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MODERN INFORMATION TECHNOLOGIES. DIGITAL TRANSFORMATION OF LIBRARIES

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Readiness of Bulgarian public libraries for digital transformation

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Abstract. In the study, the data on implementation of new digital technologies into Bulgarian regional libraries and their preparedness for digital transformation (DT) are analyzed. For this purpose, the set of indicators formed the foundation for the model of periodic monitoring of DT development degree. The study was conducted during July and August 2024 among 27 regional libraries in Bulgaria.

The interest in this topic is driven by the ongoing process of modernization across various organizations, including libraries, and influenced by the rapid advancement of information and communication technologies (ICT) and the formation of a new intelligent information society (IIS). Today, the digital transformation is viewed as the final stage of integrating ICT into organisational structures and processes, which, in its turn, drives to significant changes in individual organizational subsystems or the organization as a whole. Thus, it could be argued that the achieved level of DT corresponds to the degree of engagement with the IIS. Besides, the issues related to DT and adaptation to IIS are crucial for understanding the prevailing social, societal and economic

processes. Currently, there is a lack of specific data on the implementation and the effects of DT in organizations, particularly libraries.

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Keywords: digital transformation, digital readiness, Bulgarian public libraries

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Introduction

The necessity for the digitisation of libraries became apparent as early as the late 20th century and during the first decade of the 21st century. Initially, the issues were primarily associated with the saturation of these organisations with equipment and technologies, followed by activities related to the digitalisation and usage of the objects from library collections.

The concept of digital transformation (DT) has emerged recently. This transformation in libraries is now regarded as the integration of digital technologies into all library processes, offered services and user engagement [**1**]. Moreover, DT not only pertains to the adoption of new technologies but also encompasses a fundamental change in the operational approach of libraries and response to evolving user expectations [**2, 3**]. The DT of libraries is influenced by several factors that reflect external pressures and internal motivations. In order to elucidate these factors, a comprehensive view of technological advancement, societal changes and evolving user expectations is imperative: a) *Technological Advancement*: The rise of cloud services, mobile technologies and big data analytics enables organisations, including libraries, to significantly enhance their services; b) *User Expectations*: Contemporary users expect instant access to information anytime and from anywhere; c) *Societal Changes*: The COVID-19 pandemic accelerated the adoption of digital tools across various sectors, including education and public services;

d) *Democratisation of Access to Information:* DT allows organisations to eliminate barriers (e.g. location of the library) that previously restricted access to information.

As digital tools permeate the public systems, processes and activities (i.e. the society is becoming digital), user expectations regarding library services have evolved significantly; thus, there is growing external pressure for DT in libraries. Despite the anticipated significant benefits of DT, libraries face several challenges [**4, 5**]: a) *Financial Constraints***:** Many libraries are hindered by limited budgets, which restrict their ability to invest in new technologies, develop modern services or enhance the DT literacy of their staff; b) *Training and Adapting Staff:* The transition from traditional to new practices aligned with contemporary realities necessitates ongoing training for library personnel to ensure that they gain the necessary skills to operate and manage a digital environment; c) *Maintaining Relevance:* As more information becomes available online through various digital and online platforms, libraries must continually demonstrate their unique offerings since they operate in an environment marked by increased competition from private organisations that provide access (either paid or free) to vast amounts of information resources and databases; d) *Data Management and Privacy Concerns:* For users, the secure management of their personal data is paramount while libraries must also adhere to privacy regulations at national and international levels. These challenges require libraries to develop strategic responses to navigate the complexities of DT successfully.

The assessment of the DR of libraries involves identifying the current state, comparing it with the desired level of development and evaluating the realistic capabilities needed to achieve a new digital status. The adoption of the latest technologies (data extraction, data analysis, data spaces, cloud computing and services, artificial intelligence, Internet of Things, Internet of Everything, blockchain, etc.) builds a new technological ecosystem within libraries, necessitating significant changes in the operations across the organisation.

Methods

Scope of the Study

The present study is based on the data collected during July-August 2024 through an online questionnaire. The responses from respondents were obtained via a completed online survey. The target group included all 27 regional libraries in Bulgaria (100%)[1]. A total of 21 completed surveys were received, representing 78% of all regional libraries. Notably, these libraries share the same status, functions and responsibilities, as their operations are regulated by a specific Bulgarian law – the Public Libraries Act. However, as evident from the data, these libraries significantly differ in terms of collection size, staff employed, services offered and the quality of their physical and technological infrastructure.

Based on empirical data, the present study aimed to identify the adoption and penetration of IIS technologies in Bulgarian regional libraries and sought answers to the following research questions:

RQ 1: What IIS technologies are currently utilised in libraries?

