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# Implementing CRIS interfaces with RIS Synergy: Challenges and opportunities of a multidisciplinary bottom-up approach

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## Abstract

This paper introduces the RIS Synergy project, an Austrian digitisation project that aims to synergise CRIS Systems across a diverse research landscape. The project brings together various Austrian research institutions and funders to collaborate on the development and implementation of open, standardised interfaces and shared services for research information services. In this paper, we present how the project's bottom up approach proves to provide an effective method to manage system interoperability and information exchange in a multidisciplinary consortium. Furthermore, we offer an insight into RIS Synergy's approach to the conception of an Austrian research portal.

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## 1. Introduction

This paper analyses how RIS Synergy, a digitisation project aiming to synergise CRIS systems across the Austrian research landscape, will meet this goal by building open, standardised interfaces and by laying the groundwork for a national research portal as a collaborative bottom-up initiative. As such, the project strongly

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reflects on change management as a key theme throughout various aspects, such as the organisation and decision-making processes of a multidisciplinary consortium and the systems architecture.

RIS Synergy has two main goals: One, the project aims to develop and build interfaces to connect the research information systems of funding organisations and research institutions; two, the project establishes a concept study for an Austrian national research portal. There have been previous attempts and initiatives in Austria to pursue one or both of these goals; however, what makes RIS Synergy uniquely qualified in actually reaching them is the project's collaborative environment: Funding organisations and research institutions collaborate in all work packages in order to achieve the project objectives.

We provide an overview of the project along with key insights and findings that render RIS Synergy's bottom-up approach an effective method to manage system interoperability and information exchange between different research institutions and funders. First, a background chapter situates RIS Synergy within the diverse Austrian research landscape, explaining the need for a joint digitisation project. Next, insights and findings showcase concrete examples of both the challenges and opportunities presented by such a collaborative bottom-up initiative. This is followed by an outlook demonstrating how the technical solutions built by RIS Synergy can serve as the foundational infrastructure for a national research portal. One of the RIS Synergy objectives is to conduct a concept study for such a portal. Open interfaces, standardised solutions, a collaborative working environment and the vision of a joint platform for Austrian research are some of the ways in which RIS Synergy seeks to contribute to the sustainable digital future of research information management and research support in Austria.

## **2. Background: RIS Synergy and the Austrian research landscape**

Austria has a diverse research landscape, owing to the independence of universities as legal entities since 2002. In addition to 22 public universities, a large proportion of research is done by universities of applied sciences, private universities, research institutes, and companies.

The biggest source of national research funding stems from Austrian businesses who fund about half of the total expenditures, followed by the public sector, especially the federal government. The National Foundation for Research, Technology and Development is responsible for distributing publicly financed funds. It operates through various funding institutions supported by the federal government [1]. Funds are granted to funding applicants - researchers, research organisations or companies - within the framework of each funding organisation's funding guidelines [2].

Due to a wide range of reasons, institutional workflows and research information systems are not always compatible or interoperable, neither between research institutions themselves, nor between funding organisations and research institutions. This leads to the main focus of RIS Synergy: Building on existing inter-institutional bottom-up initiatives, such as the Austrian FIS/CRIS Network, RIS Synergy establishes a new form of collaboration between research institutions and funders. The project seeks to consolidate standardised metadata across diverse CRIS systems at universities and funding organisations, for instance by deploying the once-only principle, while honouring the status quo of diverse and decentralised systems. The solutions suggested by RIS Synergy consider the universities' and funders' individual systems - on both a technical and an organisational level - and include international infrastructures and standards, such as CERIF and various persistent identifiers to ensure sustainable structures and further developments.

RIS Synergy was launched at TU Wien in March 2020 as part of the so-called Research Data Cluster, which brings together digitisation projects across the project lifecycle. RIS Synergy is financed by the Federal Ministry of Education, Science and Research (BMBWF) after a successful application to the call for tender "Digital Transformation in Higher Education". As of now, 12 universities and 3 funding organisations from all over Austria are project partners. The TU Wien is the project lead and is responsible for reporting progress to the ministry and for

the overall project management. Every partner nominates an institutional project leader who is the key contact for their institution regarding project matters, and who reports to the overall project lead at TU Wien; and each project partner contributes additional in-kind personnel resources.

The project pursues various objectives. Most importantly, it seeks to optimise administrative support for research projects; increase data quality and transparency for research institutions, funding organisations and public bodies; and raise the international visibility of Austrian research.

The first major objective of RIS Synergy is to define and establish technical interfaces for exchanging relevant metadata of the research process between universities and funding organisations. The open, standardised interfaces and machine-readable content created in the project will be open source and available for reutilisation. The currently prioritised interfaces that will be implemented during the project concentrate on call information, project metadata, research output, financial data, data management plans, organisational structure and account management. Further use cases were identified and will be implemented in the post-project phase and in follow-up projects, as they are very well documented and can be used as add-ons to already implemented use cases.

