European Commission

Mutual Learning Exercise

Citizen Science Initiatives - Policy and Practice

Fourth Thematic Report: Enabling Environments and Sustaining Citizen Science

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Mutual Learning Exercise on Citizen Science Initiatives - Policy and Practice
Fourth Thematic Report: Enabling Environments and Sustaining Citizen Science

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Mutual Learning Exercise on Citizen Science Initiatives – Policy and Practice

Fourth Thematic Report - Enabling Environments and Sustaining Citizen Science

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List of Abbreviations

CO: Citizen Observatory

CS: Citizen Science

CSAA: Coordination and Support Action

CSI-PP: Citizen Science Initiatives - Policy and Practice

CSO: Civil Society Organisation

DG: Directorate-General

DG-R&I: Directorate-General for Research & Innovation

ECitizen ScienceA: 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

PSF: Policy Support Facility

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

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FOREWORD

This report has been prepared under the auspices of the Policy Support Facility (PSF) set up by the Directorate-General for Research and Innovation (DG-R&I) to provide practical support to Member States on specific and operational R&I challenges that they have expressed interest in addressing. The practical support, independent high-level expertise, and guidance offered by the PSF Challenge service aim to identify good practice, lessons learned and success factors for participating Member States and Associated Countries.

The purpose of this Mutual Learning Exercise (MLE) is to facilitate the exchange of information, experience and lessons learned, 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. An additional objective is to identify Citizen Science campaigns that have high potential to be implemented in a collaborative way across the European Research Area (ERA).

The role of Citizen Science in supporting research and innovation (R&I) in the European Union (EU) has been growing in the past years. Starting with the 2014 White Paper on Citizen Science[1], which rolled out a strategy for a substantial increase of the use of Citizen Science and practice in support of scientific advances, the attention given to the potential of Citizen Science for Member States and the EU has been increasing. A clear example is the incorporation of Citizen Science as a core dimension of the new ERA. The 2020 Commission Communication stated that engagement of citizens, local communities and civil society will be at the core of the new ERA to achieve greater societal impact and increased trust in science.[2] Moreover, the 2021 Council Recommendation on a "Pact for R&I in Europe[3]" lists "active citizen and societal engagement in R&I" as a priority area for joint action in the EU.

The Horizon Europe Programme also 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".[4]

This MLE exercise responds to the request submitted by the Trio Presidency of Germany, Portugal and Slovenia, and eleven countries are participating (Austria, Belgium, France, Germany, Hungary, Italy, Norway, Portugal, Romania, Slovenia and Sweden).

"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,

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[1] Serrano Sanz, F., Holocher-Ertl, T., Kieslinger, B., Sanz Garcia, F., & Silva, C. G. C. G. (2014). *Socientize-White Paper on Citizen Science for Europe*.
https://ec.europa.eu/futurium/en/system/files/ged/socientize_white_paper_on_citizen_science.pdf
[2] European Commission (2020). Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions - *A new ERA for Research and Innovation.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:628:FIN
[3] Council of the European Union (2021). *Council Recommendation (EU) 2021/2122 of 26 November 2021 on a Pact for Research and Innovation in Europe.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2021.431.01.0001.01.ENG
[4] European Commission (2018). *Proposal for a Regulation Of The European Parliament And Of The Council establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018PC0435

observation initiatives, and civic engagement. The objective is clear! To empower citizens in the transition to a climate-neutral and sustainable Europe".[5]

- Commissioner Mariya Gabriel, 7 December 2020

1. Introduction

1.1. Citizen Science within the Global Open Science Movement

As the world is faced with unprecedented challenges such as the recent Covid-19 pandemic, the climate crisis, and political unrest, amongst others, it is clear that addressing these challenges will require all actors across the quintuple helix (research and innovation centres, industry, government, public, and the environment) to act in collaboration together to share information and expertise openly and transparently, and to co-produce new knowledge and insights. This collaboration between science and society is a core aspect of the global movement towards Open Science.[6]

UNESCO places the broad engagement of societal actors in science and innovation processes at the heart of their Recommendations on Open Science, and promotes:

> *"extended collaboration between scientists and societal actors beyond the scientific community, by opening up practices and tools that are part of the research cycle and by making the scientific process more inclusive and accessible to the broader inquiring society based on new forms of collaboration and work such as crowdfunding, crowdsourcing and scientific volunteering.*
>
> *In the perspective of developing a collective intelligence for problem solving, including through the use of transdisciplinary research methods, open science provides the basis for citizen and community involvement in the generation of knowledge and for an enhanced dialogue between scientists, policymakers and practitioners, entrepreneurs and community members, giving all stakeholders a voice in developing research that is compatible with their concerns, needs and aspirations".[7]*

Participatory practices such as Civic Science, People-Powered Science, Volunteer Mapping, Participatory Action Research, Community Science, Citizen Sensing, Citizen Observatories, Crisis Mapping and Citizen Generated Data - all of which can be grouped under the

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[5] 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

[6] See: European Commission, Directorate-General for Research and Innovation (2016). *Open innovation, open science, open to the world: a vision for Europe,* Publications Office. https://data.europa.eu/doi/10.2777/061652; and: European Commission, Directorate-General for Research and Innovation (2020). Mendez, E., *Progress on open science: towards a shared research knowledge system: final report of the open science policy platform*, Lawrence, R.(editor), Publications Office, 2020, https://data.europa.eu/doi/10.2777/00139

[7] UNESCO (2021). The UNESCO Recommendations on Open Science, https://unesdoc.unesco.org/ark:/48223/pf0000379949

overarching umbrella term 'Citizen Science'[8] - are key means by which this closer collaboration between science and society can be achieved.

This same emphasis on the importance of engaging citizens is at the heart of the European agenda for research and innovation, and is a key element of the EU Missions and their aim to improve the lives, communities and environment of all Europeans. The Missions and the European Green Deal aim to mobilise citizens around common goals to address the challenges facing society, and contribute to meaningful change:

> *"Missions also capture the insight that opening science and innovation to civil society advances human knowledge and accelerates the transformation of our communities towards more sustainable and resilient practices. Citizens play a key role in the research and innovation cycle by providing feedback on new technologies and by ensuring societal uptake of disruptive solutions".[9]*

As more citizen engagement and Citizen Science initiatives are implemented across the ERA, it is increasingly important to establish and strengthen the key enabling environments that will allow them to achieve their aims for societal, policy, economic, scientific, and environmental impact, increase societal trust in science, and enable a collaborative approach to addressing the urgent issues at the heart of the EU Missions and the Green Deal.

1.2. Enabling Environments for Citizen Science

Many European Member States are already aware - or are becoming increasingly aware - of the importance and value of societal engagement within future science policy and practice, and the value of participatory knowledge production that includes the insights and local knowledge of societal actors[10]. Yet societal engagement and Citizen Science practices still often remain under-discussed, under-recognised and under-funded, even in comparison to other areas in the context of Open Science, making it harder for participatory initiatives to reach their full potential and intended impacts.

