

Research Information Management (RIM)/Current Research Information (CRIS) Systems for Research Organizations: A Project Brief from the Open-Source VIVO Community

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Abstract

The use of Research Information Management (RIM) or Current Research Information Systems (CRIS) can significantly enhance the efficiency and innovation capacity of research organizations. RIM/CRIS systems aggregate, curate, and utilize diverse data on institutional research activities, enabling the strategic utilization of data for decision-making. VIVO is an open-source RIM/CRIS system that enables the recording, editing, searching, browsing, and visualizing of scholarly activity using linked open data. VIVO is customizable and supports additional domains of scholarly activity. The VIVO community is actively engaged in developing and evolving the system to expand its usability and utility through internationalization, multilanguage capabilities, installation of new versions, and API improvements. As an open-source RIM/CRIS system, VIVO is customizable to suit the unique use cases of an institution. Institutions own and control their data, enabling them to manage their privacy or security needs. Moreover, VIVO supports the move towards open science practices as an open, semantic system.

Different use cases with different approaches using VIVO are shown, which can serve, among others, as showcasing, research collaboration, data visualization & impact and researchers & research assessment and evaluation.

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1 RIM/CRIS Systems at Research Organizations

Compared to other types of organizations, research organizations often do not use their research data for strategic decision-making (Borgman & Brand, 2022). However, the strategic utilization of data on current and emerging research could guide budgetary decisions, hiring, development of library collections, and matching researchers to funding opportunities. Addressing this gap in strategic decision-making could enhance the efficiency and innovation capacity of research organizations.

To bridge this gap, research organizations have implemented or purchased Research Information Management (RIM) systems or Current Research Information Systems (CRIS). RIM/CRIS systems are designed to support the aggregation, curation, and utilization of diverse data on institutional research activities (Bryant et al., 2018). RIM systems have significant value for research institutions as they integrate local, internal data with external, global data, providing new efficiencies and insights across the organization, as well as the potential for regional, national, and transnational sharing and benchmarking. (Stvilia et al., 2018)

There are several types of RIM/CRIS systems that are designed to support different functions, use cases, and workflows. For instance, some RIM/CRIS systems serve at the global scale (e.g., ResearchGate, Google Scholar), national scale (e.g., NARCIS), or regional scale (e.g., Florida ExpertNet, Ohio Innovation Exchange), while others serve specific disciplinary communities (e.g., DIRECT2Experts) or individual institutions (e.g., VIVO, DSpace-CRIS, Symplectic Elements, Pure) (Lee et al., 2023). RIM/CRIS systems support several use cases, including reputation management, research assessment, expertise discovery, data reuse, research intelligence and data analytics, and compliance (Bryant, Clements et al. 2018).

2 VIVO, the Open-Source RIM/CRIS System

VIVO is a semantic, open-source RIM/CRIS software and ontology for representing scholarship using linked open data. VIVO enables the recording, editing, searching, browsing, and visualizing of scholarly activity, and it facilitates research discovery, expert finding, network analysis, and research impact assessment. VIVO is customizable and easily extensible to support additional domains of scholarly activity.



Figure 1. Heterogenous data sources for a RIM/CRIS System

VIVO acts as a hub of data siloed in local and external systems through four strategies: (1) The consistent use of persistent identifiers (PIDs) for people, objects, and institutions; (2) The use of reasonably consistent data models or ontologies across the systems; (3) The incorporation of application programming interfaces (API), so that data can be harvested and shared automatically; (4) Community support for the development of a good data governance policies that balances openness and security (Fig. 2).

