European Commission

Enabling Environments
for Supporting and Sustaining Citizen Science

Topic 4 Discussion Paper

PSF CHALLENGE

HORIZON EUROPE
POLICY SUPPORT FACILITY

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Report

ON DEMAND SUPPORT

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Research and Innovation

Mutual Learning Exercise on Citizen Science Initiatives – Policy and Practice

Topic Four Discussion Paper: Enabling Environments for Supporting and Sustaining Citizen Science

EUROPEAN COMMISSION

Mutual Learning Exercise on Citizen Science Initiatives - Policy and Practice

Topic Four Discussion Paper:

Enabling Environments for Supporting and Sustaining Citizen Science

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LIST OF ABBREVIATIONS

CO: Citizen Observatory

CS: Citizen Science

CSA: Coordination and Support Action

CSI-PP: Citizen Science Initiatives - Policy and Practice

CSO: Civil Society Organisation

DG: Directorate-General

ECSA: European Citizen Science Association

ERA: European Research Area

EU: European Union

HEI: Higher Education Institution

MLE: Mutual Learning Exercise

NBS: Nature-based Solutions

NGO: Non-Governmental Organisation

RFO: Research Funding Organisation

R&I: Research & Innovation

RPO: Research Performing Organisation

RRI: Responsible Research and Innovation

SDGs: Sustainable Development Goals of the United Nations

UN: United Nations

ENABLING ENVIRONMENTS FOR SUPPORTING AND SUSTAINING CITIZEN SCIENCE

"The engagement of citizens, local communities and civil society will be at the core of the new European Research Area to achieve greater societal impact and increased trust in science...

...We would like to support projects enabling citizens to act on climate change, for sustainable development and environmental protection through education, citizen science, observation initiatives, and civic engagement. The objective is clear! To empower citizens in the transition to a climate-neutral and sustainable Europe....

There are so many scientific areas for citizens to add value." [1]

- Commissioner Mariya Gabriel, 7 December 2020

1 Introduction

1.1 The Context of this Discussion Paper

This discussion paper is the third in a series within the Mutual Learning Exercise (MLE) on '*Citizen Science Initiatives - Policy and Practice*' (CSI-PP). The purpose of this MLE is to facilitate the exchange of information, experience and lessons, as well as to identify good practices, policies and programmes in relation to varying approaches at local, regional and national levels, towards supporting and scaling up citizen science. Eleven countries are participating in the MLE (Austria, Belgium, France, Germany, Hungary, Italy, Norway, Portugal, Romania, Slovenia and Sweden), and the process is structured in five rounds of meetings on specific topics that have been pre-identified by the participating countries.

The topic of this discussion paper relates to Topic 4 in the series '***Enabling Environments for Supporting and Sustaining Citizen Science***'.

The role of Citizen Science (CS) in policy and decision making has been growing across Europe, and is becoming increasingly important for Member States to embrace and support as a core dimension of

(1) the new European Research Area (ERA) to achieve greater societal impact and increased trust in science,

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[1] from the Speech by Commissioner Mariya Gabriel at the 3rd Citizen Engagement and Deliberative Democracy festival, 7 December 2020
https://ec.europa.eu/commission/commissioners/2019-2024/gabriel/announcements/speech-commissioner-mariya-gabriel-3rd-citizen-engagement-and-deliberative-democracy-festival_en

(2) the 2021 Council "Pact for R&I in Europe" that lists "active citizen and societal engagement in R&I" as a priority area for joint action in the EU, and

(3) the Horizon Europe funding Programme, which aims to "*engage and involve citizens and civil society organisations in co-designing and co-creating responsible research and innovation agendas and contents, promoting science education, making scientific knowledge publicly accessible, and facilitating participation by citizens and civil society organisations in its activities*".

The first Thematic Report in this PSF MLE Challenge on Citizen Science presented the topic ''*Introduction and overview of citizen science*'', and the first Discussion Paper in the series (on Topic 2) presented the topic "*Ensuring Good Practices and Impacts*". This Discussion Paper along with the two Thematic Reports can be found in the online repository of the EC Policy Support Facility.[2]

1.2 Scope of this Discussion Paper

This Discussion Paper introduces Topic 4, which focuses on the institutional and governance arrangements within Member States that can support and sustain citizen science and citizen engagement over the longer term.

In this Discussion Paper we present a range of recommendations for creating an enabling environment for Citizen Science from Project Reports, Policy Briefs, and Roadmaps that have been produced by projects supported by the Horizon 2020 'Science with and for Society' funding programme, along with our own recommendations for further reading.

1.3 Purpose of this Discussion Paper

The purpose of this Discussion Paper is to introduce Topic 4 to the participants in the PSF MLE and provide inputs for discussion in advance of the Topic 4 meetings that will take place in Austria in June 2022 (part I) and in Hungary in September 2022 (part II). At these meetings, the participating Member States will discuss and analyse the supportive and sustaining mechanisms in their own countries that create an enabling environment for citizen science initiatives over the longer term.

The recommended reading contained in this discussion paper will be informative for the discussions to follow during the Topic 4 workshops, which aim to address:

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[2]PSF Challenge / Mutual Learning Exercise on Citizen Science Initiatives - Policy and Practice.https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility/psf-challenge/mutual-learning-exercise-citizen-science-initiatives-policy-and-practice

1. Supportive governance and institutional governance, with a focus on institutional changes to research performing organisations including universities,

2. Multi-stakeholder approaches, with a focus on the roles of different stakeholders, including local coalitions of research, public authorities, businesses and civil society, and

3. Overarching strategies for creating enabling environments through open science, dedicated CS strategies, or specific funding schemes and modalities.

2 Sustaining and Supporting Citizen Science

2.1 CS Projects vs CS Initiatives

Citizen Science is most frequently described in the context of research projects that have a beginning and an end - often culminating in the publication of outcomes and new knowledge or insights when initiated by researchers or culminating in recommendations towards a new policy or action when initiated by civil society organisations or citizens. CS projects that receive external funding from national or European funding bodies most typically have a length of three to four years.

However, CS can also have a long-term character, collecting and analysing data that continues to contribute to the generation of new insights or ongoing monitoring over longer periods of time. Such CS initiatives may experience phases of project funding that have a beginning and end, while the underlying CS activities themselves continue beyond the end of the funding, or between phases of funding. In some cases, such activities can develop their own sustainable business model, which we can draw on for inspiration.

For the purposes of this Discussion Paper, we refer to CS projects when there is a distinct end date, and to CS initiatives, or Citizen Observatories, when the underlying CS activity is ongoing.

2.2 What are Citizen Observatories?

Longer-term CS initiatives in Europe are increasingly becoming known as Citizen Observatories (COs). COs are typically community-based environmental monitoring or public health monitoring initiatives in which the public contribute observations, data and information in complement to authoritative, traditional in-situ and remote sensing Earth Observation data, or other sources of formal data (such as public health data).

The term 'Citizen Observatory' was first coined by Prof. Jacqueline McGlade, the then head of the European Environment Agency (EEA), in her 2009 Earthwatch Lecture entitled *Global citizen observatory - The role of individuals in observing and understanding our changing world'*, wherein she stated that

> *"it is no longer sufficient to develop passive lists or reports to 'inform' citizens of changes in our environment. We need to engage with citizens and ask how they can 'inform' us."*[3]

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[3]McGlade J: Global citizen observatory - The role of individuals in observing and understanding our changing world. Annual Earthwatch lecture - Citizen Science, Oxford, 16th February 2009 http://www.eea.europa.eu/media/speeches/global-citizen-observatory-the-role-of-individuals-in-observing-and-understanding-our-changing-world

This concept of Citizen Observatories was taken up within the European Commission and supported across both the FP7 and Horizon 2020 funding programmes, as using

> *"innovative earth observation technologies (in particular those based on use of mobile telephony) . . . [and] community-based environmental monitoring, data collection, interpretation and information delivery systems; [COs] empower communities with the capability to monitor and report on their environment; and enable communities to access the information they need to make decisions in an understandable and readily usable form."*[4]

COs can thus play an important role in crucial areas such as biodiversity monitoring, climate change, sustainable development, air and water quality monitoring, flood and drought monitoring, and land cover or land-use change.[5] New domains of application are also emerging in epidemiology,[6] public health and wellness,[7] and patient co-research for symptom monitoring.[8]

COs are unique in providing new data sources for policymaking and the ongoing monitoring of the UN Sustainable Development Goals (SDGs) and can result in increased citizen participation in environmental management and governance at a large scale. Key to their impact is the ability to sustain activity over the longer term.

