Check for updates

OPEN LETTER

Establishing a national research software award

[version 1; peer review: 2 approved]

Isabelle Blanc Catala[1], Roberto Di Cosmo[2], Mathieu Giraud[3], Daniel Le Berre[4], Violaine Louvet[5], Sophie Renaudin[6], College of experts for source code and software Committee for Open Science

[1]Ministère de l'Enseignement supérieur et de la Recherche, F-75000 Paris, France
[2]Inria, Université Paris Cité, F-75000 Paris, France
[3]Univ. Lille, CNRS, Centrale Lille, UMR 9189 CRIStAL, Centre de Recherche en Informatique Signal et Automatique de Lille, F-59000 Lille, France
[4]Univ. Artois, CNRS, UMR 8188, Centre de Recherche en Informatique de Lens, F-62300 Lens, France
[5]Univ. Grenoble Alpes, Grenoble INP Institute of Engineering, CNRS, UMR 5224 LJK, Laboratoire Jean Kuntzman, F-38000 Grenoble, France
[6]Direction de la recherche clinique et de l'innovation, Assistance Publique - Hôpitaux de Paris, F-75000 Paris, France

v1 **First published:** 25 Oct 2023, **3**:185
https://doi.org/10.12688/openreseurope.16069.1
Latest published: 25 Oct 2023, **3**:185
https://doi.org/10.12688/openreseurope.16069.1

Abstract

Software development has become an integral part of the scholarly ecosystem, spanning all fields and disciplines. To support the sharing and creation of knowledge in line with open science principles, and particularly to enable the reproducibility of research results, it is crucial to make the source code of research software available, allowing for modification, reuse, and distribution.

Recognizing the significance of open-source software contributions in academia, the second French Plan for Open Science, announced by the Minister of Higher Education and Research in 2021, introduced a National Award to promote open-source research software. This award serves multiple objectives: firstly, to highlight the software projects and teams that have devoted time and effort to develop outstanding research software, sometimes for decades, and often with little recognition; secondly, to draw attention to the importance of software as a valuable research output and to inspire new generations of researchers to follow and learn from these examples.

We present here an in-depth analysis of the design and implementation of this unique initiative. As a national award established explicitly to foster Open Science practices by the French Minister of Research, it faced the intricate challenge of fairly evaluating open research software across all fields, striving for inclusivity across domains, applications, and participants. We provide

Open Peer Review

Approval Status ✓ ✓

	1	2
version 1 25 Oct 2023	✓ view	✓ view

1. **Karthik Ram**, University of California Berkeley, Berkeley, USA

2. **Jesús M. González Barahona**, Universidad Rey Juan Carlos, Móstoles, Spain

Any reports and responses or comments on the article can be found at the end of the article.

a comprehensive report on the results of the first edition, which received 129 high-quality submissions. Additionally, we emphasize the impact of this initiative on the open science landscape, promoting software as a valuable research outcome, on par with publications.

Plain language summary
Software is crucial for modern research. For the goals of open science, reproducibility, and wider reuse, sharing software source code and acknowledging software development are essential. In France, in 2021, the Minister of Higher Education and Research introduced the National Plan for Open Science.

The plan highlights the role of open-source software in academia and aims to give software the same recognition as publications and data. A part of the plan is the introduction of a National Award to recognize open-source research software contributions. This award acknowledges software projects and their teams, which have often worked without much recognition. It also emphasizes the importance of software as a research output, hoping to inspire future researchers.

This article examines the award's design and implementation. It addresses the challenges of assessing open research software from different research fields. In the first edition of the award, there were 129 high-quality submissions, indicating the award's potential to shift perspectives on software's role in open science, aligning it with the importance of academic publications. Through a detailed account of our experiences and the insights gained, we aim to provide a reference for other countries or institutions considering to establish similar recognitions.

Keywords
open science, research software, open-source software, software engineering, research policy, institutional support, research infrastructure, research assessment, knowledge sharing



This article is included in the Software gateway.



This article is included in the Horizon Europe gateway.

Corresponding authors: Roberto Di Cosmo (roberto@dicosmo.org), Mathieu Giraud (mathieu.giraud@univ-lille.fr)

Author roles: Blanc Catala I: Conceptualization, Supervision, Writing – Review & Editing; **Di Cosmo R**: Supervision, Writing – Original Draft Preparation, Writing – Review & Editing; **Giraud M**: Conceptualization, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Le Berre D**: Conceptualization, Data Curation, Formal Analysis, Investigation, Supervision, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Louvet V**: Conceptualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Renaudin S**: Conceptualization, Writing – Original Draft Preparation, Writing – Review & Editing;

Competing interests: No competing interests were disclosed.

Grant information: Roberto Di Cosmo's contribution to this work has been partially funded under EU Horizon grant number 101057344 (Expanding FAIR Solutions across EOSC [FAIR-IMPACT]).
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Copyright: © 2023 Blanc Catala I *et al*. This is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

How to cite this article: Blanc Catala I, Di Cosmo R, Giraud M *et al.* **Establishing a national research software award [version 1; peer review: 2 approved]** Open Research Europe 2023, **3**:185 https://doi.org/10.12688/openreseurope.16069.1

First published: 25 Oct 2023, **3**:185 https://doi.org/10.12688/openreseurope.16069.1

Introduction

The development and diffusion of software has become a crucial part of the scholarly ecosystem[1], and the latest version of the French Open Science Monitor[2] now provides compelling evidence that software using and sharing span across all fields and disciplines (Figure 1).

Software is not merely a tool, but a form of *executable knowledge* that is written by humans for humans, in the form of software source code, and later turned into *executable code* for machines. The importance of software in research cannot be overstated: it enables scientists to perform complex simulations, data analysis and modeling. The precision of software source code in implementing and describing data generation and collection, analysis, visualization, transformation, and processing cannot be matched by scholarly articles alone. As stated in the French policy on data, algorithms and open source[3] and the Second National French Plan for Open Science (PNSO2)[4], "software plays a key role in scientific research, as it is both a tool, a result, and a subject of study. Making software source codes available, with the ability to modify, reuse, and distribute them, is a major challenge to allow the reproducibility of scientific results and to support the sharing and creation of knowledge in an open science approach."

To address this challenge, proper mechanisms need to be put in place to ensure the preservation and referencing of software source code[5,6], as well as build awareness about the complexity of supporting reproducibility[7,8], and provide proper training for researchers and engineers. In recent years, with growing awareness of the relevance of software in research, we have seen a variety of initiatives focused on software in academia: translations for software of basic principle designed for data description like FAIR[9,10] or data citation[11]; publications of software descriptions[12,13], or reproducible research[7,14]; indexing software relevant to specific disciplines[15,16].