Because VIVO is a semantic system with linked, open data, it helps support the creation of emerging knowledge graphs (Chaves-Fraga et al., 2022) (Manghi et al., 2022)

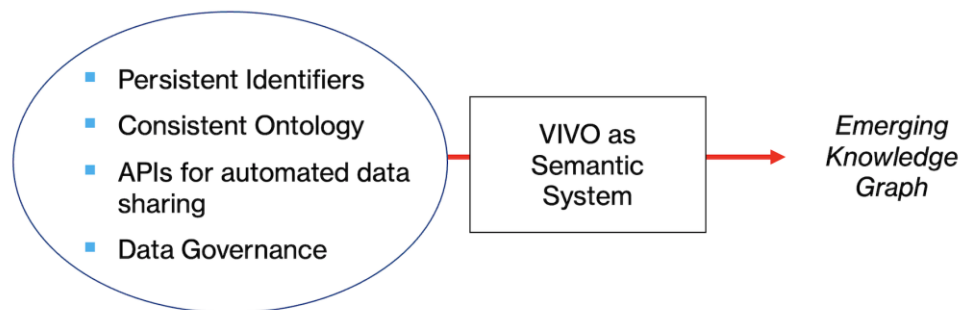


Figure 2. VIVO as a semantic system.

VIVO is supported through the VIVO open-source community, which is a member-supported community associated with Lyrasis (*Lyrasis - Cerca de Google*, n.d.). Lyrasis is a non-profit member organization serving and supporting libraries, archives, museums, and cultural heritage organizations around the world. Lyrasis is based in the United States.

VIVO has several active sites around the world and it's expanding its implementations to Europe and Iberoamerica. Has relevant VIVO active groups in Germany and South America and there is a growing interest in such open, community-managed solutions.

One of the use cases increasingly seen is that of aggregated information, examples of national portals such as Brazil's BrCRIS, which aims to aggregate the research activities and results of the country's universities, or the Berlin University Alliance (BUA). All of this demonstrates the potential that VIVO has in the service of research.

VIVO has several advantages over similar commercial systems. As an open-source RIM/CRIS system, VIVO is customizable to suit the unique use cases of an institution. Institutions own and control their data, enabling them to manage their privacy or security needs. Moreover, VIVO supports the move towards open science practices as an open, semantic system.

In the end, VIVO is an application built entirely with Semantic Web technologies promoted by the World Wide Web Consortium. Its main features are:

- Implements an Ontology based on standard international ontologies
- Stores data as RDF expressed in terms of vocabularies called ontologies

- provides persistent URIs for data.
- Represents the expertise of people engaged in the creation, transmission, and preservation of knowledge and creative works.
- Contains FAIR data, complying with Linked Open Data Standards
- VIVO may be hosted on one or more physical servers, on virtual servers, or in the cloud.

3 VIVO Roadmap

The VIVO community is actively engaged in the further **development** and evolution of the VIVO systems and well as building and supporting its community. The development work is focused on expanding the usability and utility of the VIVO system through an internationalization of the systems, working on multilanguage system capabilities, easy the installation of new versions and API improvements, gender perspective and interoperability improvement among others.

Within the community, an additional objective is to establish **partnerships** with pertinent organizations to enhance and improve the software. To this end, VIVO entered into a collaborative agreement in 2021 with the not-for-profit international association euroCRIS, which was established in 2002 that conveys research information experts, with a particular focus on research information systems (CRIS). The mission of euroCRIS is to promote cooperation and knowledge-sharing among the research information community and to support research information interoperability through the adoption of the Common European Research Information Format (CERIF) standard.

The primary goals of the VIVO-euroCRIS partnership are to align the CERIF framework with the VIVO ontology, facilitate interoperability, promote communication between the communities, and attend mutual conferences. One of the first tasks undertaken by the partnership was to create a **mapping between the VIVO ontology and the CERIF** interoperability standard.

Furthermore, the community is committed to enhancing **VIVO's interoperability** with other relevant open-source repository systems, specially DSpace, with a particular emphasis on furthering the mission of research information sharing and collaboration. (*DSpace-VIVO Integration Task Force - VIVO - LYRASIS Wiki*, n.d.)

In short, the community is engaged in leveraging the power and utility of VIVO through enhanced analytics and reporting functions to serve an important value proposition for research institutions around the world (Fig. 3.).

