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The Necessity of Implementation of RI‘s Module to the Ukrainian Research Information System

The **objective** of implementing an RI (Research Information) module to the Ukrainian Research Information System is to enhance the management, visibility, and accessibility of research-related information within the Ukrainian research ecosystem. The module aims to improve the efficiency of research administration, promote collaboration among researchers and institutions, and facilitate the dissemination of research outputs. In this article, the authors attempted to investigate the need for developing a comprehensive classification of national research infrastructures with the aim of implementing a separate module into the national CRIS system. The work is aimed at analyzing the possibilities and advantages of implementing the RI (Research Information) module in the Ukrainian Research Information System. **Methods.** Developing the national classifier, the experience and methodology of the EU were utilized, taking into account both legislative and technical peculiarities specific to the country. Additionally, the approaches of various Ukrainian research institutions in defining and classifying research infrastructures were studied, and the existing experience in CRIS systems related to this matter was also examined. **Results.** The research should highlight the existing challenges and limitations in managing research-related information within the Ukrainian research ecosystem. This could include issues related to data fragmentation, lack of standardization, limited accessibility, inefficient research administration processes, and low visibility of research outputs. Based on the research findings, a set of proposed features and functionalities for the RI module should be presented. These features should address the identified challenges, stakeholder needs, and lessons learned from international practices. The proposed module should aim to improve data management, collaboration, visibility, and efficiency in research administration. Besides, the authors are trying to figure out the role of the libraries into CRIS implementation process. The scientific library's expertise in research data management, data curation, user support, collaboration, and promotion makes it an invaluable partner in implementing a Research Information module into the current Research Information System. **Conclusion.** The research should provide a comprehensive understanding of the necessity and potential benefits of implementing an RI module to the Ukrainian Research Information System, guiding future decision-making and actions in this regard. In general, the need for developing an operational classifier for the national CRIS system is driven by the fact that such a step will provide structured frameworks for managing research activities, efficient allocation of resources, including financial resources, strategic planning, and collaborations.

Keywords: research infrastructure; CRIS systems; classification of research infrastructure; open science; open access; digital tools in science; libraries

Introduction

The research infrastructure classifier for a CRIS (Current Research Information System) system is an essential component that plays a critical role in enabling effective research management and decision-making process. The research infrastructure classification refers to the categorization of research resources, such as equipment, facilities, and services, into a hierarchical structure that helps to identify and manage these resources systematically (Biesenbender et al., 2019).

The classification of research infrastructure (RI) in a CRIS system enables the identification and tracking of available resources, which helps to ensure that resources are allocated effectively and efficiently. Also, by providing a comprehensive overview of the available

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RI, a CRIS system with a robust classification system can support strategic planning, including identifying areas for investment and improvement. The RI classification could be used for supporting reporting and evaluation, by providing a structured framework for tracking and measuring research outputs, including publications, patents, and grants.

Also taking into account the EU experience, the research infrastructure classification is an essential component of a CRIS system, providing a structured framework for managing research infrastructure and enabling effective resource allocation, strategic planning, collaboration, and reporting. Even more, in EU the classification systems for CRIS appear with the administration purpose (Zendulková et al., 2022).

The objectives of this article is analyzing the possibilities and advantages of implementing the Research Information (RI) module in the Ukrainian Research Information System. Developed by the State Scientific and Technical Library (SSTL) of Ukraine, this module focuses on enhancing the management, visibility, and accessibility of research-related information within the Ukrainian research ecosystem. One of the key objectives of implementing the RI module is to improve research management in Ukraine. By integrating research-related information into a centralized system, the module enables more efficient tracking and monitoring of research projects, funding, and collaborations. This streamlines administrative processes, facilitates resource allocation, and enhances decision-making for research institutions, funding agencies, and policymakers.