In parallel with these efforts, it is of paramount importance to promote software development as a valuable research activity, and research software as a key enabler for Open Science/Open Research, recognizing in the careers of academics their contributions to high quality software development. This was stated in the November 2018 Paris Call on Software Source Code[17], and clearly put forward in the agreement on reforming research assessment published on July 20, 2022[18]. This is still a challenge today[1]: Promoting software development is not an easy task, due to the many kinds of software projects and the broad varieties of expertise involved[19]. Designing, coding, debugging, maintaining, documenting, testing, support, and management, are activities that require *specific skills*, ranging from scientific and technical knowledge, to community building and management, to writing and maintaining documentation that facilitates the use and appropriation of software.

An award to advance recognition of research software

For all these reasons, a proper integration of software contributions in the evaluation of the research outcomes of individuals and institutions will take time, but it is important to start the process. As one of the means to advance the recognition of software as a research outcome on par with publications, the French Ministry of Research decided in 2021 to establish a national Open Science award for research software. Awarded since 2022, the *Prix Science Ouverte du Logiciel Libre de la Recherche* draws the scientific community's attention to exceptional achievements as well as to the most promising ones, giving visibility to software that can serve as a model for future generations of scientists[2].

This initiative is different, in many respects, from other software awards that were established a long time ago in specific research fields, some of the most prestigious ones being the ACM Software Systems award[20], the ACM Programming Language Award in Computer Science and the Gordon Bell prize[3] or dedicated software competitions[21].

[1] While in some disciplines and some countries the contributions of software developers are taken into consideration by institutional authorities[19], other countries ignore completely software development in the evaluation process for researchers.

[2] https://www.ouvrirlascience.fr/

[3] There are also a few other awards specifically for Free Software[22] or Open Source[23], for specific institutions[24], or specific fields in a discipline[25].

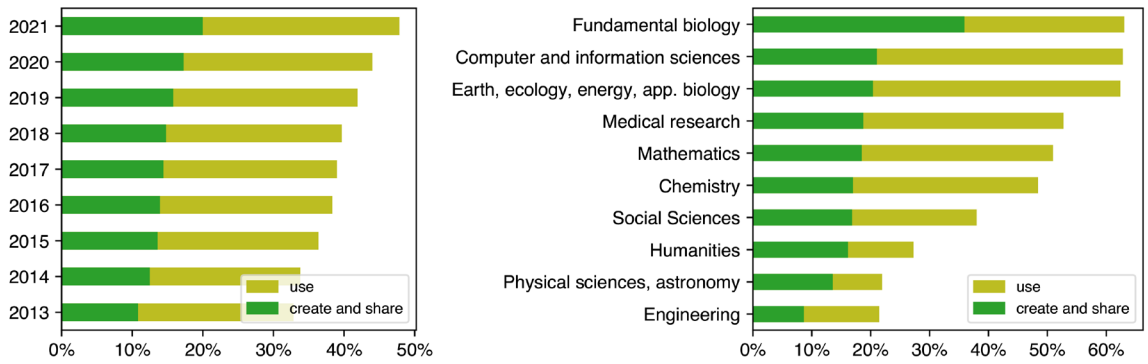

Figure 1. Software use and creation/sharing mentioned in French research articles by year (left), and, in 2022, by domain (right). Data from 2.

Focused explicitly on research software, the award we present here is set in the framework of Open Science, thus it only considers software that is distributed as open source. Being cross-disciplinary, it explicitly recognizes the many facets of software contributions that go beyond the technical and scientific ones[4]. Sponsored by the Ministry of Higher Education and Research in France, its scope is restricted to software created or improved at the national level.

As such, it comes with specific challenges, and this article provides an in-depth view of the way this award has been designed and set up, a report on the results of the first edition in 2022 and the updates for the 2023 edition, as well as the lessons learned from the intense work that involved a significant number of experts from a variety of domains. We believe that this will provide a solid basis for establishing other national or international awards for research software. In the following, we discuss the institutional promotion of open research software, we present the steps taken in setting up this national prize, especially to ensure diversity in the awarded projects, and we report on the first edition of the prize.

Establishing a national award

The National Open Science Research Software Award can act as a positive incentive for research institutions to promote and support software development and dissemination that benefit a wide scientific audience. From a research institution perspective, a national award is relevant for a plurality of objectives:

- *Identification of software production.* Research software has traditionally been difficult to track for research administration, and currently, limited resources are dedicated to software management, especially outside the software engineering or computer science communities. The call for applications for the award is an opportunity for the administration to engage with their research teams and learn about the software being developed across their organizations.

- *Opportunity for technology transfer.* A software award can foster collaboration within academia and partnerships with developer communities, and non academic actors locally or internationally.

- *Recognition and visibility of faculty.* Awards can have a significant impact on the visibility of authors and teams, leading to increased collaborations, but also to increased citations and recognition of their expertise.

- *Visibility of the institution.* Highlighting the achievements of research teams can raise the institution's profile in the scientific community, contributing to talent retention and attraction. It can also be used as leverage to attract more funding for software projects.

[4] Sometimes, a software system may have high scientific value but lack strong software engineering skills, as was put on the limelight with a simulation software for the COVID-19 pandemic (link).

Defining research software

A key preliminary step in this endeavour is to define precisely which software falls in the scope of the award. As a first step, we focus on *research software*. This is software designed, maintained, and/or used by scientists and/or research institutions. It is developed to meet a specific need of science, hence it results from research work and/or enables scientific work, which is notably valued by publications before/on/around/with the software. We acknowledge the broad variety of forms that software can take: standalone and/or in interaction within an ecosystem, a platform, middleware, or a library, module or plugin of another software. Furthermore, to be eligible for an Open Science award, research software should be licensed as *free and open source software*, typically under one of the licenses approved by the Open Source Initiative[5]. The "gray zone" for the status of some projects will be discussed below.

Challenges and solutions in establishing the award

Establishing a *national* prize designed to take into account the *diversity* of software contributions *aligned with the Open Science vision* and *across all disciplines* turned out to be a far from trivial task. In this section, we report the main challenges and the solutions that have been retained to address them.

Delimiting the national scope. Supported by the French Ministry of Higher Education and Research, the prize is intended to be *national*. It aims to highlight research software which has been supported by a French university or research institute. In practice, eligibility had to be assessed using several criteria. To be eligible, a software should have been initiated or should have received a strong contribution to its development from a French institution. As such, software maintained by an international community is eligible provided it can demonstrate that kind of support. In particular, it was decided that a research software developed during a PhD or postdoc in France can be submitted by its author even if they no longer are affiliated to a French institution. The submission itself should be endorsed by one of the active developers of the software. This scope had a significant influence on other topics, particularly on domain diversity, as discussed below.