The term 'Enabling Environment' encompasses the various forms of support that encourage, enable, support, and sustain Citizen Science practices, researchers and participants.

UNESCO has highlighted seven priority areas of action in its Recommendations on Open Science, which form a useful framework for understanding the types of activities that are crucial for building an enabling environment for Open Science at the individual, institutional, national, regional, and international levels, namely:

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

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[8] Haklay, M., Fraisl, D., Greshake Tzovaras, B., Hecker, S., Gold, M., Hager, G., Ceccaroni, L., Kieslinger, B., Wehn, U., Woods, S. and Nold, C., 2021. Contours of citizen science: a vignette study. Royal Society open science, 8(8), p.202108. https://doi.org/10.1098/rsos.202108

[9] European Commission (2022). *EU Missions & citizen engagement activities* [online] Available at: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/eu-missions-citizen-engagement-activities_en. Accessed 9 October 2022.

[10] See for example: *Citizen science awards to put the public at the heart of key research*. (2021). Retrieved 21 October 2022, from https://www.ukri.org/news/citizen-science-awards-to-put-public-at-heart-of-key-research/

2.   Developing an enabling policy environment for Open Science,

3.   Investing in Open Science infrastructures and service,

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

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

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

7.   Promoting international and multi-stakeholder cooperation in the context of Open Science and with a view to reducing digital, technological and knowledge gaps[11].

To flesh out the details of these action areas and provide guidance for state actors, UNESCO has launched a global call for the collection of best practices[12], and has convened five Working Groups to focus on the key impact areas of Capacity Building, Policies and Policy Instruments, Funding and Incentives, Infrastructures, and Monitoring Frameworks[13].

Given the key role of Citizen Science practices to achieve societal engagement within the movement towards Open Science, these recommendations similarly provide a relevant framework for the discussion of the enabling environments for Citizen Science within the context of the MLE. By doing so, it is possible to link the lessons and insights from across the world, which are captured by UNESCO's work, with the European best practices.

1.3. The Main Challenges facing Citizen Science Initiatives and Research Practices

The experience of the European Citizen Science community of researchers and project initiators, as gathered in the project reports and policy briefs produced throughout the Horizon 2020 '*Science with and for Society*' funding programme, show that the main challenges facing Citizen Science initiatives and Citizen Science as a research practice, relate to the awareness of these approaches, their acceptability as sources of valuable data and insights, and their operational, organisational, and governance continuity beyond the typical project-funding lifetime[14].

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[11] UNESCO (2021).R*ecommendations on Open Science.*
https://unesdoc.unesco.org/ark:/48223/pf0000379949/PDF/379949eng.pdf.multi.page=20
[12] UNESCO (2022). *UNESCO launches a global call for best practices in open science*. [online] Available at: https://www.unesco.org/en/articles/unesco-launches-global-call-best-practices-open-science. Accessed 21 July 2022].
[13] UNESCO (2021.) *Implementation of the UNESCO Recommendation on Open Science.* [online] Available at:https://www.unesco.org/en/natural-sciences/open-science/implementation Accessed: 19 September 2022.
[14] See in particular: 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.

The MLE Topic 4 Discussion Paper[15] which served as input to the workshops that we summarise here, presented three aspects of sustainability within the context of this MLE:

1. **Sustaining Citizen Science projects and initiatives over the mid to long-term**, in terms of their ability to secure financial support for ongoing operations and the continued engagement of participants, and thus the ability to achieve their stated objectives and impacts. This includes finding sources of funding after successful pilot phases, developing new business models that can secure revenue for the coordinating organisation, or convincing public authorities of the need of a sustained monitoring over time of the challenge addressed to support the continuation of the initiative as well as other related activities.
2. **Sustaining the wider uptake of Citizen Science data and multi-stakeholder engagement practices**, such that the broader aimed-for impacts of Citizen Science approaches can be achieved. This entails building awareness of Citizen Science approaches amongst a range of stakeholders, fostering trust in Citizen Science data quality and the underpinning technologies and protocols, and continuously demonstrating impact through wide communication and dissemination of outcomes and impact stories[16], and
3. **Sustaining Citizen Science as a research practice** within Research Performing Organisations (RPOs) and Higher Education Institutions (HEIs), such that Citizen Science is taught within the curriculum as a valuable research approach, is supported within the context of research groups or operational scientific processes and is recognised and rewarded within the career trajectories of the people initiating and undertaking such participatory research initiatives. These new forms of recognition and appreciation are necessary to encourage and support researchers in pursuing Citizen Science approaches in their own research, and to adequately reward the effort that it takes to engage with external stakeholders and participants.

Addressing these challenges requires planning on the part of those initiating new Citizen Science projects to account for these needs during the very first phases of conceiving and forming the initiative, but dedicated support and funding are also key, along with the cultural aspects of an enabling environment.

Citizen Science practitioners report a large unmet need for dedicated funding for Citizen Science at the national and regional levels, that there are still barriers to the uptake of Citizen Science data in policy and decision making, and that capacity is missing in higher education and research performing organisations to both support Citizen Science operationally and to exchange know-how on best practices.

1.4. The Enabling Factors for Citizen Science

The Topic 4 Discussion Paper also introduced a framework for the MLE enabling factor discussions that is based on the work of the International Labour Organisation to develop

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[15] European Commission Policy Support Facility (2022). *Topic 4 Discussion Paper: Enabling Environments for Supporting and Sustaining Citizen Science.* https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/Discussion%20Paper%20Topic%204%20Enabling%20Environments%20FINAL_BT.pdf

[16] 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.

toolkits for '*Enabling Environments for Sustainable Enterprises*'[17]. The 5 categories of enabling factors within this framework are:

1. National Legal & Policy Frameworks,

2. Institutional Internal Policies & Culture,

3. Capacity Building & Networks,

4. Supporting (Data) Infrastructures, and

5. Societal Dialogue.

These categories, supported by dedicated funding as shown in Figure 1, align well with the UNESCO priority areas of action and the 5 Working Groups launched by UNESCO listed in Section 1.2 above, and have also provided a more manageable scope to focus on within the MLE workshops.

As pointed out by MLE workshop speaker Patrick Lehner of the Ludwig Boltzmann Gesellschaft (LBG) Open Innovation in Science (OIS) Centre, such enabling factors are indeed key to the success of any scientific research endeavour - in order to achieve a successful outcome for any type of initiative it is crucial that effective organisational design, clear governance structures, good leadership, and core values and principles are all supported.

