São Paulo Research Foundation (FAPESP)
University of São Paulo, Brazil

Research Software - What to fund?

by Prof. Fabio Kon

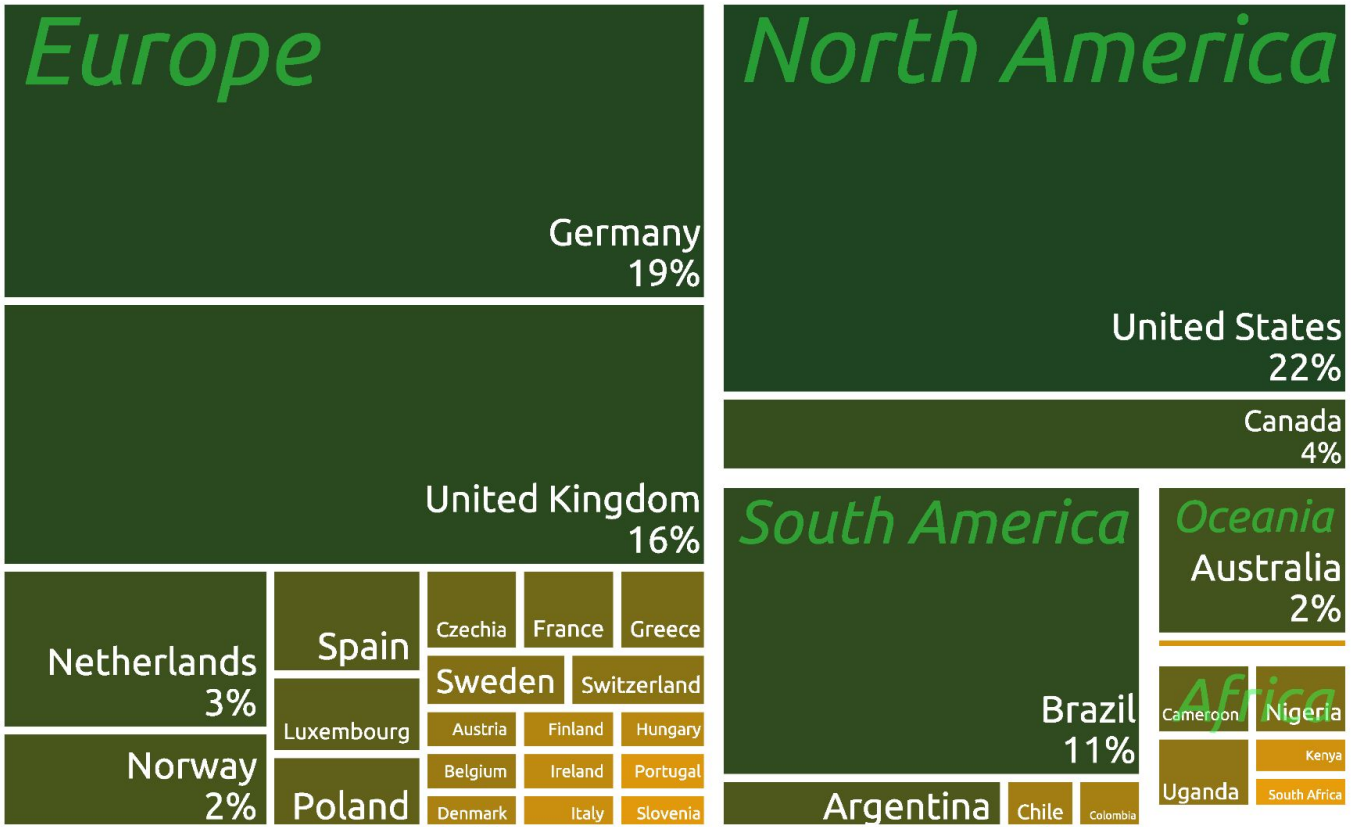
General survey information

280 participants

First response in **2022-11-09**
Last response in **2023-01-23**

Country	Responses
United States	63
Germany	54
United Kingdom	47
Brazil	32
Canada	13
Netherlands	11
Australia	8
Norway	7
Argentina	4
Spain	4
Luxembourg	3
Poland	3
Cameroon	2
Czechia	2
France	2
Greece	2
Nigeria	2
Sweden	2
Switzerland	2
Uganda	2
Austria	1
Belgium	1
Chile	1
Colombia	1
Denmark	1
Finland	1
Hungary	1
Ireland	1
Israel	1
Italy	1
Kenya	1
New Zealand	1
Portugal	1
Slovenia	1
South Africa	1
Sum	280

Countries participants



Most participants are from:

1. USA – 22%
2. Germany – 19%
3. UK – 16%
4. Brazil – 11%

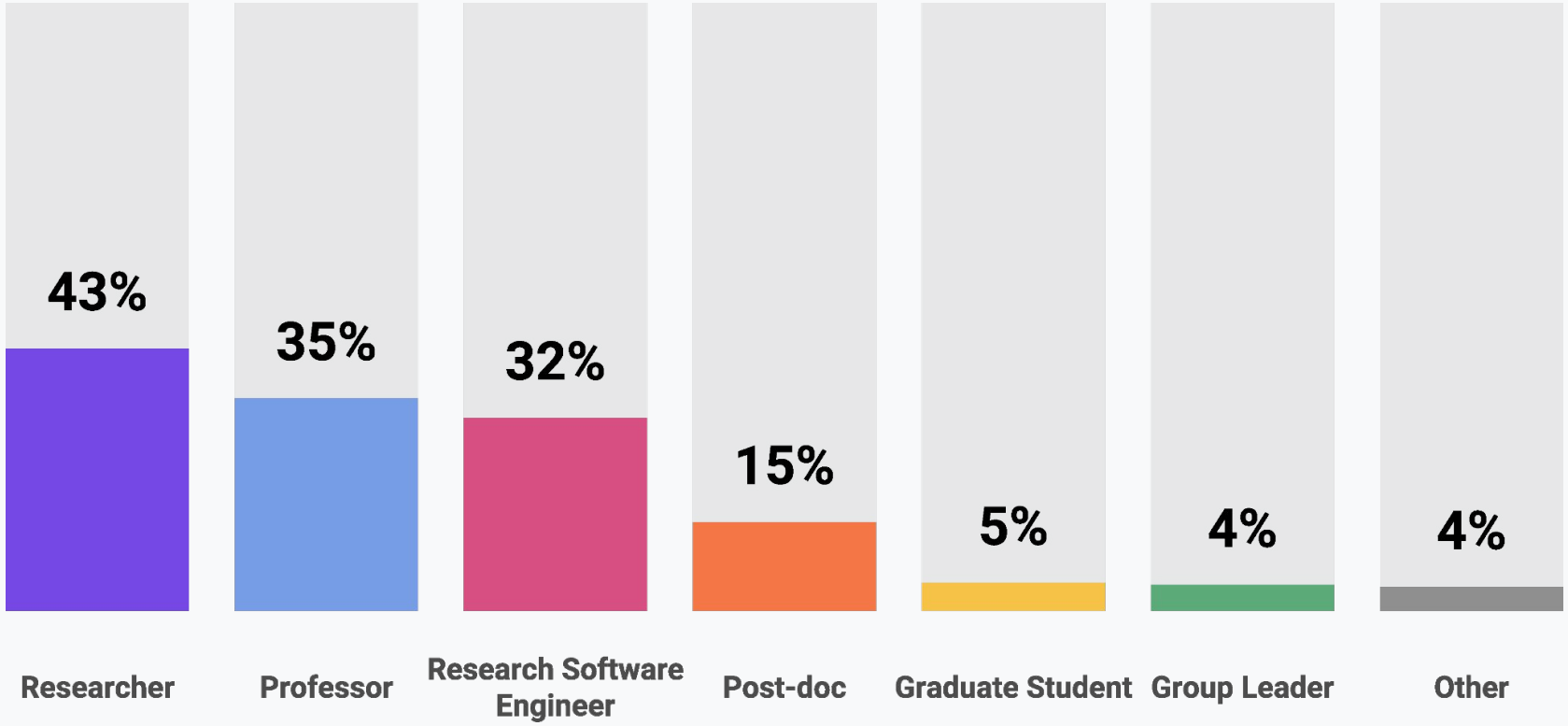
Institutions

Amsterdam UMC	Aperio Software	Argonne National Laboratory	ASTRON	Auckland Bioengineering Institute	AUTH, Greece
Barcelona Supercomputing Center	Bayero University Kano	Calculus Institute, University of Buenos Aires / National Scientific and Technical Research Council (Argentina)	California Institute of Technology	Carnegie Mellon University	CCAD-UNC
CEFET-MG	Center for Advanced Systems Understanding (HZDR)	CERN	Charles University, Prague	Clayton State University	CONICET
CU Boulder	Curvenote	Dalhousie University	Delft University of Technology	Durham University	Emory University
EPHE	Erasmus university Rotterdam	Ersilia Open Source Initiative	European Molecular Biology Laboratory (EMBL)	Federal Institute Farroupilha	Federal University of Bahia
Federal University of Rio de Janeiro	Federal University of Rio Grande do Norte	Federal University of Rio Grande Do Sul	FEI	Forschungszentrum Jülich	German BioImaging
Harvard Medical School	Harvard University	Helmholtz Zentrum Dresden Rossendorf	Humboldt-University Berlin	ICIPE, OpenScienceKE	IFPB
Indiana University	INRIA	Institute for Computational Physics	Institute of Metal Forming	International Institute for Applied Systems Analysis	Iowa State University
IRB Barcelona	ITA	Jagiellonian University	Johannes Gutenberg-Universität Mainz	Juelich Supercomputing Centre	Lawrence Berkeley National Lab
LBL	Leibniz University Hannover, Computational Biology	Leiden University Medical Center	LMU Munich	Louisiana State University	Luxembourg Centre for Contemporary and Digital History
Luxembourg Centre for Systems Biomedicine	Mboalab	MIT	Molecular Sciences Software Institute (MolSSI)	National Center for Atmospheric Research (NCAR)	National Institute of Standards and Technology
National Renewable Energy Lab	NCAR	New York University School of Law	Newcastle University	Northwestern University	Open Force Field
Open University of the Netherlands	Pázmány Péter Catholic University	Politecnico di Milano	Potsdam Institute for Climate Impact Research (PIK)	PUCRS	Qimr berghofer

