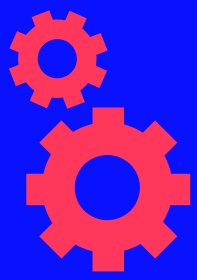
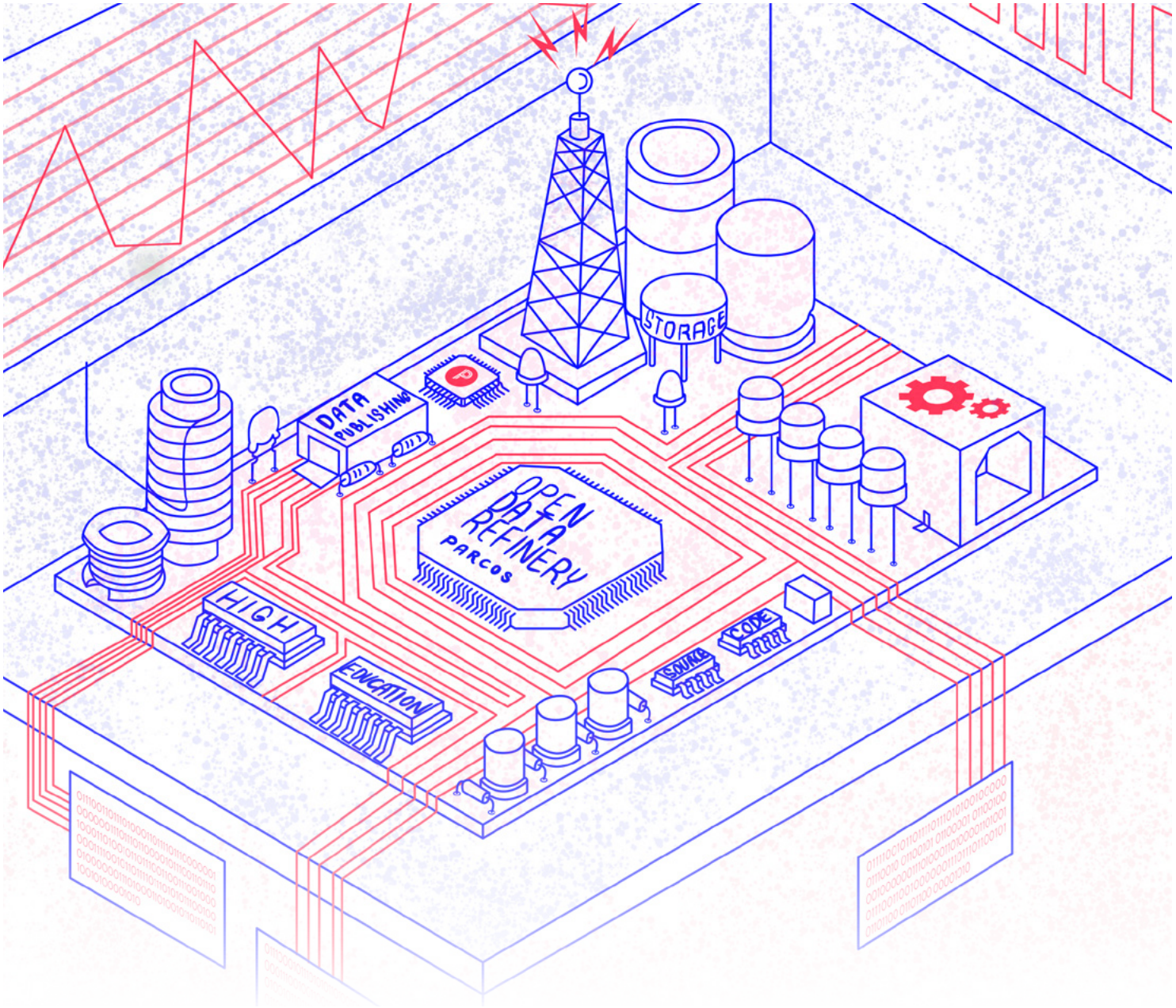
PARCOS
Participatory Communication of Science



Policy Brief
Participatory Communication of Science

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreeement 872500



Communicating science data

Historically, science and innovation opportunities have only been available to a minority of the population, such as staff in universities or large companies with research departments. Publicly funded science has for some time incentivized the publishing of open data sets in order to make science more transparent and accessible. However, open release of datasets is not enough to enable the public to access this data – there must be structured science communication activities and resources to enable participants make sense and understand the evidence behind scientific findings.