RQ 2: In which library activities and processes are IIS technologies applied?

RQ 3: What is the self-assessment of libraries regarding their achieved level of DT?

Herein, the authors analysed data that could be utilised for further research to identify the drivers of library DT, potential benefits and barriers, the extent of organisational change and limitations of new models.

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[1] "The number for the public libraries includes four categories: the National Library; 27 regional libraries; 19 municipal libraries and 2,762 chitalishte libraries. The regional libraries are the most developed public libraries in the country and form the backbone of the national territorial library and information services network. The Ministry of Culture coordinate the activities of Bulgaria's public libraries through the regional libraries. Regional libraries are subordinate to the corresponding municipality. The chitalishte libraries are closest to the public, as there is a chitalishte in every Bulgarian town and in almost every village. Chitalishte are non-government organizations, established in the 19th century as reading centers. Nowadays they are functioning as community clubs." (IFLA. Library Map of the World. Country Pages: Bulgaria. https://librarymap.ifla.org/countries/Bulgaria (accessed: January 10, 2025).

Demographic characteristics

The demographic characteristics of the sample are as follows (n = 21): 1–30 employees – 7 (33.3%); 31–60 employees – 12 (57.1%); > 60 employees – 2 (9.5%). Number of employees define the size of the library (Figure 1).

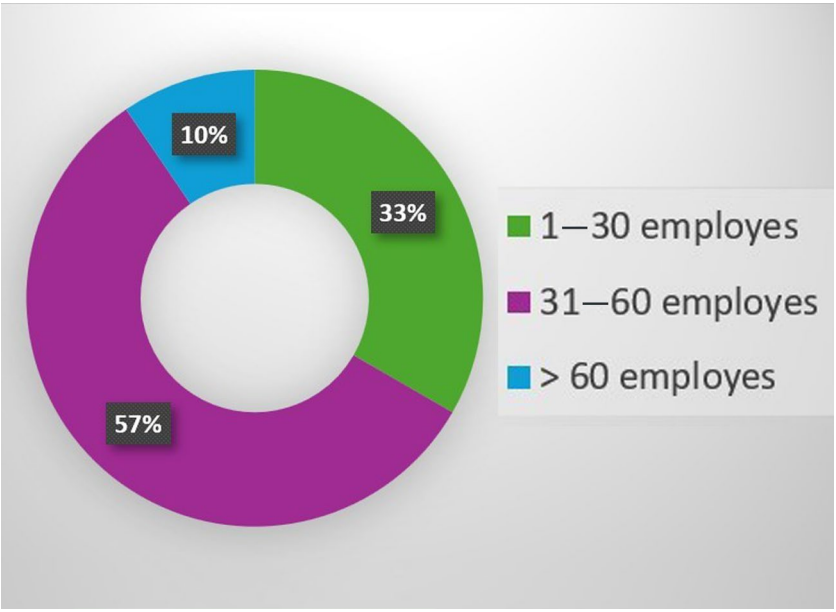

Figure 1. Libraries by staff number

Geographical coverage

The study includes public libraries from across the country. The provincial cities of Bulgaria included in the study were as follows: Northwest region (Montana, Vratsa, Lovech); North Central region (Veliko Tarnovo, Gabrovo, Ruse, Silistra); Northeast region (Dobrich, Shumen); Southeast (Burgas, Yambol, Stara Zagora); South Central region (Plovdiv, Haskovo, Pazardzhik, Smolyan, Kardzhali); and Southwest (Sofia, Blagoevgrad, Pernik, Kyustendil) – figure 2.

Figure 2. Map of Bulgarian regions with public libraries participating in the study (Global Libraries – Bulgaria Foundation. 2017–2025©. https://glbulgaria.bg/en/network-of-libraries/library-map)

Limitations of the Study

Furthermore, the DT is not limited solely to the adoption of new technologies but encompasses a comprehensive change in how an organisation operates, its competitiveness and its ability to deliver value. Consequently, this transformation provokes a re-evaluation of established organisational models and is a multidimensional process that fundamentally transforms various industries and organisations.

Notably, digitisation, digitalisation and DT represent different levels in the evolution of ICT within organisations. This study adopts the following definitions:

Digitisation is the process of changing from analogue to digital form, also known as digital enablement. It can also be explained as follows: digitisation changes an analogue process into a digital form without any different-in-kind changes to the process itself [**6**].

Digitalisation is the use of digital technologies to modify a business model and provide new revenue- and value-producing opportunities. Thus, it is defined as the process of moving to a digital business [**7**].

DT is concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organisational structures or modification in the automation of the processes [**8**].