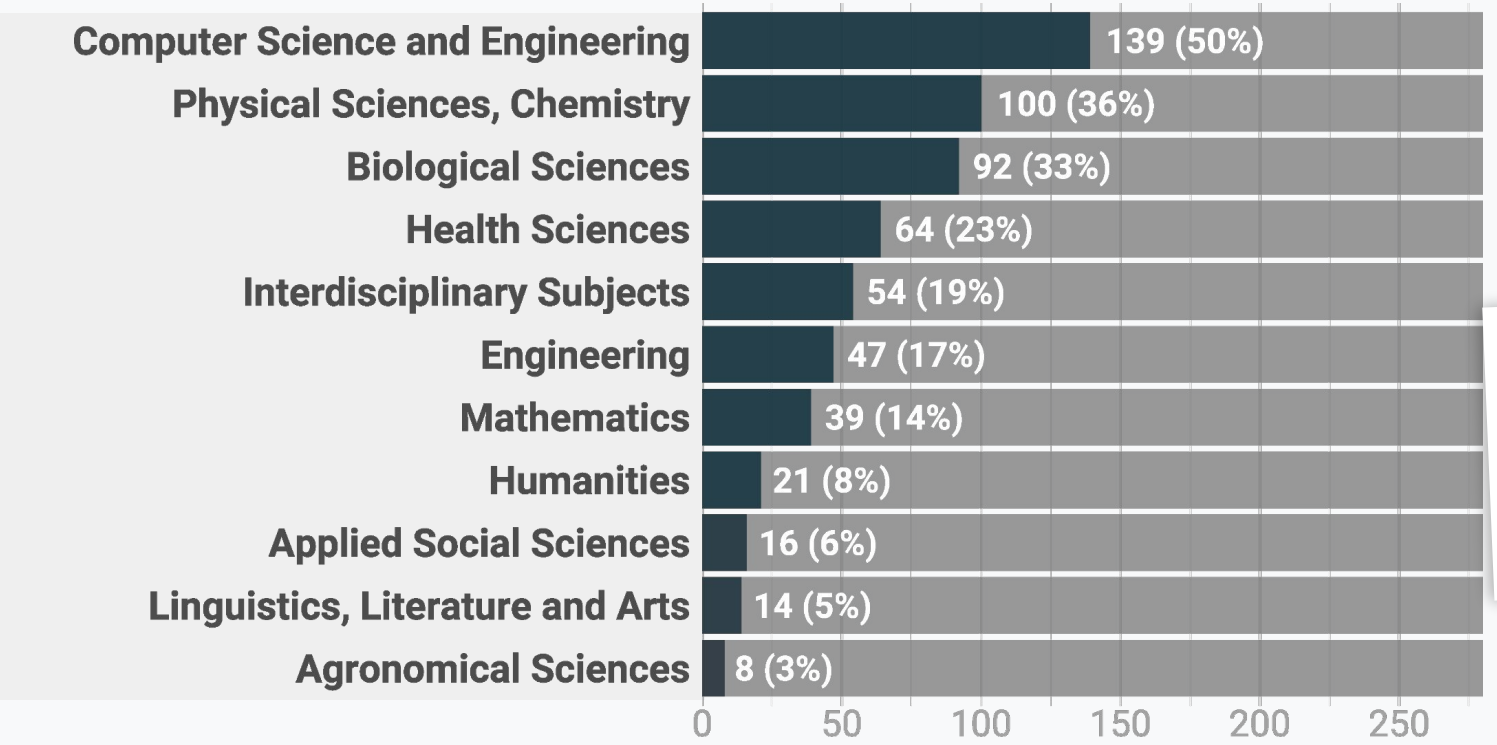
Institutions (continued)

Queen's University Belfast	RECETOX	Sandia National Labs, St. John's University, MN	School of Data Science, University of Virginia	Science and Technology Facilities Council	Sciformation GmbH
Simon Fraser University	SLAC National Accelerator Laboratory - Stanford University	SRUC	Stockholm University	Sunnybrook Research Institute	Swinburne University of Technology
Tel Aviv University	The Alan Turing Institute	The Arctic University of Norway	The National Gallery, London	The Open University	The University of Tennessee
TU Delft	TU Dortmund University	TU Dresden	TU Dresden, CODECHECK	UC Chile	UCL
UCSB Library	UESPI	UFPE	UFV	UiB	UiO
Unicamp	Universidad Industrial de Santander	Universidade Federal de Alagoas	Universidade Federal do Pampa	Universidade Federal do Recôncavo da Bahia	Universidade Federal Rural de Pernambuco
Universität Regensburg	Université de Montréal	Université de Sherbrooke	University College Dublin	University College London	University Corporation for Atmospheric Research
University Health Network, Toronto	University of Amsterdam	University of Applied Sciences Düsseldorf	University of Brasilia	University of Bristol	University of Cambridge
University of Coimbra	University of Goettingen	University of Greifswald	University of Groningen	University of Helsinki	University of Illinois
University of Konstanz (Germany), Monash University (Australia)	University of Luxembourg	University of Manchester	University of Melbourne	University of Nottingham	University of Oslo
University of Ottawa	University of Portsmouth	University of Queensland	University of Rostock	University of São Paulo	University of South Alabama
University of Southern California	University of Stuttgart	University of the Witwatersrand, Johannesburg, South Africa	University of Tübingen	University of Warsaw	University of Washington
University of Wisconsin — Madison	University of York	UNL	USF IMaRS	Vanderbilt University	