2.3 What we mean by Sustainability

2.3.1 Citizen Science that contributes towards sustainability issues

The term 'sustainability' in CS is most commonly associated with sustainable development or environmental and ecological sustainability to maintain a healthy environment and balanced ecosystem. The literature reflects this with many findings on the ways in which CS and CO initiatives can actively contribute

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[4]Rubio Iglesias, J.M. Citizens' observatories for monitoring the environment: A commission perspective. In Proceedings of Workshop on Citizen's Involvement in Environmental Governance, Arlon, Belgium, 7 October 2013; Directorate General Research and Innovation, European Commission: Brussels, Belgium, 2013. (As quoted in Grainger 2017)

[5] Hager, Gerid, Margaret Gold, Uta Wehn, Raquel Ajates, Linda See, Mel Woods, Valantis Tsiakos et al. "Onto new horizons: insights from the WeObserve project to strengthen the awareness, acceptability and sustainability of Citizen Observatories in Europe." JCOM: Journal of Science Communication 20, no. 6 (2021).https://doi.org/10.22323/2.20060201

[6] Grazuleviciene, R.;Andrusaityte, S.; Rapalavicius, A. Measuring the Outcomes of a Participatory Research Study: Findings from an Environmental Epidemiological Study in Kaunas City. Sustainability 2021,13, 9368. https://doi.org/10.3390/su13169368

[7] European Observatory on Health Systems and Policies & Heiss, Raffael. (2020). Fighting health infodemics: the role of citizen empowerment. Eurohealth, 26 (3), 23 - 25. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/338919

[8] for example the Topfit CitizenLab for Diabetes co-research
https://www.topfitcitizenlab.nl/grip-on-diabetes/citizenlab-grip-on-diabetes/

towards environmental stewardship and the preservation of vital ecosystems for nature and ourselves (see for example Vohland et al. 2019[9]) and with recent investigations into the ways that CS can support the UN SDGs (see for example Fraisl et al. 2020).[10]

Within the context of this MLE topic, we are not referring to sustainability in this sense, but rather in terms of the enabling environment for CS as a practice.

2.3.2 Sustaining the CS project or initiative

The first way in which we refer to sustainability is therefore that of any given CS project or initiative itself, in terms of its ability to maintain financial support for ongoing operations and the continued engagement of participants over the longer term, and thus the ability to achieve its stated objectives. This includes finding alternate sources of funding and developing business models that can secure revenue for the coordinating organisation, to support the continuation of the project as well as other related activities.

2.3.3 Sustaining the uptake and impacts of CS projects and initiatives

The second way in which we refer to the sustainability of CS is the wider uptake of CS data and multi-stakeholder engagement practices, such that the broader aimed-for impacts of CS approaches can be achieved. This entails building awareness of CS approaches amongst a range of stakeholders, fostering trust in CS data quality and the underpinning technologies and protocols, and continuously demonstrating impact through wide communication and dissemination of outcomes and impact stories.[11]

2.3.4 Sustaining CS as a research practice

Within the context of Open Science practices more broadly there is a growing movement to address how researchers and academic staff are recognised and rewarded for their work beyond the number of publications and the impact factor of Journals, with greater emphasis on communication, collaboration (team science), societal engagement (CS), education, and the societal impact aspects of their work. These new forms of recognition and appreciation are necessary to encourage and support researchers in pursuing CS approaches in their own

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[9] Vohland, K., Sauermann, H., Antoniou, V., Balazs, B., Göbel, C., Karatzas, K., ... & Winter, S. (2019). Citizen Science and sustainability transitions. Available at SSRN 3511088.https://doi.org/10.1016/j.respol.2020.103978

[10] Fraisl, D., Campbell, J., See, L., Wehn, U., Wardlaw, J., Gold, M., ... & Masó, J. (2020). Mapping citizen science contributions to the UN sustainable development goals. Sustainability Science, 1-17 https://doi.org/10.1007/s11625-020-00833-7

[11] Hager, G., Gold, M., Wehn, U., Ajates, R., See, L., Woods, M., Tsiakos, C., Masó, J., Fraisl, D., Moorthy, I., Domian, D. and Fritz, S. (2021). 'Onto new horizons: insights from the WeObserve project to strengthen the awareness, acceptability and sustainability of Citizen Observatories in Europe'. JCOM 20 (06), A01. https://doi.org/10.22323/2.20060201.

research, and to adequately reward the effort that it takes to engage with external stakeholders and participants.

Changes towards a new 'Recognition and Rewards'[12] environment need to happen on the level of institutional policy, but also within the culture of research groups to shift the focus away from individual excellence towards a supportive and collaborative work environment for researchers, and an enabling environment for innovation and collaboration. Additionally, as the European Commission continues to promote societal engagement as a criterion for assessing research impact,[13] the acquisition of these skills will need to be embedded in research career trajectories.

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[12] See for example, see the Dutch Universities Position Paper on Rewards and Recognition https://www.universiteitenvannederland.nl/recognitionandrewards/recognition-and-rewards/index.html , and the San Francisco Declaration on Research Asessment https://sfdora.org/read/

[13] European Commission, Directorate-General for Research and Innovation, Enabling open science and societal engagement in research, Publications Office, 2021, https://data.europa.eu/doi/10.2777/057047

3. What is an Enabling Environment?

The term 'Enabling Environment' can be found in a range of contexts such as strengthening the informal economy, or sustainable business enterprises,[14] and it refers to the factors that allow a desirable occurrence or state of affairs to come about, grow and thrive, the components of which are similar for any subject.[15]

We describe these components or enabling factors in the context of CS as follows:

3.1 Supportive legal and policy frameworks and their implementation and enforcement, such as:

- Legislation aimed at sustaining or scaling-up current CS projects across various sectors,

- National research funding strategies to explicitly encourage and support citizen engagement in research and innovation,

- National directives to incorporate CS generated data in policy making and local governance, and

- Strengthened connections between national policy and European policy and directives.

3.2 Institutional policy frameworks, operational structures, and management cultures, such as:

- Institutional policies within research performing organisations (RPOs) and research funding organisations (RFOs) to promote and recognise CS research practices, for example within the context of Open Science or Responsible Research & Innovation (RRI),

- Support for CS practices embedded in operational structures,

- Career-path recognition for the value and importance of such practices, with matching rewards and incentives

- Local coalitions of RPOs, public authorities, businesses and Civil Society Organisations (CSOs) on topics being addressed by CS research or COs,

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[14] See for example the International Labour Organization toolkit for promoting enabling business environments https://eese-toolkit.itcilo.org/index.php/en/about/overview.html

[15] Enabling environment definition and reference to tools | Capacity4dev (2022). Available at: https://europa.eu/capacity4dev/iesf/discussions/enabling-environment-definition-and-reference-tools (Accessed: 15 May 2022).

- Non-governmental Organisation (NGO) support of longer-term CS initiatives and COs,

- Internal communication structures and dedicated role descriptions for multi-stakeholder engagement within local authorities, national governance bodies, and non-governmental actors,

- Operational support of multi-stakeholder coordination across institutional boundaries, and

- Creation of an organisation function (e.g., "office of CS") which provides support, promotion, and management capacity.

3.3 Capacity building activities, such as:

- Integration of skills training for CS as a practice within academic, professional, and life-long educational offerings,

- Dedicated roles within institutions for engaging with the public and CSOs, supporting CS research practices, and/or developing pathways for citizen-generated data, and

- National and regional-level CS platforms and associations for knowledge exchange, training, and development of best practice.

3.4 Supportive technological and data infrastructure, such as:

- Technological tools and platforms for data gathering and analysis, and data infrastructures for data aggregation and data sharing, that are findable, accessible, interoperable, and reusable (FAIR),

- Integration with official data systems and frameworks,

- Integration of CS infrastructure within national data systems, and

- Funding support for ongoing development of technological tools and platforms for CS and COs.