Taking into account software diversity: Development practices. Research software is often developed by researchers who are *not* professional software engineers. Even researchers in computer science may specialize in theoretical or modeling aspects rather than software development. While software engineering domains are expected to apply state-of-the-art practices, other domains may not follow these practices. For example, the Covid-sim C++ source code was deemed sound and correct as a simulator despite not being received well by software engineers[26]. Non-professional software developers may also become expert developers in their research area.

[5] The OSI-approved licenses are available at https://opensource.org/licenses/

To take this diversity of practices into account, it is crucial to refrain from looking at research software only through the software engineering lens. Promoting good software engineering practices is important as they are necessary skills for producing good quality code, but this must not be a hard requirement for the award.

Taking into account software diversity: Maturity. Some research software have been developed for decades, while others are very new, for example a prototype written during a PhD thesis. Some software have institutional support and significant resources for their development, others are supported by a large international community, while the remaining ones are maitained by a few, or just one, individuals without any particular help. A direct comparison of the research software with the above criteria often favor established projects with institutional support, but the committee aimed to consider the challenges and achievements of smaller and more recent projects as well. As such, the achievements of a software was related to the resources available.

As will appear in the Results section, the vast majority of the submissions in 2022 corresponded to software started between 2005 and 2019 (96 out of 129). Nevertheless, 46 submissions were recent (started after 2015), which corresponds to the rise of Open Science. However, it was quite difficult to compare those young software against mature and well-established ones, especially in the first edition of the prize: submissions of mature software denoted software that "survived" more than a decade of research (often two decades, three decades for the oldest). Those software have built a strong community, opened dedicated research directions which made them *de facto* eligible in all categories. As such, in 2023, the jury also has the possibility to award in each category an *emerging software* to recognize promising recent software (less than five years old).

Dealing with the open-source gray area. To be in accordance with the Open Science vision, research software should be licensed as *free and open source software* to be eligible. This property should be easy to check, by just looking at the licence. In practice, there are more complex situations. Some significant research software have started to be developed before the free and open source licenses were published, and never added a license afterwards since it would require much effort to contact all contributors to do so. Some other projects, despite being more recent, are made available without a license. The submission process, which requires selecting an open source license, incites the software development team to take into account that important aspect. It may be the case that the software itself is open-source, but requires a proprietary platform to be executed (think *e.g.* of Matlab scripts), or that some parts of the software may not be open-source (*e.g.* in an industrial context). Generally speaking, while it is essential that the scientific output should be as open as possible, it was decided to have the largest definition as possible of openness, *i.e.* even within closed ecosystems, to promote reproducibility and enable others to build upon such research.

Awarding community. Software is often not developed by a single person, and the prize wishes to also recognize the role of the community behind the software. The prize is thus not awarded to individuals but to the software and the research effort itself. It is worth noting that individuals with short-term contracts such as PhD students, post-doctoral fellows, and engineers often make key contributions to research software, and may even build them from scratch. They may have left their research institution or even a research career when the software is mature or well-recognized enough to win the prize. We believe that in all cases, the fact that the software they contributed to is distinguished will help them for their career.

Defining the award categories. The broad spectrum of research software led us to consider initially several other categories, such as "societal and economic impact", but it was finally decided to keep the framework simple, with only three categories: *scientific/technical*, *documentation*, and *community*.

These categories are very broad and are intended to highlight different aspects of research software. The first one aims to showcase successful research results implemented in software or obtained with software. The second one focuses on the importance of the documentation of the software, both from a user and a developer perspectives. The last one highlights the ability to build and sustain a community of developers, maintainers, and/or users around the software.

A special Jury Prize allows the jury to distinguish remarkable research software from a different perspective than the previous categories. Starting in 2023, submissions may specify one or several award categories, but the committee may reassign some software to other categories.

Composition of the committee. Considering all of the above, it is essential to convene a committee that is not only legitimate but also has a broad spectrum of expertise and sensibility. To achieve this goal, the committee[6] included members from various research areas, both from academia and industry, as well as from the open-source community. Some of these members had extensive knowledge of research software in their respective domains, which was essential to contextualize the submissions.

Evaluation criteria. The criteria considered by the committee apply to the application itself. This includes clarity, writing quality, completeness, number of developers, relevance for research, and publications around it, assessment of academic, societal, and industrial impact, number of software citations, community organization, and user and developer documentation. Furthermore, the criteria also apply to public information obtained directly from the project's website or code repository, such as the activity of the source code repository, contributors, issue tracking, and forks. Although not all

[6] The committee's composition is available at https://data.enseignementsup-recherche.gouv.fr/explore/dataset/ fr-esr-jury-prix-science-ouverte/table/

submissions used a source code repository, this information was helpful to break ties among comparable projects.

The concept of community was also discussed. Some software may have a pure research community, while others may have an impact on the socio-economic world, with varied contributions (code, extensions, tutorials, books, consortiums, organizations). The organization of events (workshops, conferences, meetings) to animate the user or contributor communities has also been taken into account. It is worth noting that research software may require very specific knowledge to understand its inner details, which can limit the number of people who can effectively contribute to the code. However, this does not prevent them from being widely used and building a dedicated (and sometimes large) user community.

Open science awards ceremony. The main goal of the prize is to recognize and showcase the exceptional quality of the teams behind the research software, and not just to provide a monetary reward, which can be negligible compared to the positive impact that the award may have on the project's ability to secure additional funding. During a public ceremony, the Minister of National Education and Research awarded a trophy to each project laureate (see Figure 3).

Results and discussion

The first edition of the National Open Science Research Software Award was held in 2022, with 129 complete submissions received. The submissions were of a very high quality, demonstrating the impact that high-quality research software can have. Since this was the first edition of the prize, the jury had some freedom to develop the award selection process, that is now better formalized for the 2023 edition.

A diversity of submissions

Very mature software were submitted, among which some initiated in the 80's, while many submissions were much more recent (2018–2021, Figure 2a). While many applications come unsurprisingly from computer science and mathematics, the remaining ones come from a wide variety of domains, including humanities (Figure 2b, see end of section).

The vast majority (94%) of submissions used OSI-approved licenses (Figure 2c). They include the GNU GPL (49 submissions, including 35 in GPLv3/GPLv3+), LGPL, and MIT, as well as the French CeCILL licenses, particularly the CeCILL(-A) variant, which is compatible with the GNU GPL.