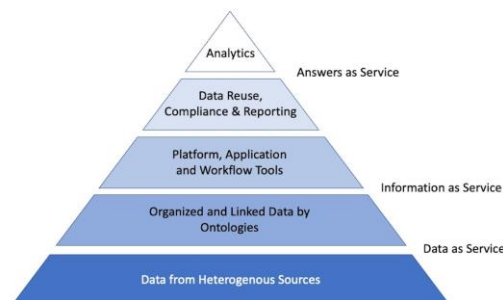


Figure 3. Data analytics value pyramid for VIVO as a RIM/CRIS system.

4 VIVO use cases

Here are some relevant use cases that show the potential of a tool like VIVO

- 1) **Researchers's profile** examples, same software can have different appearance since VIVO is versatile and adaptable to institution needs.

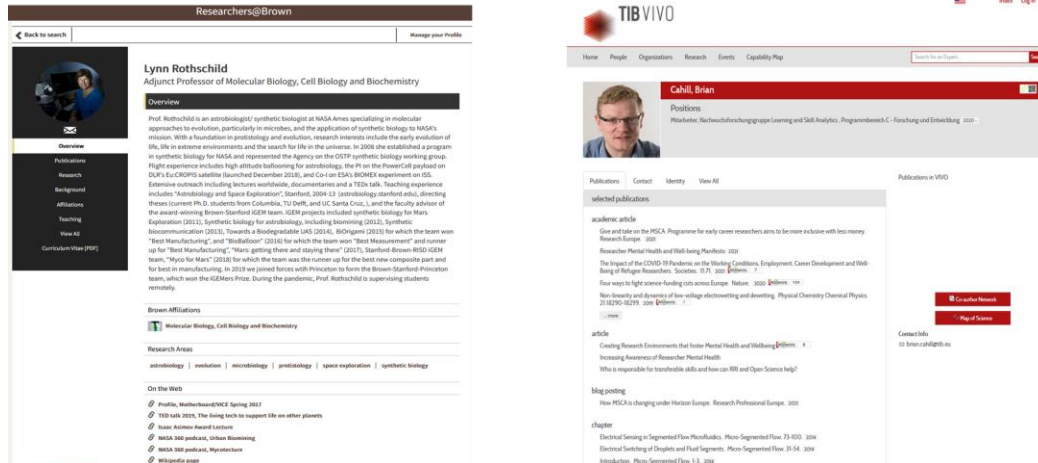


Figure 4. VIVO researcher's profile examples

- 2) VIVO can be considered as a tool to create a **network of collaborations**, so it has graphics that allow promoting this collaboration, showing the network of co-authors (with whom the researcher publishes) and co-investigators (with whom the researcher carries out projects). It also allows you to go from one researcher to another.

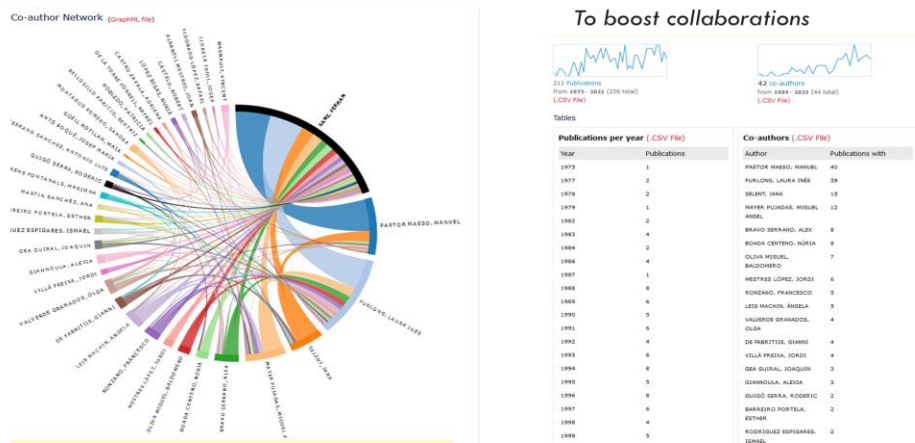


Figure 5. VIVO co-author network

- 3) Some institutions focus on collaborations, networking, etc. others want to show the **impact** of their researchers, to visualize it or for evaluation, etc. In the figure 6 example, which is the detail of a journal article from a researcher, in addition to the information of the publication there is an impact section, with different metrics and indicators (in this case from a Spanish university).