3.5 Societal dialogue and public fora promoting participation of public and private stakeholders, such as:

- National research agenda setting in collaboration with the public and CSOs,

- Impactful alliances between CSOs, NGOs and community-based organisations to promote dialogue and knowledge exchange, and

- Supportive infrastructure for public-private collaborations.

4. Findings of the WeObserve CSA regarding the challenges of Sustainability[16]

The Horizon 2020-funded WeObserve project was a Coordination and Support Action (CSA) that aimed to help move CS and Citizen Observatories into the mainstream by consolidating knowledge about the key elements for a sustainable ecosystem of COs and related activities and sought to understand more deeply what underlying factors may hold COs back from becoming more sustainable over the long term and achieving their intended impacts.

The challenge of sustainability was found to primarily relate to the operational, organisational, and governance continuity of COs beyond the typical project-funding lifetime, and the necessity of planning for this right from the launch of the CO.

The WeObserve consortium collated the experience and insight of a range of COs via a series of workshop events, interviews, and Community of Practice collaborations. The most in-depth insights came from interactions with the four CO projects that were closely partnered with WeObserve, namely Ground Truth 2.0 (https://gt20.eu/), the GROW Observatory (https://growobservatory.org/), LandSense (https://landsense.eu) and Scent (https://scent-project.eu/).

This section presents the findings of the WeObserve project with respect to Sustainability Challenges, as reported in the project deliverable '*EU Citizen Observatories Landscape Report II: Addressing the Challenges of Awareness, Acceptability, and Sustainability'.*[17]

4.1 Insights from the 4 COs Workshop Event

On the 9th of October 2019 WeObserve organised an event in Brussels together with the four COs with which it was closely partnered on "Observing the Environment: Challenges and Opportunities in Citizen Science" (The '4COs Workshop' - illustrated in Figure 1 below) to showcase their achievements, share best practices, and discuss their impact and sustainability beyond the project lifecycle, along with a range of project stakeholders and policymakers.

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[16] Please note that this section draws directly from the outputs of the WeObserve project, as cited below, which can be found in the project's Zenodo repository [[https://zenodo.org/communities/weobserve].

[17] Gold, Margaret, Wehn, Uta, Bilbao, Ane, & Hager, Gerid. (2020). EU Citizen Observatories Landscape Report II: Addressing the Challenges of Awareness, Acceptability, and Sustainability. Zenodo. https://doi.org/10.5281/zenodo.4472670
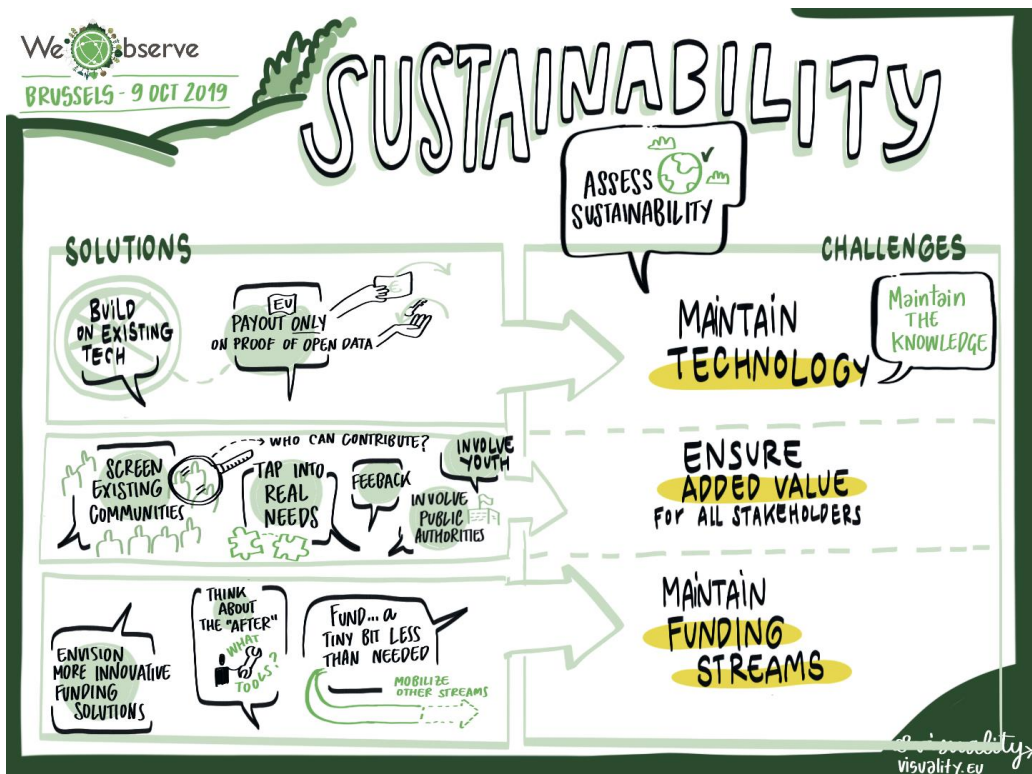
Figure 1. The 4COs Workshop on the Challenge of Sustainability.[18] **Illustration:** Mara Callaert, Visuality.eu

During this workshop, a range of factors relating to the maintenance of the underlying technology that need to be accounted for when considering sustainability planning came to light, including:

- Data ownership

- Embedding of the CO activities into an institutional setting for longer term operations

- Interoperability between existing and emergent platforms

- Running and maintenance costs

- Technological readiness and the need for further development

- Embedding required data skills, such as developing data models and data visualisations for different types of data

- Technological sustainability, and the use of or contribution to open source

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[18] Gold et al. (2020).

- The longevity and reliability of key technology partners and suppliers

- Sharing CO outcomes with participants beyond the end of the project, and properly acknowledging their involvement

- Technology transfer into new hands at the end of the project

Similarly, the needs of the community of active participants that has been built up within the CO were discussed, for the maintenance of ongoing CO activity by that community, and these included:

- Centralised effort to continue to build and keep the community

- Managing different expectations of the actors for how the CO should be sustained, and by whom

- Maintaining consortium alignment, or alignment with consortium partners

- Recognising different citizen motivations and needs in the sustainability planning

And finally, how to maintain a balance in delivering on the values of science, policy, and citizens was discussed:

- How to balance pressures to seek commercial exploitation or commercial support with the needs and motivations of the community

- How to develop the underlying technology if the market was not yet established

- Aligning value of commercial exploitation with the value of the CO

- Ownership and institutional embedding without compromising the CO's purpose

- How to support the ongoing involvement of policy makers

- How to address environmental sustainability issues surrounding the sensors, e.g., plastic packaging

- Reaching agreement on the ambition and scope of the CO post-funding.

4.2 Recommendations from the WeObserve Landscape Report

In order for CS initiatives and COs with a longer-term character to make an impactful contribution to tackling society's greatest challenges, an enabling environment must be built around them such that they can sustain their activities and deliver both value and impact. These conditions include:

- A network of stakeholders and active place-based community, that is linked with other networks and communities of practice,

- Skills, capacity building, training and knowledge sharing capabilities,

- Suitable and reliable technology, data infrastructures and standards, and

- Legal, policy and funding frameworks that support flexibility, sustainability, and impact and value delivery.

