The Importance of Interoperability in European Research Infrastructures

Allan T. Souza
Terhi Rasilo
Jaana Bäck
Institute for Atmospheric and Earth System Research INAR, Forest Sciences, Faculty of Agriculture and Forestry, P.O. Box 27, 00014, University of Helsinki, Finland.

Background

Research Infrastructures (RI) are facilities that offer resources and services for research communities to conduct research and promote innovation. RI can be a single site or distributed and include major scientific equipment, collections, archives or scientific data, computing systems and communication networks.

Interoperability is an important aspect of Open Science (OS). It refers to the ability of different systems and organizations to work together and exchange information seamlessly. Interoperability involves establishing common standards, formats, and protocols that enable different systems or components to communicate with each other and exchange the data without loss or distortion of information. Data interoperability addresses challenges related to data compatibility, structure, semantics, and technical integration. It involves defining and adhering to shared data models, schema, and metadata standards, as well as utilizing common communication protocols and interfaces. In the context of OS, interoperability allows for the integration and interconnection of research infrastructures, reducing the fragmentation of the research and innovation ecosystem and avoiding the duplication of effort. Achieving interoperability across resources and services within RIs can present several challenges. Most of the interoperability challenges can be divided into two blocks, namely technical and social challenges (Figure 1).

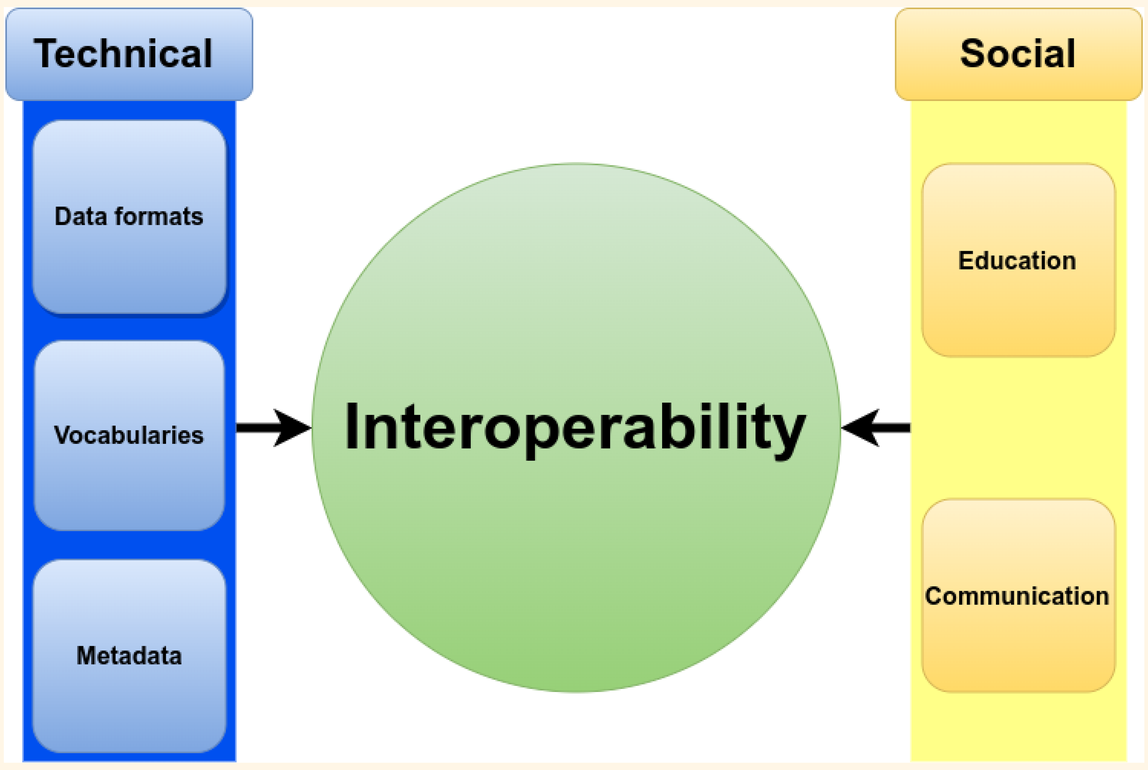

Figure 1. Challenges achieving data interoperability among research infrastructures can be divided in two groups: technical and social.

The **technical challenges** in data interoperability are various, but probably the most relevant ones in the context of RIs are the data formats, the vocabulary standards and the metadata quality.
The **social challenges** in interoperability can also be split into two groups, namely education (of the scientific community) and communication (among RIs).
Even though researchers are well-educated people in their fields, many times they lack training or access to information related to the best practices in research data management. Communication, or lack of communication among RIs is another challenge, as it can prevent the fragmentation of the RI landscape.

Conclusions

Challenges achieving data interoperability among research infrastructures can be divided in two groups: technical and social.In conclusion, RIs are crucial for promoting scientific research and driving innovation in various fields. To maximize their impact, achieving interoperability is a key challenge that needs to be addressed. Centralized hubs of standards, such as common vocabularies and data formats, can facilitate communication and collaboration among research infrastructures. Improved communication and coordination among research infrastructures can also help prevent the duplication of effort and increase efficiency. These initiatives are essential for accelerating scientific progress, bridging gaps, and improving the usability of RIs.

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