These solutions also contribute to the concept for a national research portal, for which RIS Synergy will lay the groundwork. The second major objective, then, conducts a concept study defining the framework conditions, requirements and functionalities of a national research portal for Austria, which could serve as a database for innovation research and system evaluation. In a first step, three focus groups analysed the needs as well as the dos and don'ts with regard to defining and installing a national research portal in Austria. One focus group reviewed past national initiatives to ascertain which lessons could be learned from them. A second group analysed the national research portals of other countries for best-practices, and examined them in order to evaluate which of the implemented features could be feasible for an Austrian portal solution. Lastly, another focus group carried out a stakeholder analysis that was followed by a questionnaire sent to the identified stakeholders to inquire about their needs and visions. The findings of these three focus groups will be summarised in a concept paper that will serve as a suggestion for implementing a national research portal for Austria.

At the national level, RIS Synergy collaborates with two other digitisation projects in the higher education and research sectors: the projects FAIR Data Austria and Austrian DataLAB and Services. Together with RIS Synergy, these three projects comprise the Research Data Cluster - a network of digitisation projects launched in 2020 and funded by the Federal Ministry of Education, Science and Research. The cluster is an opportunity to use synergies and to network with the other projects, as all projects in the cluster share work results and build on each other's work packages. What is more, the cluster is aligned with the Austrian EOSC Initiative (represented by the EOSC Support Office Austria) in that both strive for a coordinated development of the Austrian Open Science Policy and the European Open Science Cloud (EOSC). The realisation of these goals includes the creation of an open multi-disciplinary environment to publish, find and re-use data, tools and services for research, innovation and educational purposes, to make scientific processes more open and effective for open innovative and applied research. RIS Synergy, in particular, contributes to these ambitions by way of the concept study for a national research portal. It describes a one-stop shop for research enabled by standardised infrastructures, community standards and shared services. The evaluation of the status quo as well as feasible models for a national research portal are an essential stepping stone for Austria's contribution to the EOSC.

### **3. Insights and findings: RIS Synergy and the challenges and opportunities of a bottom-up approach**

Whereas previous initiatives with similar goals were devised top-down by university administrations or federal ministries, RIS Synergy utilises a solution- and stakeholder-oriented bottom-up approach, thus providing self-acting change management that is largely motivated by internal factors. Daradkah et al. [3] highlighted the differences between top-down and bottom-up approaches in project management. While top-down approaches advance "from the general to the specific", bottom-up approaches pursue the opposite direction. Interestingly, Daradkah et al. conclude that a combination of top-down and bottom-up strategies is ideal. More specifically, they recommend a

top-down approach at the beginning of a project in order to facilitate the planning process and properly distribute tasks; after this, the working groups should refine the details of tasks in a bottom-up strategy, as this would be less time-consuming than a continuing top-down perspective. In the bottom-up-led initiative that is RIS Synergy, collaboration takes place primarily among mid-level management departments, which are involved in the day-to-day operations of CRIS and repositories, and therefore have a better understanding of the tasks at hand. RIS Synergy initiates a process of change that was generated by the needs and requirements of the service units themselves - a classic bottom-up approach where the participating institutions first specify their needs and then work together in order to generally implement joint solutions.

The project also needs to consider the interests of its multiple stakeholders. The project team is guided by the principles of stakeholder management identified by the Clarkson Center for Business Ethics (1999) and compiled by Friedman and Miles [3]. The process encapsulates acknowledging, monitoring, and listening to stakeholder concerns and contributions, raising awareness for differences, interdependencies and opportunities for cooperation. In order to map the stakeholders in the project in the first place, RIS Synergy follows the stakeholder assessment process of Freeman et al. [4].

This stakeholder-oriented bottom-up approach is the foundation for all aspects of conducting the project, from the general decision-making processes and project management to the actual implementation of open-source products.

### *3.1. Project Management*

In the RIS Synergy consortium, the participating institutions jointly develop products and solutions within the framework of the project. Decision-making is a shared process from the beginning to the end, and has a ripple effect into the participating institutions, meaning that the implementation of these solutions is facultative and optional: Each institution can implement the changes in their in-house CRIS as they see fit, but they have to approve the general setting.