The nature of the software itself has implications in the way it had to be evaluated (Figure 2c). For instance, libraries are often more easily reusable than standalone software. Additionally, there is a greater chance of having contributors for a library since it is primarily aimed at developers. This is also generally true with software for a computer science audience compared to software used in other scientific domains. Libraries also generally benefit from standardized documentation and distribution channels depending of the language used, which can also favor their adoption. Another important aspect is the target audience of the software. Some are specifically addressed to their scientific community; others make some results accessible in other research areas or outside academia. Those different audiences lead to different documentation requirements and community management. It should also be noted that some of the submitted software were designed to support data collection and manipulation, rather than results production. Both are valuable. However, for the purpose of this award, the jury focused solely on software that contributed to results production.

Award process

In the initial screening, each submission was reviewed by three members of the committee. Each member provided a feedback on each submission: *strong support*, *support*, *do not support*. All submissions that received at least two *strong support* were considered eligible to an award. Those 40 submissions were then reviewed by all other members of the committee. The submissions were classified by scientific domain in comparable software sets. The most promising software in each set were selected, which ended up in 15 very different, not easily comparable software.

The final ranking was obtained from that selection of 15 software, by awarding a software in each category (4), and providing an honorable mention to some remaining remarkable software in each category (6). With 10 laureates, the committee believes they reached the goal of awarding software from diverse scientific domains, diverse institutions, with diverse practices. These 2022 awards cover a variety of fields, including fondamental topics such as proof assistance[7], machine learning[8], multi-agent systems[9], as well as more applied topics such as routing in computer architecture[10], computer music[11], astrophysics[12], bioinformatics[13], brain-computer interfaces[14], seismology and volcanology[15], and linguistics[16].

Conclusion and perspectives

In the past, several awards have been established to recognize remarkable software projects within specific disciplines, communities, or organizations. However, the aim of a National Open Science Research Software Award is distinct: it serves to acknowledge and incentivize the development of high-quality research software across all disciplines, and to establish software development as a research output on par with publication. The creation of the "Prix Science Ouverte du Logiciel Libre de la Recherche" posed challenges due to the diverse scientific domains and practices involved in conceiving, developing, documenting, and distributing research software while also fostering a community. The submissions

[7] https://coq.inria.fr
[8] https://scikit-learn.org
[9] https://gama-platform.org
[10] http://coriolis.lip6.fr
[11] https://faust.grame.fr
[12] https://gammapy.org
[13] https://vidjil.org
[14] http://openvibe.inria.fr
[15] https://ipgp.github.io/webobs
[16] https://sppas.org

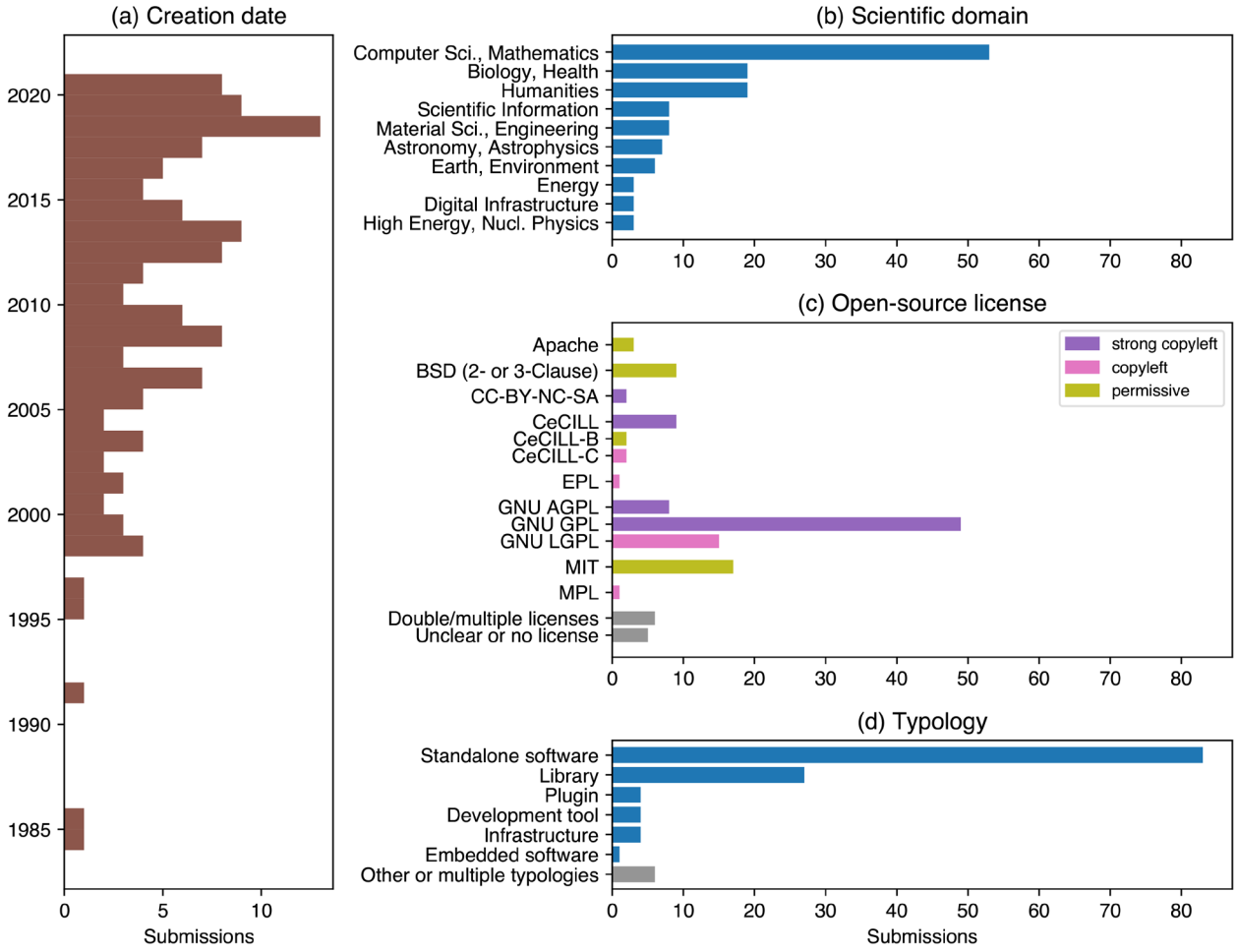

Figure 2. The 129 submissions to the first edition of the "Prix Science Ouverte du Logiciel Libre de la Recherche", in 2022, show a variety of maturity, domains, licenses, and software typologies. Note that, in 2022, the scientific domains of the submissions was not given by the applicants but inferred from the submissions.