Roles of the participants

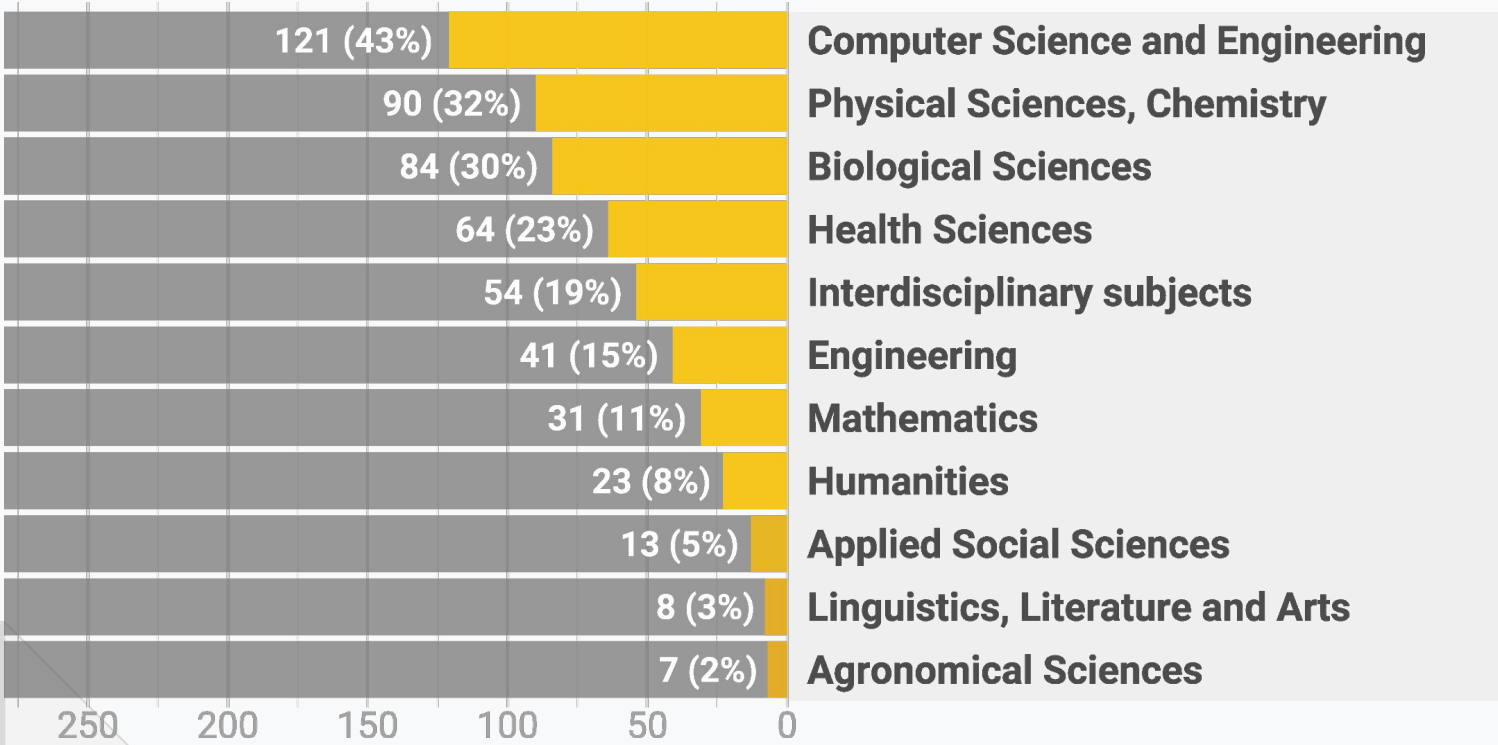


Major scientific areas of interest

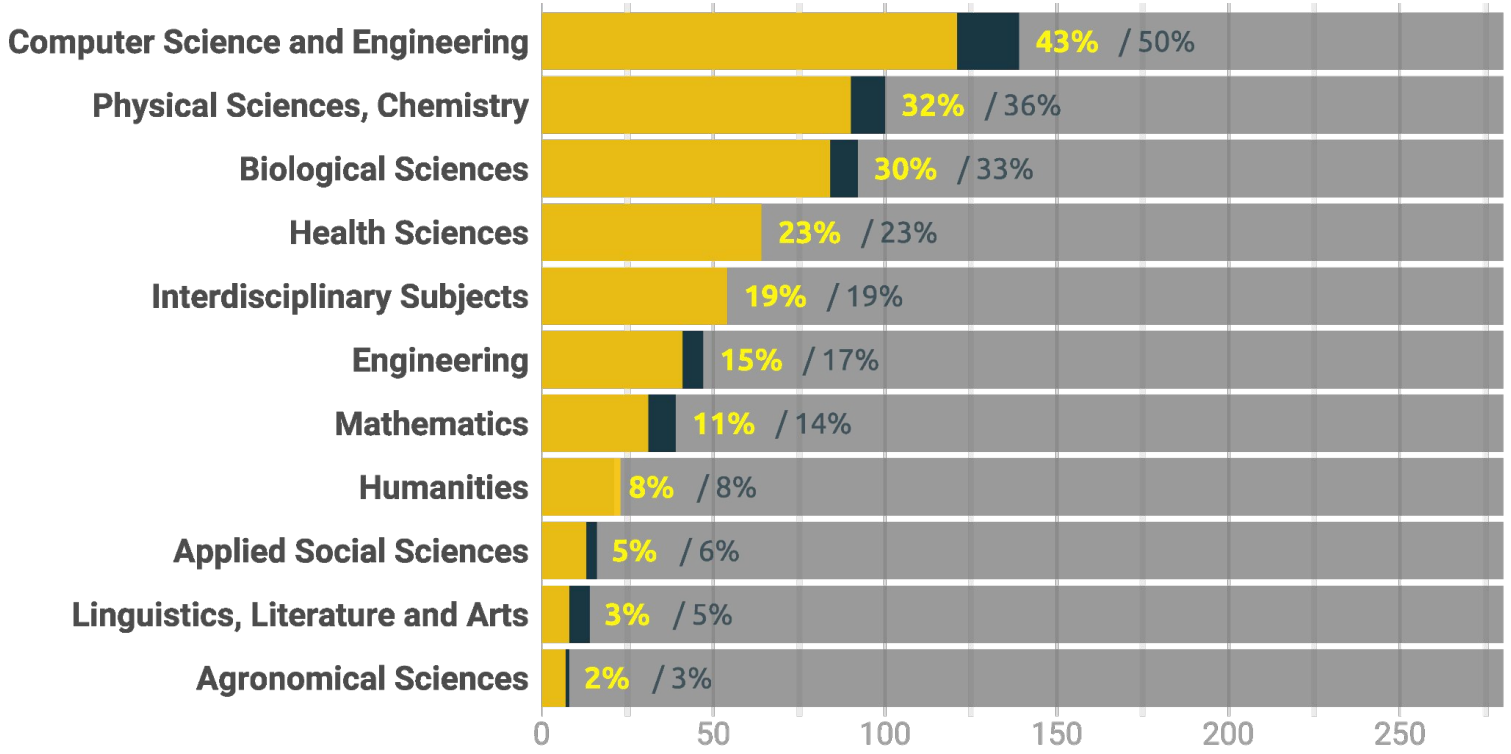


Other areas mentioned: **Earth, Environmental and Climate Sciences** in addition to **Astrophysics Science**