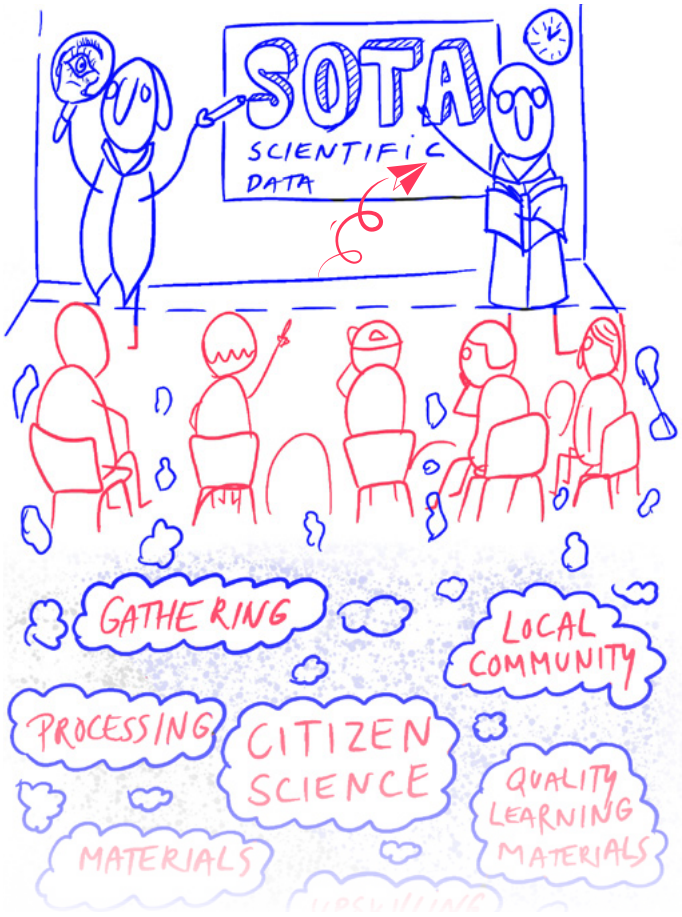
There is a range of approaches to science communication from unidirectional transmission of information to active participation, with different methods of engagement in between. More participatory approaches view science communication as a dialogue and discussion between the public, experts, and decision-makers. In these approaches, such as citizen science, people are involved in research and actively make sense of science data. Active and engaging participation leads to better awareness, enjoyment, interest, and understanding of science. Furthermore, we propose that better access to science data and the use of multiple forms of interactive media will enable more diverse and engaging ways of science communication.

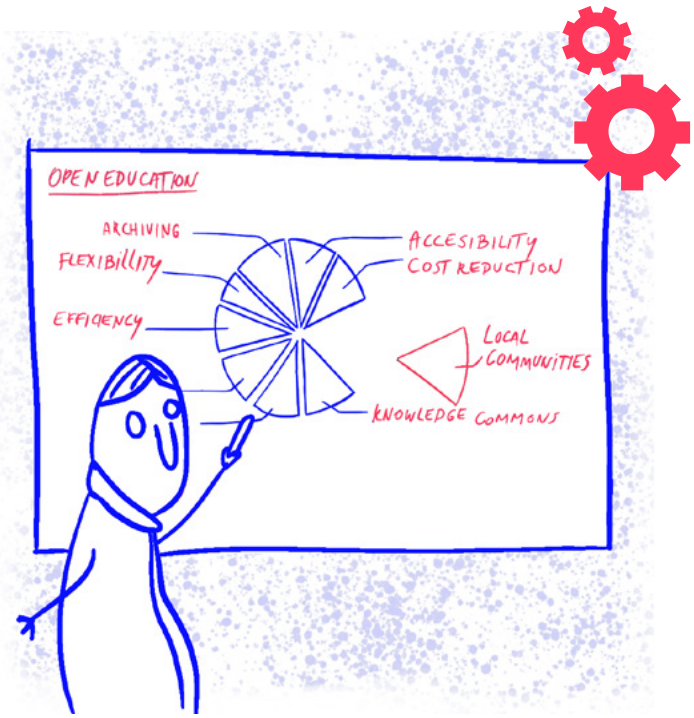
This report, aimed at academics and academic policy makers, will highlight the benefits of not just publishing science data for other scientists but making it easier for the public to use. We will also highlight the benefits of widening the ways in which the public can participate in science research, depending on the level of involvement that they want – whether it is active participation or if it is simply having better access to underlying evidence of published science communications.