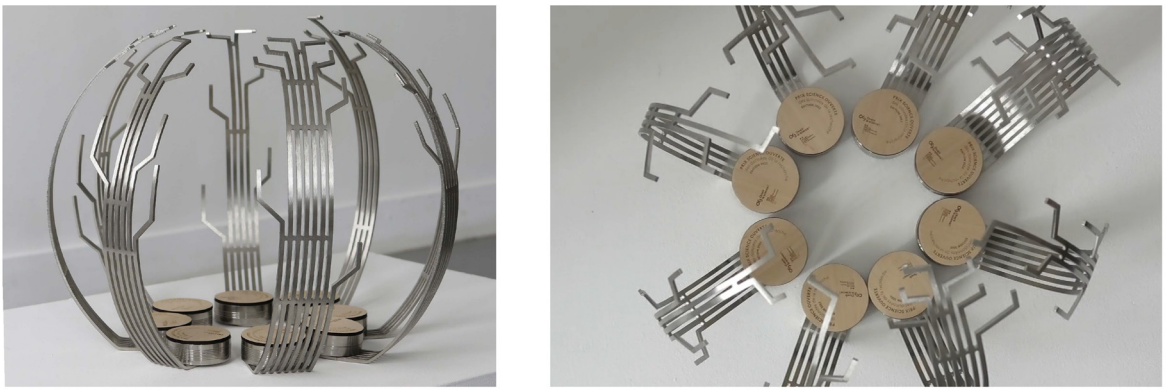

Figure 3. The award trophies were designed by Alix Nadeau, Rose Vidal, Hugo Bijaoui, and Lorris Sahli, who are students at the École des Arts décoratifs (Paris). The trophies symbolize how collaboration through open code and data can improve science outreach. Each trophy has a unique shape, and the designs and code used to produce them are open-licensed (https://github.com/LorrisEnsad/Trophee_OpenScience), reflecting the principles of open science that the award seeks to promote.

and awardees of the first edition demonstrated the variety of software that aligns with the Open Science vision.

In France, this award is endorsed by the Ministry of Higher Education and Research, which organizes it annually following the seminal 2022 edition. Promoting open-source software at the institutional level will enhance the reproducibility of scientific results and support the sharing and creation of knowledge within an open science framework. We are delighted to see that an award has already been announced in Australia in 2023[17]. We now encourage institutional stakeholders worldwide to replicate this initiative, freely building on the model and experience described here.

Data and software availability

Underlying data

Recherche Data Gouv Dataverse: Données anonymes concernant les candidatures au premier prix science ouverte du logiciel libre de la recherche, https://doi.org/10.57745/HN6O85

For each of the 129 submissions, this dataset includes metadata on the start date of development, programming language(s), license(s), and scientific domain. Personal information was removed. Data are available under the terms of the Etalab Open License 2.0.

Acknowledgements

We thank all the applicants to the award, the committee members of the 2022 award (François Elie, Stéfane Fermigier, Christine Gaspin, Martin Grandjean, Alexis Kauffmann, Daniel Le Berre (chair), Lucas Nussbaum, Guillaume Plique, Viviane Pons, and Stéphane Popinet), and Sandrine Blazy who will be the chair of the 2023 committee. We thank the members of the "Collège Codes sources et logiciels du Comité pour la Science Ouverte" (Florent Chuffart, Mélanie Clément-Fontaine, Ludovic Courtès, Sébastien Gérard, Mathieu Giraud, Timothée Giraud, Jean-Yves Jeannas, Nicolas Jullien, Daniel Le Berre, Violaine Louvet, Camille Maumet, Clémentine Maurice, Grégory Miura, Raphaël Monat, Sophie Renaudin, Nicolas Rougier, François Sabot, Sylvie Tonda-Goldstein, and Samuel Thibault). We finally thank Alix Nadeau, Lorris Sahli, Rose Vidal, Hugo Bijaoui, and their teacher Martin De Bie for the design of trophees.

[17] https://ardc.edu.au/article/enter-ardc-eureka-prize-for-research-software/

References

1. French Ministry of Higher Education and Research: **Open science monitor.** March, 2023.
Reference Source
2. Van Noorden R, Maher B, Nuzzo R: **The top 100 papers.** *Nature.* 2014; **514**(7524): 550–553.
PubMed Abstract | **Publisher Full Text**
3. French Ministry of Higher Education and Research: **French policy on data, algorithms and open source.** March, 2021.
Reference Source
4. French Ministry of Reseach and Higher Education: **Second National Plan for Open Science.** 2021.
Reference Source
5. Di Cosmo R: **Archiving and referencing source code with Software Heritage.** In: *ICMS*, of *Lecture Notes in Computer Science.* Springer, 2020-07-15, 2020; **12097**: 362–373.
Publisher Full Text
6. Di Cosmo R: **Building the software pillar of Open Science.** In: *Open Science European Conferencem (OSEC 2022).* OpenEdition Press, 2022-01-01, 2022; 183–193.
7. Rougier NP, Hinsen K, Alexandre F, *et al.*: **Sustainable computational science: The ReScience initiative.** *PeerJ Comput Sci.* 2017; **3**: e142.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
8. Benureau FCY, Rougier NP: **Re-run, Repeat, Reproduce, Reuse, Replicate: Transforming Code into Scientific Contributions.** *Front Neuroinform.* 2018; **11**: 69.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
9. Wilkinson MD, Dumontier M, Aalbersberg IJJ, *et al.*: **The FAIR Guiding Principles for scientific data management and stewardship.** *Sci Data.* 2016; **3**: 160018.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
10. Lamprecht AL, Garcia L, Kuzak M, *et al.*: **Towards FAIR principles for research software.** *Data Science.* 2020; **3**(1): 37–59.
Publisher Full Text
11. Smith AM, Katz DS, Niemeyer KE, *et al.*: **Software citation principles.** *PeerJ Comput Sci.* 2016; **2**: e86.
Publisher Full Text
12. Smith AM, Niemeyer KE, Katz DS, *et al.*: **Journal of Open Source Software (JOSS): Design and first-year review.** *PeerJ Prepr.* 2018; **4**: e147.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**
13. Schloss Dagstuhl Leibniz-Zentrum für Informatik GmbH: **Dagstuhl Artifacts Series (DARTS).** 2015.
Reference Source
14. Colom M, Kerautret B, Krähenbühl A: **An Overview of Platforms for Reproducible Research and Augmented Publications.** In: Bertrand Kerautret, Miguel Colom, Daniel Lopresti, Pascal Monasse, and Hugues Talbot, editors, *Reproducible Research in Pattern Recognition.* Springer International Publishing, Cham, 2019; **11455**: 25–39.
Publisher Full Text
15. Greuel GM, Sperber W: **swmath - an information service for mathematical software.** In: Hoon Hong and Chee Yap, editors, *Mathematical Software - ICMS 2014.* Springer Berlin Heidelberg, 2014; 691–701.
Publisher Full Text
16. Allen A, Berriman GB, DuPrie K, *et al.*: **The Astrophysics Source Code Library: What's New What's Coming**. In: Pascal Ballester, Jorge Ibsen, Mauricio Solar, and Keith Shortridge, editors, *Astronomical Data Analysis Software and Systems XXVII, volume 522 of Astronomical Society of the Pacific Conference Series*. 2020; **522**: 731.
Publisher Full Text
17. **Paris Call: Software Source Code as Heritage for Sustainable Development**. UNESCO Expert group meeting, 2019.
Reference Source
18. Coalition for Advancing Research Assessment: **Agreement on reforming research assessment**. July, 2022.
19. Alliez P, Di Cosmo R, Guedj B, *et al.*: **Attributing and Referencing (Research) Software: Best Practices and Outlook From Inria.** *Comput Sci Eng.* 2020; **22**(1): 39–52.
Publisher Full Text
20. Association for Computing Machinery: **ACM Software System Award**. 1983.
Reference Source
21. Free Software Foundation: **Award for the Advancement of Free Software**. 2005.
Reference Source
22. Wikipedia: **O'Reilly Open Source Award**. 2005.
Reference Source
23. NASA: **Software of the year award**. 2005.
Reference Source
24. ACM SIGGRAPH: **Computer Graphics Achievement Award**. 1983.
25. Sutcliffe G: **The CADE ATP System Competition - CASC.** *AI Magazine.* 2016; **37**(2): 99–101.
26. Wooldridge M: **The software that led to the lockdown**. July, 2020.
Reference Source