Methods

For the purpose of this research, authors conduct a comprehensive analysis of the current Ukrainian Research Information System to identify its strengths, weaknesses, and areas for improvement. This analysis should involve assessing the existing infrastructure, data management processes, user requirements, and stakeholder expectations. Another method, used for this research is key stakeholder engagement, including researchers, research institutions, funding agencies, and policymakers, to gather their input, requirements, and feedback regarding the implementation of the RI module. This was be done in our case through interviews and workshops. Based on the analysis and stakeholder engagement the functional requirements of the RI module was defined. This includes determining the types of research information to be included, data standards, metadata requirements, user roles and permissions, reporting capabilities, integration with existing systems, and user interface design.

Regarding to the importance of RI classifiers and their usage in CRIS systems there are several EU research projects presented a classification system for research infrastructures in CRIS systems based on the type of infrastructure, the research domain it supports, and its maturity level.

In our research, we use the experience of existing classification systems for research infrastructure in CRIS systems:

The Common European Research Information Format (CERIF) classification system is a widely used standard for classifying research infrastructure in CRIS systems. It includes categories for facilities, equipment, services, and expertise, and allows for the creation of hierarchical relationships between different types of infrastructure (EuroCRIS, n.d.).

The European Research Infrastructure for Science, technology and Innovation Indicators (RISIS) classification system is another widely used standard for classifying research infrastructure in CRIS systems. It includes categories for research infrastructure types, domains, and governance, and allows for the creation of relationships between different types of infrastructure.

The CLASS classification system developed by the Danish Agency for Science, Technology and Innovation is a national standard for classifying research infrastructure in

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Denmark's CRIS system. It includes categories for research infrastructure types, domains, and access modes, and allows for the creation of hierarchical relationships between different types of infrastructure.

The Nordic e-Infrastructure Collaboration (NeIC) classification system is a regional standard for classifying research infrastructure in the Nordic countries' CRIS systems. It includes categories for research infrastructure types, domains, and geographical coverage, and allows for the creation of relationships between different types of infrastructure (Guideline for the ONLINE S3, n.d.).

Also, separately we used the experience of EU RI classification project for case study and adaptation of EU practice for Ukrainian infrastructures. In this context it should be mentioned the MERIL project (Mapping of the European Research Infrastructure Landscape) ((MERIL. (n.d.)) and CatRIS (Catalogue of Research Infrastructure Services) (https://portal.meril.eu/meril/).

Results and Discussion

Based on the EU experience we try to elaborate the functioning RI taxonomy for using first of all in Ukrainian CRIS – URIS. The Ukrainian Research Information System (URIS) is a national system designed to collect, store, and disseminate information about research activities and results in Ukraine. URIS provides a comprehensive view of research activities and results in Ukraine, including information on projects, publications, patents, and other research outputs. URIS is designed to be compatible with international research information systems, making it easier for Ukrainian researchers to collaborate and connect with the global research community and provides a wealth of data on research activities and outputs, making it a valuable resource for research evaluation and assessment. By providing a centralized platform for the dissemination of research information, URIS can enhance the visibility and impact of Ukrainian research both nationally and internationally. URIS has the potential to significantly enhance the research ecosystem in Ukraine by providing a centralized platform for the collection, storage, and dissemination of research information (Kaliuzhna & Auhunas, 2022).

Even though the system is already operational, URIS is under construction and RI module should become the one of important component. The system of RI classification should correspond the following tasks:

Data management. A classification system can help to manage research infrastructure data in a standardized and structured way, making it easier to input, retrieve, and analyze information. This can help to ensure data quality and consistency, and reduce errors and duplication.

Reporting. A classification system can enable more accurate and comprehensive reporting on research activities and outputs, by providing a standardized framework for categorizing and analyzing research infrastructure data. This can help institutions to meet reporting requirements for funders, government agencies, and other stakeholders.

Resource allocation. A classification system can inform resource allocation decisions in CRIS systems, by identifying areas where investment in research infrastructure may be needed. This can help institutions to allocate resources more effectively and efficiently, and to ensure that resources are directed to areas of greatest need and potential impact.

Collaboration. A classification system can facilitate collaboration between researchers and institutions, by providing a standardized way to identify and categorize different types of research infrastructure. This can help to foster partnerships and interdisciplinary research initiatives, and facilitate knowledge sharing across domains and institutions.