Addressing each of these challenge areas has positive knock-on effects towards growing awareness of the benefit and impact of CS approaches, and increasing the acceptability of Citizen gathered data, as illustrated in Figure 2 below.
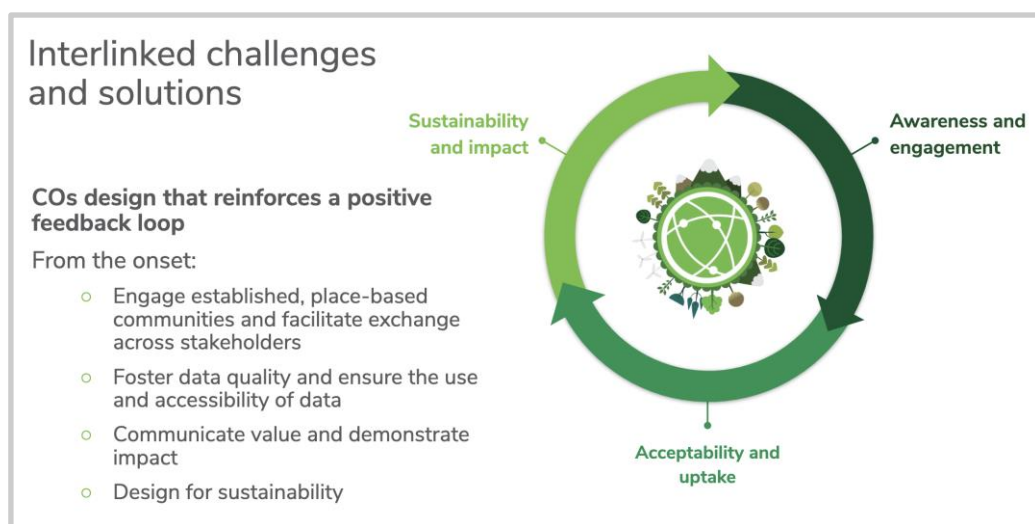
Figure 2. The challenges and solutions facing COs are interlinked[19]

Based on their investigations, the WeObserve project recommended a number of distinct actions for (i) those who initiate and run CS initiatives, (ii) those who can use the data generated with COs to support their decision making, and (iii) those who fund and support the existence of COs. The nature of these recommendations fall into three main categories:

1. **Communication, co-design, community and network building actions**: These actions may include, e.g., engaging with decision makers, policy and government agencies early on, collaborating with SMEs, or engaging the media.

2. **Actions to further improve data quality and standards, integration and interoperability, accessibility and protection**: These actions can range from describing and defining the purpose of gathered data across

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[19] Gold et al. (2020)

stakeholders, to developing semantics for data collection further, to establishing new models to balance privacy and data protection requirements with the mandate for open access data and transparent data governance.

3. **Actions to allow technology transfer and business prototyping**, including actions to e.g., build on and reuse existing, open access technologies, calculate and communicate CO costs and benefits, or include business partners to develop the market potential of Cos.

4.2.1 Recommendations to Project Coordinators and Initiators

During the proposal development phase when it is crucial to build in sufficient budget and planning, and the subsequent design and launch of the CS project or initiative, coordinators should:

- Plan and provide resources for strong communication,

- Plan for the support of the community beyond the end of the project, especially with regard to financial and resource support,

- Plan for ongoing 'agile' development of any supportive technologies, and their long-term maintenance, and

- Plan for replicability and scaling up of successful approaches.

4.2.2 Recommendations to Policy Makers and Public Authorities

The crucial link that public authorities and policy makers (particularly at local levels) provide towards the formation of formal policy and related decision making based on the data and insights gathered in CS approaches, makes it essential for them to:

- Realise their influence as cheerleaders and change agents amongst their peers to foster the uptake of citizen gathered data and Citizen Observatories,

- Seize opportunities to share experiences and success stories, and elaborate on their own CO experience and success stories, especially towards fellow policy makers and decision makers, and

- Reach out to other peers to learn from their experience with CS and COs

4.2.3 Recommendations to Funding Bodies

(As also presented in the Policy Brief 'Mission Sustainable: *Fostering an enabling environment for sustainable Citizen Observatories*'[20])

Several challenges for the sustainability of COs need to be addressed on the level of the policy and funding frameworks that set the conditions for CS projects and COs to function and sustain their activities. They shape the enabling environment for the generation and execution of successful COs. Funding bodies should:

- Provide greater flexibility within funding schemes for the co-design of Citizen Observatories, namely:

    ○ Provide adequate flexibility to allow stakeholder needs to be identified via co-design processes after the launch of the funded CO project.
    ○ Find ways to trust in the "yet to be defined" outcomes of proposals based on co-design in order not to bias funding towards the 'safe bets'.
    ○ Provide appropriate financial support for core scientific research, outreach and engagement activities, and the iterative development of underlying technology such as mobile applications and data platforms.

- Encourage the use of open-source software, shared code bases, and sustainable hardware, and support ongoing technology development via iterative user feedback, i.e.:

    ○ Encourage re-use and further development of existing technologies, so that development efforts are focused on responding to user feedback, and iteratively improving supportive technology.
    ○ Prioritise open-source technologies where available, or require open access, so that all developed code is shared, and many (community) initiatives can be supported through the availability of a richer set of features and functionalities that can be applied in other contexts.
    ○ Encourage use, reuse, repair and adequate disposal and recycling of sustainable hardware for any sensing technology, both in terms

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[20] Gold, Margaret, & Wehn, Uta. (2020). Mission Sustainable: Fostering an enabling environment for sustainable Citizen Observatories. WeObserve policy brief 2. Zenodo. https://doi.org/10.5281/zenodo.4001672

of the environmental sustainability of the product and packaging, and in terms of the ongoing support and development of the hardware. Repairing activities with participants can provide further engagement and learning opportunities and outcomes for projects.

- ○ Require sufficient budget allocation by projects to enable agile development cycles based on user feedback during the project, thus vastly improving the technology and platform effectiveness and usability.

- Explicitly include COs in mission driven research funding schemes as a means for citizen and stakeholder engagement, i.e.:

  - ○ Identify COs as a formally recognised approach to stakeholder engagement in mission driven research funding schemes, in order to clarify their relevance for applicants as well as evaluators.
  - ○ Drive for quality Citizen Observatories that do not reinvent the wheel but instead build on best practice by implementing sustainable Citizen Observatories, and collaboration and partnerships across the Quadruple Helix of stakeholders.

- Provide longer term funding support for Citizen Observatories and CS initiatives with a long-term character, i.e.:

  - ○ Provide alternative funding models that recognise the longer time periods over which Citizen Observatories and some types of CS initiative operate.
  - ○ Scale proven approaches in order to move beyond (dispersed) piloting.
  - ○ Make follow-on or alternative sources of funding available to projects that hit key performance indicators, in order to fully maximise the potential for societal and environmental impact.

4.3 Recommendations of the WeObserve project for the uptake of the Citizen Observatories Knowledge Base.

The focus of the WeObserve project, although highly relevant for CS practices more broadly, was on the specific long-term character of Citizen Observatories and their unique potential value towards addressing socio-ecological challenges, complementing official data sources, and achieving the EU's aim of widening participation in the aims of the European Green Deal and the Missions of Horizon Europe.

Fully tapping into the innovation and impact potential of Citizen Observatories requires continuous investments and targeted actions, and these were summarised by WeObserve in a detailed research and innovation roadmap that outlines four focus areas, a range of dedicated pathways and proposed actions in each of them (as illustrated in Figure 3 below).
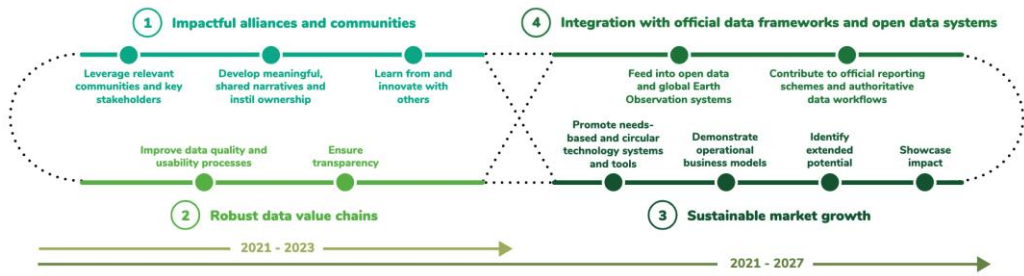
Figure 3. Main areas and pathways of the WeObserve Roadmap for the uptake of the Citizen Observatories knowledge base, including interlinkages between areas[21]

These four main areas, with their pathways and actions are:

AREA 1: Impactful alliances and communities

- *PATHWAY - Leverage relevant communities and key stakeholders*

    - Engage with active, place-based communities, community organisations and citizen-driven initiatives
    - Engage with decision makers, policy and government agencies
    - Secure support from gatekeepers and community champions
    - Develop operational relationships with the media and business/industry

- *PATHWAY - Develop meaningful shared narratives and instil ownership*

    - Tap into media intelligence and media R&D for audience development and innovative participation models
    - Ensure strong and suitable communication and facilitation across stakeholders
    - Employ co-design approaches to democratise processes and foster ownership and buy-in
    - Acknowledge and reward voluntary participation