Open Peer Review

Current Peer Review Status: ✔ ✔

Version 1

Reviewer Report 24 November 2023

https://doi.org/10.21956/openreseurope.17349.r35882

© **2023 González Barahona J.** This is an open access peer review report distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

✔ **Jesús M. González Barahona**
Universidad Rey Juan Carlos, Móstoles, Community of Madrid, Spain

The article presents the experience of running the French National Award to promote open-source research software. It discusses its rationale, in the context of the recognition of the importance of free, open source software (FOSS) for open science, the details of how it was targeted, and the software that applied for it evaluated, and a brief analysis of the projects presented to the first edition of it.

I really enjoined reading the article. I find the initiative very interesting in the context of the recognition and promotion of open science practices, and the fact it is described in such detail helps a lot to understand it, and to reproduce it in other contexts.

The rationale for the described initiative is well described, with good detail, and put in context appropriately.

The article is not much about opinions, but mostly about facts, See below, in "other comments", for some aspects that could be discussed in some more detail, but in general I see only a few opinions, and when presented, they are adequately put in the context of the facts that raised them.

To my knowledge, factual statements are correct and supported. In this case, they are usually not supported by citations, but by facts (related to the design and execution of the process for granting the awards).

The article is well written and easy to read, and the language is accessible.

The article does not discuss in depth next steps and recommendations. Given the uniqueness of the initiative described, and its importance, this is the only drawback that I find in the article. I encourage authors to describe the lessons they learned (some of them are mentioned briefly as changes for the 2023 edition), but also how do they think the award could evolve in the future, how the initiative could be transplanted to other realms (other countries, or international awards

of the same kind, for example), and in general, next steps that they may recommend, after their experience with the award, in the field of recognizing the importance of FOSS in open science.

All in all, I find the article interesting, relevant and sound.

Some other comments. Most of them relate more to issues that I personally find interesting to discuss more than anything else. However, given the unique opportunity that authors had in considering these issues, having more details on these aspects could also be important for many other readers of the article.

* Abstract & plain language summary: "129 high-quality submissions". If this is the total number of submissions, maybe it is better to just write "129 submissions". Even if all of them were good, it is difficult to assess that all were high-quality except if that is backed by some fact (and likely, there is no need for the qualification at this point).

* Establishing a national award: "Recognition and visibility of faculty." Of course, I don't know if that was one of the objectives, but beyond recognition, I see opportunities for facilitating the evaluation of activities related to the production of research software as a research activity, which could be important for a more fair evaluation of research activities in the context of open science.

* Defining research software: "This is software designed, maintained, and/or used by scientists and/or research institutions. It is developed to meet a specific need of science,..." Maybe it would be interesting to have a more nuanced description of the definition. My guess is that the authors are considering software that is described by both sentences simultaneously, not either of them, But it is not clear from the text. If my guess is right, I would suggest a more explicit definition such as "Research software was defined as software fulfilling the following conditions: it is designed, maintained, and/or used by scientists and/or research institutions; it is developed to meet a specific need of science,..." In fact, since in different context "research software" is defined in different ways, this definition, if clear and detailed enough, could be a "canonical" definition, suitable for being used by others.

* Delimiting the national scope. Being FOSS so prone to international collaboration (specially if it succeeds), I may think that this condition could cause some problems in practice, and could for example make it difficult to award the work of French developers heavily involved in medium-large international FOSS projects, even if their contributions were similar or more important (in "absolute" value) than other relatively smaller contributions to software supported o originated by French institutions. Some discussions about the rationale of this delimitation (which seems mostly based on "institutional support" as opposed to "individual contribution") would be rather interesting, since similar problems could be found in other situations, and in any case, from a FOSS perspective, considering institutions above persons (if that were the case for this matter) could deserve an explanation. However, I understand that all of this likely arises from the problems of defining a national scope (which was needed due to the funding of the award), to many cases which are international by nature.

In fact, this matter could be a part of a deeper issue, which I don't find discussed in the article: the award seems to be targeted at "software", not at "people producing software". Even when that is of course a sensible decision (to visualize and recognize software instead of individual or group contributions), since both approaches could have been reasonable, the reasons for the specific

approach chosen could be worth some discussion in the article. I see this commented later in "Awarding community", "The prize is thus not awarded to individuals but to the software and the research effort itself." But this seems contradictory with the eligibility criteria, which, as I said, seems to be institution-driven.

* Dealing with the open source gray area. "it was decided to have the largest definition as possible of openness, i.e. even within closed ecosystems, to promote reproducibility and enable others to build upon such research." Nothing is said in this sentence about the software that lacked a license (which is described in the previous sentences). It would be interesting to know if such software was also considered, if it was required to decide on a license before being considered, and if not, how it was solved the problem that software without a license, can hardly be used and redistributed without some legal risk.

* Evaluation criteria. It is mentioned the importance of the community, and the distinction between development and user communities. It would be interesting to know how the importance of those communities was weighted, if there were some specific criteria for that. Since they really represent very different aspects of a software project, but are also related (for example, people in the user community may become people in the development community at some point).

