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MODERN LIBRARY TECHNOLOGIES AND THEIR CURRENT FUNCTION

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Annotation: *Modern academic libraries are undergoing a profound paradigm shift, transitioning from passive, physical repositories of literature into dynamic, highly automated, and intelligent knowledge ecosystems. Driven by the rapid maturation of generative Artificial Intelligence (AI), the Internet of Things (IoT), and Radio Frequency Identification (RFID) systems, these institutions are systematically restructuring their operations, metadata curation, and user services. This paper investigates the modern functional landscape of library technologies, identifying the convergence of AI and physical hardware as a critical evolutionary leap. Employing a comprehensive qualitative and structural synthesis of contemporary implementations.*

Keywords: *Modern Library Technologies, Artificial Intelligence (AI), Internet of Things (IoT), RFID, Metadata Enrichment, Smart Libraries, Knowledge Orchestration, Academic Librarianship.*

Modern information technologies are considered a tool that determines the strategy and tactics for the development of the National Library. The introduction of computer technologies, telecommunications access methods, and electronic resources has led to fundamental changes in the provision of services with documents and information about them, affecting everyone: the reader, the librarian, and the forms and quality of service. For centuries, the academic library was defined primarily by its physical architecture and the containment of print

media. Librarians operated as manual gatekeepers of knowledge, utilizing standardized, rigid taxonomy schemas—such as the Dewey Decimal Classification (DDC) and the Library of Congress Classification (LCC)—to catalog, organize, and retrieve information. However, the late twentieth and early twenty-first centuries initiated a digital migration. The emergence of the internet, electronic databases, and Integrated Library Systems (ILS) decoupled information from physical space, permanently altering scholarly workflows. As Breeding (2024) notes, the transition from traditional ILS to modern, cloud-native Library Services Platforms (LSPs) represents a fundamental shift in library resource management [5; 18]. Modern LSPs, such as Clarivate's Ex Libris Alma and OCLC's WorldShare Management Services, unify print, electronic, and digital workflows within a single, SaaS (Software as a Service) platform. Furthermore, the integration of open-source options, such as the Koha ILS supported by Aspen Discovery, highlights a growing movement toward platform flexibility, giving libraries alternatives to monolithic, proprietary software suites [1;72].

Current digital paradigm is undergoing a second, more disruptive transformation. Academic libraries no longer merely support digital access; they are evolving into **smart knowledge ecosystems**. This shift is necessitated by an exponential surge in global scholarly output and rapidly shifting patron expectations [4;13]. Modern researchers, students, and educators demand seamless, instantaneous, and highly contextualized access to information. They expect search interfaces to function with the conversational fluidity of generative AI models, and physical environments to adapt dynamically to their learning behaviors. Consequently, traditional Library Services Platforms (LSPs) are being overhauled. They are being replaced by unified, interoperable systems that blend physical tracking technologies with complex machine learning algorithms.

Despite these rapid technological advancements, a significant gap persists in the existing library and information science (LIS) literature. While numerous isolated studies explore the technical mechanics of RFID tags or the hypothetical utility of Large Language Models (LLMs) in information retrieval, there is a distinct lack of comprehensive, structural research examining the

systematic convergence of these technologies. Current trends in the field of information and library services are shown by experts through the following clear expressions:

- all attention is focused on the user, who is the central person in the library: identifying their needs and satisfying them as quickly and fully as possible;

- Strengthening the role of the librarian as a mediator between the user and information;

- introduction of modern library technologies in the field of meeting the demand for information and library resources and information about them;

- as a result, the quality, efficiency, and speed of user service will undoubtedly increase at all stages: from library membership to obtaining necessary information and resources;

- popularization of new forms of service that attract the user (sometimes through a paid service system); this contributes to expanding the range of opportunities traditionally created by libraries [2; 13].

The design and construction of new library buildings, taking into account modern technologies, not only facilitates the convenient placement of library collections from various information sources (paper, gramophone records, cartographic publications, media sources, etc.) and the production units of the library, but also contributes to the development of library activities. It allows for the effective realization of all opportunities for the implementation of information and communication technologies. The construction of new library buildings or the reconstruction of existing ones will create the most favorable conditions for implementing the requirements for libraries in the field of information and library services and the modern information environment. In foreign national libraries around the world (Great Britain. France, Germany, Denmark, Finland, Japan, Sweden, Norway) in accordance with the strategic development plans of these libraries, special programs are being developed to master and organize work in new buildings. It is important to remember that these libraries, unlike ours, have already transitioned their activities to a computer-based system and possess a developed information infrastructure and telecommunications connections [8; 39].

