

Research Equipment in CroRIS in Support of Open Research Infrastructures in Croatia

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Abstract:

Croatian Research Information System (CroRIS) contains complete, comprehensive, and reliable data related to the system of science and higher education in the Republic of Croatia. It unifies standardized data on Croatian scientific activity – from institutions, projects and researchers to publications, equipment, services and patents – making them publicly available in a single system, thereby increasing the visibility and transparency of research in Croatia. One of the CroRIS modules that promote open science is Equipment and Services. This presentation focuses on the equipment sub-unit of that module, which contains metadata on scientific equipment located at scientific, research, and higher education institutions in the Republic of Croatia. The availability of equipment information supports more efficient use of existing equipment, justifies its acquisition, and encourages cooperation among research institutions, researchers, and between science and industry. Equipment data were migrated to the CroRIS database from the former Šestar database. The presentation describes the technical characteristics of the system, the migration process, the metadata used to describe equipment, data management practices, the use of equipment data for official purposes by different types of CroRIS users and stakeholders, and interoperability possibilities.

Keywords:

CRIS ; Croatian research information System ; CroRIS ; research equipment ; research information management

1. Introduction

Croatian Research Information System (CroRIS) is a national-level Current Research Information System (CRIS) in Croatia, designed to provide comprehensive, complete, and accurate data on national research activities. The system serves as a central point for collecting, integrating, and managing information on researchers, research organisations, projects, publications, and research infrastructure. By providing structured and interoperable data, CroRIS supports evidence-based decision-making, research evaluation, and strategic planning at the national level, while also enhancing the international visibility of Croatian research (Konjević, Alilović and Šarić, 2025).

This paper focuses on the equipment data in CroRIS, which form a part of the Equipment and services module. This module is one of the functional units within the CroRIS system. It consists of two segments, each implemented as a separate sub-unit within the module. The equipment sub-unit enables the structured recording and monitoring of scientific and research equipment. It contributes to increased transparency of available research infrastructure, supports more efficient use of resources, and facilitates collaboration among research organisations. As part of a national CRIS, the equipment component represents an important element in strengthening research infrastructure management and enhancing the overall accessibility of research capacities. An equipment record can be linked to records in other CroRIS modules: CROSBI (publications), Persons, Projects, Organizational Units, as well as Services (an entity within the Equipment and Services module). Most equipment data are publicly available, except for certain information related to the protection of personal data of related parties.

Access to the module is based on centralized user authentication and authorization through single sign-on (SSO) service, facilitated via the AAI infrastructure, which is applied across the entire CroRIS system. All registered CroRIS users are authorized to create new equipment entries. Entered records undergo a data verification process by module editors. The editors' task is to review and verify the accuracy of the data contained in the entries associated with their institutions, thereby ensuring the credibility of the information (Alilović et al., 2024).

Prior to CroRIS, information and data about research equipment and instruments acquired by the Ministry of Science and Education were available in the *Database of Instruments for Scientific Research – Šestar*. It was developed in 2006 by the Centre for Scientific Information (former Library) of Ruđer Bošković Institute. Initial development was supported by the then Ministry of Science and Education, and since 2007, the Ruđer Bošković Institute has independently continued to develop and maintain the database using its own resources. The aim of Šestar was to provide transparent information on the existence and availability of scientific research instruments at Croatian public institutions within the science and higher education system, in order to enable better planning for the acquisition of new equipment and the financing of maintenance of existing equipment. Users could log in to Šestar through the AAI infrastructure, create new entries and connect them with institutions. Institutions appointed database administrators who were responsible for editing records associated with their institutions (Mayer and Konjević, 2021).

CroRIS was later developed within a national strategic framework aimed at establishing a comprehensive research information system. It was created as part of the "Scientific and Technological Foresight" strategic project, led by the Ministry of Science and Education and co-funded by the European Union. Development began on December 1, 2017, with the University Computing Centre (SRCE) as the partner responsible for the development and maintenance of the CroRIS system. On October 19, 2021, the Ruđer Bošković Institute joined the project, which enabled access to existing equipment data from the Šestar application so that the data could be mapped, cleaned and imported into the CroRIS central database (Macan and Konjević, 2022).

2. Data migration process

2.1 Conceptual and Technical Framework of Integration

Following the data migration in 2022, the legacy database was closed for active use and new data have since been entered exclusively into CroRIS. At the time of migration, Šestar contained more than 3,000 records. Equipment data from the Šestar database were migrated into the CroRIS database and are available through the newly developed Equipment and Services module.. The integration was carried out in accordance with CERIF principles, with the aim of achieving structural and semantic interoperability, standardized metadata, and clear connections between different types of research information within a national CRIS. In this context, the CroRIS equipment component plays a key role in supporting the visibility, accessibility, and reuse of research infrastructure resources, thereby contributing to the development of open research infrastructures in the Republic of Croatia.