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Based on the EU practices and taking into account the existing researches we are thinking that RIs can be classified in different ways for URIS purposes, depending on the needs and goals of the specific system (using different classification groups).

In our classification model, we use hierarchy system laboratories - sets of instruments - scientific equipment. All these unites classify by different way according to the different approaches:

1. RI classification based on specific scientific domains or disciplines. For example, you can have classifications like biological research infrastructure, physical sciences research infrastructure, social sciences research infrastructure, etc. This approach allows for a more focused categorization based on the specific needs and requirements of each domain.
2. RI classification based on its scale or size. This approach can include classifications like national research infrastructure, regional research infrastructure, institutional research infrastructure, and even individual research infrastructure. It helps in understanding the scope and magnitude of the infrastructure available in different contexts.
3. Functional Classification. This approach involves classifying research infrastructure based on their functions or purposes. For example, you can have classifications like experimental research infrastructure, computational research infrastructure, data storage and analysis infrastructure, or collaborative research infrastructure. This approach focuses on the specific roles and capabilities of the infrastructure. For instance, for the URIS we will use the classification bellow:

Equipment and Facilities
This category includes research equipment and facilities such as laboratories, observatories, and research vessels.

Data and Information Services
This category includes data repositories, archives, and information services that support research activities.

Research Networks and Collaborations
This category includes networks and collaborations between researchers, research institutions, and industry partners.

Research Support Services
This category includes services that support the research process such as project management, legal and ethical compliance, and funding acquisition.

Education and Training Services
This category includes services that provide education and training opportunities for researchers, students, and staff.

Outreach and Engagement Services
This category includes services that promote the dissemination of research results to the wider public and encourage engagement with stakeholders.

4. RI classification based on the level of accessibility or availability to different user groups. This can include classifications like open access research infrastructure, restricted access research infrastructure, or specialized access research infrastructure. It highlights the different levels of accessibility and helps researchers identify infrastructure that suits their needs.
5. RI classification based on its interdisciplinary nature or its ability to support research across multiple disciplines. This approach recognizes the importance of interdisciplinary collaboration and encourages the development of infrastructure that can facilitate such collaborations.

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Interdisciplinary classification of research infrastructure involves categorizing infrastructure based on its ability to support and facilitate interdisciplinary research. Interdisciplinary research refers to the integration and collaboration of multiple disciplines or fields of study to address complex problems or research questions that cannot be effectively tackled within a single disciplinary framework.

The infrastructure classified under this approach is capable of accommodating and supporting researchers from multiple disciplines. It includes facilities, equipment, and resources that are relevant and applicable across different fields of study. For example, a shared laboratory space that can be used by researchers from biology, chemistry, and physics would fall under this classification.

The goal of interdisciplinary classification is to identify and classify RI that can support interdisciplinary collaborations and enable researchers from different disciplines to work together effectively. This classification recognizes the importance of infrastructure in fostering interdisciplinary research and helps researchers find and access the necessary resources for their interdisciplinary projects.

Interdisciplinary classification of RI refers to the categorization or grouping of research infrastructure based on their interdisciplinary nature and the diverse fields or disciplines they support. The example of how research infrastructure can be classified in an interdisciplinary manner could be:

Data and Computing Infrastructure
High-performance computing clusters
Data storage and management systems
Data visualization tools and software
Cloud computing platforms

Laboratory Facilities
Biotechnology laboratories
Material science laboratories
Chemistry laboratories
Biochemistry laboratories

Imaging and Microscopy Facilities
Electron microscopy
Confocal microscopy
Fluorescence microscopy
X-ray imaging

Genomics and Proteomics Facilities
DNA sequencing platforms
Genomic data analysis tools
Mass spectrometry
Protein structure determination

Environmental Monitoring and Analysis
Climate monitoring stations
Air and water quality monitoring
Ecological field stations
Remote sensing and GIS (Geographic Information System)
Simulation and Modeling
Computational fluid dynamics (CFD) simulations

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Molecular dynamics simulations
Agent-based modeling
Systems dynamics modeling

Human Studies and Behavioral Research
Neuroimaging facilities
Cognitive psychology labs
Experimental economics labs
Social science research centers