- *PATHWAY - Learn from and innovate with others*

    - Ensure transdisciplinary anchoring and responsible research practice
    - Join/start groups for knowledge and experience exchange on relevant topics

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[21] WeObserve consortium. (2021). Roadmap for the uptake of the Citizen Observatories' knowledge base. Zenodo. https://doi.org/10.5281/zenodo.4646774

AREA 2: Robust data value chains

- *PATHWAY - Improve data quality and usability processes*

  - Describe and define the purpose and value of gathered data across stakeholders
  - Provide high-quality training to participants and data providers
  - Document data quality and strive towards achieving existing data standards
  - Further develop semantics and tools for data collection, annotation and review

- *PATHWAY - Ensure transparency*

  - Establish transparent data policy models that balance data ownership, privacy and data protection requirements with the mandate for open access data and transparent data governance
  - Deploy a transparent and integrated ethics framework

AREA 3: Sustainable market growth

- *PATHWAY - Promote needs-based and circular technology systems and tools*

  - Address communities and/or local authorities with existing data needs as key, demand-side market players and provide enabling technologies that help maximise community and/or policy impact
  - Build on and reuse existing, open access technologies and tools
  - Strive for zero emission/zero waste approaches and actively tackle waste issues

- *PATHWAY - Demonstrate operational business models*

  - Include business partners to maximise the uptake potential of Citizen Observatories
  - Prepare implementation and handover of Citizen Observatory business models

- *PATHWAY - Identify extended potential*

  - Embed Citizen Observatories' ambitions within a global change context
  - Strengthen links to Citizen Observatories outside Europe as well as to global initiatives
  - Leverage use of Citizen Observatories in new domains

- *PATHWAY - Showcase impact*

- ○ Publicise Citizen Observatory costs and benefits
- ○ Showcase Citizen Observatory capabilities, success and impact stories

AREA 4: Integration with official data frameworks and open data systems

- *PATHWAY - Feed into open data and global earth observation systems*
  - ○ Integrate with large open data and open research infrastructures
  - ○ Share interoperable resources and data through standardised platforms and services
  - ○ Improve uptake of Citizen Observatory data in GEOSS and the usability of GEO services for Citizen Observatories

- *PATHWAY - Contribute to official reporting schemes and authoritative data workflows*

  - ○ Enable the uptake of Citizen Observatory data
  - ○ Align data protocols
  - ○ Elevate Citizen Observatory initiatives' capabilities
  - ○ Disseminate and support best-practices
  - ○ Secure investment and engagement

5. Insights, Policy Briefs and Recommendations for Citizen Science[22]

In this section we present a range of recommendations from Reports, Policy Briefs, and research that have been produced by recent projects and initiatives across Europe, such as those supported by the Horizon 2020 'Science with and for Society' funding programme, and those engaging with the UN Sustainable Development Goals (SDGs).

5.1 EU-Citizen.Science: Citizen Science for Policy across Europe

The high-level policy event "Citizen Science for Policy across Europe" was held on 22 June 2021 as a satellite event of the European Research and Innovation Days 2021, organised by the EU-Citizen.Science project consortium and the Spanish Foundation for Science and Technology (FECYT)/Ibercivis Foundation, with the support of the European Commission, the Spanish Ministry of Science and Innovation, the Portuguese Ministry of Science and Technology and Higher Education and the German Federal Ministry of Education and Research.

The discussion that took place between representatives from ministries across Europe and at the regional and local levels about CS and its benefits for policy making were encapsulated in the 'Brief Report of the High-Level Policy Event held on June 22nd as a satellite event of the R&I Days 2021 Citizen Science for Policy across Europe'.[23]

Recommendations and insights that emerged during the discussion include:

- The importance of community tools and platforms to share data and knowledge at the national level to enable the provision of CS data, data analysis and interpretation for policymaking.

- The importance of engaging with public administrations, national statistical offices and similar bodies on how to benefit from CS.

- The importance of a dedicated staffed role within Ministries with Science in their portfolio for Science Communication and Citizen Engagement, to ensure that citizens are part of the decision-making process.

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[22]Please note that the summaries in this section are drawn directly from the cited sources.
[23]Radicchi, A., Fabó Cartas, C., Sanz, F., Camacho, P. (2021). Citizen Science for Policy Across Europe, MfN, Berlin, Germany https://eu-citizen.science/static/site/files/EU-Citizen_Science_2021_report-policy-event.pdf

- The role of political support for better financing of public-private partnerships, increased visibility of CS initiatives and their impacts, and stronger connection to research units and infrastructures.

- The role that National Statistical Offices and Environmental Protection Agencies can play in helping to overcome challenges such as funding, access to tools and open-source solutions, and strengthening the connection between CS and the SDGs.

- The need to establish spaces, platforms and discussion sessions that bring citizens and policy makers together to share experiences and foster collaboration competencies for addressing societal issues together.

5.2 ACTION: Recommendations to Mainstream Citizen Science in Policy

The ACTION project organised six masterclasses about the interaction of CS with policy in five countries (Italy, Netherlands, Norway, Spain, the UK), in which more than a hundred people participated in across the country masterclasses, and more than 75 participated in the final overarching masterclass. All participants indicated their interest in the connection of CS with policy. Participants included policymakers, civil servants, citizen science actors, and scientists.

RECOMMENDATIONS TO MAINSTREAM CITIZEN SCIENCE IN POLICY

ACTION

The recommendations[24] that the Action project gathered from these sessions for helping CS to live up to its potential to bridge science, society, and policy and to support governments and administrations to make sensible policies in relation to grand societal challenges include:

- Fund CS in the science system with the goal to mainstream CS as a scientific method

- Set up national / regional CS networks to connect CS actors and facilitate knowledge exchange

- Promote and create awareness of how CS can be used in policy to convince policymakers to adopt CS

[24] Notermans, Igno, Montanari, Cléa, Janssen, Annelli, Hölscher, Katharina, Wittmayer, Julia, & Passani, Antonella. (2022). Recommendations to mainstream citizen science in policy (Version 0). Zenodo. https://doi.org/10.5281/zenodo.5772237 https://actionproject.eu/wp-content/uploads/2022/03/Recommendations_to_mainstream_citizen_science_in_policy_final.pdf

- Establish an open data platform to share and integrate CS data to inform policy and establish it as a legitimate policy mechanism

- Take time for co-creation to allow for co-ownership and alignment of efforts

- Develop a local platform for exchange, to connect policymakers with CS actors

The final recommendations document also includes specific advice for policymakers in Italy, Netherlands, Norway, Spain, and the UK.

5.3 TReNDS: Counting on the World to Act
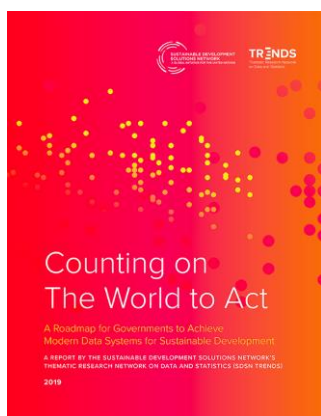
The Thematic Research Network on Data and Statistics (TReNDS[25]) is an initiative of the UN Sustainable Development Solutions Network, and their report '*Counting on the World to Act*'[26] details an action plan for governments and their development partners that will enable them to help deliver the SDGs globally by 2030.

Their recommendations specifically aim to empower government actors – whether they be national statisticians, chief data scientists, chief data officers, ministers of planning, or others concerned with evidence in support of sustainable development – to advocate for, build, and lead a new data ecosystem that also includes citizen-generated data via CS initiatives that use 'frontier technologies' to engage with impacted communities on the ground:

> "*The data revolution for sustainable development is fundamentally about using new, frontier technologies to produce data, conduct analysis, generate insights, and disseminate results that might support our progress towards a more sustainable future. Frontier technologies are constantly changing but include artificial and machine intelligence, robotics, sensors, drones, cutting-edge spatial technology, and insights derived from telecommunications data. In addition, as part of the data revolution, efficiencies are being derived from lower-tech approaches such as using citizen-generated data and smartphones to speed up existing survey-based approaches*"

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[25] https://www.sdsntrends.org

[26] Espey, J., Badiee, S., Dahmm, H., Appel, D., & Noe, L. (2019). Counting on the world to act: A roadmap for governments to achieve modern data systems for sustainable development. https://www.sdsntrends.org/research/countingontheworld

In Chapter 4 of their report they describe the need for:

1. better systems to encourage interoperability;

2. greater accessibility to new methods, technologies and techniques; and

3. more capacity development and training - in order to support and enable the uptake of citizen-generated data by national governments.