2.2 Metadata Mapping, Data Harmonization and Authority Control

The integration process began with the specification of metadata elements in the legacy databases, followed by detailed data mapping to identify differences between the source systems and the CroRIS data model. One of the main challenges in developing the new module was mapping the existing data, including the reimplementation of controlled vocabularies in the form of classification schemes and related categories. Another key challenge was data import, which required extensive data cleansing and the integration of data from multiple sources into CroRIS (Balenović, Kremenjaš and Orel, 2022). A comprehensive analysis of existing data was conducted to ensure the consistency, completeness, and accuracy of records in CroRIS, thus enabling reliable use of the system. Due both to CERIF requirements, which prescribe standardized data structures, controlled vocabularies, and clearly defined relationships between entities, and to new functionalities introduced by CroRIS, such as data exchange and the ability to connect entities across different system modules, targeted data interventions were required. These included completing missing values and correcting or removing invalid or inconsistent records. In the new system, metadata elements, their repeatability, and the contexts in which they are used were clearly defined. Data cleaning was approached as a curatorial process aimed at improving the reliability and interpretability of records. This process focused on enhancing metadata quality, reducing ambiguity, and ensuring the consistent use of standardized values across records. Rather than treating data cleaning as a purely technical task, it was understood as an essential step in supporting long-term data reuse, interoperability, and meaningful integration of equipment records within the broader CroRIS ecosystem.

Particular attention was given to the cleaning and disambiguation of personal name data associated with equipment records. Fields such as Authorized Users, Instrument Manager, Contact Persons, Institution, Project Name under which the instrument was acquired, and Price were systematically reviewed. A unified list of persons linked to equipment records was extracted and analyzed together with the identifiers of the corresponding instrument records. Incorrect entries were removed, spelling errors were corrected, and incomplete name data were supplemented. Only after the completion of this process was it possible for the cleaned personal data to be reliably linked to person records in the CroRIS database, enabling consistent identification and reuse of information on persons across different system modules.

2.3 Institutional Alignment and Project Linking

Since it was decided that the association of equipment records with institutions in CroRIS would be limited exclusively to institutions listed in the official institutional registry, further data harmonization was necessary. During the data cleaning phase, instrument records linked to sub-entities were reassigned to their parent institutions. However, information about sub-entities related to the equipment was preserved through the CroRIS location section, which allows a more detailed description of the exact location of the instrument within an institution.

In the legacy Šestar database, the project name during which an instrument was acquired was stored as a free-text field, resulting in inconsistent naming practices and incomplete references. For migration into the CroRIS database, these data were cleaned by aligning them with authoritative project records from the POIROT database, which had also been cleaned and imported into the central CroRIS database. This enabled explicit linking between equipment and project entities within CroRIS, in line with CERIF recommendations for describing relationships between research infrastructure, projects, and funding activities.

2.4. Functional and Regulatory Implications

The module is primarily intended for recording equipment of a higher value, more specific and rare in the Croatian scientific and research community, equipment which the institution offers for use to users from other institutions, or equipment which is included in different types of official reports for different CroRIS stakeholders (ministries, state agencies, universities etc.) by the criterion of equipment value. For institutions within the science and higher education system of the Republic of Croatia, it is important to register equipment records in CroRIS because an increasing number of project funders (e.g. Croatian Science Foundation) require equipment to be entered into CroRIS when applying for financing. Additionally, when applying to public calls issued by the Ministry of Science, Education and Youth, where funding is requested for repairs, maintenance, or upgrades of research equipment, the equipment must be registered in CroRIS (Macan and Konjević, 2022). Data about scientific equipment, along with other data from CroRIS, are used in the reaccreditation process of higher education institutions and research institutes carried out by the Agency for Science and Higher Education (AZVO). Data are used for generating certain reports for the reaccreditation process, which are available through the module Reports. Regular entry of equipment data into CroRIS also enables systematic record-keeping and improved transparency for the institution's internal needs.

The basic set of equipment data in CroRIS must be entered in Croatian, although entry in other languages is also supported. Descriptive metadata include general and technical descriptions, operating principles, measurement and operational ranges, usage rules, manufacturer, and model. Equipment records are further classified by acquisition cost category, level of integration, equipment type, analytical capabilities, and application domain, all selected from controlled vocabularies. Lifecycle information, such as acquisition date, acquisition cost, estimated value, usability period, and operational status, is also recorded.

Equipment records are explicitly linked to person entities through clearly defined roles (e.g. contact person, authorized user), with contact information drawn from authoritative person profiles. Funding information is mandatory and can be recorded either by linking the equipment to a project through which it was acquired, upgraded, or serviced, or by linking it to a funding organization, following the same procedures used for project records. Equipment records may additionally be linked to services,

digital objects (e.g. images and documents), and locations, supporting rich contextualization and reuse of equipment data across CroRIS. Additionally, an application programming interface (API) is available for the module, enabling data exchange and interoperability with external information systems.

3. Conclusion

The integration of the Šestar database into CroRIS demonstrates how a domain-specific legacy system can be transformed into an interoperable, CERIF-aligned CRIS module that actively supports open research infrastructures. Through the use of standardized metadata, controlled vocabularies, authoritative person and organization records, and clearly defined relationships between entities, the CroRIS Equipment module improves the findability, accessibility, interoperability, and reusability (FAIR) of information on research equipment at the national level. These features enhance the transparency, discoverability, and reuse of equipment data for the research community, while supporting institutional reporting, funding application processes, and strategic planning of equipment purchasing. As such, the CroRIS Equipment module represents a key component of the national CRIS ecosystem in Croatia, contributing to data governance, interoperability, and the development of an open and sustainable research infrastructure landscape in line with CERIF and open science principles.

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