The role of CroRIS in promoting Open Science in Croatia

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In an era marked by rapid knowledge creation, open access becomes the key to accelerating progress. Open science, by advocating for the unrestricted dissemination of research findings, methodologies, and data, fosters enhanced collaboration and innovation, thereby amplifying societal benefits. Integral to this movement, it's essential to highlight the significance of digital repositories. These repositories are crucial in ensuring open access, serving as dedicated platforms for the storage, preservation, and public dissemination of research outputs, including scholarly articles, datasets, and other academic materials. They are foundational to the open access movement, aiming to eliminate barriers to information and encourage a culture of sharing and collaboration among researchers worldwide.[1]

Mirroring the significance of digital repositories, Current Research Information Systems (CRIS) play a pivotal role by offering deep insights into the workflows that underpin institutional research activities, enabling effective teamwork across various research support units, including research libraries.[2] This not only facilitates the implementation of Open Access and Research Data Management (RDM) policies but also promotes a more integrated and transparent approach to managing research information.

CRIS systems significantly bolster open science initiatives through a suite of key functionalities that streamline and enhance the research ecosystem. At their core, they facilitate metadata aggregation and standardization, which involves the collection and uniform formatting of metadata from diverse courses, simplifying the search and access process for research outputs. This is complemented by their interoperability capability, ensured through adherence to international standards, allowing data to be seamlessly shared and understood across various platforms and institutions. Additionally, by enhancing the visibility and facilitating impact analysis of research activities and outputs, CRIS systems play a pivotal role

[1] Lynch, C.A. (2005). Institutional Repositories: Essential Infrastructure for Scholarship in the Digital Age. Library Trends, 53(4), 556-567.
[2] De Castro, P. (2018). The role of Current Research Information Systems (CRIS) in supporting open science implementation: the case of Strathclyde. Informačné technológie a knižnice (ITLib).

in promoting wider engagement with research findings, thereby amplifying their societal impact.

Within this broader context, the Croatian Research Information System (CroRIS) plays a crucial role in bolstering open science practices in Croatia, driving significant transformations across the research ecosystem.

Current status and development of CroRIS

CroRIS was developed as a part of the "Scientific and Technological Foresight '' strategic project of the Ministry of Science and Education. The project was co-financed by the European Union through the European Regional Development Fund. The Croatian Ministry of Science and Education, the Ruđer Bošković Institute (RBI), and the University of Zagreb, University Computing Centre (Srce) have reached an agreement regarding the nationwide implementation, development, and maintenance of CroRIS. The goal of CroRIS is to build an integrated and interoperable system that brings together all relevant information about Croatian scientific activity.

Even though there was no centralised research information system prior to CroRIS, information on Croatian research activities was dispersed through various separate information systems that were collecting information about different segments of research activity.[3] Notable among these were Croatian Scientific Bibliography - CROSBI, Database of Project Activities in Science and Higher Education in Croatia - POIROT, and Database of Scientific Instruments - Šestar, developed by the RBI, alongside Digital Academic Archives and Repositories - Dabar, a product of collaboration among a large number of institutions and individuals from the academic community.[4] CROSBI, POIROT, and Šestar, though initially separate, were designed to interoperate and have now been integrated into CroRIS as distinct modules, marking a significant leap towards centralised information management.

By launching CroRIS instead of various separated systems, the research community in Croatia have at disposal one centralised information system which unifies all data on scientific activities. CroRIS consists of several key modules, including The Ministry of Science and Education Registers, Persons, Project, CROSBI, Equipment and services, Patents and Products, Events, Journals (authority files), and Organisational units. All information regardless of the module is interconnected between each other. So it is possible to switch between different modules from one record to another. For example, from a researcher's profile, you can access information about their publications, project involvement, and equipment. Likewise, from a

[3] Macan, B., Petrak, J. (2019). The Current State and Future Perspectives of the Research Information Infrastructure in Croatia. Journal of Information and Organisational Sciences (Online), 43(1).

[4] Mayer, M., Konjević, S. (2021). U trendu i sa sedamdeset: nove (stare) usluge Centra za znanstvene informacije. Vjesnik bibliotekara Hrvatske, 64(1), 227-250.

project record, you can access related publications, assigned institutions, or used equipment. Similarly, from a publication, you can find links to related projects, assigned institutions, and the equipment used in the research.

CroRIS system is based on the Common European Research Information Format (CERIF) that enables exchange of information between different CRIS systems.[5] Standardized CERIF format establishes a framework for comprehensive research information management. CroRIS, with its publicly available data, marks an important step towards promoting open science. CroRIS entities are characterized by comprehensive metadata descriptions aligned with the CERIF format. However, certain entities, particularly publications, exhibit a greater level of richness and detail in their metadata descriptions. At the moment aligning the metadata with OAI-PMH protocol is in the final phase which ensures comprehensive and standardized data representation, thus providing further interoperability with OpenAIRE, other CRIS systems globally, and other open access systems. Equipment and services module already adjusted the entry fields with European Open Science Cloud (EOSC) requirements.

All of the metadata can be accessed through a user-friendly application programming interface (API), which facilitates seamless integration and data retrieval. CroRIS offers a diverse range of APIs, including those for Organisation units, Researchers, Projects, Equipment, and CROSBI, catering to various informational needs. Notably, all APIs, with the exception of the data about researchers, are openly accessible to the public, promoting transparency and wide usability.

CROSBI records on publications furnish details about whether the publication is available in open access and include a link to access the paper through Green, Diamond, or Gold routes. They also indicate whether the publication has undergone peer review and allow users to input information regarding any APCs paid for open access publishing. These features and functionalities not only elevate the visibility of Croatian research output in the realm of open access but also enable enhanced functionality and potential analysis of the Croatian research publishing landscape.

