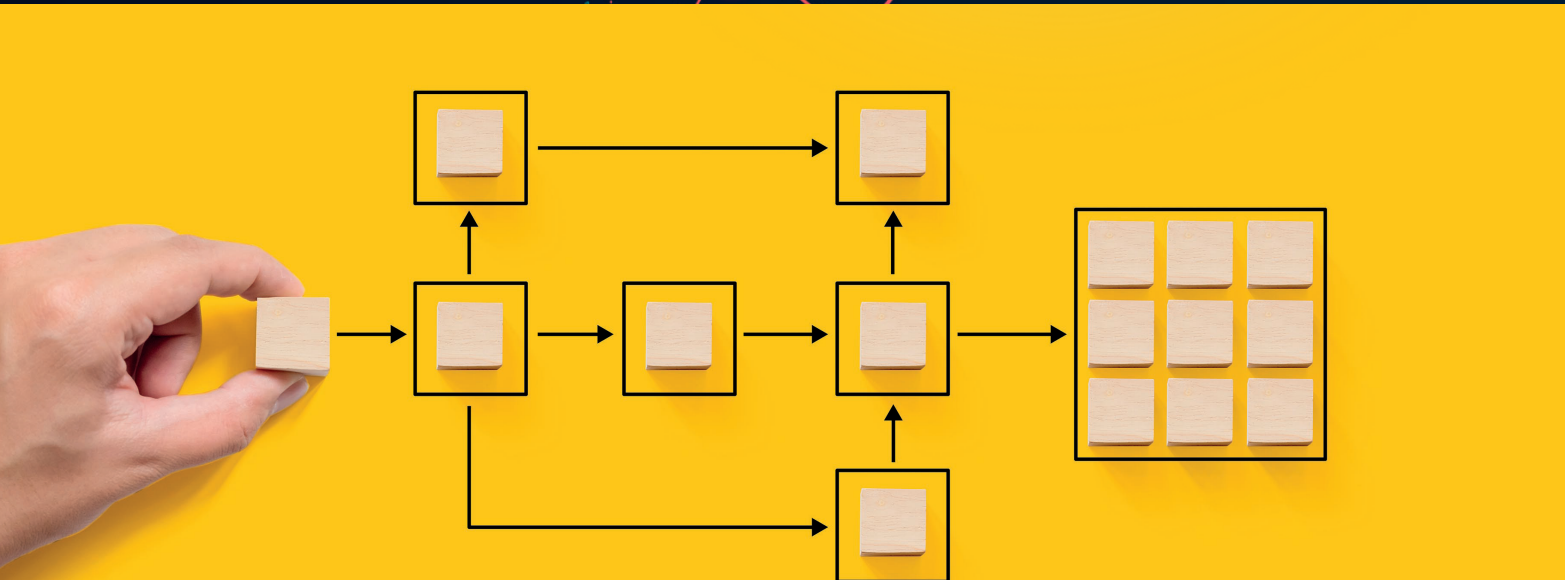




FAIRness assessment using F-UJI for selected research software repositories in the SemTec team at ZB MED Equation



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Summary:

Software plays a crucial role in academic research, not only as a tool for data analysis but also as a research outcome or result, or even the object of research itself. FAIR (Findable, Accessible, Interoperable, Reusable) research software can increase the transparency, reproducibility, and reusability of research. For this to happen, software needs to be well-described (by metadata), inspectable, documented and appropriately structured so that it can be executed, replicated, built-upon, combined, reinterpreted, reimplemented, and/or used in different settings. The FAIR4RS Principles aim to guide software creators and owners on how to make their software FAIR. FAIR-IMPACT offered two support actions designed to enhance the FAIRness and impact of research software:

- Assessing and improving existing research software using a new extension of F-UJI which implements some of the metrics for automated FAIR research software assessment.
- Implementing the Research Software MetaData (RSMD) guidelines for better archiving, referencing, describing, and citing research software artefacts.