The screenshot shows a VIVO page for a journal article. At the top, the Universitat Pompeu Fabra logo is visible. The page title is "DisGeNET: a comprehensive platform integrating information on human disease-associated genes and variants". The authors listed are Piferno J, Bravo A, Queralt-Rosinach N, Gutiérrez-Sacristán, Deu-Pons J, Centeno E, García-García J, Sanz F, Furlong LI. The journal is "Nucleic Acids Research", published in 2017, volume 45, number D1, pages 833-839. The abstract discusses the genetic basis of human diseases and the development of DisGeNET. On the right, a "Bibliometric Indicators" section shows Scopus (789 times cited), Web of Science (769 times cited), and various SJR and Index H SJR metrics. An Altmetric badge shows 17 mentions, including 2 news outlets, 19 tweets, 455 readers on Mendeley, and 3 readers on CiteULike. The footer includes "©2022 VIVO Project | Universitat Pompeu Fabra | Powered by VIVO" and links for Index, Technical note, Legal notice, and Log in.

Figure 6. VIVO showcasing the researchers impact

- 4) TIB Hannover and University of Osnabrück are currently developing the Tapir project, a toolchain for partially **automated import of metadata based on persistent identifiers** from open data sources into VIVO, and a customizable reporting component which will allow outputs compliant with national reporting standards.

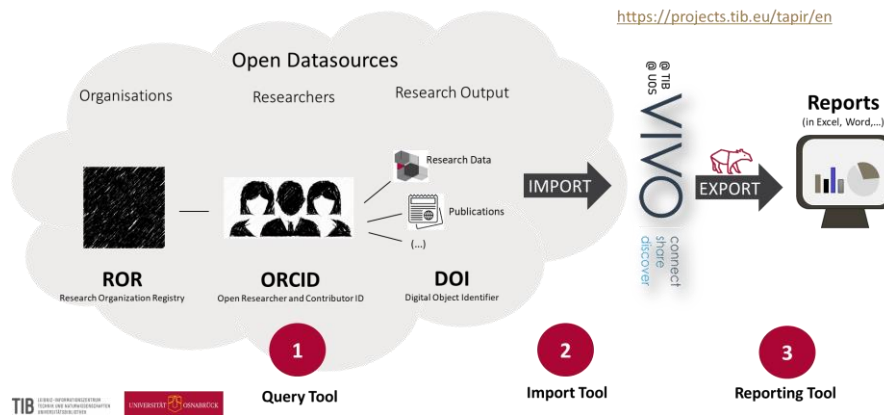


Figure 7. TAPIR project schema

- 5) Another project is from Texas A&M works on the use of classifications and expertise to create a **knowledge graphs** using the linked data that VIVO provides, to establish, execute, and evaluate institutional research strategy & evaluation, to obtain this kind of great visualizations.

