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Digital Curation: Opportunities and Challenges for Ukrainian Libraries

Objective. Today digital landscape continues to evolve rapidly, presenting libraries with the dual challenge of not only preserving digital content but also curating it. This is particularly pertinent given the needs of open science and open data, which emphasize searchability, accessibility, interoperability, and reuse (FAIR principles). **Methods** include a critical review of domestic and international publications on digital curation, official documents, and websites of Ukrainian libraries dedicated to open research data. **Results.** The current challenges necessitate the development of effective library strategies for digital curation and research data management and the enhancement of librarians' relevant skills through library education and lifelong learning. The paper examines key global trends in digital curation and explores the prospects for implementing these practices in Ukrainian libraries, especially in light of the National Open Science Plan and increased access to research data. The study argues that engagement in and leadership of digital curation practices could significantly transform the role, perception, and identity of academic libraries, thereby enhancing their ongoing relevance to research communities. Additionally, it emphasizes the necessity of advancing librarians' skills and competencies in digital curation and considers the complexities of collaborating with scholars in this context. **Conclusions**. The study's findings highlight the need to comprehensively consider digital curation as a new library function. It also underscores the role of university libraries in coordinating and advocating for these efforts at the institutional level. Additionally, it suggests the introduction of digital curation as a specialization within the library field, with roles such as data librarian (data curator) who could participate in research groups focused on data management.The article also concludes with an agenda for future research.

Keywords: digital curation; research data; research data management plan; data repository; data librarian; Ukraine

Introduction

Digital data whether digitized or "born-digital" – has been created at such a rapid pace over the last 25–30 years that it is often referred to as a "data flood," encompassing governmental, research, educational, personal, and business data. Significant changes have occurred in the scientific field, particularly with research data, as science becomes increasingly digital and open. Libraries, traditionally engaged with information, knowledge, and (meta) data, have adapted to these changes. Moreover, with the development of open access, librarians were among the first to participate in creating institutional repositories and electronic libraries, as well as in developing relevant policies for digital content management. They also developed their own competencies in this area.

Today, the landscape of information search technologies and methods for accessing data has changed significantly. The creation, management, use, preservation, storage, and security of data - along with the necessary infrastructure and services - are all evolving. This is especially relevant in the context of open science, particularly with the implementation of Ukraine's National Open Science Plan (Cabinet of Ministers of Ukraine, 2022) and proposed amendments to the Law of Ukraine "On Scientific and Scientific and Technical Activities," which address research infrastructure and support for young scientists (Verkhovna Rada of Ukraine, 2023). Additionally, the Ministry of Education and Science of Ukraine is preparing now the methodological recommendations on research data management for universities and scientific institutions.

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Digital curation, as a relatively new function for libraries, requires careful consideration and implementation. Data librarians need to acquire new skills and knowledge to effectively participate in research groups. Library and information education must also evolve to support these changes, including through continuous professional development.

The purpose of this article is to review the main global trends in digital curation and to explore the prospects for implementing these practices in Ukrainian libraries, particularly in light of the National Open Science Plan.

Methods

The article includes a critical review of domestic and international publications on digital curation, as well as official documents and websites of Ukrainian libraries focused on open research data and relevant data management practices.

Results and Discussion

Digital curation is defined as the selection, collection, maintenance, preservation, and archiving of digital assets (Higgins, 2008). This concept is sometimes referred to as “The Five Cs” or phases of digital curation: collection, categorization, critiquing, conceptualization, and circulation (Deschaine & Sharma, 2015). The Digital Curation Centre suggest that “Digital curation is concerned with actively managing data for as long as it continues to be of scholarly, scientific, research and/or administrative interest, with the aim of supporting reproducibility of results, re-use of and adding value to the data, managing it from its point of creation until it is determined not to be useful, and ensuring its long-term accessibility and preservation, authenticity and integrity” (Digital Curation Centre, 2017). Successful digital (or data) curation broadly encompasses support and management throughout all stages of the digital data life cycle, including creation, selection, preservation, storage, provision of long-term and reliable access, and organization for multiple uses. It also involves acquiring value-added digital information for current and future use (Yaroshenko & Serbin, 2023). Effective data management ensures the authenticity and integrity of data, protects against digital obsolescence, enhances the credibility, reliability, and reproducibility of research results, facilitates interpretation and reuse, and provides opportunities for confirming, developing, and improving research findings. Additionally, it aligns with the requirements of most organizations or foundations that fund research - requirements that are also starting to appear in Ukrainian legislation, though currently only for state-funded scientific projects. Responsible digital curation is essential for ensuring the continued use, accessibility, and preservation of data. This is aligned with the FAIR principles, which ensure that data and other digital research assets remain Findable, Accessible, Interoperable, and Reusable. Key aspects of digital curation include creating quality metadata, managing format migration, conducting data backup and recovery, and organizing security and access mechanisms. Additionally, new and emerging technologies, such as cloud storage, blockchain, artificial intelligence, and machine learning, are transforming digital curation practices.