Figure 1 Categories of Enabling Factors for Supporting and Sustaining Citizen Science
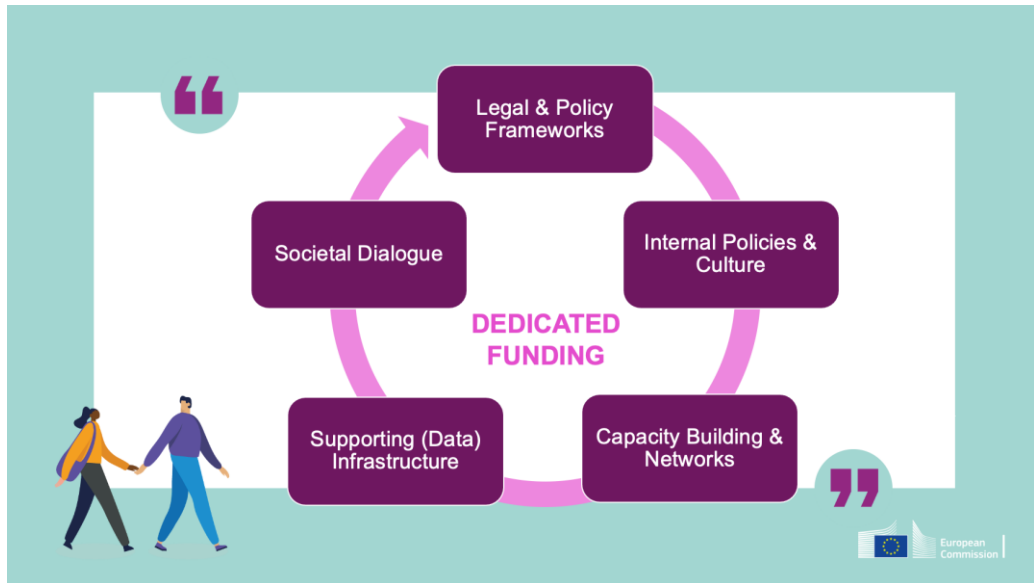
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1.5. Scope of this Report

This Thematic Report - fourth within the series of five topics being explored throughout the MLE - focuses on enabling environments and the institutional and governance arrangements that can support Citizen Science, with a particular focus on the role of different stakeholders, including research institutes, funding bodies, public authorities, businesses and civil society organisations in promoting Citizen Science.

Two separate two-day workshop sessions were held to follow up on and discuss the recommendations contained in the Topic 4 Discussion Paper on enabling environments[18], to compare best practices within the countries represented by the participants, and to identify opportunities to develop and implement new enabling actions for Citizen Science.

The aim of this report is to share the outcomes of these discussions, and to describe the good practices, lessons learned, and success factors identified in those meetings.

1.6. Workshop Methodology

As mentioned above, the aspects of enabling environments for Citizen Science covered by Topic 4 of the MLE have been explored across two separate two-day workshop sessions - the first held in Vienna on the 7th and 8th of June 2022, and the second held in Budapest on the 12th and 13th of September 2022.

The Topic 4 Discussion Paper on enabling environments[19] served as preparation for the discussions and presented the enabling factors framework (Figure 1) within which the discussions were placed.

The total workshop series consisted of five parts:

The 5 Factors & Spheres of Influence - A deeper exploration of the enabling factor categories and examples of supporting factors for Citizen Science within them, and the spheres of influence of the MLE participants to create and implement these factors or encourage their creation and implementation.

Journey of a Citizen Science Project - Consideration for how these factors can address needs specific to each phase of the journey of a Citizen Science project or initiative.

Starting from Scratch - Co-creation with fellow MLE participants of an idealised enabling factor that is within the sphere of influence of the participant to put into place, with consideration for the implementation or operational barriers that might be faced, and how these might be addressed. Three such enabling factors were selected and co-created during this workshop session

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[18] European Commission Policy Support Facility (2022). *Topic 4 Discussion Paper: Enabling Environments for Supporting and Sustaining Citizen Science.* https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/Discussion%20Paper%20Topic%204%20Enabling%20Environments%20FINAL_BT.pdf
[19] European Commission Policy Support Facility. (2022). *Topic 4 Discussion Paper: Enabling Environments for Supporting and Sustaining Citizen Science.* https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/Discussion%20Paper%20Topic%204%20Enabling%20Environments%20FINAL_BT.pdf

Comparison of Best Practice - Sharing the experiences of the participating Member States in implementing and iteratively further developing various examples of enabling factors in their own countries.

Roadmap Design - Consideration for how a guidance document or an implementation framework might be developed to assist the MLE participants and other EU Member States in designing and implementing enabling factors that are not yet in place in their home countries, further developing existing enabling factors to take advantage of best practice examples in other countries, and how front-runner experiences might be shared across the range of different contexts and maturation rates.

1.7. Structure of this Report

Following the purpose and the context of this topic within the MLE, and the 5-enabling-factors structure that the remaining sections follow, Section 2 presents the topic of 'Dedicated Funding'. Dedicated Funding is an overarching requirement for each of the subsequent categories, as illustrated in Figure 1 above. Sections 3 - 6 then present each of the five enabling factor categories in turn.

Each section opens with an exploration of the types of enabling factors that fall within that category and goes into more detail regarding one or two factors that are of particular importance in that category. Each section then presents the outcomes of the interactive workshop sessions related to that enabling factor, highlights one or two best practice examples that were shared, and reports on the conclusions and recommendations arrived at during these sessions. Each section then closes with a further recommendation drawn from the wider community of Open Science and Citizen Science practice across Europe, either from the literature or from project reports and policy briefs.

The final section of this report describes the next steps within the MLE, and the questions that remain to be explored in the lead up to the Final Report.

2. Dedicated Funding for Citizen Science

We present the need for dedicated funding separately, even though it conceivably sits within the first enabling factor of 'National Legal & Policy Frameworks'. This is because dedicated funding support is a core requirement across all enabling factor categories - until such time as Citizen Science research practices have been fully mainstreamed within the scientific research landscape, and multi-stakeholder participatory processes that include societal actors are fully embedded within national research and innovation pathways.

Ensuring the availability of dedicated funding will require both funding instrument innovation and explicit attention for participatory practices in research policy, in order to enable the close collaboration of knowledge institutions with societal actors for the production of new knowledge and insights and sustaining these over the longer term.

Dedicated funding is required across all of the categories of enabling factors, not just within research funding programmes:

- Investment in 'Institutional Internal Policies & Culture' is needed to support the development of enabling policies that are implemented within RPOs and HEIs;

- the 'Capacity Building & Networks' to support the development and maintenance of coordination capacity and research and communication support within institutions and national networks, and to develop training and best practice resources;

- Investment in 'Supporting (Data) Infrastructures' is needed to fund the iterative development of the tools and platforms needed to gather, analyse, visualise, store and share citizen-generated data; and

- Investment in 'Societal Dialogue' is needed to fund the planning and executing of dialogue-supporting events and the coordination of contact points for societal actors to enter into discussions with scientists and other key actors on topics relevant to society.

This need is also expressed in the third and fourth priority areas of action identified by UNESCO, as listed in Section 1.2 above, namely: (3) "Investing in Open Science infrastructures and services", and (4) "Investing in human resources, training, education, digital literacy and capacity building for Open Science".