Areas for new proposals

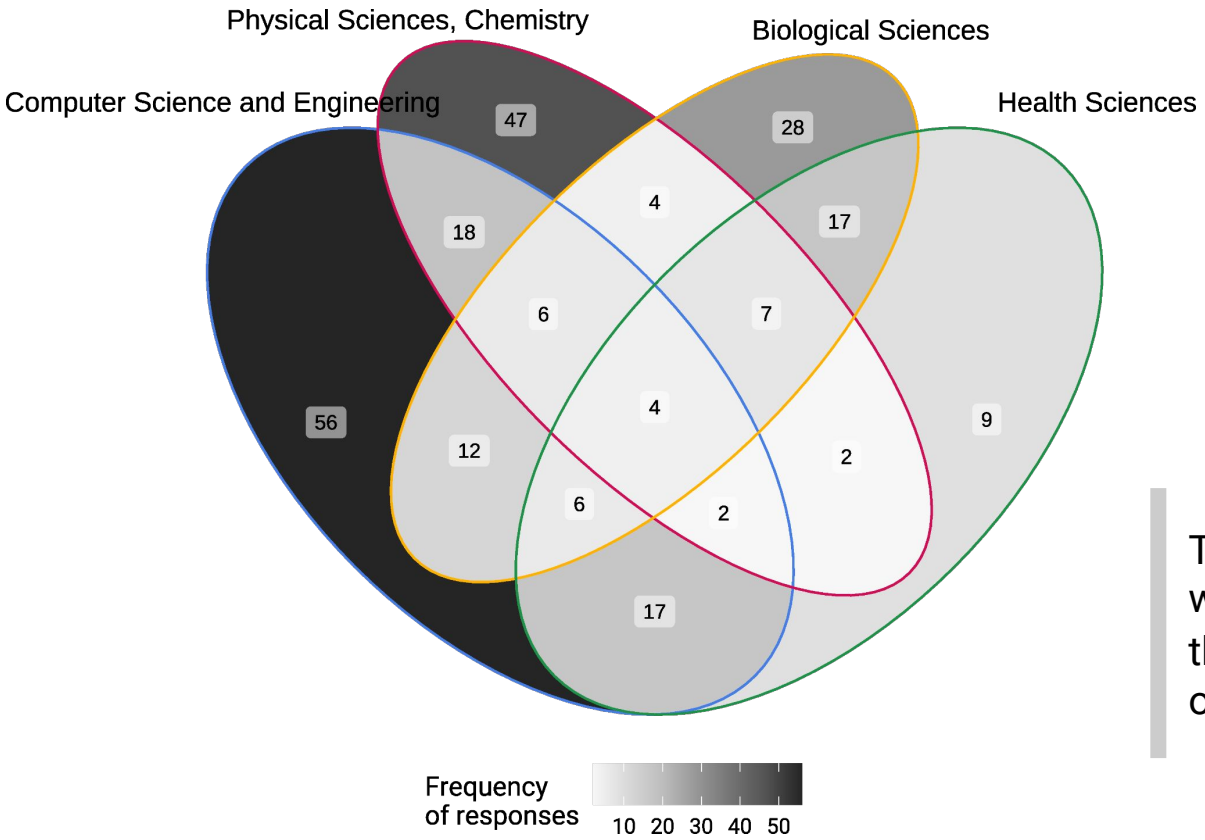


Areas of interest & for new proposals



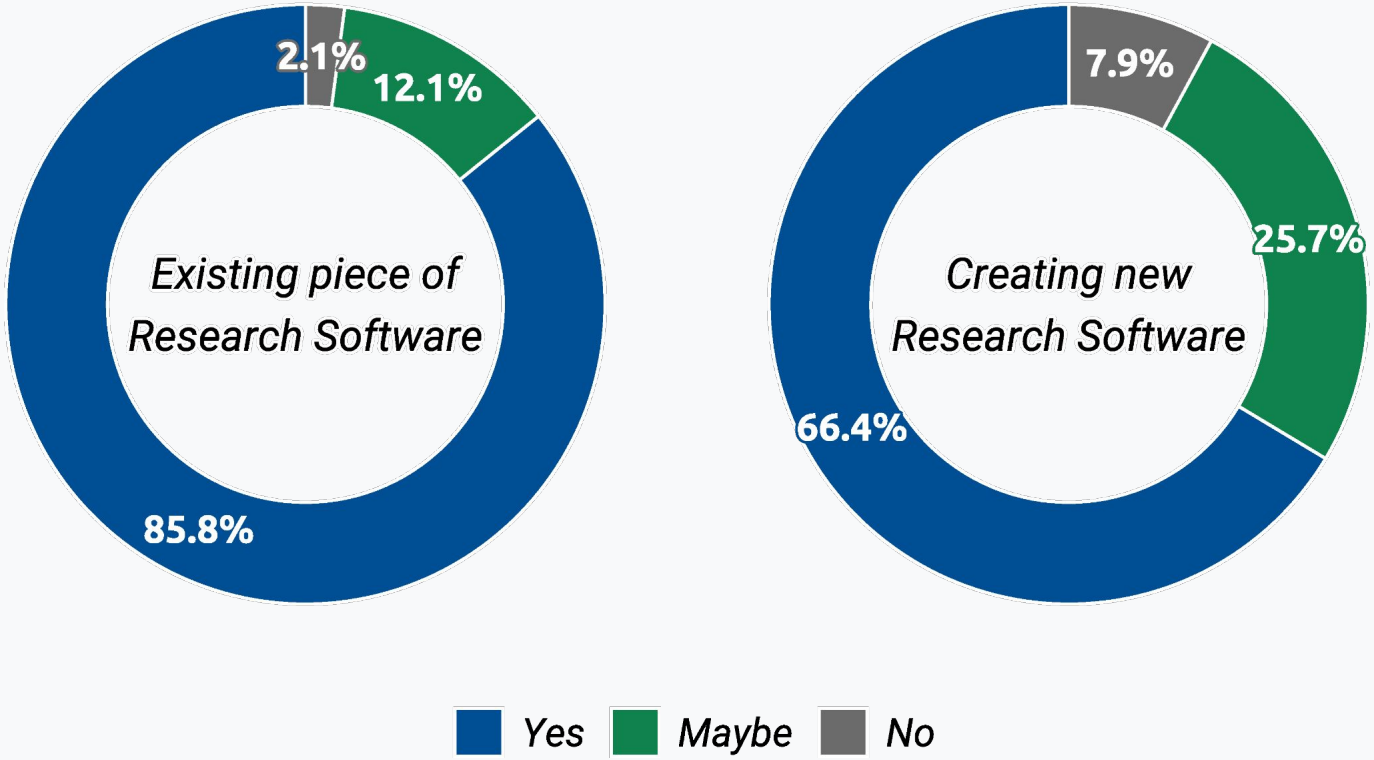
84% in the top 4

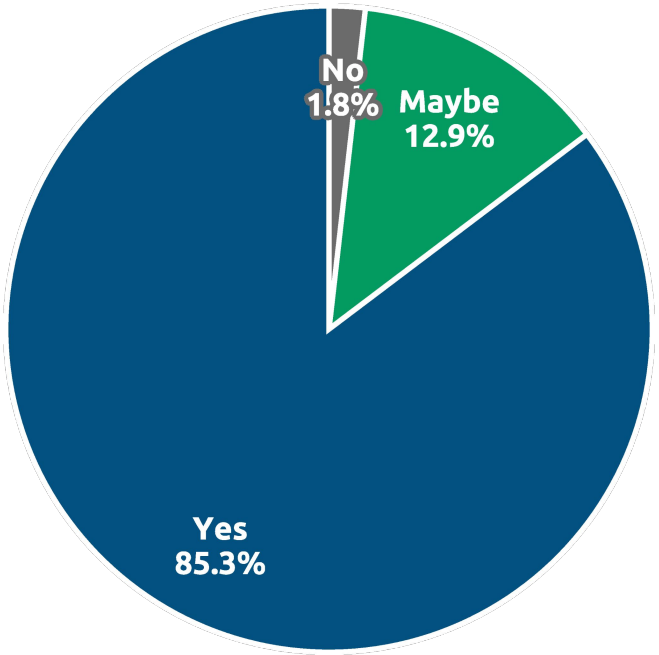
The four most voted areas for new proposals



The number of participants who chose at least one of these areas represents **84%** of all participants

Would you be interested in submitting a proposal to a funding call?