Currently, unfortunately, most universities and research institutions in Ukraine still largely lack experience in research data management, as well as relevant policies, services, and infrastructure. Libraries can not only initiate such changes at the institutional level but also play a leading role in research data management or digital curation.

The term "digital curation" was first introduced at the seminar "Digital Curation: Digital Archives, Libraries and e-Science," held in London on October 19, 2001. The seminar emphasized the importance of interdisciplinary dialogue among archivists, librarians, and academics,

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highlighting that such collaboration involves not only the preservation or maintenance of digital collections but also adding value through data management for future reuse (Beagrie & Pothen, 2001). In 2002, the UK's Joint Committee on Information Systems established a Working Group on Digital Data Stewardship to explore the benefits of a strategic approach to preserving and reusing primary research data. This group defined digital curation as encompassing not just the preservation of data but also the opening and organization of access, along with planning and managing data for both the duration of a study and its future use. The findings of the working group led to the establishment of the Digital Curation Center (DCC) at the University of Edinburgh in 2004. The DCC Curation Lifecycle Model was first published in 2007 ("The DCC Curation", n.d.). The DCC remains a leading institution in developing digital curation strategies and practices, conducting workshops, and publishing research in its journal, the *International Journal of Digital Curation*.

Digital curation centers are now present in nearly all leading universities around the world, often as part of the university library structure. Data management or digital curation is rapidly becoming a distinct discipline and profession globally, with roles such as Data Curator, Data Steward, Data Librarian, Data Scientist, Data Engineer, and Data Policy Officer. Unfortunately, in our country, both the theory and practice of data management are not so developed, and the profession of digital curator is still absent in the Ukrainian Classification of Professions. There is neither a defined professional standard nor a clear definition of the necessary knowledge and skills, nor even a standardized terminology, including in the job title, and the understanding of its content and tasks remains somewhat vague.

Libraries and Digital Curation

Management of Electronic Resources has become an integral part of any library's operations. Ukrainian libraries have long been dynamic centers of digital content and services, through activities such as digitizing their own documents, creating data- and knowledge bases, establishing institutional repositories and electronic libraries, providing access to online resources, and transforming scientific journals into open access publications, and, in some cases, playing a prominent role in Library Publishing. Many libraries also preserve websites and social media content that hold significant value as digital heritage with potential importance for future digital research.

University libraries all over the world are increasingly supporting the management of research data generated on their campuses (American Library Association, 2013; Xu, 2022; Kulyk, 2023). One cornerstone of this support is institutional repositories, which provide long-term storage and access to various types of scholarly outputs, including research data, from specific universities or research institutions. However, institutional repositories are not the only potential home for research data. International and national organizations, academic societies, and multi-institutional collaborations also host data repositories, often centered around particular disciplines or data types. Examples include the Worldwide Protein Data Bank, the British Atmospheric Data Centre, the Inter-university Consortium for Political and Social Research, and the Ecological Society of America Data Registry.

In many libraries around the world, data librarians (or data stewards) are already working, and corresponding services and functions have been established. These include research data management, publication and data repositories, support for publication activities and related analytics (such as scientometrics and bibliometrics, as well as new methods of evaluating scientific publications – altmetrics), creation of research profiles (for institutions, departments, or individual researchers), intellectual property issues, consultations, and training on these topics. Data curation and RDM also take into consideration technical capabilities, ethnical and legal issues etc. (Pinfield Cox, & Smith, 2014).

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However, current challenges in open science and open data require new approaches and set new tasks: libraries must not only assist researchers but also actively participate in research teams, managing research data throughout all stages of the data lifecycle - from collection and analysis to preservation, long-term management, and reuse. The competencies of librarians in searching, organizing, preserving, evaluating, and disseminating information have a significant impact on the creation, development, and management of digital content. Therefore, in our opinion, academic libraries should become key partners for the long-term future of open science, particularly in the area of digital curation.

