

# ONTOLOGY FOR LIBRARY ORGANIZATION

Vinnitsia National Technical University

## Анотація

*Мета дослідження присвячена розробці та аналізу моделі онтологічної бази знань для ефективної організації бібліотек, практичного застосування інформаційних технологій у цій галузі. Модель на основі онтології забезпечує структуроване представлення знань, щоб полегшити доступ до інформації та ефективності процесу пошуку користувачами. Дослідження передбачало оцінку переваг онтологічного моделювання в бібліотеках порівняно з традиційними методами класифікації, каталогізації та вибору відповідних програмних засобів для реалізації онтологічної моделі. Результати дослідження можуть прокласти шлях до впровадження та тестування онтологічної моделі в реальних умовах бібліотеки та оцінки її економічної ефективності.*

**Ключові слова:** онтологія, бібліотека, організація знань, інформаційні технології, база знань.

## Abstract

*The purpose of the research was to develop and analyze an ontological knowledge base model for the effective organization of libraries while exploring the potential practical applications of information technology within this field. The ontology-based model enables structured knowledge representation to facilitate easy access to information and efficient search processes for users. The research involved evaluating the advantages of ontological modeling within libraries compared to traditional classification and cataloging methods and selecting suitable software tools for implementing the ontological model. The results of the study could pave the way for the implementation and testing of the ontological model in real-world library settings and the evaluation of its economic efficiency.*

**Keywords:** ontology, library, knowledge organization, information technology, knowledge base.

## Introduction

Modern libraries face ongoing challenges in managing resources and ensuring efficient access for users. Traditional classification and cataloging methods have limitations, leading to the exploration of alternative approaches for library organization. Ontological modeling, a method used in computer science and information management, offers a promising solution for structuring and representing library knowledge in a more effective manner, with benefits including improved resource discovery and adaptability within evolving information landscapes.

This study aims to investigate the potential of ontological modeling for enhancing library organization and develop practical applications within this domain. The research will examine current library organization approaches, assess feasibility of ontology-based modeling, and evaluate suitable software tools for implementing the model.

The findings will contribute to the understanding and potential implementation of ontological models in real-world library settings, examining their effectiveness, practicality, and adaptability for meeting diverse information needs of library users.

## Analysis of known approaches to library organization

Assessing traditional library organization approaches is crucial for understanding their strengths, weaknesses, and the need for alternatives like ontological modeling. This section briefly discusses several widely used systems and their limitations [1].

- Dewey Decimal Classification (DDC) and Universal Decimal Classification (UDC): Both systems use hierarchical structures with numerical codes to categorize resources. Despite their extensive adoption, they face issues such as inflexibility for new subjects or interdisciplinary materials, reliance on fixed structures, cultural biases, and difficulty managing updates [2].

- Library of Congress Classification (LCC): LCC uses a combination of letters and numbers for broad subject categories. However, like DDC and UDC, it struggles with integrating new topics, has a complex structure, and requires regular updates [3].

- Colon Classification: This faceted approach offers improved flexibility for new subjects and interdisciplinary materials but is complex, necessitating specialized knowledge for effective implementation.

Traditional systems have made significant contributions to library organization but lack adaptability amidst the evolving information landscape. With increasingly diverse and interdisciplinary resources, alternatives like ontological modeling are needed to effectively address the changing demands of library organization.

### **The Potential and Viability of Ontological Modeling for Library Knowledge Base Organization**

To address the limitations of traditional classification systems in library organization, ontological modeling has emerged as a promising alternative. This section examines the potential and viability of ontology-based approaches for library knowledge base organization, highlighting the advantages in comparison to conventional methods [4].

- Enhanced semantic representation: Ontological models enable a more detailed and meaningful representation of knowledge, capturing explicit relationships among concepts and providing richer metadata. This allows users to access and interpret library resources more easily and accurately, leading to more efficient information retrieval and a better understanding of resource content.

- Improved flexibility and scalability: Ontologies are designed to adapt and evolve as new information and concepts are introduced, making them more suitable for managing continually growing and changing knowledge domains found in modern libraries. Moreover, ontologies support the integration of new subjects and interdisciplinary materials with minimal adjustments to their structure.

- Facilitated resource discovery: Ontological models enhance search capabilities by enabling more precise queries based on relationships between concepts and metadata associated with resources. This improves resource discoverability, allowing users to find relevant materials more efficiently.

- Interoperability and integration: Ontologies provide a structured and standardized format for managing and exchanging information, which enables seamless integration with other systems and technologies. This feature facilitates the linking of various library resources, improving the organization and management of interconnected information.