2.1. Dedicated Citizen Science Funding in the MLE participant countries

The Second MLE Thematic Report: '*Ensuring Good Practices and Impacts*'[20] reports on the dedicated national funding programmes for Citizen Science that are currently implemented within the 11 participating countries of the MLE. These can be found in Table 3 of that report.

Here, we highlight the Austrian case, which was presented during the Topic 4 Workshops in Vienna by four speakers who introduced the dedicated funding instruments for Citizen Science available in Austria (see Box 1 below) to the MLE participants, namely:

- Hubertus Schmid-Schmidsfelden, Deputy Head of Section of the Federal Ministry of Education, Science and Research;

- Marika Cieslinski of OeAD- Austria's Agency for Education and Internationalisation;

- Patrick Lehner of the Ludwig Boltzmann Gesellschaft (LBG) Open Innovation in Science (OIS) Centre; and

- Gerit Oberraufner of the Austrian Science Fund.

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[20] European Commission Policy Support Facility. (2022). *Second Thematic Report: 'Ensuring Good Practices and Impacts*': https://op.europa.eu/en/publication-detail/-/publication/99c69553-e862-11ec-a534-01aa75ed71a1/language-en/format-PDF/source-259873087

In 2007, the Austrian Federal Ministry of Education, Science and Research (BMBWF) launched its first dedicated 'Sparkling Science' funding programme to bring Citizen Science research projects into schools in cooperation with "real" research projects funded by other national and international research programmes outside the Sparkling Science programme. More than 107,000 participants from 200 research institutions, 535 schools and 185 partners from business and society took part in this unique and unconventional research programme. They worked together on current scientific issues in a total of 299 research projects. Around 34.9 million euros were available for this purpose until the end of the programme at the end of 2019.

This initiative has been renewed in 2021 as "Sparkling Science 2.0", to run until 2026 with a focus on funding high-quality Citizen Science research projects in which scientific institutions cooperate with educational institutions and, if possible, partners from business and society.

Within the 1st tender, 34 outstanding Citizen Science projects will be funded with a total funding volume of €11.5 million, and up to €350,000 per project. For the implementation of this funding, the Ministry negotiates performance agreements with all Universities, with a dedicated contact person within each university in Austria.

The programme is supported by Austria's Agency for Education and Internationalisation (OeAD), which established the Centre for Citizen Science in 2015 to provide information, build a network for the exchange of know-how and expertise, to facilitate the funding, and to award prizes in the annual competition for schools and individuals who have made a contribution in Citizen Science projects.

More information: https://www.sparklingscience.at/en

Evaluations of the programme (in German) can be found at: https://www.sparklingscience.at/en/Rueckblick/evaluierungen.html

The Austrian Science Fund (FWF), together with the OeAD, has also launched funding calls dedicated directly to funding Citizen Science initiatives in the Top Citizen Science programme (Förderinitiative Top Citizen Science / TCS). The target group for this fund are researchers who already have FWF funding support, in order to enable them to expand their current research to include Citizen Science approaches and engage societal actors as co-researchers. In this way, 29 TCS projects have been funded, across six calls, for a total funded amount of €1.4 million.

The TCS initiative is designed to support research activities that enable citizens to contribute to generating substantial additional research results and insights on the basis of their abilities, expertise, curiosity, and willingness to participate – without sacrificing the excellence of the research work.

More information: https://www.fwf.ac.at/de/forschungsfoerderung/fwf-programme/foerderinitiative-top-citizen-science

2.2. Recommendations for Dedicated Funding

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- "*Adapt research funding schemes to reward participatory methods, develop more long-term funding, recognize the high startup costs of citizen science, and make funding also possible for non-university actors*",[21]

- "*Offer mechanisms for funding that address the different project characteristics of Citizen Science and Open Science 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*",[22] and

- "*Increase and diversify the opportunities for small seed funding for project prototyping and experimentation in Citizen Science and Open Science*",[23]

- "*Provide specific funding to and require appropriate governance structures for creating multi-actor coalitions and engaging civil society actors throughout the research and innovation process*".[24]

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[21] 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

[22] 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/

[23] Ibid

[24] RI-Configure project, policy brief 4 http://riconfigure.eu/publication/policy-brief-4-0/

Alongside the implementation of dedicated funding, it is important that the funding instruments themselves be fit-for-purpose, and this can best be accomplished by co-creating them together with the stakeholder groups that they aim to serve, with the inputs of members of the Citizen Science community who are active in those domains of practice and thus have experience with the unique needs and considerations of Citizen Science initiatives in those contexts. Whilst funders and policy makers realise that funding is crucial, a group of environmental civil society organisations indicate that they need[25]:

- Greater clarity on how funders expect CSOs to be able to participate in calls;

- Intentional efforts from funders to reach out to small and medium sized CSOs;

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

- More flexibility and trust, and a curated approach to accountability practices for CSOs;

- Ambition to step outside conventional project-based funding and deliverable based funding models;

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

Noteworthy is the following observation in the Socientize White paper on Citizen Science in Europe from 2014, which was the outcome of a large-scale consultation over two years, the challenge of designing funding schemes and launching programmes specific to Citizen Science:

> *".. lies in the design of these programmes which should allow for participation of grassroots initiatives driven by either civil society organisations or independent citizen scientists. Broad dissemination and support activities will be needed as well as minimal bureaucracy. The creation of a committee of researchers and citizens involved in the decision-making process regarding such funding programmes is recommended*".[26]

Support the inclusion of societal actors in research partnerships should thus be one of the key areas of innovation to focus on, as well as creating follow-on funding instruments to enable successful pilot initiatives to continue their activities over the longer term, reach out more widely to increase the scale of impact, or scale up nationally and even internationally.

The German Citizen Science community recently undertook a major consultation exercise to produce a White Paper Citizen Science Strategy 2030 for Germany with the support of the Federal Ministry of Education and Research (BMBF), and participation of 219 people from 136 organisations - from scientific institutions and research libraries to science shops, societies and private individuals - with a total of 1,343 contributions, 119 comments and 31 position papers from organisations and institutions. Their recommendations on dedicated funding for Citizen Science are shown in Figure 2 below.

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

[26] Serrano Sanz, F., Holocher-Ertl, T., Kieslinger, B., Sanz Garcia, F., & Silva, C. G. C. G. (2014). *Socientize-White Paper on Citizen Science for Europe*. https://ec.europa.eu/futurium/en/system/files/ged/socientize_white_paper_on_citizen_science.pdf

2.3 Recommended actions for area funding instruments

2.1

Funding institutions and other stakeholders should expand specific **funding instruments for projects** and further open up existing funding programmes to Citizen Science as a research and communication method. In addition to international and national funding, the federal states and municipalities should also feel involved. The amount of **low-threshold funding (microfinancing)** should be expanded. Funding for **accompanying research and research on the impact of Citizen Science** should be supported (e.g. as part of project funding). In addition to expanding project-related funding, **structural measures** (e.g. new staff positions) should be implemented to **build long-term capacity**.

2.2

Funders and participants should support the **expansion of advisory services** for different target groups at the national and regional level.