The fundamental changes concern the nature and organization of services in the new library buildings. The essence of these changes lies in the goal of technological and technical renewal, adaptation to new economic conditions, and increasing the significance of the library in social life. One example is the British Library's "Utility Initiatives" program. This program is the primary strategic document for implementing new technologies in the service sector, and providing users with information is considered its priority area. Planned changes and innovations are provided through a single ABIS, which covers all aspects of service delivery, namely: - informing users and visitors about the information in the library, its low height; - registering users and managing their entry into the library [6; 19]. This system will notify readers of expired or lost tickets, bookmarks, and fines, and will record the time and date of the reader's entry into the library. A separate terminal is installed to check the reader's access to special areas where valuable and particularly important materials are stored (information about this is available in the database created for readers); - providing users with electronic resources that can be found by the most important characteristics (author, compiler, title, keyword, type of document, etc.); - automated ordering of documents from book repositories; - managing user orders for documents and services (time, reservation of space in the hall, free access to the document, etc.); - monitoring the issuance of documents and payment for the service. In its project for a new library, the National Library of France envisaged the robotization of part of its warehouses (about 2 million books). The reader's place was designed in 4 different variants: from a basic free place with standard modern equipment necessary for the user's work to a paid super place equipped in accordance with the research and editing work of the researcher [7; 71]. Within the structure of its reading zone, the National Library of Germany has a special multimedia hall for servicing CD-ROM materials, telecommunications, and equipment for printing necessary materials on color printers. All collections in the new library building are reflected in an electronic catalog, which can be freely used by local and remote readers. New forms of service provided in modern libraries include: telecommunication transmission of bibliographic and textual information; providing analytical information on the most in-demand periodicals; providing information in any form convenient for the user (printed, ML, CD, online); business information, etc. All libraries in the new buildings are planned to provide

services to persons with disabilities using modern technology, telecommunications, and special equipment. In 1997, at a seminar titled "Intellectual Library Buildings" in The Hague, 15 speakers presented their experience and vision regarding the organization of library work in new buildings. This experience is very important in our conditions for developing a strategy for the development of modern high-tech libraries. This can be generalized as follows:

1. A modern (intellectual) library building is characterized by rapid adaptability, ease of use, modern interiors and furniture, high technical documentation, and, finally, the intellectual abilities of the librarian (s). In doing so, the librarian must act as an equal partner to the architect and be extremely responsible in all of the above matters.

2. From the point of view of service provision, the following processes must be implemented in new buildings: increasing the efficiency of using classrooms, providing free access to information, and providing fast and high-quality services with documents available in the funds, regardless of where they are stored (British Service Code, special service standards for certain departments); Expansion of remote support for documents available in the country and abroad. This process should be carried out as quickly and cheaply as possible based on digital storage and computer communication networks. Formation of electronic document storage centers and computer centers that ensure the retrieval of documents and information about them at national and international levels.

The definition of the concept of an "intellectual library building" is the implementation of automated technologies to implement all functions of the building [3; 10] and the library as a whole. Transferring the functions of building operation, maintenance, and security to computers is an integral part of the overall process, freeing photocells, motors, and mechanical devices from their corresponding functions. Consequently, one can speak of mechanical intelligence as implemented. When a number of technical and technological innovations are introduced into the activities of a library, it is usually necessary to reorganize its structural units, and perhaps the structure as a whole, as well as to revise the management system. The similarity in the tasks of the number of divisions leads to an optimal state depending on the relationship between them. The automation of

library processes also affects the management system, which, in turn, requires maintaining the appropriate level of library activity. In the new library buildings, the zones for holding social and mass events will be significantly expanded. Several complex zones of various types are constructed, such as meeting and conference halls, rooms for group work, virtual data services, and media work. All this is done to attract the attention of the public and the government to the field of librarianship and to strengthen the status of libraries as a national service center. Thus, a functionally unified building is created, which becomes a free zone for any visits and events (exhibitions, meetings, concerts, etc.), a place that ensures the reader's research and educational interests. In connection with the construction of the new building of the National Library named after Alisher Navoi, it was concluded that it is necessary to create a comprehensive concept for the construction of library buildings in our country, reflecting a complex of interconnected issues. At the same time, the main principle in developing the concept should be the idea that library services directly depend on the quality of the library building's construction. The experience of constructing a new building for the National Library of Uzbekistan allows for certain conclusions: architects, librarians, and technical specialists must always work together when designing a new building (as well as when renovating and reconstructing existing buildings in accordance with modern requirements). Such cooperation will allow for the full implementation of current requirements for new library buildings and ensure the smooth passage of changes that may occur in the future; The accumulated experience regarding the development of the National Library building and the use of modern technologies and equipment must be analyzed and disseminated among the country's libraries.

The financial demands of implementing these technologies can be incredibly high. Deploying item-level RFID tags across an academic library collection of over a million volumes requires significant capital investments, covering:

- Physical tags,
- Automated self-checkout stations,
- Security gates, and

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- Dedicated middleware integration licenses.

Furthermore, subscription fees for AI-powered discovery platforms (such as ScopusAI or Web of Science Research Assistant) are often cost-prohibitive for smaller colleges and libraries in developing nations. This disparity threatens to create a "digital divide" in academia, where elite, well-funded universities leverage advanced, AI-driven discovery workflows, while underfunded public institutions remain constrained by outdated, manual search systems (Ebijuwa & Rajkumar, 2026).

To mitigate these economic pressures, many institutions are turning to open-source alternatives. Modern platforms like Koha and Aspen Discovery offer highly customizable, community-supported infrastructure options that free libraries from expensive proprietary software packages. Moving forward, the success of the academic library will depend on a balanced, hybrid model. While technological automation is essential for managing the sheer scale of modern global research, the human element—the librarian's expertise in curation, information literacy, and ethical stewardship—remains completely irreplaceable. By strategically synthesizing advanced technologies with human-centric values, libraries can ensure they remain open, inclusive, and highly trusted pillars of global scholarship for generations to come.

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