Their recommendation to UN Member States is to work with the UN custodian agencies and the UN Statistical Commission to collaborate on methodological exchanges where new approaches to measurement of specific indicators and issues can be evaluated, debated, and categorised to make them more accessible to NSOs and other relevant government departments.

5.4 DITOs: Citizen Science & Open Science: Synergies & Future Areas of Work

The Doing It Together Science (DITOs) project was one of the first H2020-funded projects dedicated to the field of CS, and had the aim to increase participation in CS across Europe by coordinating and supporting 500 public events encompassing the full spectrum of activities from top-down to bottom-up, in which more than 1.5 million participants were engaged over the three years of the DITOs project.[27] The DITOs partners also ran activities with the explicit purpose of "policy engagement," i.e., reaching out to decision makers with the aim to provide information and good practice on CS and DIY science, which resulted in a range of policy briefs.

The third Policy Brief '*Citizen Science & Open Science: Synergies & Future Areas of Work*'[28] highlights how CS and Open Science together

can address grand challenges, respond to diminishing societal trust in science, contribute to the creation of common goods and shared resources, and facilitate knowledge transfer between science and society to stimulate innovation. It aims at informing decision makers who have adopted CS or Open Science on the

[27] Göbel, C., Nold, C., Berditchevskaia, A. and Haklay, M., 2019. How Does Citizen Science "Do" Governance? Reflections from the DITOs Project. Citizen Science: Theory and Practice, 4(1), p.31. DOI: http://doi.org/10.5334/cstp.204

[28] DITOs consortium, (2017). Citizen Science and Open Science: Synergies and Future Areas of Work. DITOs policy brief 3 .https://discovery.ucl.ac.uk/id/eprint/10043574/

synergies between these approaches and the benefits of considering them together, and recommends that the following challenges be addressed:

1. Openness

    a. Improve data management and stewardship for CS.

    b. Continue work on findability, accessibility, interoperability and reusability of CS data, with examples of implementing FAIR Principles.

    c. Acknowledge different types of contributions to science and find adequate ways of making them visible, traceable and reusable, regardless of whether the CS outputs are data, software or project platforms or something else.

    d. Work to resolve legal uncertainties and share approaches to intellectual property and licensing issues at the intersection of CS and OS.

2. Inclusion & Empowerment

    a. Expand the involvement of CS volunteers beyond data collection and analysis by opening all stages of the research cycle to participation and enabling more co-creation of research results and co-design of research projects.

    b. Foster equitable and sustainable science.

    c. Promote global-level dialogue and cooperation between stakeholders.

3. Education & training

    a. Include CS in research education and training on OS and vice versa and include both in general research education and training.

    b. Ensure means for science education and communication to accompany CS initiatives.

    c. Build CS and OS into teacher training.

4. Funding

    a. Increase and diversify the opportunities for small seed funding for project prototyping and experimentation in CS and OS.

b. Offer mechanisms for funding that address the different project characteristics of CS and OS initiatives, such as scoping phases for co-design of research agendas, flexibility in accepting changes to project execution, and recognition of CSOs as well as citizens as applicants and grant holders.

c. Fund positions and horizontal measures for community management.

d. Treat increased transparency and public participation in research projects as an opportunity to reduce bureaucracy around such projects.

5. Infrastructure & Reward Systems

a. Recognise and support the integration of CS and OS as or within research infrastructures. In some sectors, there is a need for specific research infrastructures for CS, such as the Atlas of Living Australia, which supports biodiversity data collection through CS projects.

b. In other cases, CS can also be part of domain infrastructures, e.g. My Ocean Sampling Day, an environmental sampling project that hosts their data at a global ocean data centre.

c. Lastly, CS and OS can be understood as providing a socio-technical research infrastructure in their own right

5.5 DITOs: Making Citizen Science Work - Innovation Management for Citizen Science

The DITOs project also investigated the main archetypes of operations in CS and grassroots 'DIY' science by comparing 35 different types of CS projects and identifying them in terms of (i) the individual or organisation running the project, (ii) how the project was funded, (iii) the length of time the project has been running, and (iv) the scale of the project's operation (including the geographical scale and funding scale). This insight was used to develop five broad business models in CS, which they termed: (1) Motivated individual, (2) Small Crowdsourcing; (3) Outreach; (4) Research and Innovation; and (4) Long Term NGO.

Drawing on the field of Social Innovation for insights, they made a number of recommendations (reported in deliverable '*D6.6 Innovation Management Plan: "Making citizen science work'*[29] and summarised in Policy Brief '*Making Citizen Science Work – Innovation Management for Citizen Science*'[30]) as to how CS can learn and adopt approaches for the long-term management of innovation initiatives:

1. Innovation in the area of CS and DIY science requires attention and support, as the field is still emergent and needs research, experimentation, and funding.

2. Infrastructure for innovation management in CS needs to be provided. Parts of this infrastructure are starting to emerge (e.g. the analysis of Intellectual Property Rights) but there is a long way to go. This will require dedicated attention from funders.

3. In the current landscape, NGOs seem to be the most capable of running long-term projects, with membership fees being the most sustainable funding model. This should be taken into account when developing CS projects that are expected to last over a long time period.

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[29] DITOs Consortium,2018. Doing It Together science: D6.6 Innovation Management Plan: "Making citizen science work".UCL, London

[30] DITOS Innovation Management Policy Brief #5 - March 2019 DITOS Consortium and WeObserve Consortium (2019) Making Citizen Science work: Innovation Management for Citizen Science. https://discovery.ucl.ac.uk/id/eprint/10073927

4. Universities and research institutions should team up with NGOs who have a mission that is closely aligned with the research area of the CS project, so as to become a potential legacy partner for the R&I project.

5. There is a specifically challenging situation for Motivated Individual and SCS projects, where there is currently plenty of innovation and evidence of entrepreneurship (sometimes inside an organisation). These efforts should be supported and enhanced; social innovation mechanisms might be effective here.

6. Specific attention should be given to those projects which have successfully transitioned from one archetype model to another. This will allow for a better understanding of the enabling factors and how best to support such transitions to longer term and more stabilised models and funding sources.

5.6 INOS: Roadmap for Capacity Building on Open Science and Citizen Science for Research Libraries

The INOS project (Integrating open and citizen science into active learning approaches in higher education) has been developing activities, experiences and tools to encourage Higher Education Institutes (HEIs) to be part of the growing Open Science and CS movements through teaching, learning, training and taking part in open innovation and knowledge activities.

Universities are involved in an increasing number of open knowledge and open innovation initiatives, engaging students, teachers, researchers and citizens in digitised projects for a social purpose in an open framework of collaboration. But the INOS project acknowledges that the advancement of Open Science and CS is no easy task, with many challenges to implementation in HEIs and Research libraries. Building on the expertise and experience of the research libraries' community, the INOS '*Roadmap for Capacity Building on Open Science and Citizen Science for Research Libraries*'[31] presents 10-steps for capacity building for OS and CS in research libraries, with a focus on addressing the three major gaps that have been identified: resources, targeted communication, and structured training. Their recommendations are:
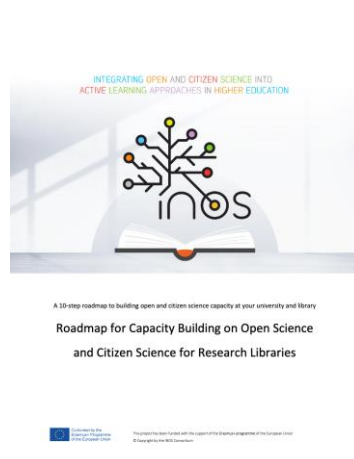
- Secure resources to support capacity building

    ○ Include OS as a priority within the institutional strategy
    ○ Establish OS collaborations across the HEI and research libraries

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[31] https://zenodo.org/record/5636187#.YX_TQ57MI2w

- Build on the position of research libraries as key stakeholders in achieving CS goals
- Be actively involved in establishing support programmes for researchers in HEI and research libraries
- Share information on the existing financial support for OS and CS initiatives

- Target OS communication to foster capacity building

    - Support establishing easily available knowledge transfer procedures within HEI
    - Focus OS-related communication and strategic marketing efforts on the benefits of OS for researchers

- Implement structured capacity building

    - Make targeted CS training a part of the general OS training
    - Focus training on a diverse range of stakeholders
    - Create and/or contribute workflows that help define the process and define roles within the HEI, with the involvement of its library

5.7 EKLIPSE: Multiple Scales, Multiple Approaches – Towards Meaningful Engagement In Europe

The EKLIPSE project aims to help governments, institutions, businesses and NGOs make better-informed decisions regarding biodiversity management and policy in Europe.