2.3

Funders should remove administrative and technical barriers to funding so that in particular civil society groups can participate more easily in funding programmes. **Long evaluation phases** should be avoided and **flexible offers** should be created.

2.4

Business, administration and educational institutions (e.g. continuing education centres) should also exploit opportunities to specifically promote Citizen Science projects.

2.5

Scientific institutions, organisations, administrations, educational institutions, associations and professional societies should support Citizen Science **coordinators and communicators** through third-party funding or permanent positions.

2.6

Create "**tech pools**" for citizen scientists: Citizen Science projects often require a basic supply of relevant literature and technical equipment, especially in natural history, archaeology and astronomy. One example is the recording programmes of the Dachverband Deutscher Avifaunisten (Federation of German Avifaunists, DDA) for breeding birds and waterbirds or the reporting of chance observations on the reporting portal ornitho.de. A prerequisite for taking part is – in addition to specialist knowledge – a whole range of identification literature and optical equipment (binoculars, spotting scope with quiver and tripod, sometimes tablets or smartphones for digital recording, etc.). The cost of procuring all this is very high for volunteers (depending on the brand, between 500 to over 1500 euros) and is an obstacle not only for young people who are interested in joining in. Therefore, it would help significantly if the project funding would also cover the price of purchasing the necessary basic equipment, e.g. rental equipment. Borrowing could be organised through the coordinators or through libraries over the long term (for specialist literature) and continuing education centres (→ action area 13).

2.7

Participants from civil society should be given greater consideration when selecting members for various selection committees and selection processes for Citizen Science funding. They bring an important perspective to the selection and review processes for Citizen Science projects (e.g. relevance, degree of feasibility, applicability, innovative potential). In addition to selection committees, this could be extended to awarding prizes, implementing strategy processes and evaluations.

Addressees

| Practitioners | Civil society | Science | Educational organisations | Policymakers | Funding bodies |

At the pan-european level, the League of European Research Universities (LERU) has also produced specific policy recommendations for research funding organisations (RFOs) to promote excellence in Citizen Science. They encourage RFOs to:

1. "*Recognise a wide range of success criteria when supporting citizen science projects, including but not limited to traditional measures of scientific quality;*

2. *When evaluating citizen science projects, ensure adequate funding for community management, platform development and other non-research functions characteristic of citizen science;*

3. *Promote the use of open science practices in citizen science projects, by requiring open access publication, open data standards, use of open-source software, etc.; and*

4. *Set clear legal and ethical criteria for data privacy according to existing laws, such as personal data control*".[28]

In summary, we can see a consistent call for targeted funding, and for a significant response from the scientific community and other societal actors when such funding is offered. Frequently, these programmes are highly subscribed (as was the case with many SwafS calls in Horizon 2020). Moreover, the recommendations that we review here, which cover a period of a decade, are fairly consistent with each other.

3.   National Legal & Policy Frameworks

The range of supportive legal and policy frameworks for Citizen Science, beyond national research funding policy as described above, can include such factors as legislation aimed at sustaining or scaling-up current Citizen Science projects across various sectors, and national directives to incorporate Citizen Science-generated data in policy making and local governance, with a connection between those policies and European policy and directives.

The MLE participants added the following enabling factors, which they identified as also belonging in this category and relevant to their own context, or their own institution:

- New national recognition and reward policies for R&I that explicitly include Citizen Science practices,
- Centralised support for national Citizen Science networks,
- Legal frameworks for research careers modified to include Citizen Science approaches,
- Information channels put in place with policy makers to raise awareness of the added-value of Citizen Science and the impacts of Citizen Science approaches,
- Initiatives to develop a national strategy for Citizen Science in policy and research, which include stakeholders from civil society, and
- Ethics frameworks which address Citizen Science practices,

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[27] Bonn, A. et al. (2021). White Paper Citizen Science Strategy 2030 for Germany. Helmholtz Association, Leibniz Association, Fraunhofer Society, universities and non-academic institutions, Leipzig, Berlin. SocArXiv http://osf.io/preprints/socarxiv/ew4uk

[28] League Of European Research Universities - LERU (2016). Advice Paper no.20. Citizen science at universities: Trends, guidelines and recommendations. October 2016. https://www.leru.org/files/Citizen-Science-at-Universities-Trends-Guidelines-and-Recommendations-Full-paper.pdf

3.1. Embedding Citizen Science in National Science Policy

There are a range of emerging examples of Citizen Science embedded in national funding policies and science research policies across Europe, although they are still implemented to varying degrees of depth and breadth.

The Second MLE Thematic Report: '*Ensuring Good Practices and Impacts*'[29] identified dedicated national funding programmes for Citizen Science that are currently implemented within the 11 participating countries of the MLE. These can be found in Table 3 of that report. In addition, a large-scale investigation into the policies of 55 RFO's across all European countries illustrates various levels of aspirational focus on and practical translation of Citizen Science, be it as part of Open Science policies or as part of Public engagement or third mission[30].

Further examples were brought to light during a high-level policy event organised by the EU-Citizen Science project consortium and the Spanish Foundation for Science and Technology (FECYT) during the European Research and Innovation Days in 2021. At this event, representatives from the European Commission, the Spanish Ministry of Science and Innovation, the Portuguese Ministry of Science and Technology and Higher Education, the German Federal Ministry of Education and Research, and the Dutch Ministry of Education, Culture and Science shared examples of how Citizen Science has been embedded in their national science landscapes, either in funding programmes, science policy, or both.

One such example was shared by Carmen Castresana from FEYCT, mapping the path from collaboration between the Foundation, the Spanish Ministry of Science and Innovation, and the Ibercivis Foundation to foster citizen science - the launch of the Spanish Observatory of Citizen Science in 2016, the introduction of dedicated support for Citizen Science in the Scientific and Innovation Culture funding programme with dedicated calls, and the explicit mention of Citizen Science in the Spanish Strategy for Science, Technology and Innovation (2021-2027). (See Figure 3 below for an illustration of this presentation).