- Customization and extensibility: Ontological models can be tailored to suit the specific requirements of different library environments and disciplines, enabling the creation of customized knowledge bases that cater to diverse user needs and preferences.

Given these advantages, ontological modeling holds significant potential for improving library knowledge base organization. The use of ontologies in libraries has the potential to overcome the limitations of traditional classification systems, offering a more adaptable and efficient approach to managing and organizing information resources. Overall, ontology-based methods present a viable alternative for libraries to enhance their ability to serve users effectively in today's rapidly evolving information landscape.

### **Identifying Appropriate Software Tools for Ontological Model Implementation**

When implementing an ontological model for libraries, it is crucial to identify suitable software tools that offer a balance of usability, functionality, and scalability. This section discusses the rationale behind choosing Protégé as the optimal software tool for ontological model implementation [5].

Protégé, a widely used, open-source ontology editor and framework, offers several advantages over other software tools in the market, making it the best choice for creating and managing knowledge bases in library systems:

- Rich functionality: Protégé provides a comprehensive set of tools and features that allow users to create, edit, and visualize ontologies, enabling them to design complex models with ease and precision.

- User-friendly interface: The software offers an intuitive graphical user interface, allowing users with varying levels of technical expertise to effectively create and manage ontologies with minimal learning curve.

- Extensibility and compatibility: Protégé supports a wide range of ontology languages, such as RDF, RDFS, OWL, and SKOS, ensuring compatibility with existing library systems. Its open-source architecture also allows for easy integration with other tools and customization to accommodate specific needs.

- Active community and support: Protégé benefits from a robust user community and extensive documentation, providing users with access to valuable resources, support, and opportunities for collaboration.

- Scalability: Protégé is capable of handling large and complex ontologies, making it suitable for managing knowledge bases in diverse library settings, from small institutions to large-scale systems.

Based on these advantages, Protégé stands out as the ideal software tool for implementing ontological models in library organization settings, providing libraries with an efficient, user-friendly, and scalable solution that can cater to their evolving information needs.

### Conclusions

In the face of growing challenges for libraries, the need for innovative approaches to knowledge organization and resource management has become critical. Ontological modeling, as an alternative to traditional classification and cataloging systems, demonstrates promising potential for improving library organization, access, and resource discovery.

This study examined the advantages of using ontological modeling in libraries, highlighting its potential benefits such as enhanced semantic representation, improved flexibility, and scalability, and facilitated resource discovery. The research also identified Protege as the optimal software tool for implementing ontological models, considering its rich functionality, user-friendly interface, extensibility, compatibility, and scalability.

In conclusion, the adoption of ontological modeling, supported by appropriate software tools such as Protege, can enable libraries to devise effective and adaptive knowledge organization frameworks. This, in turn, empowers libraries to better serve their users in the ever-evolving landscape of information and technology. Future research should focus on implementing ontological models in real-world library settings, testing their efficacy in practice, and evaluating the economic and practical impact of these models on library organization.

### REFERENCES

1. Chan, L. M. Dewey Decimal Classification: History and Current Status. Encyclopedia of Library and Information Sciences. Taylor & Francis, 2007.
2. OCLC. Dewey Decimal Classification (DDC). URL: <https://www.oclc.org/en/dewey.html>.
3. Library of Congress. Library of Congress Classification (LCC). URL: <https://www.loc.gov/catdir/cpsol/lcco>.
4. Hodge, G. Systems of Knowledge Organization for Digital Libraries: Beyond Traditional Authority Files. Journal of Digital Information, 2000.
5. Noy, N. F., & McGuinness, D. L. Ontology Development 101: A Guide to Creating Your First Ontology. Stanford Knowledge Systems Laboratory Technical Report KSL-01-05 and Stanford Medical Informatics Technical Report SMI-2001-0880, 2001.

*Денисюк Валерій Олександрович*, к.т.н., доцент, доцент кафедри комп'ютерних наук, Вінницький національний технічний університет, Вінниця, Україна, e-mail: [vad64@i.ua](mailto:vad64@i.ua).

*Андріянов Олександр Олександрович*, студент, група 2КН-22м, факультет інтелектуальних інформаційних технологій та автоматизації, Вінницький національний технічний університет, Вінниця, Україна.

*Denysiuk Valerii Olexandrovich*, PhD, assistant professor of Computer Sciences Department, Vinnytsia National Agrarian University, Vinnytsia, Ukraine, e-mail: [vad64@i.ua](mailto:vad64@i.ua).

*Andriianov Olexandr Olexandrovich*, student, Faculty of Intellectual Information Technologies and Automation, Vinnytsia National Agrarian University, Vinnytsia, Ukraine.