Various working groups have been formed to implement different work packages, with their topics reflecting the corresponding interface that the group aims to implement as part of RIS Synergy's objectives. The working groups are:

- Working Group 1 – Call Information: interface to collect information on funding programmes shared by the funding organisations
- Working Group 2 – Project Metadata: interface to exchange project metadata
- Working Group 3 – Research Output: delivery of research output to funding organisations
- Working Group 4 – Financial Data: interface with a focus on facilitating project accounting
- Working Group 5 – Organisational Structure and Account Management: automated transmission of organisational structures, allowing authentication across institutions
- Working Group 6 – Standards: adapting the interfaces to CERIF; discussion of common compliance issues
- Working Group 7 – Data Management Plans: exchange of metadata relevant to DMPs

The working groups consist of team members of all participating project partners and can draw on multidisciplinary expertise from across different departments and academic backgrounds. In other words, RIS Synergy presents itself as an opportunity and platform to pool diverse perspectives and skill sets in order to achieve a common goal of digitising the Austrian research information landscape. Such a nation-wide consortium requires diverse communication tools and team-building strategies to guarantee effective communication between project partners and working groups.

The COVID-19 pandemic presented a major challenge, as the project launch in March 2020 coincided with the first nationwide lockdown in Austria. Therefore, the project was launched digitally, and working groups have had to maintain virtual means of communication and collaboration throughout the first year of the project. Their main

digital tools are two Atlassian products: Confluence, a virtual collaboration software, and Jira, a project management software. Microsoft Teams became the main tool used for virtual meetings. Collaboration and video conferencing software have been tremendously helpful in establishing a virtual environment in which every partner institution can contribute to the work packages, allowing them to develop a good working environment regardless of geographical distance and in spite of the challenges posed by the global health crisis.

To come to decisions in a project that involves this many diverse project partners, the project management team established a weighted decision-making process. Two thirds (10) of the project partners being present constitutes a quorum. Resolutions are then approved by a simple majority. The weight of votes for general decisions relates to the commitment of the project partners, i.e. the received grant funds and in-kind commitments. This system ensures that the major partners can realise essential interests but that smaller partners together have a chance for a veto or can carry through specific needs or requirements.

To successfully carry out a project in a consortium, it is paramount to define a common understanding of key aspects such as terminology, organisational structures, or the different CRIS systems and their requirements. For this purpose, the team first analysed the research information landscapes of all project partners, and discussed common denominators as well as differences. For instance, one of the first objectives to meet was to find a shared understanding of the project life cycle across partner institutions. To achieve this, the project team modelled a meta process that depicts a research project's full workflow. Based on this, the team then wrote use cases to describe the exchange of data between the CRIS systems of funding organisations and universities. As a next step, the working groups then refined these use cases to describe in more detail the exchange of funding programmes, financial data, project data, project output, and organisational data. While requirements were being defined, a project-wide glossary and vocabulary were set up to provide a classification scheme to document a shared understanding of key terms and processes. All project partners bring with them their own unique perspectives and motivations for contributing to this digitisation project. As interests and needs vary between organisations, finding a common ground is both a major challenge and opportunity in RIS Synergy.

The chosen bottom-up approach also seems to invite new collaboration, since more universities have joined the project consortium as partners even after the launch. For research institutions as well as research funders, the project offers the opportunity to define systems and interfaces according to their needs, improve the way of collaborating with each other, and reduce the administrative workload of researchers.

### *3.2. Standardisation and Interfaces*

One of the ways in which the project meets the institutions' system setups is by means of standardisation: The interfaces developed by RIS Synergy conform to the Common European Research Information Format (CERIF) and the OpenAIRE Guidelines for CRIS Managers. Since research institutions and funding organisations use different data management systems - some are third-party products such as PURE, whereas others are built in-house - one of the challenges in RIS Synergy is to synchronise these systems. Using an international open standard such as CERIF is the ideal way to do so. The interfaces are not based on the data model of one specific data management system; this means that the individual requirements of the project partners can be considered while maintaining the clear structure that is provided by CERIF. Since the focus of RIS Synergy is to develop decentralised data interfaces, the project specifically focuses on the latest version of the OpenAIRE Guidelines for CRIS Managers (v.1.1.1), a further development of the original CERIF XML and a data exchange format that allows not only for OpenAIRE harvesting but also the exchange of information between institutions [6]. Out of the ten information elements included in the OpenAIRE Guidelines for CRIS Managers, RIS Synergy employs the entities Publication, Project, Funding, OrgUnit, and Person to create metadata sets for project data, publication data, organisational data and programme information data while taking into account the specific needs of universities and funding agencies. The implementation of the OpenAIRE Guidelines for the development of RIS Synergy's interfaces therefore supports an extension of the standard to enable a realistic representation of Austrian research activities. The decision to develop

data interfaces based on the OpenAIRE Guidelines was coordinated by the whole project consortium, which again aligns with RIS Synergy's bottom-up approach, and moreover ensures a long-term commitment from all project partners.