DT underlies the development of organisational and ICT-based capabilities that allow an organisation to form a new technological ecosystem (intelligent environment; Ambient Intelligence, AmI). This transformation can be achieved through information technologies and the corresponding communication infrastructure. Subsequently, the sequential development of organisational models progresses from the digitisation of data and information, through the digitalisation of processes, to the digitisation of organisational structures, production processes and their management. This process would enable the library to improve customer experience, reduce unit costs, maintain a competitive advantage through ongoing technological modernisation and organisational transformation and provide customer-oriented electronic services [**9**].

Nonetheless, the appropriate research instruments for periodic assessment of readiness or the development of DT are yet to be clearly defined, which could be due to many barriers, including the diversity of organisational structures, the sectors in which organisations operate and various forms of expression. However, whether a universal toolkit can be created to measure readiness or development specific to data levels is debatable.

Our study presents a modest framework for assessing the readiness for DT, which includes three indicators: self-assessment of respondents regarding the achieved level of digital transformation; type of technologies employed; technologies currently utilised in various business processes.

Herein, we asserted that each stage of development necessitates strategic decision-making and the initiation of specific actions for the corresponding changes in both processes and organisational models. The prevailing understanding is that the final stage of development is based on intelligent ecosystems in a completed form, preceded by 'digitisation' and 'digitalisation'. By examining the type of technologies and the degree of their adoption across various organisational processes, it can be determined how prepared they are on the scale of DT.

We have excluded the Internet of Everything to facilitate possible comparisons with the results of other studies. Importantly, Internet of Everything is defined as a network of connections between people, things, data and processes that provide general intelligence and improved cognition across the networks. This article explains the fundamentals of the Internet of Everything, its examples and its applications [**10**].

Analysis of Results

The present study aimed to understand the extent of usage of the latest technologies by the surveyed Bulgarian libraries. The analysis is based on univariate and bivariate frequency distribution of the data.

A. Self-Assessment of Respondents Regarding the Level of Digitisation (Table 1)

Based on a set of questions, we could understand how respondents perceive the level of digitisation achieved in their libraries. This self-assessment is crucial as it is impossible for an external observer to determine the exact level of technology used within an organisation. Regarding areas of operation, the regional libraries are similar since the Law regulates their activities in Public Libraries; however, the organisational models are different. Moreover, the same technology can be applied in various ways and for different purposes. What were the results following the processing of the primary data regarding respondents' self-assessment of the achieved level of digitisation?

Table 1

Self-assessment of respondents regarding the achieved level of DT

Process / Service	%
The level of digitization of core processes in the library	4.8
The level of digitization of collection/supply processes (deliveries)	4.8
The level of digitization of activities aimed at expanding offered digital services	4.8
The level of digitization in financial processes	19.0
The level of digitization of processes related to user/reader/client relationships	4.8
The level of digitization of human resource management processes	23.8
The level of digitization of processes for creating an intelligent environment	4.8

We can assert that the data presented above reflects the status of online services offered by Bulgarian regional libraries. Another study conducted in the summer of 2022 among 100% of regional libraries focuses on the accessibility and convenience for users [**11**]:

Websites predominantly belong to the Web 1.0 generation (92.6%). Some websites were created over a decade ago.

A separate 'Services' section is available on the websites of 66.7% of regional libraries; however, most of them refer to a price list of traditional library services or rules for using library resources. An additional 29.6% of the websites do not have such a section, although they may provide brief information about offered services, for instance, via 'For Readers'. Only 55.6% of the websites display the 'Services' prominently, while it is irrelevant in another 25.9% because the generation and the functionalities of the website do not support the possibility of online provision of e-services.

In 92.6% of the websites, there are no accessibility options for persons with special needs, whereas in the remaining cases, a statement indicates that the library is equipped to serve such users.

Although some level of digitisation has been achieved within the libraries, the results are not sufficiently visible to users.

The higher proportions of digital tools used by libraries in financial processes (19%) and human resource management (23.8%) should be linked to the regulations implemented by the state for these activities and their accountability. These proportions are not individual achievements of the respective libraries. Furthermore, not all respondents provide positive responses, indicating potential issues in these core activities.

B. Implemented DT Activities (Table 2)

The results concerning the activities already implemented in the realm of DT are as follows:

Table 2

Implemented DT activities

Process / Service	%
Incorporated into acquisition processes	66.7
Incorporated into library services	100
Incorporated into financial processes	52.4
Incorporated into human resource management processes	52.4
Incorporated into the formation of an intelligent environment	4.8

The high percentages indicated by respondents, particularly regarding the implemented activities associated with the introduction of systems for product/service provision (100%), do not convey the quantity or quality of the services offered, thereby indicating that the activities undertaken for DT do not signify accomplishments but rather initial steps. This assertion is directly correlated with the documented results from the self-assessment of the achieved level of DT (see section A).

