institutions in their surrounding environment, as the digital revolution has propelled them into the new information age and facilitated service delivery.

Algerian libraries are moving toward modernization through a range of advanced digital technologies used to attract more readers and researchers. These technologies include digital library management systems for lending and cataloging, digital databases, and tracking technologies such as RFID and QR codes. Their use helps libraries meet researchers' changing needs, strengthen learning and scientific research, and improve the quality of library services.

Nevertheless, Algerian libraries continue to encounter challenges that impede digitization and cause them to miss opportunities for the technological development needed to serve future generations. Future generations will necessarily rely on computers and devices equipped with advanced technologies and software. Algerian libraries therefore face a decisive choice: either prepare for digitization in a manner that meets the requirements of the new generation or cede the field to better prepared institutions.

The following recommendations are proposed:

- Library software and equipment should be developed in accordance with the needs of students and researchers in the digital age. Libraries must assume new functions and provide innovative services that restore their central role in supporting education and research.
- Human-resource competency standards should be incorporated into library operations through practical and written assessments of staff. These assessments should cover document cataloging and classification, the use of library software, and competence in software installation and equipment maintenance. A staff training program should also be established to strengthen these competencies.
- Libraries should be provided with digital infrastructure, financial support, and dedicated budgets to strengthen their digital systems.
- Legal and legislative frameworks supporting digital transformation in libraries should be established and aligned with the pedagogical policies governing scientific research and knowledge production.

[24] H. Al-Barashdi and R. Al-Karousi, "Big Data in Academic Libraries: Literature Review and Future Research Directions," *Journal of Information Studies & Technology (JIS&T)* 2018, no. 2, https://doi.org/10.5339/jist.2018.13.

- Working groups comprising information technology experts should be formed to oversee digital transformation and ensure its efficient and effective implementation.

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