Introduction

Historically, science and innovation opportunities have only been available to a minority of the population, such as staff in universities or large companies with research departments. In order to *make science more open and accessible*, open data[1] is being encouraged to be used in high education and academia around the world. For example, the current stance at the European Union is that publicly funded science should publish the data openly by default – including the science communication material such as articles and the science data itself. This specialized type of open data that underpins scientific research is often referred to as 'open research data'. However, *open release of datasets is not enough to enable the public to access this data* – there must be structured science communication activities and resources to enable participants make sense and understand the data.

The lack of simple tools and processes available to the public to easily access and make sense of the freely available data is an issue and has for example been recognized in the UNESCO recommendations





on **open science**. In addition to open data, they recommend combined access to all parts of the process: "maximizing access to scientific knowledge and the reuse and combination of data and software, including source code, and thereby maximizing the common good achieved through public investment in scientific resources and infrastructures" *and engaging the public in doing it*[2].

The first part of open participation to science, maximizing access, is being achieved more often, with the increasingly common publication of open science data. While valuable to the science community, this does not yet benefit the society at large. What is still missing is the engaging the public. We propose that for **science communication** to lead to better awareness, enjoyment, interest and understanding of science, it should be **interactive** and **engaging**[3,4]. Furthermore, there should be easily accessible science data and tools that support interactive science communication and participant-directed science activities. Finally, resources should be provided on how these tools can support participatory approaches, such as citizen science. When the process of creating new knowledge is opened through participation, it will lead to increased learning opportunities, empowerment, enjoyment, and increased science capital[5].

1. data that can be freely used, reused and redistributed by anyone, subject only, at most, to the good practice of acknowledgement, attribution and citation
2. UNESCO, (2020). Recommendations on Open Science.
3. Burns, T. W., O'Connor, D. J., & Stocklmayer, S. M. (2003). Science communication: a contemporary definition. *Public understanding of science,* 12(2), 183-202.
4. Trench, B. (2008). Towards an analytical framework of science communication models. *Communicating science in social contexts,* 119-135.
5. Hudson L., Evans, P. and Banks Gross, Z. (2020, draft). The Bristol Approach to Citizen Science, deliverable 2.1. of the Horizon 2020 project Par Cos, EC grant agreement no 872500, Lappeenranta, Finland. (Download)

Science communication and data publishing practices: how do universities communicate science?

Professionals in higher education are in the unique position that they are often both researchers who produce open research data and educators. Despite this, there is a disconnect between new scientific findings and how the public gets to interpret it.

Currently there are three most common ways to publish science. Academic papers, which are often not available to the general public; conferences, which similarly are rarely available; and press releases.

Press releases are targeted to the wider public, but media publishing practices are such that the media often sanitise data and present a curated view, e.g. a graph, with no way for public to interrogate or find different interpretations. Furthermore, the communication is almost always unidirectional, meaning that there is rarely an opportunity to discuss it with or ask questions from scientists in the way that other researchers get the opportunity to do. This, combined with the difficult access to science data, means that the public needs to take scientific findings as an article of faith, potentially leading to disinformation spreading on social media when the science news must compete with other, more engaging but misinformative sources.

How do universities support the participation of the public in science activities?