Energy and Sustainable Technologies
Renewable energy research facilities
Energy storage and conversion systems
Advanced materials for energy applications
Sustainable manufacturing technologies

Bioinformatics and Biostatistics
Bioinformatics databases and software
Statistical analysis tools for genomics
Metagenomics analysis platforms
Computational biology resources

Advanced Instrumentation and Sensor Networks
Particle accelerators
Nanotechnology research facilities
Sensor networks for environmental monitoring
Advanced analytical instruments

This classification demonstrates how RIs can span multiple disciplines and fields of study, supporting interdisciplinary research and collaboration. Researchers from various domains can access and utilize these resources to address complex scientific questions and pursue innovative solutions to real-world problems.

6. Resource-Based Classification. This approach involves classifying research infrastructure based on the types of resources they provide. For example, classifications can include laboratory infrastructure, fieldwork infrastructure, computing infrastructure, or library and archival infrastructure. It focuses on the specific resources required for research and provides a more granular classification.

During the work under the project the several problems or challenges appeared:

1. Research infrastructures can be diverse and complex, making it challenging to create a comprehensive and standardized classification system. It is not enough to use one or even two criteria for operational classification system. It should be taken into account the complex of issues as well as the connections and link between different types of RIs.

2. Different research domains have different types of infrastructures, and a classification system must be flexible enough to accommodate this heterogeneity. That is mean that the classification system should adapt to the diverse infrastructures found in various research domains. The system should be adaptable and adjustable to accommodate the differences in infrastructures across research domains. It should not be rigid or limited to a specific set of criteria or assumptions.

3. Research infrastructures can change rapidly over time, and a classification system needs to be updated to reflect these changes.

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4. Many research activities are cross-disciplinary, and it can be challenging to classify infrastructures that span multiple research domains.
5. Different disciplines and research communities often use different language and terminology, which can make it difficult to create a standardized classification system that is widely accepted.
6. In some cases, there may be limited or incomplete data available about research infrastructures, making it difficult to accurately classify them.

To address these challenges, a flexible and adaptable classification system that takes into account the diversity of research domains and infrastructures is needed. This may require collaboration between different research communities, as well as ongoing efforts to collect and update data about research infrastructures.

Also, it should be keep in mind that classification system is designed and developed based on the specific needs of the institution or organization managing the CRIS system. The classification system may be based on an existing standard or developed from scratch. Also, the classification system is plan to be regularly maintained and updated to ensure its relevance and accuracy over time. This may involve adding new categories or revising existing ones as new types of infrastructure emerge or as the needs of the institution or organization change. Researchers and other stakeholders can input data about research infrastructure into the CRIS system, using the classification system to categorize the infrastructure. They can also retrieve information about research infrastructure using the classification system to search for specific types of infrastructure.

One of the important demand for the RI module is an ability to generate reports and visualizations that provide insights into the types and distribution of research infrastructure across the institution or organization's research portfolio. This fact also taken into account during the elaboration of RI classification.

The library plays a crucial role in implementing a Research Information module into a Research Information System. From needs assessment to system integration, data management, user support, and governance, the library's expertise in research information organization and dissemination can greatly contribute to the success of the implementation process.

During the all cycle of implementation and usages of the CRIS the library staff may need to collaborate with researchers, faculty, and administrative departments to migrate and integrate existing research data into the new Research Information module. This could involve importing data from various sources, such as publication databases, institutional repositories, faculty profiles, and grant management systems. Libraries have expertise in metadata management and data standardization. So, during the first step (conduct a comprehensive needs assessment to understand the requirements and goals of integrating the Research Information module into the existing CRIS) only libraries are able to identify the specific functionalities, data sources, and workflows that need to be supported.

Besides, once the needs are identified, the next step is to integrate the Research Information module into the current CRIS infrastructure. This would involve custom development, configuration, or integration with existing library systems and databases.

The scientific library's expertise in research data management, data curation, user support, collaboration, and promotion makes it an invaluable partner in implementing a Research Information module into the current Research Information System. Therefore, the State Scientific and Technical Library of Ukraine's involvement ensures that the module is effectively designed, integrated, and utilized to support the institution's research activities.