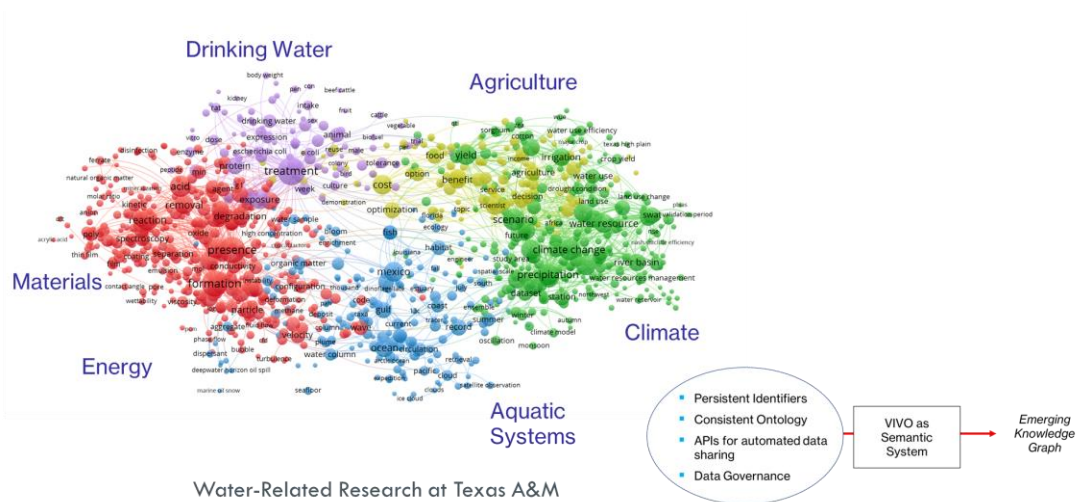


Figure 8. Texas A&M knowledge graph with VIVO data

- 6) The project NORA from Denmark. Uses the VIVO ontology to find research insights to generate amazing **visualizations**, this is to obtain national level insights from the Danish research.

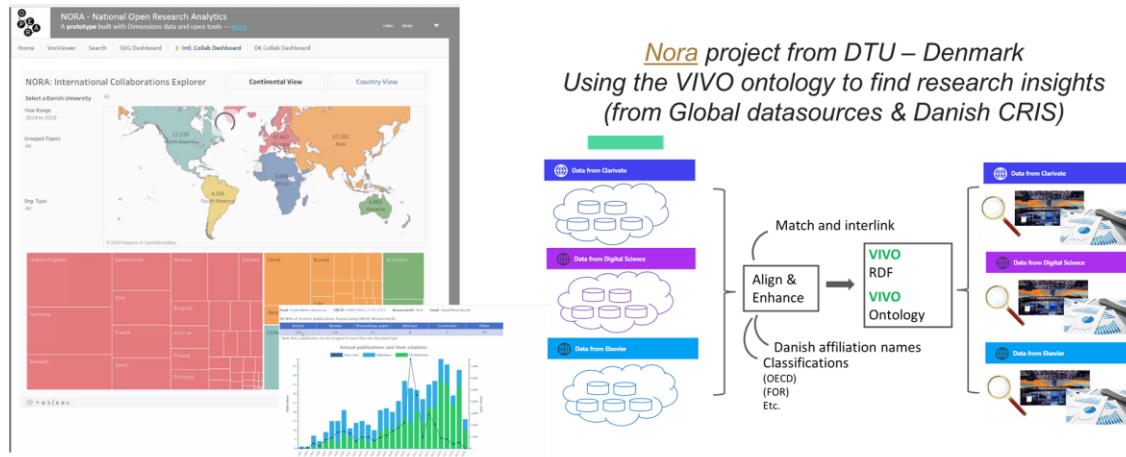


Figure 9. The NORA project

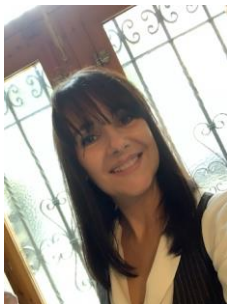
5 Conclusions and insights

- A RIM/CRIS system such VIVO, can be useful for the country's policies for research and innovation, mapping investment in Science & Technology versus Innovation results, creating a fairer Science evaluation system, in view of Open Science precepts and connecting the entire scientific ecosystem, allowing quick visualisation of complex variables, generating information for decision-makers, among others.
- VIVO has a great community behind it, has strengthened its governance and is working on a roadmap that will allow it to evolve in line with new trends, focused on open Science and data sharing, reusing, interoperability, etc.
- It is working on fostering partnerships with relevant organizations with which important collaborations can be made.
- The versatility and adaptability of the tool and the advantages offered by an ontology based on international standards that provides linked open data, are highlighted.
- There are innovative projects in the community that offer VIVO-based solutions focused on research intelligence and knowledge graphs.
- There is a clear trend to use VIVO as a research portal at regional or national level, as an aggregator of data from different RIM/CRIS systems, to provide relevant information to governments, for decision making or policy definition. And where standard of interoperability CERIF can play a key role.

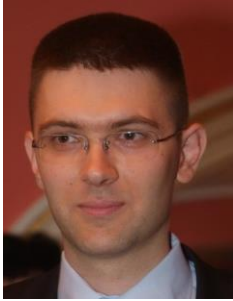
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