Future plans and strategic directions

As Croatia continues to advance its academic and research infrastructure, CroRIS plays a crucial role in its evolution. Future developments in CroRIS are not just about enhancing its current functionalities, but also reimagining how research outputs are managed, accessed, and utilized within the national and international research landscapes. The strategic

[5] Kremenjaš, D., Udovičić, P., Orel, O. (2020). Adapting cerif for a national CRIS: A case study. In 2020 43rd International Convention on Information, Communication and Electronic Technology (MIPRO) (pp. 1633–1638). IEEE.

directions planned for CroRIS are aimed at fostering a more integrated, accessible, and efficient ecosystem for researchers and institutions alike.

A pivotal aspect of CroRIS's future development is interoperability with the Dabar infrastructure, which facilitates creation and provides maintenance of open access institutional and thematic digital repositories and archives. Although Dabar was not integrated into CroRIS, further development incorporating a high level of interoperability between CroRIS and Dabar is planned for the future. This interoperability foresees that once the full-text is deposited to Dabar, it will be possible to initiate the creation of a CROSBI bibliographic record. The process of entering publications will also extend in the reverse direction. Once users input the bibliographic record of a publication into CROSBI, they can seamlessly transfer that record to the relevant institutional repository, along with storing the corresponding version of the paper that can be made available in OA. The determination of the institutional repository will be based on the corresponding institutions linked to the CROSBI record.

Another significant task which is planned for this year is the transfer of full-text files stored in the previous CROSBI system, which served also as an orphan repository, to institutional repositories in Dabar. Since the new CROSBI is a bibliographic database, those files were not transferred to CroRIS. The current plan is to make these rich files available to related institutional repositories on Dabar, allowing repository managers to decide how they would like to handle these files. Should these files be published in a reputable institutional repository under OA, Dabar will relay information back to CROSBI, including the URL from the institutional repository where the file is accessible in OA.

To enhance the utility and effectiveness of CroRIS, future developments will also focus on integrating Research Data Management (RDM) plans and research data as distinct entities in CroRIS. DMPs are increasingly becoming a critical, sometimes mandatory, part of grant applications. In 2022, the Croatian Science Foundation (HRZZ) introduced the Research Data Management Plan, mandating that project leaders not only prepare, but also store and publish their DMPs in institutional repositories in OA. [6]Dabar has been instrumental in facilitating the storage of DMPs. CroRIS plans to further this integration by incorporating DMPs as bibliographic entries with direct links to Dabar or other infrastructure where they are accessible in OA. Furthermore, there is a continuous effort to integrate bibliographic records for research data stored in various data repositories, including those hosted on the Dabar infrastructure into CroRIS. This strategic move aims at optimizing RDM and enhancing accessibility and visibility within the scientific community.

[6] Dabar. (2023, April 7). Storage of research data management plans enabled in the Dabar system. https://dabar.srce.hr/en/2023/04/07/aata-management-plan

The full interoperability will strengthen the link between research information stored in the data repositories, and other important data, including funding, related institutions, individuals, projects, etc.

This integration of DMP's and information about research data in CroRIS will significantly augment its value by enhancing efficiency in data management processes and ensuring efficient access to, and preservation of, research data. By integrating these features, CroRIS will offer researchers and institutions a comprehensive platform that facilitates seamless data sharing and collaboration while supporting adherence to data management best practices, thus promoting data integrity and the reproducibility of research outputs. Additionally, aligning CroRIS with the OpenAIRE interoperability guidelines and ensuring its indexing by OpenAIRE Explore as a CRIS system will further enhance its visibility and interoperability within the European research ecosystem. These future developments are set to transform CroRIS into an even more valuable asset for the research community, enabling more effective management and dissemination of research outputs.

At the moment, the framework within the Events module allows for events to be documented as separate records, connected to various other entities within the system. However, recognizing the need for a more comprehensive and transparent approach, the future development of CroRIS is set to introduce an innovative feature. This enhancement will not only continue the practice of logging events as distinct records but will also expand the scope of information captured within these records. Specifically, it will include details about the individuals participating in these events, specifying their roles and capacities. Furthermore, it will catalog the organising institutions, thereby shedding light on the organisations and people behind these events.

Conclusion

All these advancements are not just technical updates; they represent a strategic move towards increasing the transparency and accountability of processes within the CroRIS system. Such progression will enhance the system's ability to support research and development activities, ensuring that stakeholders have access to clear, comprehensive information. Moves of this nature are anticipated to significantly contribute to the system's overall effectiveness, making it a more robust tool for managing Croatia's research infrastructure and fostering collaboration within the scientific community.

CroRIS not only symbolizes Croatia's commitment to OS but also exemplifies the transformative power of centralised research information systems in enhancing scientific collaboration and accessibility. By providing seamless access to interconnected research data, CroRIS enhances transparency, openness, and dissemination of research outcomes, thus promoting the ideals of OS at the national level.

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Abstract:

In today's fast-paced research environment, the push for open access is key to speeding up scientific discovery and innovation. Current Research Information Systems (CRIS), like the Croatian Research Information System (CroRIS), play a crucial role in this. They make it easier for researchers around the world to share and access scholarly articles, datasets, and other academic materials without restrictions. CroRIS, brings together information on scientific activities across Croatia into one central system. This not only makes research data more visible and accessible but also ensures it can be easily shared with others, meeting international standards for data exchange. Looking ahead, CroRIS is set to expand its features, improving how it works with digital repositories and managing research data. These updates aim to make the research process more connected, easier to navigate, and more efficient, highlighting Croatia's dedication to open science. This commitment helps foster global collaboration and makes scientific research more open and accessible to all.

Keywords:
interoperability; transparency; open science practices; research ecosystem