This FAIR Implementation Story outlines the specific aims and actions of the Semantic Technologies team at ZB MED Information Centre for Life Sciences in relation to their participation in one or both support actions.



■ Introduction

In the SemTec team at [ZB MED - Information Centre for Life Sciences](#), our focus is on enhancing the use of rich metadata to describe research artefacts. However, we recognized the need to evaluate the [FAIRness \(Findability, Accessibility, Interoperability, and Reusability\) for research software](#). Through our participation in this support action, we aimed to improve the FAIRness of our research software as a pilot initiative that could serve as a model for the entire institute.

Initially, our plan focused on assessing the FAIRness of four software repositories and identifying areas for improvement. Based on these evaluations, we intended to leverage software metadata extractors to (semi) automatically enhance the FAIRness of these repositories. The enriched metadata would then be embedded and shared on our GitHub pages, making the software more discoverable by search engines and easier to integrate into software registries. By improving both the quality and visibility of our research software, we hoped to ultimately enhance the overall quality and impact of our research outputs.

■ Approach taken

During the initial workshop, we were introduced to the F-UJI tool and FAIR Research Software Metrics ([FRSM](#)), which provided valuable insights into improving the FAIRness of research software. While we were already familiar with the FAIR principles, applying them specifically to software was a new and exciting challenge. We began by using the [F-UJI](#) tool to evaluate the FAIRness of our repositories and obtained an initial baseline score, which was relatively low since we were just beginning the process.

To address this, we focused on understanding the FRSM metrics and how they could be applied to increase the FAIRness of our repositories. Initially, we discovered that much of our metadata was embedded in CITATION files or depended heavily on the GitHub API, which limited its FAIR compliance and discoverability.

We then implemented several improvements to address these gaps. This included archiving our software on Software Heritage to obtain persistent identifiers, adding a “repository status” field to clarify the state of each repository (e.g., active or archived), and incorporating a codemeta.json file to enrich our metadata. Additionally, we added file format badges, such as those provided by FAIRSharing.org, to clearly communicate the data formats used.

■ Challenges encountered and addressed

One of the primary challenges we encountered during our FAIRness assessment was the limited functionality of the F-UJI tool, particularly with the requirements.txt test, which did not evaluate subfolders, making it difficult to comprehensively assess all dependencies in our repositories. Another issue arose when repositories with similar structures and documentation received different scores, causing inconsistencies in the evaluation process.

■ Impact

Our initiative to enhance the FAIRness of our repositories has transformed our approach to research software management. We have learned that having good metadata is essential, but it must be effectively shared to ensure



machine interoperability. This realisation has prompted a re-evaluation of how we structure and publish metadata across all projects. Looking ahead, we anticipate that these improvements will greatly enhance our management of research software's FAIRness within our team and throughout the organisation. Our participation in the National Research Data Infrastructures (NFDI) initiatives, particularly the working group on [Research Software Metadata](#), the [Base4NFDI nfdi.software](#) project, and the consortium [NFDI4DataScience](#), will allow us to share insights with the broader NFDI community, raising awareness and improving the FAIRness of software produced by various consortia. Additionally, by advancing our understanding of FAIRness, we aim to enhance semi-automatic metadata extraction and enrichment aligned to the [machine-actionable Software Management Plans metadata schema](#).

During this call, we implemented several changes manually to our repositories, from adding machine-readable tags with metadata to depositing our repositories in external registries like Software Heritage and adding new file formats to deposit our metadata like codemeta. In our efforts to keep using the lessons we learned during this call, we aim to make some of the changes above automatically, by using Continuous Integration pipelines and metadata extraction tools.

■ ■ ■ Key messages

The first step before using any automated tools is to understand which are the principles behind it. In the case of F-UJI, it is crucial to read and understand the FRSM so that the score can be put into context, otherwise, one can get discouraged by it. In some cases, the score is a reflection of the things that are lacking in the evaluated repository, in others due to the limitations that the tool has right now to identify other ways in which a specific metric can be complied with.





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