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[29] European Commission Policy Support Facility. (2022). *Second Thematic Report: 'Ensuring Good Practices and Impacts*': https://op.europa.eu/en/publication-detail/-/publication/99c69553-e862-11ec-a534-01aa75ed71a1/language-en/format-PDF/source-259873087

[30] https://super-morri.eu/event/responsible-research-funding-annual-event-2022/
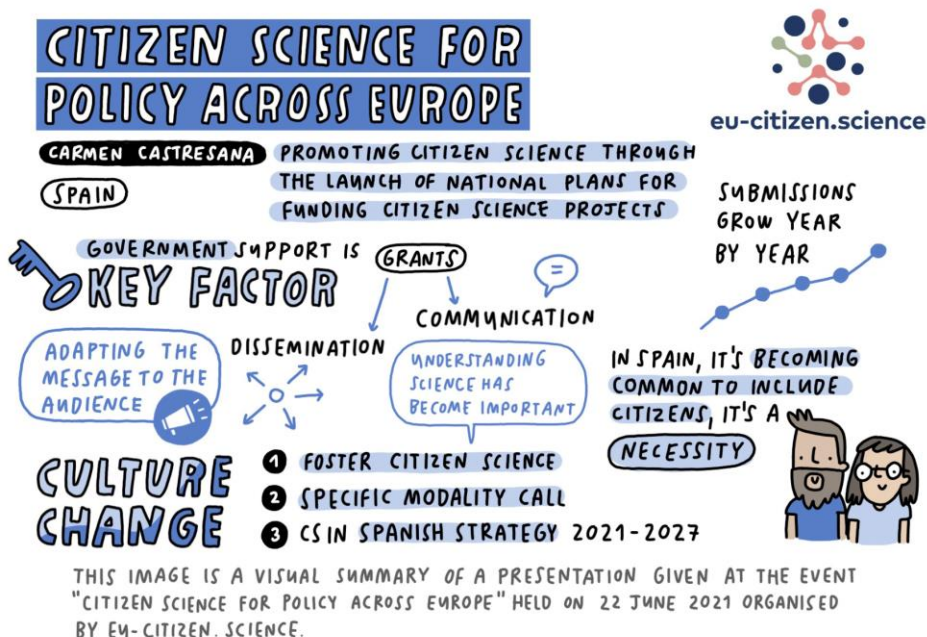
3.2. Outcomes of the Interactive Workshops on National Legal & Policy Frameworks

As outlined in section 1.6 above, the Topic 4 workshop series explored each of the enabling factors in greater detail with the MLE participants during two separate two-day workshop sessions. Here we share the outcomes of the sessions relating to National Legal & Policy Frameworks.

3.2.1. Spheres of Influence

After spending some time identifying the types of enabling factors that can be considered to fall within this category, the MLE participants discussed which of these they themselves could play a role in putting into place, either at the institutional level, or within their own department. The implementation of national legal & policy frameworks was seen as falling within the sphere of influence of the government ministries, funding agencies/bodies, and Centres for Citizen Science.

The participants representing the Ministries and Research Funding Bodies placed themselves at the centre of the sphere of influence, while those from the Research Councils, Research Promotion Agencies and other Agencies placed themselves more at the periphery. All other participants felt that their role fell more in the category of advisor or consultant to those who do have the mandate to put new national policies in place.

3.2.2. Needs at each Phase of the Citizen Science Project Journey

The journey of a Citizen Science project can be considered to have four main phases: (1) the initiation of the project, (2) the recruitment of partners and participants, (3) the execution and maintenance of the main research activity, and (4) the processing of outcomes and resulting actions.

The MLE participants considered how enabling national legal & policy might come into play at each of these various stages, and in what way they would offer support to the Citizen Science project or initiative. The outcomes are shown in Table 1 below.

Table 1 Legal & Policy Framework needs across the Citizen Science Project Journey

Initiation Phase	• The availability of sources of funding, awareness of these funding sources, and being able to access these funding calls are all key to being able to initiate new Citizen Science projects. • During the initiation phase, supportive policy frameworks can help protect ideas from being killed off too early. • Ethical guidelines and checklists are useful for project initiators to assess whether the project is ethically feasible, or in line with institutional ethical guidelines (for example when working with children). • It is helpful to align new project concepts with existing national policies to which the research question relates, an existing directive (such as clean air) or a critical policy topic (such as the Covid-19 pandemic).
Recruitment Phase	• Project activities need to be in line with data protection and copyright regulations. • Codes of conduct are helpful for Citizen Science initiatives in the recruitment phase. • Projects should set up conflict management mechanisms at this stage, and continually implement them into the 'Maintenance' phase of the project. It is important to resolve any disagreements and maintain strong stakeholder and participant engagement. Arbitration guidance and support, such as via a dedicated committee, can be helpful here, with Citizen Science networks serving as independent observers.
Maintenance Phase	• The long term commitment of policy makers within national funding and policy-making bodies, can be secured in part by involving them in internal Citizen Science working groups to embed a degree of ownership of these processes. • Results and impacts of Citizen Science initiatives should be showcased to policy makers and funders to influence funding policy and local governments.
Outcomes Phase	• Specific evaluation criteria related to public engagement in science in general and for specific calls are needed. • Policy makers can be engaged to act as ''door openers''. • Support is needed to translate the results of Citizen Science initiatives into policy documents. • Clear guidance is needed for policy makers to reassure or increase their confidence in being allowed to use citizen generated data. • There should be a degree of obligation from the private sector to get involved and ''listen'' to the citizen-generated data. • The private sector is also needed as influence to push for new laws to facilitate this.

3.3. Recommendations for National Legal and Policy Frameworks

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- "*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*".[31],

- "*Fund positions and horizontal measures for community management*".[32],

- "*Work to resolve legal uncertainties and share approaches to intellectual property and licensing issues at the intersection of Citizen Science and Open Science*",[33] and

- "*Include Open Science as a priority within the institutional strategy*".[34]

An online survey conducted in 2019 by the '*Society-Science-Policy Interface*' Working Group of the Citizen Science COST Action (#15212 "Citizen Science to promote creativity, scientific literacy, and innovation throughout Europe")[35] sought to identify and map the Citizen Science strategies, initiatives, and policies of the 36 countries represented in the COST Action.

The survey received a good response from 45 members of the COST Action, representing 33 countries covering all EU Member States, as well as Switzerland, Norway, Albania, Turkey, North Macedonia, and Israel. The authors noted however that "*these findings are a snapshot view of a highly dynamic and evolving landscape*".

One of the primary trends found by this survey was that Citizen Science activities within any given country were much more visible when there was an established and institutionalised strategy for Citizen Science at the national level.

In terms of the needs that relate to the establishment of national enabling environments for Citizen Science, there were several commonalities and cross-cutting issues reported by the survey respondents, namely:

- *"The need for research on suitable and modular impact assessment schemes,*

- *Recognition should be sought for the citizen scientists, either economic or curricular,*

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[31] 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

[32] Ibid

[33] 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/

[34] Yankelevich, Tatsiana. (2021). *Roadmap for Capacity Building on Open Science and Citizen Science for Research Libraries.* Zenodo. https://doi.org/10.5281/zenodo.5636187

[35] Manzoni, M., Vohland, K., Gobel, C., Pruse, B., & Schade, S. (2019). C*itizen science strategies in Europe: Preliminary findings from the pan-European Survey of citizen science strategies and initiatives in Europe as part of a joint initiative of the COST ACTION 15212 and the JRC.* Full WG Report: https://cs-eu.net/news/workshop-report-wg3-recommendations-development-national-citizenscience-strategies

- *Sustainability models should be promoted for successful Citizen Science initiatives to survive in time,*

- *Citizen Science should be embedded in the scientific culture and in educational programmes, both at early stages with children (to incentivise future citizen scientists) and in universities (to overcome scepticism and opposition),*

- *Support of Citizen Science scientific publications is needed to increase awareness and credibility,*

- *Infrastructure and cross-cutting technical issues (interoperability and standardisation) are common to all contexts and need to be further investigated, and*

- *Data Management also (data quality, its instrumental value –fit for purpose, its evaluation, etc.) are common to all contexts and operational levels and would need to be addressed in a coordinated and collaborative fashion".*

Additionally, the survey respondents reported that the key factors that influence their ability to effectively support and sustain Citizen Science practices nationally include political awareness of Citizen Science practices and their impacts, sustainable funding models to consolidate and mainstream Citizen Science initiatives, trust and mutual recognition amongst the various stakeholders within Citizen Science initiatives, and an overall balanced relationship between these stakeholders to create sound ecosystem dynamics.