C. Technologies Already Utilised by the Surveyed Libraries (Table 3)

Next, we developed a separate set of questions based on the concept that the areas of utilisation of the specific type of technologies by libraries can serve as a measure of readiness for DT. The technologies included in this inquiry have been identified in previous studies [**9, 12–14**].

The advent of artificial intelligence, the Internet of Things, blockchain and robotic process automation has been the subject of ongoing, predominantly theoretical research due to the lack of comprehensive data regarding their acceptance, application methods and impact. Although some studies indicate that the adoption of these technologies is increasing, the extent and manner of their implementation vary significantly across industries and organisations. Our results regarding the technologies utilised in libraries are described in Table 3:

Table 3

Technologies Already Utilised by the Surveyed Libraries

Technologies	%
Utilization of big data	9.5
Data extraction, data analysis, use of data spaces	4.8
Use of cloud computing and cloud services	14.3
Use of mobile technologies	38.1
Use of artificial intelligence	14.3
Use of the Internet of Things	33.3
Use of blockchain technologies	4.8
Use of social media	4.8
Use of content management systems (CMS)	4.8
Use of scanners for digitizing books, articles, periodicals, etc.	4.8
Use of software for processing photographic material	23.8
Use of software for processing audio recordings from vinyl records, magnetic tapes, audio cassettes	42.9
Use of software for processing video recordings from various media	4.8

Based on the above findings, it can be concluded that the aforementioned technologies are relatively new to libraries. However, many libraries worldwide are establishing specialised spaces referred to as makerspaces, fab labs and creative labs to meet users' needs by providing access to:

3D printers, laser cutters, sewing and embroidery machines, programming electronics and robotics;

design, modelling, video editing or audio editing software;

collaborative workstations that encourage group projects and the exchange of ideas.

In other words, these spaces transform the library into an environment for innovation and creativity, where knowledge is applied in practice.

Such practices are not observed in 78% of Bulgarian regional libraries. Then to what extent do Bulgarian regional libraries utilise IIS technologies? Approximately less than 5% of respondents indicate any activities related to such technologies. What is the self-assessment of Bulgarian regional libraries regarding their achieved level of DT? Again,

barely under 5% undertake tangible actions to reach a sufficient level for genuine DT and integration into the IIS.

Overall, these libraries are evidently at a stage of initial saturation with digitisation technologies, primarily at the level of resource digitisation and significantly less concerning the provision of online-based services for users.

Conclusion

Although the libraries function as democratic institutions, empowering individuals by providing free and open access to information, regardless of their socioeconomic status or background [**15**] the preferences of contemporary users differ from those more than a decade ago. The question arises that to what extent the previously critical role of libraries diminishes due to the pervasive application of DT technologies, their accessibility and the entry of businesses into the information sector.

DT is a holistic process that encompasses technological, organisational, legal and social aspects. It is also associated with a suite of activities, such as scanning documents (including rare copies), the provision of electronic resources (particularly online) to mobile applications and virtual reference services, the implementation of artificial intelligence and the development of innovative physical spaces that reflect a broad spectrum of transformations. Regardless of the technologies that catalyse the DT, the process is internal to the specific library, the formulation of digital strategies and the qualification of personnel. Together, these factors shall contribute to the new identity of libraries in the 21st century.

What is the future perspective for libraries in an increasingly digitally transforming world? The key aspects of DT of libraries include expanding digital collections, enhancing library management systems, improving online catalogues and resource discovery services, developing user-friendly websites, investing in digital storage, transforming physical spaces, offering data management services, promoting open access, providing digital literacy programs, enhancing user experience and ensuring inclusivity and accessibility. The future of library operations might involve further integration of artificial intelligence and machine learning technologies. These advancements could lead to highly automated and autonomous systems capable of providing personalised

recommendations based on user behaviour or preferences. However, various opinions regarding the extent of this transformation include minimal changes within existing structures and radical alterations that could redefine a library according to contemporary understanding. DT is not a project with a defined beginning and end, as the digital revolution is not a singular act. The influx of the Internet, mobile technologies, cloud technologies and so forth represent a series of events and innovations that have shaped the current information-related technologies. Thus, DT will also be subjected to a continuous, ongoing evolution fuelled by new technologies, business models and client needs; consequently, libraries will continue to evolve.

In conclusion, DT represents both an opportunity and a challenge for libraries as they strive to remain relevant in an increasingly digital world. Unlike in the past, library organisations are no longer the sole providers of information services and access to data. The sector now includes significant international players from the private business realm. Libraries can only transform if they adopt new technologies while concurrently addressing the inherent challenges to continue serving as vital community resources in the future.

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