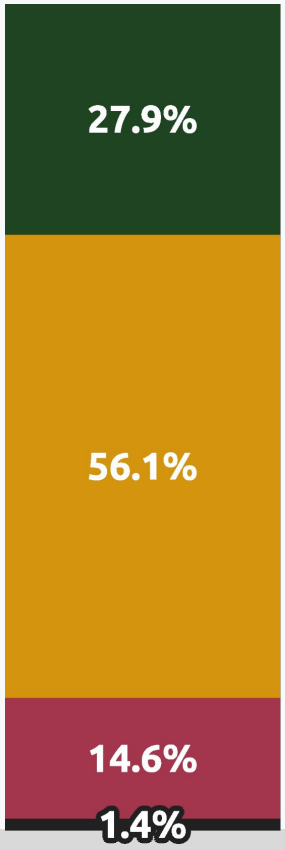


Would you be interested in applying to a multinational call, involving researchers, developers from multiple countries?

Do you already have international collaborators in mind for a joint project or would you need to look for them?

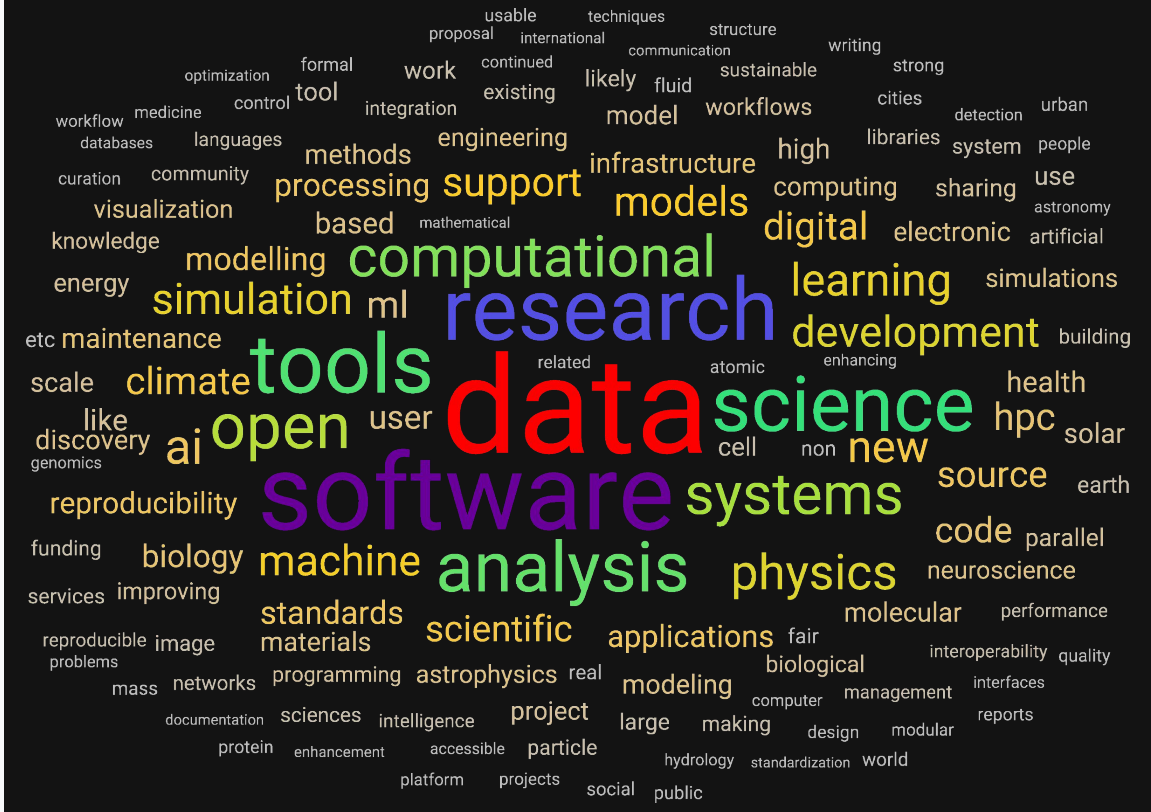
84% already have at least part of an international team

70.7% need some help to build the full team



- *Have full international team in mind*
- *Need to seek more collaborators*
- *Need to look for international potential collaborators*
- *Not interested in such an international call at this time*

If you submit a grant proposal to a multinational call on Research Software, which specific topic would you like to cover?



Proposed suggestions:

– Suggestions for the funding agencies when creating this call for proposals –

❑ Maintenance

most discussed subject

Long-term funding would be extremely helpful. It is difficult for teams to ramp up efforts when projects are only funded for, e.g., a single year. Having a multi-year period of performance helps to create some longevity and hire staff/postdocs/students that can engage for a longer period of time.

All gov funding agencies should have a dedicated funding track for research software- not just new stuff but maintenance of software, specially when it becomes a service for the research community.

Rely on people who have consistently conducted high-quality research over the years to continue what they are doing.

I would rather have a smaller amount of money per year over a long time frame, instead of a big project with short duration. Nobody will use an autodiff tool (or many other tools) whose long-term existence is in doubt, and continuity is my biggest concern.

Ensure that funding covers not just development of software, but also a plan for maintenance after the project period is over.

Maintenance funding for research software is key and often missing or an afterthought.