Let us highlight just a few potential aspects of a library's role in digital curation:

- **Data Lifecycle Management**: Participation in research teams or assisting scholars with planning, organizing, storing, and publishing scientific data. This includes creating research data management plans (RDM), advising on data structuring, documentation, and organization to ensure long-term accessibility.
- **Creation and Maintenance of Institutional Data Repositories**: Supporting or assisting with the placement of research data in international and interdisciplinary repositories. This involves integrating these repositories with other platforms (e.g., publication repositories or even electronic catalogs, or with data search, visualization, and analytics applications). It also includes enhancing the functionality, usability, and interoperability of such repositories.
- **Metadata Creation for Data**: Developing detailed metadata that describes the content, structure, context, and usage conditions of research data is a crucial component for ensuring long-term accessibility and reuse of data.
- **Consultation on Relevant Standards**: Advising on standards for data preservation and lifecycle management.
- **Consultation on Copyright**: Providing guidance on copyright issues, including Creative Commons licenses and other matters related to open access and open data.
- **Policy and Strategy Development**: Formulating appropriate policies and strategies for data management, including at the institutional level.
- **User Training and Consultation**: Educating and consulting with users - students, graduate students, researchers, university administrators - on best practices for data management, adherence to open access and preservation policies, and using digital science services and applications throughout the research lifecycle (not just for disseminating results through publications).

In Ukraine, it is worth noting the active role of academic libraries in creating digital curation services, for example, at the universities of Taras Shevchenko National University of Kyiv, NTUU "KPI", National University of Kyiv Mohyla Academy, Yaroslav Mudryi National Law University, and Kyiv Academic University, among others (Serbin & Yaroshenko, 2022). The first data repository in Ukraine was created at the National Academy of Sciences (https://opendata.nas.gov.ua/). However, such activities are still not the norm, and the work remains unsystematic and unregulated.

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Conclusions

Digital curation is critically important in the era of transition from a paper-based to a digital environment. Developing the necessary infrastructure, data management services, and the relevant competencies and skills for library and information professionals is a pressing task. Librarians can achieve greater success in managing the vast amounts of data now at researchers' disposal and in making these data visible to the relevant stakeholder communities.

Without addressing this, all current investments in digitization and the creation of digital content will yield only short-term, rather than long-term, results. The research results indicate the need for a comprehensive consideration of digital curation as a new function of libraries, the role of academic libraries in coordinating and advocating for such work at the institutional level, and the introduction of digital curation as a specialization within the library sector. Data librarians (data curators), who could be active participants in research data management teams, are essential for this purpose.

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Цифрове кураторство: можливості та виклики для бібліотек України

Мета. Сьогодні цифровий ландшафт продовжує стрімко розвиватися, що ставить перед бібліотеками подвійне завдання: не лише зберігати цифровий контент, але й курувати його. Це особливо актуально з огляду на потреби відкритої науки та відкритих даних, які наголошують на можливості пошуку, доступності, інтероперабельності та повторному використанні (принципи FAIR). **Методика** дослідження включає критичний огляд вітчизняних та міжнародних публікацій з питань цифрового кураторства, офіційних документів та вебсайтів українських бібліотек, присвячених відкритим науковим даним. **Результати.** Сучасні виклики вимагають розробки ефективних бібліотечних стратегій цифрового кураторства та управління дослідницькими даними, а також розвитку відповідних навичок бібліотекарів через бібліотечну освіту та навчання впродовж життя. У статті розглядаються ключові світові тенденції у сфері цифрового кураторства та досліджуються перспективи впровадження цих практик в українських бібліотеках, особливо у світлі Національного плану з відкритої науки та розширення доступу до дослідницьких даних. У дослідженні стверджується, що залучення до практик цифрового кураторства та лідерство в них може суттєво змінити роль, сприйняття та ідентичність академічних бібліотек, тим самим підвищуючи їхню актуальність для дослідницьких спільнот. Крім того, у дослідженні наголошується на необхідності розвитку навичок і компетенцій бібліотекарів у сфері цифрового кураторства та розглядаються складнощі співпраці з науковцями в цьому контексті. **Висновки.** Результати дослідження підкреслюють необхідність всебічного розгляду цифрового кураторства як нової бібліотечної функції. Воно також підкреслює роль університетських бібліотек у координації та адвокації цих зусиль на інституційному рівні. Крім того, пропонується запровадити цифрове кураторство як спеціалізацію в бібліотечній галузі, з такими ролями, як бібліотекар даних (куратор даних), який міг би брати участь у дослідницьких групах, зосереджених на управлінні даними. Стаття також завершується планом майбутніх досліджень.

Ключові слова: цифрове кураторство; дослідницькі дані; план управління дослідницькими даними; сховище даних; бібліотекар даних; Україна

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