The project encourages informed societal debate on environmental policy issues at the EU level using engagement methods such as science cafés, one of which was organised in Helsinki Finland on Nature Based Solutions (NBS) and resulted in the development of a Policy Brief[32] on public participation and societal engagement on environmental issues. They recommend that science, policy and society need to work together to create legitimate policies that encourage action from different actors in the European Union, and more specifically:

- Societal engagement should always be linked to current and relevant policy issues to foster a meaningful discussion with the potential for influencing or increasing knowledge on emerging policy topics.

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[32]EKLIPSE: Multiple Scales, Multiple Approaches – Towards Meaningful Engagement In Europe. (2019) Liisa Varumo; Riikka Paloniemi; Eszter Kelemen; Juliette Young; Iida-Maria Koskela; https://www.eklipse-mechanism.eu/apps/Eklipse_data/website/CORRECTED_PolicyBrief_EKLIPSE-WP6_WebVersion.pdf

- Science, policy and society should work together to ensure the best available knowledge is used at European level.

- The phase in which engagement with society takes place will differ depending on the desired impacts of engagement.

- The broader the geographical scale of the policy process, the more difficult it becomes to engage diverse audiences. Topics should always be communicated in an appropriate manner at different scales and lower-level deliberations should feed into processes at higher level and vice versa, and

- Engaging diverse audiences at broader scales (e.g., the EU level) requires innovative approaches, often combining online techniques, which guarantee an accessible and safe space to share knowledge and opinions.

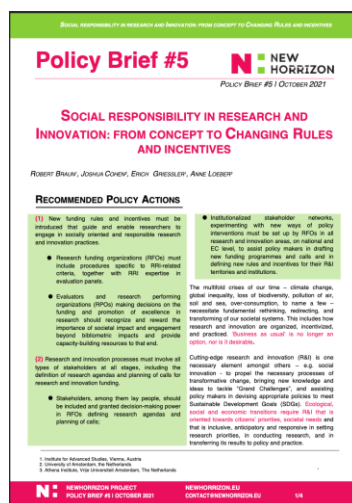## 6. Insights, Policy Briefs and Recommendations for RRI

In total 49 projects have been funded in the Science with and for Society (SwafS) strand of H2020. Alongside dedicated attention to CS, there has also been a lot of attention given to RRI, which is highly relevant and informative for sustaining and supporting Citizen Science.

As a science policy framework, RRI seeks to align technological innovation with broader social values, engage the public and societal actors in science and innovation processes, and ensure that the outcomes of research and innovation are ethically acceptable, sustainable and socially beneficial. In this section we present a range of RRI projects in which insights have been generated, and recommendations are forthcoming.

6.1 NewHoRRIzon: Social Responsibility in Research and Innovation - from Concept to Changing Rules and Incentives.

The H2020 CSA NewHoRRIzon project set out to promote the uptake and institutionalisation of RRI in H2020, which included the setting up of 19 Social Labs that engaged more than 700 researchers, policymakers, managers, CSO representatives, emerging scholars, and citizens to develop pilots and prototypes for change actions in their respective fields and institutions. The activities resulted in the production of five policy briefs:[33]

1. RRI in H2020: Current Status and Steps Forward

2. Lacking Integration of Societal Needs and Ethical Concerns into European Research and Innovation Policy Severely Limits the Ability to Tackle 'Grand Challenges'

3. Policy Transfer and Shared Knowledge Base Learning from Policy Implementation

4. Stimulating Responsible Research and Innovation with the online Societal Readiness Thinking Tool

5. Social Responsibility in Research and Innovation: From Concept to Changing Rules and Incentives

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[33] All five NewHoRRIzon Policy Briefs can be found at https://newhorrizon.eu/policy-briefs/

Policy Brief #5 '*Social Responsibility in Research and Innovation - from Concept to Changing Rules and Incentives*'[34] contains a number of specific recommendations for orienting Research and Innovation towards citizens' priorities and societal needs and setting research priorities that are inclusive, anticipatory and responsive to societal actors; namely:

- Policymakers and funders must introduce funding rules and incentives that stimulate and enable researchers to engage in responsible and socially oriented research and innovation practices.

- Funding rules and incentives must give all types of stakeholders the opportunity to take part in the research process at different stages.

- Evaluators and RPOs that make decisions on funding and promotion of outstanding researchers should recognise and reward the importance of societal impact and engagement beyond bibliometric impacts.

- Research and innovation policymakers should invest in the creation of governance networks and/or alliances thereof to enhance the R&I system towards RRI.

- Uptake of RRI in actual research projects requires (a)including a requirement to attach a supplement addressing project-specific RRI-related questions and reflections;(b) incorporating RRI-specific actions in the submission tasks, deliverables, milestones, and budgets; (c) promoting RRI-informed criteria in the evaluation of research proposals, training evaluators in RRI, open science, CS, and include RRI experts/expertise in the evaluation panel.

In the Thematic Report on Topic 4 which will be produced after the two workshops a broader overview of relevant policy recommendations for CS will be presented and further analysed.

6.2 SuperMoRRI: RRI policies to support better alignment with societal values, needs and concerns, and encourage societal actors to work together during the whole R&I cycle.

The SUPER MoRRI project[35] is currently carrying out a large data collection exercise among European RFOs (55) and RPOs (122). The data - among others- pertains to their strategic orientation and action plans with regard to engagement of stakeholders, including citizens.

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[34] Braun, Cohen, Griessler & Loeber (2021). New HoRRIzon Policy Brief: Social Responsibility in Research and Innovation - from Concept to Changing Rules and Incentives. https://newhorrizon.eu/wp-content/uploads/2021/10/newhorrizon_policy_brief_2021_October.pdf
[35] https://super-morri.eu/about-us/

Information pertaining to the 11 participating countries in the MLE CSI-PP will be included in the Thematic Report on Topic 4, for which this Discussion Paper serves as the introduction.

Additionally, the SUPER MoRRI project has carried out a case study and interviews on how accessible research funders are for CSOs, which has resulted in a consistent set of recommendations[36] to funding bodies on how they can best support CSOs in R&I programmes:

- Provide greater clarity on how funders expect NGOs to be able to participate in calls.

- Make intentional efforts as funders to reach out to small and medium sized CSOs.

- Ensure CSO participation in the creation of calls to better align them to their needs and capabilities.

- Introduce more flexibility and trust, and a curated approach to accountability practices for CSOs.

- Have the ambition to step outside conventional project-based funding and deliverable based funding models.

- Provide material support for the creation of networks and relationships between excluded CSOs.

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[36]https://blogs.lse.ac.uk/impactofsocialsciences/2021/09/02/to-support-civil-society-organisations-research-funders-must-listen-to-their-needs/

7. Research currently underway in the Horizon Europe Programme

A range of Horizon Europe projects are currently underway, which will be able to make a contribution to the topic of the sustainability of CS practices within Member States - two of which are Time4CS and INCENTIVE.

The **Time4CS[37]** project is investigating ways in which the scientific ecosystem could better take societal views into consideration by supporting RPOs in defining and implementing institutional changes that could lead to a better and more effective engagement of citizens in R&I. Outputs, finding and public deliverables will be shared in the online repository: https://zenodo.org/communities/time4cs for the project.