Sustainability and enhancement is key, even when considered new projects.

Try to support consolidation of software, rather than the creation of more new things that will soon be abandoned.

Don’t focus on funding feature development, as this is already pretty well covered by current incentive structures in academia (i.e. writing papers on new features). What’s more important is funding efforts to improve reliability, maintainability and interoperability of research software. This work is often viewed as lower-status (i.e. doesn’t lead to papers) and thus is hard to get funding for through traditional avenues.

Software has a long life - consider prioritising certainty of longer term funding even if that means that funding has to be stretched. 1 day/week for five years can have far more impact than full time for one year.

❑ Equitable science

How to make the funding outcomes more equitable across the globe. For example, the computing domain has historically excluded women, making sure that the global south is included, and then ensuring that any funded research software is open-source and open-development by default.

It is important that they consider the local perspectives of projects based in the global south.

I would love to see proposals for strengthening pooling computation resources for researchers who do not have the funds to maintain their own cluster. This would be an excellent strategy for more international and equitable science.

Please try your best to actively encourage and reward diversity, not just maintain the status quo. Please try to encourage (or even mandate if possible!) Open source software.

Establishing positive actions that promote the representation of developing regions.

❑ Documentation

Specify and demand quality criteria for the software; consider the need for the maturing process of a function-complete prototype into a user- friendly product - allow multiple phases; require fair principals and open source licensing; allow financing of not only software engineers - good software needs ux-experts, testers, product owners and scrum masters as well - and inform your reviewers in that regard; the sustainability needs for research software differ from the needs for research data - make suggestions for the post project phase and consider financing sustainability plans and community building activities

Transparency help better application in the future. Ensure that grading rules are written before hand and the rank of grades in each criteria is published afterward. It helps researchers understand where they could have improved.

Focus on individual projects and incentivize the use of standardized metadata and projects concerning similar data classes (e.g., surveys, time series data, etc.). Large, collaborative projects are usually well-funded.

Focusing on best practice research.

A focus on processing sensitive data would be valuable.

❑ Flexibility

Keep in mind the different scale of research software. I have worked in teams of 2 and >50 people when developing a single piece of research software – an ideal call for proposals would create suitable funding opportunities for small and large research software projects.

Please be flexible in the amount of effort that can be requested - in my area of research efforts of 2-3 fte would make a huge impact, but i imagine in other areas larger efforts would be needed. Also please please pay the full economic costs of the research (in the uk our funding agencies don't currently do this).

Funders directly work with the finance with the research group rather than through the host institutes which usually charge a "university/institute tax" of 20-40% of the grant.

I suggest funding multiple projects even with lower fundings, rather than funding less projects but with higher fundings. It is quite difficult to find dedicated fundings for concise software development itself - usually, these efforts (not neglectable at all from time and expertise points of view) must be integrated in larger projects where the computational achievement is diminished.

❑ Community

To think about proposals that build communities.

Require open source software with permissive license, open development from the start.

Any support for climate or earth system model software infrastructure, particularly software that improves portability, physics code interoperability, and the use of various new hardware acceleration technologies (e.g. Gpus), would be quite valuable to the climate science community.

Value sustainability aspects (fair software, rse) and sw as community services.

Fund code refactoring, fund community building, financial support (for example, to run a forum), administrative cost.

The grant should make it mandatory to release the software under a free license.

❑ Other suggestions

Fund stuff that needs doing, will have huge impact and amplification effects on software that exists now and the future at the ”underware” level not just yet another shiny thing.

I suggest that the there could be different levels the funding could be organized, such as new capabilities, enhancement of existing ones, software as sustainable service and interoperable services levels, broadly and at each level it has to be science driven with as broad an impact as possible

Aim to fund proposals that have not received funding otherwise and are trying to do something novel and unique and that may get wider adoption if it was properly implemented, rather than throwing more funding to projects that are already well funded or doing something that is already widely available.

Have separate categories for new vs established projects; the needs are often very different.

Cover costs with cloud computing for testing the softwares.

Keep some categories specific but include a also a free one - people with come up with ideas that you haven't expected.

It would be great that the call includes support not only for the development of the software but for its dissemination and to offer training to the end-users.

Allow start-ups to join and lead the development.

Why not run a call for rse centres to be delivery agencies, some kind of framework tender? This would be better than asking the scientific teams to find their own rses.

Please focus on basic sw engineering & fair qualities of the research software. Unfortunately many software pieces are vastly suboptimal and scientists often have no time or means to solve that, which leads to insane waste of both resources and human effort.

Software ecosystems matter, and have a big impact on adoption. Proposals should describe how they relate to the wider software ecosystem: e.g. what other software do they depend on, and what other software depends on them. How do they interact with those (e.g. do they submit bug reports or patches to their upstream dependencies? What assistance do they provide for user adoption of their software?).

Support also existing software and standardisation efforts so that novel software becomes compatible with previous efforts.

Connecting experienced professional programmers with researchers could help a lot move forward faster.

Research software grants are particularly tricky when research itself is intermingled with software development. For example, the software that I would propose will need to be involved in and adaptive to research advances because both the software and the physical models it implements are very old and rather out of date.

Focus on high-level languages to decrease maintenance cost.

Thank you all!

Prof. Fabio Kon (University of São Paulo)

kon@ime.usp.br
twitter.com/FabioKon