Another important reason for the RIS Synergy project to follow the EU's recommendation on implementing the CERIF standard for research information exchange and depiction is the opportunity to be part of an international network of institutions and systems that conform to and further develop the standard. Since research and its funding happen globally, there is a strong interest in being able to exchange and present research information on an international level. The necessary cooperation of institutions as well as the interoperability of systems can be enabled through the standardisation of user-oriented use cases.

The data interfaces developed by RIS Synergy are open-source solutions, meaning that the project partners can implement the interfaces individually. Other research or funding institutions with an interest in using the interfaces can do the same. In addition, the publicly available documentation serves as a reference for similar international projects and initiatives. A decentralised architecture in connection with a centralised registry modelled after the Austrian Higher Education Systems Network (AHESN) allow for jointly developed products as well as specific solutions based on each institution's individual requirements [7]. Current and future partners can share machine-readable descriptions and endpoints of the specific APIs they choose to implement.

As RIS Synergy is a digitisation project concerned with research infrastructure, FAIR research data management is a topic that fundamentally affects the development of the various data interfaces. What is more, the FAIR Data Austria project is also part of the Research Data Cluster. FAIR Data Austria develops tools and training for researchers, universities, and funders to further strengthen FAIR research data management in Austria. The two projects closely communicate on topics regarding the intersection of FAIR research and FAIR research infrastructure.

One of the key elements for automating data exchange involving such a large number of different organisations and applications is the use of unique and persistent identifiers (PIDs). Together with FAIR Data Austria, information about existing global PIDs, such as the DOI, the ORCID ID, and the Crossref Grant ID, and their applicability for the RIS Synergy consortium, is collected and discussed not only among the project partners but also communicated to representatives of the research community (e.g., by way of a jointly-hosted webinar on the value of PIDs).

RIS Synergy's project deliverables go beyond the implementation of decentralised interfaces and include two shared products that the project partners develop, manage and maintain as a consortium: A database for funding programme information and a repository for data on the organisational structure of the participating universities. Building shared services and tools creates synergies for Austrian research institutions and funding agencies, thus enabling a more resource-efficient research infrastructure.

#### **4. Outlook: Conceptualising a national research portal**

RIS Synergy creates the foundation for the national and international exchange and presentation of Austrian research, and therefore for a national research portal, in several ways:

First, the project implements interfaces for the digitisation and exchange of research information. Standardised interfaces are not only designed to exchange data between organisations but also enable the collection of data from different data sources in one data hub.

Second, the project establishes close cooperation of universities, funding organisations and other research institutions on a technical and an organisational level. The various institutions in Austria's research landscape face similar administrative, technical and organisational issues. Collaboration in digitisation projects brings together staff

from the same types of service units but at different institutions, thus strengthening the exchange of expertise and the development of across-the-board and resource-efficient solutions.

Third, RIS Synergy develops shared services and tools that meet the standards of current and future research activities and promote excellent and cross-institutional research at different institutions, large and small.

As a bottom-up initiative, RIS Synergy has the advantage that the different target groups of a national research portal are involved in the concept study from the very beginning, and their needs can be substantially integrated into the development of different minimum and maximum scenarios. An international comparison of national and regional research portals and discussions with portal operators in Finland (Finnish Research Hub) [8], Croatia (CroRIS) [9], Catalonia (PRC) [10], Flanders (FRIS) [11] and Denmark (NORA) [12], among others, have shown that clear top-down guidelines can facilitate the objectives of a portal but that this also entails the loss of other target groups. Therefore, RIS Synergy aims to provide a clear concept that has been developed bottom-up but which subsequently results in well-grounded top-down decisions and long-term commitments.

## 5. Conclusion: RIS Synergy and sustainable solutions

We set out to examine RIS Synergy as a collaborative, multidisciplinary digitisation project aiming to connect CRIS across a diverse research landscape on the initiative of universities and funding organisations alike. RIS Synergy offers a variety of components that comprise a toolbox for implementing change and digitisation in the research support sector: a collaborative platform; standards and interfaces; processed data; informative core messages and public outreach practices; the concept for a national research portal; and an invitation to redirect energies and resources in research support services.

This paper demonstrated that the solutions suggested by RIS Synergy result from a user-oriented bottom-up approach that considers the universities' and funders' individual systems on both a technical and an organisational level. In other words: All participating institutions come together to develop solutions that address the needs and requirements identified by the mid-level service units directly involved with operating their institutional research information systems. What is more, the project's integration of standardised and open-source infrastructures, such as CERIF, OpenAIRE and various persistent identifiers, ensures the sustainable handling and reusability of RIS Synergy's interfaces and the independence and continuance of various national CRIS systems. Studying the RIS Synergy approach to project management and implementation is therefore of interest to current or future initiatives with a similar goal of putting system interoperability into practice.

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