To facilitate institutional change, TIME4CS has identified four Intervention Areas (IAs) that alone or combined seem to stimulate public engagement in R&I activities:

1. **Research**: Acknowledgment by the RPOs' ecosystem of CS as an evolving methodology with societal and educational benefits, through its use in research projects and by the creation of CS communities of practice;

2. **Education & Awareness:** Activities that increase the recognition and build capacity amongst researchers, funders and civil society of criteria for successful CS activities in compliance with ethical, legal and privacy regulations;

3. **Support resources and Infrastructure**: Creation within the RPOs of points of contact for addressing CS questions and of a system to support researchers implementing CS activities;

4. **Policy & Assessment:** Evaluation of CS contributions and adaptation of research evaluation policies and reputation systems accordingly, incentivising the implementation of CS activities

TIME4CS also carried out a comparison of 38 RPOs to evaluate the factors that support their transformation toward a greater support for CS. The research shows the for organisations that are starting to support CS activities, a diversity of projects in different disciplines is important. Later on, establishing CS champions and supporting their work is important, as well as access and use of national and international funding. When CS is integrated within an organisation, there will be an institutional plan for CS and public engagement, and finally a specific function for supporting CS and funding a coordinator.

The **INCENTIVE[38]** project is establishing CS Hubs in European RPOs and RFOs to drive institutional change and ground RRI in society. The aim of this project is

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[37] https://time4citizenscience.wordpress.com/

[38] https://incentive-project.eu

to accelerate the transition of these institutions to more inclusive, open and democratic innovation and scientific governance, under the principles of RRI. Moreover, the project seeks to deliver a legacy to European and international research institutes on how to create and operate their own CS Hubs with the aim to secure a democratic and collaborative way of designing, implementing and monitoring scientific progress and technological growth.

In their recent deliverable report '*Requirements and motivations of quadruple helix stakeholders for active engagement in the Citizen Science Hubs,[39]* the INCENTIVE consortium presented the outcomes of interviews with a range of stakeholders from civil society, the private sector, public administration, and academia to discuss their views, perceptions, concerns, terms of engagement, expectations and motivations for actively engaging in the CS Hubs that are expected to be established during the duration of the INCENTIVE project. The report provides insights into motivational factors for establishing CS Hubs and takes a particular look at the hindering and enabling factors of CS in Lithuania, Greece, Spain and the Netherlands. Over the course of this project these insights will be developed into recommendations for action.

7.1 Related fields of research - CS and Human Rights

Research currently being undertaken on the connection between CS, Law, Human Rights, and Jurisdictional issues is also relevant to the discussion on the enabling environment for CS, especially with relation to national legal frameworks.

For example, the right to access environmental information has an impact on the role that CS can play in bringing environmental issues to light,[40] the recognition of CS data in environmental risk governance, and environmental decision making.

Informative research on these topics can be found via the Joint Research Centre and the Senjus project,[41] and the published study framing citizen sensing/monitoring from a legal perspective.[42]

8. NEXT STEPS - Questions for Discussion

The purpose of this Discussion Paper has been to provide inputs and structure for the discussions to take place during two workshops with the participants in the MLE CSI-PP, which will then be encapsulated in the Topic 4 Thematic Report.

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[39] https://incentive-project.eu/wp-content/uploads/2021/07/INCENTIVE-D1.3.pdf

[40] See for example: de Abreu Ferreira, Sofia. "Fundamental Environmental Rights in EU Law: An Analysis of the Right of Access to Environmental Information." Managing Environmental Justice. Brill, 2010. 123-142.https://doi.org/10.1163/9789042029385_009

[41] https://sensingforjustice.webnode.it

[42] Suman, Anna Berti. "Citizen sensing from a legal standpoint: legitimizing the practice under the Aarhus framework." Journal for European Environmental & Planning Law 18.1 (2021): 8-38.https://brill.com/view/journals/jeep/18/1/article-p8_8.xml

The question that we now pose to the participants is to reflect on the current status quo regarding the above-described factors that make up an enabling environment for CS, namely:

1. What are the supportive legal and policy frameworks in your country?

2. What are the institutional policy frameworks, operational structures, and management cultures, within RPOs and RFOs in your country?

3. What are the capacity building activities for skills training, knowledge sharing, and development of best practice?

4. What are the supportive technological and data infrastructures for CS in your country?

5. What other existing infrastructures and facilities can be adjusted to provide better support for CS (e.g., information system for collections in natural history museum)? How can these be leveraged?

6. What are the examples of societal dialogue and public fora to promote participation of public and private stakeholders?

Some of this information has been gathered during the first workshops held as part of the MLE, such as information on national networks for CS and dedicated funding for CS, both of which are reported on in the Topic 2 Thematic Report: Ensuring Good Practices and Impacts. The Topic 4 workshops will therefore focus on fleshing out the remaining questions, and going into greater detail on the factors that contribute to an enabling environment to support and sustain CS.

The questions that were raised on this topic by the participants in the first MLE workshop, which we will seek to address in the workshop sessions and in the final report on this topic are:

- What should we expect from CS projects/initiatives and how to properly integrate them into the overall science policy priorities?

- How can we best support the exchanges (in time and financially) between citizens and scientists?

- How could we develop and sustain CS research in the social sciences and humanities?

- What are the needed infrastructures (IT-tools, applications, recruitment and best practices) for relevant, ethically sound and successful CS?

- CS also from the policy/programme perspective (which are the most relevant and efficient policies/actions/strategies for supporting the development of CS at national level taking into account that the transition

process towards open science is at the beginning and the fact that CS is at the early stage of development).

- Examples of successful CS funding schemes / programmes / calls for proposals existing at European level – developed by other European RFOs (e.g., objective, what activities were funded, types of projects funded).

- What are the basic activities that should be taken into consideration within capacity building for CS?

- How can results from CS projects be implemented in policy decisions more easily?

- How can CS projects be (financially) supported over a longer period (more than three years), since many CS initiatives are pursuing long-term goals?

- Funding is a big issue. Sometimes it is very challenging to convince RFOs to support a CS project. How could CS be more efficiently promoted for funders?

To provide a framework for these questions and the resulting discussions during the upcoming MLE workshops, we refer to the seven priority areas of action[43] that UNESCO highlighted in the Recommendation for Open Science, for which this MLE can focus on the related aspects for CS at the individual, institutional, national, regional and international levels, namely:

1. Promoting a common understanding of CS, associated benefits and challenges, as well as diverse paths for CS methods and approaches,

2. Developing an enabling policy environment for CS,

3. Investing in CS infrastructures and services.

4. Investing in human resources, training, education, digital literacy and capacity building for CS,

5. Fostering a culture of open science and aligning incentives for CS,

6. Promoting innovative approaches for CS at different stages of the scientific process, and

7. Promoting international and multi-stakeholder cooperation in the context of CS and with a view to reducing digital, technological and knowledge gaps.

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[43] See: UNESCO launches a global call for best practices in open science, 31 March 2022
https://www.unesco.org/en/articles/unesco-launches-global-call-best-practices-open-science

APPENDIX - Additional Reading

The below list of additional resources has been selected from those compiled by the EU-Citizen.Science consortium in the '*Brief Report of the High-Level Policy Event*'[44].

- [Best Practices in Citizen Science for Environmental Monitoring](#)

- [Exploring Citizen Science Strategies and Initiatives in Europe](#)

- [Activity Report on Citizen Science – discoveries from a five year journey](#)

- [White Paper Citizen Science Strategy 2030 for Germany](#)

- [The Science of Citizen Science](#) (Book)

- [Brief summary of the US citizen science policy efforts "Public Comment on Draft NOAA Citizen Science Strategy"](#)

- [White Paper on Citizen Science for Europe](#)

- [Reports from the Spanish Observatory](#) (in Spanish, executive summary in English)

- [Policy brief prepared by the EU-Citizen.Science project](#)

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[44] Radicchi et al. (2021) https://eu-citizen.science/static/site/files/EU-Citizen_Science_2021_report-policy-event.pdf

For Citizen Science to fully live up to its potential to achieve real societal impact as well as new scientific knowledge and insights, it is essential for Member States to put an enabling environment in place that will allow Citizen Science initiatives to be sustained and thrive, and Citizen Science practices to be supported and promoted. This Discussion Paper presents a range of recommendations for creating an enabling environment for Citizen Science from Project Reports, Policy Briefs, and Roadmaps that have been produced within the Horizon 2020 'Science with and for Society' funding programme, as well as from initiatives engaging with the UN SDGs and the UNESCO Recommendations for Open Science.

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