If the jury used some kind of template for scoring, detailed criteria, or whatever, that would be a nice complement to the article, maybe as an annex, and would help for the reproducibility of the experience elsewhere.

* A diversity of submissions (and some other sections). The description of the projects seem to correspond only to the 2022 edition. Some parts of the article suggest that is the case, but since the 2023 edition is also mentioned, it would be worth making it clear.

* A diversity of submissions. "For instance, libraries are often more easily reusable than standalone software" I guess authors have in mind "reuse of the software as a component, in other software". However, "reuse" can also mean "reuse n some other research team than in the original team building the software". It could be interesting to complement this sentence explaining that the second kind of reuse, which is core in open science, is not more difficult to evaluate for standalone software (maybe it is easier, since the use of the software in those cases is more evident).

Is the rationale for the Open Letter provided in sufficient detail? (Please consider whether existing challenges in the field are outlined clearly and whether the purpose of the letter is explained)

Yes

Does the article adequately reference differing views and opinions?

Yes

Are all factual statements correct, and are statements and arguments made adequately supported by citations?

Yes

Is the Open Letter written in accessible language? (Please consider whether all subject-specific terms, concepts and abbreviations are explained)
Yes

Where applicable, are recommendations and next steps explained clearly for others to follow? (Please consider whether others in the research community would be able to implement guidelines or recommendations and/or constructively engage in the debate)
Partly

Competing Interests: I share participation in some boards (especially the IMDEA Software Board of Trustees, where I represent my University), with one of the authors (Roberto di Cosmo). I have also discussed matters related to FOSS with him, due to our coincidence in several forums related to FOSS during the last years, and our common interest in the matter. However, I didn't have previous notice of the paper, neither of the design or implementation of the award described in it. In my opinion, this relationship has had no influence on my review of the paper, which I did on its own merit.

Reviewer Expertise: Analysis of software development, free open source software, software analytics, XR data visualization

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 21 November 2023

https://doi.org/10.21956/openreseurope.17349.r35884

© 2023 Ram K. This is an open access peer review report distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Karthik Ram
University of California Berkeley, Berkeley, California, USA

Review of Establishing a national research software award

Summary:
"Establishing a National Research Software Award," authored by Isabelle Blanc Catala *et al* explores the critical role of software in academic research. The paper discusses the inception of a National Award for open-source research software in France, introduced as part of the French Plan for Open Science in 2021. This initiative seeks to acknowledge and promote exceptional research software projects and their teams, many of whom have made substantial contributions over the years with minimal recognition. Additionally, the award aims to highlight software as a key research output and to inspire future researchers in this field.

The article effectively outlines the establishment of this award, underscoring its significance.

Comments:

The abstract, plain language summary and introduction strongly emphasize the necessity of open-source software for reproducibility and broader reuse. While advocating for open-source research software, especially those funded publicly, is commendable, it is not a strict prerequisite for reproducibility. Merely providing binaries under an open license could suffice for reproducing and validating previous results. Therefore, I suggest that you refine this argument, underscoring that open-source software not only facilitates the examination of code for accuracy and building upon existing work but also supports reproducibility and reuse. For instance, open-source software, being freely available and modifiable, endures even if the original creators cease maintenance. The paper later adopts a more flexible stance on openness (bottom of page 6), so maintaining this perspective throughout would be consistent.

While the paper effectively narrates the importance of software in research and the rationale behind instituting a national award, it is somewhat lacking in detailing the review criteria and process. The Evaluation Criteria section (page 6) could benefit from more explicit information. For example, clarifying the metrics for assessing a software's community impact would add value. Is it possible to provide additional details about the evaluation rubric, or would that exceed the scope of this article?

An important aspect that seems overlooked is how the award's criteria might secondarily elevate the quality of software in France. Clear criteria for the award could incentivize software projects to adopt best practices, thereby improving their standards even if they don't win the award (e.g., "software projects made available without a license"). The award's existence alone could thus serve as a model for exemplary practices within the French research community.

The discussion could potentially expand on how the award might evolve based on learnings from this iteration. Are there any considerations regarding the future trajectory of the award, especially in light of the varying number of submissions across different fields?

Minor Suggestions:

Consider rephrasing the sentence: "The development and diffusion of software has become a crucial part of the scholarly ecosystem." A more straightforward and clear alternative could be: "The widespread development and adoption of software is increasingly integral to the scholarly ecosystem." This revision enhances clarity and simplicity.

Is the rationale for the Open Letter provided in sufficient detail? (Please consider whether existing challenges in the field are outlined clearly and whether the purpose of the letter is explained)

Yes

Does the article adequately reference differing views and opinions?

Yes

Are all factual statements correct, and are statements and arguments made adequately

supported by citations?
Yes

Is the Open Letter written in accessible language? (Please consider whether all subject-specific terms, concepts and abbreviations are explained)
Yes

Where applicable, are recommendations and next steps explained clearly for others to follow? (Please consider whether others in the research community would be able to implement guidelines or recommendations and/or constructively engage in the debate)
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Open source, open science, reproducible research, computational biology, global change biology, software sustainability

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Comments on this article

Version 1

Reader Comment 09 Feb 2024

Teresa Gomez-Diaz, Laboratoire d'informatique Gaspard-Monge, Not Applicable, France

Comments to Establishing a national research software award https://open-research-europe.ec.europa.eu/articles/3-185/v1 by Teresa Gomez-Diaz (CNRS/LIGM, France) and Tomas Recio (University Antonio de Nebrija, Spain)

As the authors of the references mentioned below, we would like to express our acknowledgment of this interesting French initiative that will undoubtedly help to build an Open Science ecosystem in which research software finds its right place as a research production.

This award will help to convey best dissemination practices [1,2] such as, for example, to put a free/open source license in the software before its dissemination. It will also help to increase the visibility of research software produced within French (research) institutions and establish research software models to be followed at, which will help to install and expand an Open Science culture.

It will also establish a model to be followed, which is already in its beginning pace with the Australian award mentioned at the end of this Open Letter.

On the other hand, we would also like to offer some comments on this Open Letter. We hope that

they can contribute to enrich the discussion on the involved subjects. Moreover, we think that these suggestions could also be useful for the authors to react to the referees' comments when they discuss and ask for more precision regarding both the concept of research software presented in the Open Letter, and the proposed evaluation criteria and steps.

[Definition of Research Software] In the 'Defining research software' section, it is stated: research software is software designed, maintained, and/or used by scientists and/or research institutions. It is developed to meet a specific need of science, hence it results from research work and/or enables scientific work, which is notably valued by publications before/on/around/with the software.