Amongst the conclusions reached by the authors from their detailed analysis of the survey results, those that relate to strengthening the landscape for Citizen Science are:

- *"Evidence of impact of Citizen Science activities are found, to different extents, on all segments of the hosting ecosystem, namely at policy, scientific, economic and social level.*

- *The enabling pre-conditions for Citizen Science activities to grow, are mutual trust and interest in common challenges.*

- *The key influencing factors determining the development of Citizen Science initiatives are the presence of dedicated plans supported by funding models for long-term sustainability.*

- *The main obstacle hindering the use of Citizen Science approaches seems to be political will, due to lack of awareness of the benefit brought about by Citizen Science activities by policy makers.*

- *There is a need to create alliances amongst the different stakeholder communities (Governments, NGOs, Scientific communities/academies, private sector and CoPs) to exploit synergies and join up resources, and*

- *The most notable obstacle to the uptake, development and mainstreaming of Citizen Science approaches in support to policy making processes, appears to be the lack of a sufficient degree of awareness and understanding by policy makers of Citizen Science potentialities".*

The report concludes with the recommendation to invest effort at all levels in identifying and promoting the benefits that Citizen Science brings to relevant and effective policy making, to encourage the development of relevant strategies to support and sustain Citizen Science practices and initiatives over the long-term.

In summary, the recommendations here are showing a wide range of options. This is not surprising when considering the wide range of research and innovation systems across Europe. Therefore, the policies need to be tailored to the appropriate local context and consider all phases of a Citizen Science Project journey, including initiation, recruitment, maintenance and outcomes.

4.   Institutional Policies & Culture

From a large-scale investigation into the policies of 122 RPOs across all European countries, various levels of aspirational focus on and practical translation of Citizen Science can be discerned, albeit to a much lesser extent than the RFOs in those countries. This analysis will be presented by the SUPER MoRRI H2020 SwafS-funded project (forthcoming 2023). The range of institutional policy and cultural factors that support Citizen Science, as drawn from the Topic 4 Discussion Paper summary of policy briefs and project recommendations, can include such factors as:

- Institutional policies within RPOs and RFOs to promote and recognise Citizen Science research practices,

- Support for Citizen Science practices embedded in operational structures,

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

- Internal communication structures and dedicated role descriptions for multi-stakeholder engagement,

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

- The creation of internal operational functions to provide support, promotion, and management capacity.

The MLE participants added the following enabling factors to the above, which they identified as also belonging in this category and relevant in their own context, or their own institution:

- Institutional mission statements that explicitly include achieving societal impact and engaging society with science;

- Developing additional award criteria for the inclusion of societal actors in participatory research practices and Citizen Science projects;

- Building human resource capacities at RFOs to directly address the skills needed in Citizen Science initiatives;

- The presence of clear will and focus to support and promote Citizen Science at the leadership level across the institute horizontally, and throughout the structure of the institute vertically;

- Attention for building capacity across the institution;

- Establishing an ethics committee with the remit to support responsible Citizen Science practices and ensure their quality; and

- Creating learning opportunities for research group coordinators, educators and students about Citizen Science.

4.1. 'Rewards and Recognition' for Citizen Science

Within the career pathways for academics, scientists, researchers, and other knowledge experts there should be room to pursue a range of Open Science practices that have value for the quality of the research, the quality of the work environment, and the value or impact of the research outcomes. For this to be possible, research practices that engage with society across the spectrum of science communications, public engagement and Citizen Science need to be recognised as having value to both the quality of the science and to society, and thus need to be rewarded within the normal career progression of the researcher career.

In the Netherlands, for instance, a range of organisations in the academic community have formed a 'Recognition & Rewards' programme to put into practice the shared ambition to modernise the Dutch academic career system to bring about a substantial culture change and improve the quality of education, research, impact, leadership and (for university medical centres) patient care. The principles behind this movement are described in the report 'Room for Everyone's Talent'[36] and include encouraging Open Science practices, promoting more diversity in career paths and profiles, and recognising and rewarding a greater range of competences and talents - all of which improve the supportive career environment for researchers engaging the public and society in research.

4.2. Dedicated Support Centres for Citizen Science within RPOs

The Horizon 2020-funded Time4CitizenScience project is researching and gathering knowledge on the types of actions and institutional changes within RPOs that can help to promote public engagement and Citizen Science research practices in science and technology. As part of this work, they are gathering case studies illustrating state-of-the-art for the adoption and maintenance of Citizen Science initiatives within research institutions.

One of the frontrunners they showcase is the Citizen Science Competence Centre in Zurich, which is a 'one-stop-shop' set up to support Citizen Science in the city of Zurich and more widely across Switzerland. See Box 2 below for a brief description of the Centre, along with some of the key elements that make it a best practice example for creating an institutional environment favourable to Citizen Science.

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[36] Recognition and Rewards (2019). *Room for Everyone's Talent*. [online] Available at: https://recognitionrewards.nl/about/position-paper/ Accessed: 5 October 2022.

The Citizen Science Competence Centre is a joint initiative of the University of Zurich and the Swiss Federal Institute of Technology, ETH Zurich. Created in 2017, its purpose is to enable researchers and citizens to create and conduct Citizen Science research collaborations that produce excellent science. The Centre focuses on supporting academic-quality processes and results and prioritises those activities and projects – defined in the literature as "co-created" – that maximise the collaboration between citizens and scientists in all phases of the research process.

The Centre provides support in four key areas:

1. tools and infrastructure (including open web and mobile platforms),
2. expertise and methodology (easily accessible set of protocols and procedures, including aspects of data quality, research ethics, and more),
3. community management (support with creating and nurturing an engaged community of citizens and researchers), and
4. networks and partnerships (various collaborations, members in diverse Citizen Science networks, etc.).

Some of the ways in which the Centre provides a best practice example[37] of how to embed dedicated support centres for Citizen Science within research institutions include:

A strong community-of-practice network has been established. The Centre has collaborations and partnerships with other groups and networks for Citizen Science, such as the Citizen Cyberlab, Citizen Science Network Austria (CSNA), Science et Cité – Schweiz forscht locally, the League of European Research Universities (LERU), and the European Citizen Science Association (ECSA) at the European level, and the Citizen Science Global Partnership globally.