First, universities support open participation in theory through publishing open research data that may be accessed by the public. They may be hard for the public to find, as URL is listed in the academic paper (which is not available to public). They often miss a lot of context and are badly described[6].

Second, there exists initiatives such as STEAM education networks and junior universities that actively encourage youth to take a greater role in science and understand what universities do, but this is often still with pre-defined activities and unidirectional flow of information.

Lastly, there exists the open schooling paradigm, which offers self-directed educational resources to youth and the public. This may offer a more genuine approach, but further work is needed that enables participants to have self-directed and engaging science activities.

For the public to make sense of science data, there needs to be educational support materials, initial scaffolding to support the activities, and for example a set of sandbox-like tools that support the participants in making evidence-based analysis of the data. At the same time, the scaffold must be flexible enough that it can acknowledge different narratives and voices that emerge when participants to focus on specific issues and make their own conclusions. This will allow participants to ground their thinking on the scientific evidence they are working on, removing any faith-based steps from the process – and equipping them to critically evaluate science claims in the future.

Finally, how can communities benefit from the scientific findings, analysis tools, and from the learning resources on utilizing science data? Involving communities may be the missing link that allows connecting the education and community practice side of science phenomena.

6. Sadiq, S., & Indulska, M. (2017). Open data: Quality over quantity. *International Journal of Information Management, 37*(3), 150-154.

How can the public participate in science?

Most commonly public engagement in science occurs by the university researcher performing the research and engaging people in the findings. To improve public participation and engagement of the public in scientific work, an approach called citizen science has been introduced.

In citizen science, scientific work is undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institution. The level of participation varies depending on the approach – participants can be only contributors or be involved in all stages, starting from generating ideas and setting the initial direction[5].

Engaging the public in citizen science can increase awareness of scientific research and involve society in addressing problems faced in everyday life as well as global challenges. It also provides opportunities for citizen science participants, including learning opportunities, empowerment, enjoyment, social engagement, and enhanced scientific capital[5,7].

One example of a citizen science method is the Bristol Approach[8]. It is a participatory design methodology and a way to orchestrate community participation in citizen science in a manner that is people and issue led rather than pushing pre-determined solutions on people[5]. A central concept to Bristol Approach is the development of a City Commons, where resources, tools, expertise, and technologies are shared for the common good. A key principle is ensuring that there are no barriers to taking part and at the same time enabling all stakeholders to contribute to the best of their ability. In science communication activities, the Bristol Approach would start with engaging the public at an early stage – to identify what issues the community would need to investigate with the scientific method and to set a shared goal. Science communication tools, educational resources to facilitate skills development and training, open science data, and refined findings by all stakeholders would be all contributed to the shared commons that would be accessible by the community.

7. Edwards, R., Kirn, S., Hillman, T., Kloetzer, L., Mathieson, K., McDonnell, D. and Phillips, T. (2018). Learning and developing science capital through citizen science. In: Hecker, S. and Haklay, M. and Bowser, A. and Makuch, Z. and Vogel, J. and Bonn, A., (eds.) Citizen Science - Innovation in Open Science, Society and Policy. (pp. 381-390). UCL Press: London.
8. What is Bristol Approach? - https://www.bristolapproach.org/bristol-approach/

Recommendations for academic science communicators and policy makers
recommendations for academia

There is a need to *promote better practices amongst researchers for data sharing*, not just the "put it there and they can find it" but to imagine different types of audience for the data including scientists without domain knowledge, or data skills, and understand how to support them to use and engage with the scientific evidence, or science data.