This definition is unclear as it seems to us that it does not delimit a precise subset of software, as software used by scientists and/or research institutions include many different layers of software at the very instant a scientist opens a computer or a phone for its every day work. Would every word processor, used to write scientific papers, qualify as research software? A much more precise definition would be something like: research software is software designed and developed by scientists to meet a specific need of science, hence it results from research work and/or enables scientific work, which is notably valued by the publication of the scientific results obtained with the software.

This means that the software that is qualified as research software is a product of the research work, coinciding thus with the research software definition provided in section 2.1 of [3].

The authors of the Open Letter should clarify the precise formula proposed for the research software concept and put it in perspective with the definition provided in [3]. We would like to remind here that much of the software developed by scientists or by research institutions is simply not maintained, then this qualification should be avoided in the definition, otherwise it will be gambling to define an almost empty set.

As not every software produced by scientists is disseminated as free/open source software, or simply disseminated, this should not be a characteristic that enters in the definition of research software, but in the software that is considered within the award context. As remarked by the first referee, this point could benefit of more insight about how it was dealt with the software without a license.

[Evaluation criteria] The first referee comments: * Establishing a national award: I see opportunities for facilitating the evaluation of activities related to the production of research software as a research activity, which could be important for a more fair evaluation of research activities in the context of open science. This point is also remarked by the second referee: The Evaluation Criteria section (page 6) could benefit from more explicit information. Which also coincides with the point: * Evaluation criteria of the first referee.

We also agree with both referees, and this presentation of the French national research software award will gain in interest if the evaluation criteria could be disclosed. Among other benefits, it will provide a more transparent context that will help potential candidates to improve the conditions to present new research software to the future editions of the award. In particular we would like to

compare these award criteria with the CDUR evaluation protocols proposed in [3]. CDUR stands for Citation, Dissemination, Use and Research, and proposes these four steps in order to evaluate different aspects of the research software. We submit here a precise question to the Open Letter authors: how the three considered levels 'strong support, support, do not support' are related to the basic/good/excellent levels that we do study in the section 4.3 CDUR: a use case step-by-step of [3].

[Standing on the shoulders of Giants] As this French research software award shows, the situation of research software in France is in a privileged status, where many important points related to this research production are in discussion at the Ministry level. But to arrive to this situation has taken different and previous stages that have not occur in other countries or that are currently in construction, which also shows the French idiosyncratic situation.

Among all the pre-existing work, we would like to mention the French Devlog network [https://www.devlog.cnrs.fr/] that gathers the software development community. It was launched in 2009 with a website and a mailing list, it organised the JDEV2011, the '1ère édition des Journées nationales du DEVeloppement logiciel' in Toulouse. This network was launched by some developers, members of the research community that were already part of the team of the French PLUME Project (2007-2013) [4]. The platform where this project published software descriptions was closed in 2022, which is surely the reason for not to mention it in the Open Letter, nevertheless, descriptions of the project goals, and of the work realized by the PLUME team can be found in [3,4]. Readers interested to have more insight about this project can consult [https://hal.science/hal-00592935, https://hal.science/hal-00559460, https://hal.science/hal-00559446, https://zenodo.org/communities/plume-patrimoine-logiciel-laboratoire/, http://igm.univ-mlv.fr/~teresa/logicielsLIGM/ (work related to years 2007-2013)] and the video [https://webcast.in2p3.fr/video/presentation-du-projet-plume]. Among all the publications produced within the PLUME Project we would like to highlight [5], and the already mentioned [1], others are available at the mentioned links [https://zenodo.org/communities/plume-patrimoine-logiciel-laboratoire/, http://igm.univ-mlv.fr/~teresa/logicielsLIGM/].

[Data award] A possible new version of this Open Letter could also mention the Data award also organized by the French Minister of Higher Education and Research in 2022, see [https://www.enseignementsup-recherche.gouv.fr/fr/prix-science-ouverte-des-donnees-de-la-recherche-86179, https://www.ouvrirlascience.fr/remise-des-prix-science-ouverte-des-donnees-de-la-recherche-2023/]

Again, we would be interested to have more knowledge about the review criteria process that has been used in this Data award, as we would like to compare it with our proposed evaluation protocols for research data [6,7].

Note: These comments have been disseminated also as a Zenodo Preprint [8].

Teresa Gomez-Diaz (CNRS/LIGM), Tomas Recio (University Antonio de Nebrija), January 2024.
References
[1] Gomez-Diaz T, (2010). Diffuser un logiciel de laboratoire : recommandations juridiques et administratives, Publication for the French PLUME Project (2007-2013),

https://zenodo.org/record/7096216
2] Gomez-Diaz T, (2014). Free software, Open source software, licenses. A short presentation including a procedure for research software and data dissemination, Zenodo Preprint, Septembre 2014, http://zenodo.org/record/11709/. Presented at the Workshop on open licenses: Data licencing and policies, EGI Conference 2015, Lisbon, May 2015, https://indico.egi.eu/event/2452/sessions/1522. Spanish version: Software libre, software de código abierto, licencias. Donde se propone un procedimiento de distribución de software y datos de investigación, Zenodo Preprint, Septembre 2015, https://zenodo.org/record/31547/
[3] Gomez-Diaz T and Recio T, (2019). On the evaluation of research software: the CDUR procedure [version 2; peer review: 2 approved], F1000Research 2019, 8:1353, https://doi.org/10.12688/f1000research.19994.2
[4] Gomez-Diaz T, (2019). Le Projet PLUME et le paysage actuel des logiciels de la recherche dans la science ouverte, Zenodo Preprint, https://zenodo.org/record/2591474
[5] Gomez-Diaz T, (2015). Article vs. Logiciel : questions juridiques et de politique scientifique dans la production de logiciels, 1024 - Bulletin de la Société Informatique de France N. 5 - March 2015, https://hal.science/hal-01158010. First version published for the French PLUME Project (2007-2013) in 2011, https://zenodo.org/record/7063154
[6] Gomez-Diaz T and Recio T, (2022). Research Software vs. Research Data I: Towards a Research Data definition in the Open Science context [version 2; peer review: 3 approved], F1000Research 2022, 11:118, https://doi.org/10.12688/f1000research.78195.2
[7] Gomez-Diaz T and Recio T, (2022). Research Software vs. Research Data II: Protocols for Research Data dissemination and evaluation in the Open Science context [version 2; peer review: 2 approved]. F1000Research 2022, 11:117, https://doi.org/10.12688/f1000research.78459.2
[8] Gomez-Diaz T and Recio T, (2024). Open comments on the "Open Letter: Establishing a national research software award", Zenodo Preprint, https://zenodo.org/records/10493797

Competing Interests: No competing interests were disclosed.