Draft Amsterdam Declaration on Funding Research Software Sustainability

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Introduction

The crucial role of software in research is becoming increasingly apparent, as is the urgent need to sustain it and to invest in the people who develop and maintain it. Research software sustainability is vitally important for the reproducibility of research outcomes and has a direct bearing on the process of research, including the efficient use of financial and human resources.

Funders can play a crucial role in ensuring software sustainability by structurally supporting it. Over the past few years, a variety of methods for sustaining research software have been explored, including improving and extending funding policies and instruments. During an international workshop held on 8-9 November 2022 in Amsterdam, funding organizations joined forces to explore how to effectively contribute to making research software sustainable. This resulted in the Amsterdam Declaration on Funding Research Software Sustainability.

The Declaration builds on actions undertaken by the Research Software Alliance, research funding organizations, and the community surrounding it to develop awareness about the role funders can play in sustaining software in the longer term. The Declaration is a first step to formalize, on a global level, the basic principles and recommendations related to funding the sustainability of research software, including the people needed to achieve this goal.

For the purpose of this declaration, research software is defined as: "Source code files, algorithms, scripts, computational workflows and executables that were created during the research process or for a research purpose. Software components (e.g., operating systems, libraries, dependencies, packages, scripts, etc.) that are used for research but were not created during or with a clear research intent should be considered software in research and not Research Software. This differentiation may vary between disciplines."[1]

Research software may or may not be open-source software, while not all open-source software is research software. The reusability of research software is essential to its sustainability. Reusability ultimately depends on people, who need to have the skills to enable reusability and be incentivised to do so; infrastructures, which need to exist to support the discoverability of research software to facilitate reuse; and funding and policies, which are needed to encourage reuse.

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[1] Barker, M., Chue Hong, N.P., Katz, D.S. et al. Introducing the FAIR Principles for research software. *Sci Data* **9**, 622 (2022). https://doi.org/10.1038/s41597-022-01710-x

The signatories of the Amsterdam Declaration on Funding Research Software Sustainability support the adoption of the following principles and practices.

Principles
1. Research software is critical to research and to the impact of research on society.
2. Sustainable research software is vital to the reproducibility of research outcomes in all disciplines that use computing, notwithstanding disciplinary differences. Therefore, research software should be sustained for a reasonable period after research outcomes are produced.
3. Sustainable research software improves the progress of research, including by the efficient use of financial and human resources.
4. Research software sustainability requires collaboration between public and private partners on a global scale because research software is embedded in larger webs of dependencies – of software, infrastructure, expertise – that exceed institutional and national boundaries.
5. The shelf life of research software, and therefore its sustainability, is relative to the pace of technological development, the robustness of underlying dependencies and the needs of researchers.
6. Research software should adhere to open-science standards as much as possible. Open science (as defined by UNESCO[2]) promotes reuse, reproduction, transparency, and verification of scientific results; and research software enables key aspects of open science.
7. A crucial factor in research software sustainability is reusability. This means that software is made to be more generally applicable and reusable across disciplines whenever possible. Reusability depends on technology (good engineering), expertise (training), and social trust.

Recommendations
1. Funding agencies should explicitly address the discrepancy between research software as an outcome of temporary (project) funding and the continued need for research software as a research instrument after the project has ended.
2. Funding agencies should encourage reusing and improving existing software instead of creating new software whenever possible.
3. Funding agencies should consider the value and impact of research software as a research output in its own right and therefore define and implement appropriate reward and recognition measures for all people involved in the creation and sustainability of it.
4. Funding agencies should encourage the use of appropriate metrics to assess the degree of permanence, reusability, and impact of research software.
5. Funding agencies should encourage responsible citation practices and the provision of information about the specific contributions of each author to a specific piece of research software.
6. Funding agencies should broaden their open science policies to include open research software and the sustainable management of research software.

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[2] UNESCO Recommendation on Open Science, UNESCO, 2021, https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en

7. Funding agencies should support funding mechanisms or research programmes that include elements aimed at supporting and training research and support staff to be able to meaningfully contribute to the creation, use and maintenance of sustainable research software.
8. Funding agencies should support the inclusion of both research and support staff as part of research projects when it promotes software sustainability.
9. Funding agencies should support the hiring and funding of those who can sustain research software.
10. Funding agencies should acknowledge the importance of and encourage the creation of communities that support research software.

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Science Granting Councils Initiative
Simons Foundation
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