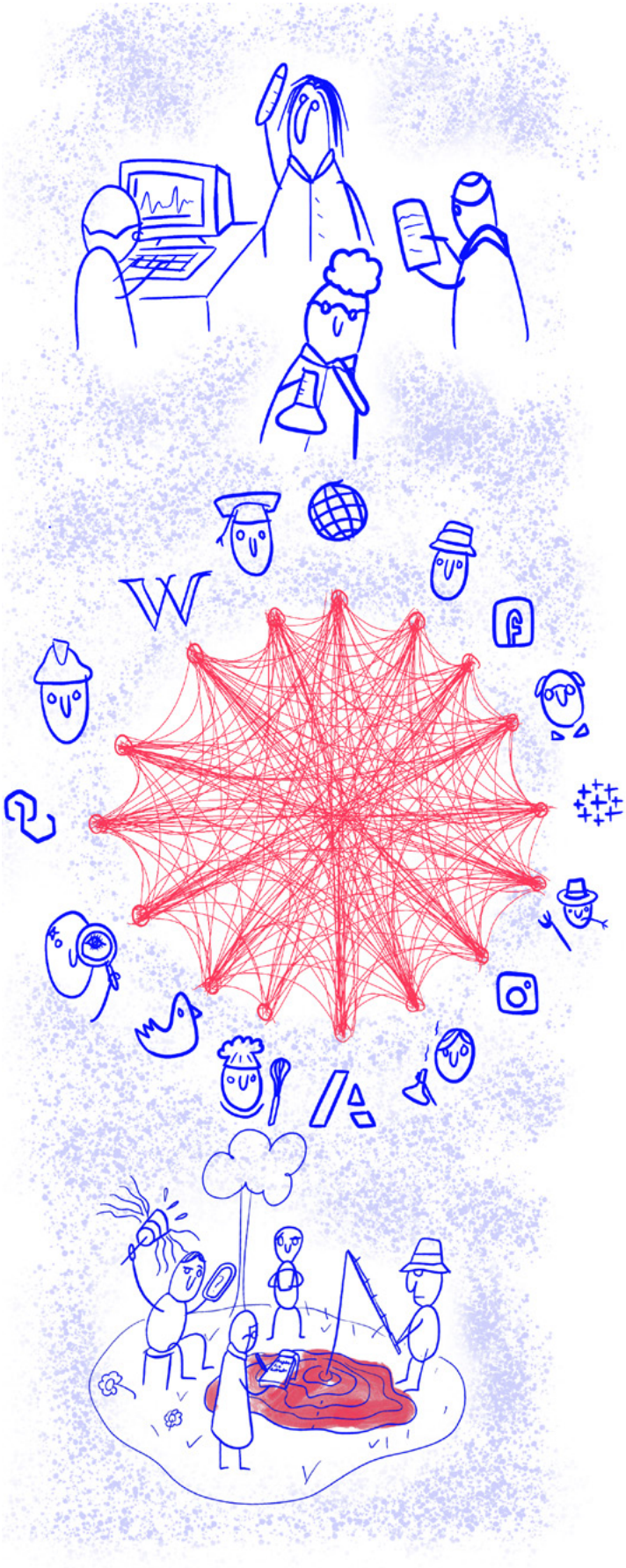
Researchers should arrange different ways for people to engage with the science data, including participant-directed activities, engagement and visualization tools, and good practices in social media or blogs to include links to data that readers can explore for themselves.

These goals cannot be accomplished by researchers alone. Universities need to *support capacity building and establishing these relationships* and make it easier for schools and communities to reach out for different type of support. This kind of support should include widening and lowering the barrier to access scientific datasets, providing better tools, and educational resources.

Recommendations on supporting community stakeholders

Community centers and civic organizations, such as KWMC, ME-talo, or Global Shapers Helsinki, are an *important bridge between the public and organizational stakeholders*, also known as middle-out facilitators [9]. They facilitate public engagement, working with their local communities to help make improvements. At the same time, these organizations are rarely well-resourced in collaborative projects with universities, limiting their capabilities.

We propose that two kinds of resourcing are needed for the community organizations. First, *community and civic organization need sufficient funding to resource their activities*. Second, universities and researchers need to establish working links and *engage these communities in science communication*. This requires *more interactive ways of engaging people in science* and more engaging ways and tools to create content – and to share citizen-sourced findings or stories.



9. Fredericks, J., Caldwell, G. A., Foth, M., & Tomitsch, M. (2019). The city as perpetual beta: Fostering systemic urban acupuncture. *In The Hackable City* (pp. 67-92). Springer, Singapore.

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A horizon 2020 research and innovation action

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Duration:
1/2020 – 12/2022

Grant:
H2020-872500 (Call H2020-SwafS-2019-1)

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