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Conclusion

The RI module in URIS can help decision-makers allocate resources effectively and efficiently by identifying gaps and priorities in research infrastructure and in the same time to evaluate the effectiveness of research infrastructure investments, by providing a basis for assessing the impact of different types of infrastructure on research outcomes. This can help to ensure that resources are directed to areas of greatest need and potential impact.

RI classifier will facilitate collaboration between researchers and research institutions by providing a standardized way to identify and categorize different types of infrastructure. This can help to foster partnerships and interdisciplinary research initiatives.

Also, the RI‘s module to the Ukrainian Research Information System will inform strategic planning by providing insights into the current state of research infrastructure and identifying areas where investment and development may be needed;

facilitate the sharing of knowledge and best practices by providing a common language and framework for discussing research infrastructure across different domains and institutions;

helps institutions and organizations manage and share information about their research infrastructure more effectively, improving their ability to plan, evaluate, and communicate the value of their research activities.

At the same time, the RI classification can be useful for URIS to organize and categorize research infrastructure data, and to facilitate analysis and reporting of research activities and outputs. It can also help to identify gaps in research infrastructure and guide decision-making on investment and resource allocation.

Scientific libraries have extensive experience and expertise in managing research data. They understand the complexities of research information, including publications, datasets, and other scholarly outputs. Their knowledge of data organization, metadata management, and data preservation ensures that the Research Information module is designed and implemented effectively.

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Необхідність впровадження модуля «Дослідницька інфраструктура» до Національної електронної науково-інформаційної системи URIS

Мета. Метою впровадження модуля ДІ (Дослідницька інфраструктура) до Національної електронної науково-інформаційної системи URIS є покращення управління, видимості та доступності інформації, пов'язаної з дослідженнями, в українській науковій екосистемі. Модуль спрямований на покращення ефективності адміністрування досліджень, сприяння співпраці між дослідниками та установами, а також на полегшення розповсюдження результатів досліджень. У цій статті автори спробували дослідити потребу у розробці комплексної класифікації національних дослідницьких інфраструктур з метою впровадження окремого модуля в національну систему управління науково-дослідницькою інформацією (CRIS). **Методика.** При розробці національного класифікатора використовувалися досвід та методологія ЄС, з урахуванням законодавчих та технічних особливостей, властивих країні. Додатково були вивчені підходи різних українських наукових установ до визначення та класифікації дослідницьких інфраструктур, а також був проаналізований наявний досвід, що наразі використовується у CRIS системах з цього питання. Крім того, автори намагалися зрозуміти роль бібліотек у розробці та впровадженні CRIS систем. **Результати.** Дослідження повинно висвітлити наявні проблеми та обмеження управління інформацією, пов'язаною з дослідженнями, в українській науковій екосистемі. Це може включати проблеми, пов'язані з фрагментацією даних, відсутністю стандартизації, обмеженою доступністю, неефективними процесами адміністрування досліджень та низькою видимістю результатів досліджень. На основі результатів дослідження повинен бути представлений набір запропонованих функцій та можливостей для модуля ДІ. Ці функції мають вирішувати виявлені проблеми, враховувати потреби зацікавлених сторін та використовувати міжнародну практику. Запропонований модуль має на меті покращити управління даними, сприяти співпраці, видимості та ефективності в адмініструванні досліджень. **Висновки.** Дослідження має надати всебічне розуміння необхідності та потенційних переваг впровадження модуля ДІ до Української системи науково-дослідницької інформації, що буде сприяти майбутнім прийняттям рішень. Необхідність розробки робочого класифікатора для національної системи управління науково-дослідницькою інформацією обумовлена тим, що такий крок надасть структуровані рамки для управління науковою діяльністю, ефективного розподілу ресурсів, включаючи фінансові, стратегічного планування та сприятиме співпраці.

Ключові слова: дослідницька інфраструктура; CRIS системи; класифікатор дослідницьких інфраструктур; відкрита наука; відкритий доступ; цифрові інструменти в науці; бібліотеки

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