Institutional Citizen Science Champions have been nurtured. The Centre was founded by two champions of Citizen Science at both UZH and ETHZ, and the Board of Directors includes experts in participatory approaches to research who are effective evangelists within the institution (such as, among others, Prof. Mike Martin, Institute of Psychology and Center for Gerontology at UZH; Prof. Ernst Hafen, Institute of Molecular Systems Biology and the former President of ETH Zurich; and Kevin Schawinski, a former professor at ETHZ Institute for Astronomy, and the founder of Galaxy Zoo).

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[37] From the Time4CS Case Study: *Zurich Competence Center – Citizen Science.* (2021). Retrieved 23 October 2022, from https://time4citizenscience.wordpress.com/competence-center-citizen-science/

Training programmes for Citizen Science are offered for multiple actors and roles. The Centre offers training for students, researchers and citizen scientists through its Swiss Foundation-funded Participatory Science Academy, which has developed 15 courses with different formats, including introductory and advanced courses for doctoral students and postdocs (for example "Introduction to Citizen Science" and "Citizen Science Advanced"), but also for researchers and citizens, including an annual Citizen Science School.

Informal interaction and exchange are supported internally. The Centre actively nurtures its community of UZH and ETHZ researchers by organising regular in-person and virtual meetups (such as bi-monthly brown bag lunches), providing knowledge exchange channels (such as an active blog), and creating opportunities for collaboration.

Seed Funding is available for internal and local pilots. The Centre's Participatory Science Academy awards seed grants to a number of projects that are supported both financially and with know-how and tools.

More information: https://citizenscience.ch/en/

4.3. Outcomes of the Interactive Workshop on Institutional Policies & Culture

As outlined in Section 1.6 above, the MLE participants explored this enabling factor in greater detail during the Topic 4 workshop sessions, the outcomes of which we share here.

4.3.1. Spheres of Influence

The types of enabling factors that can be considered to fall within the category of institutional policies and culture are by their very nature within the hands of those institutes, and therefore all participants felt that they had some degree of influence over putting such policies in place internally or helping to nourish an institutional culture that is supportive of Citizen Science.

However, some participants felt that they personally were unable to bring about such internal changes from their role within their home organisation, as these factors fall outside their own professional spheres of influence.

4.3.2. Needs at each Stage of the Citizen Science Project Journey

The MLE participants considered how enabling factors within institutions might come into play at each of the stages of a Citizen Science project or initiative, and in what way they would offer support. The outcomes are shown in Table 2 below.

Table 2 Internal Policy & Culture needs across the Citizen Science Project Journey

Initiation Phase	- Internal institutional cultures will determine whether taking a participatory approach will be recognised as valuable and rewarded, 'does anybody care'? - This also influences the motivation of the researcher or project initiator, balancing the anticipated impact against what they will be supported or even allowed to do in terms of Citizen Science approaches.

	• Without such internal support, this can feel like a career risk for the researcher, or even be a risk.
Recruitment Phase	• Internal expertise centres can help researchers prepare for the unexpected, and offer support within the community as a part of the community • Similarly, other sources of expertise around Citizen Science approaches can help project initiators to plan for different scenarios • Dedicated support centres can also offer communication support, drawing for example on science communication skills.
Maintenance Phase	• Rewards for scientists that recognise the effort of good communication and the value of other forms of impacts beyond the classical research outputs help maintain both motivation and activity. • Alternative activities that should also be recognised and rewarded include 'behind the scenes' work at museums or research institutions that engage citizens • Have a Citizen Science support office/person at least in big research institutions and also the ministries/RFOs;
Outcomes Phase	• To ensure that impact can be shown, institutional recognition of those impacts is needed, as well as the means to share and showcase that impact • This requires good communication channels, and institutional support to find those channels. • To ensure impact can be realised, institutional support is needed to fund papers; to spend the time needed for research uptake; and to produce alternate forms of output sharing • This additionally requires a change of mindset of funders (projects cannot end but need to be sustained if we want them to demonstrate their impacts - longer funding is therefore needed)

4.3.3. Additional Insights from Guest Participants in the MLE

During the Vienna-hosted workshops, a discussion was facilitated in 'Fishbowl' format, which enables large groups to enter in a discussion with space for all to participate by creating a smaller inner circle of discussants with one empty chair, allowing a new person to enter the conversation when they have something to share and requiring another to leave the inner circle to create an open space again.

The four guests invited were Ronald Würflinger from Blühendes Österreich; Taru Sandén, from the Austrian Agency for Health and Food Safety (AGES); Steffen Fritz from the International Institute for Applied Systems Analysis (IIASA); and Sonja Polan from the Austria Wirtschaftsservice (aws).

During the discussion one of the questions asked was '***Why and how was Citizen Science integrated in your institution?***, which offered interesting insights into the enabling factors within the organisations and institutions of the invited guests:

- *''I work at a national funding bank which funds different projects, one of them is the regional transfer centres project which is about enabling environments for Citizen Science. In this programme there are three regional innovation hubs which bring together universities of applied sciences and they get money for the project through the government to foster knowledge transfer (one of the hubs organises projects to foster Citizen Science e.g., through organising hackathons to overcome SDGs and organising workshops on how to apply Citizen Science in a scientific project). The main aim of the regional transfer centre is to foster the transfer of knowledge in our society - what better transfer of knowledge in society is there than involving citizens in projects!''.*

- *''Our organisation is the biggest food consumer agency in Austria. We need to engage with citizens as part of our consumer strategy. The new movement on Citizen Science from the network on Citizen Science was really helpful''.*

- *''I work at the Austrian Agency for Health and Food Safety - by bringing citizens to the agency, we saw the huge potential Citizen Science has. The Agency is now doing a lot with Citizen Science with farmers and can do more''.*

- *''The IIASA strategy explicitly mentions Citizen Science. At IIASA they have done a lot of work in promoting Citizen Science in addition to the strategy (e.g., they conducted a consultation with high-level stakeholders on what is needed after Covid). One outcome of this consultation was that engagement with citizens is absolutely critical and relates to the work IIASA has been doing. Very active engagement of citizens and drastic behavioural change is needed to ensure added value''.*

4.4. Recommendations for Institutional Policies and Culture

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- "*Actively work on policy linkages: Translate and disseminate the existing knowledge on Citizen Science to make explicit what policy levels and departments can make use of what kind of Citizen Science. It can help to work with examples, and to develop a cross-departmental governmental position on the use of Citizen Science for policy to provide policy makers with a contact point*".[38]

- "*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 Citizen Science and the SDGs*".[39]

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[38] 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

[39] 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

- "*Universities and research institutions should team up with NGOs who have a mission that is closely aligned with the research area of the Citizen Science project, so as to become a potential legacy partner for the R&I project*".[40]

- *"Establish Open Science collaborations across the HEI and research libraries", and "Build on the position of research libraries as key stakeholders in achieving Citizen Science goals".[41]*

At the pan-European level, the League of European Research Universities (LERU) recognises the potential of Citizen Science for research and its role in the Open Science movement, and their recommendations to universities are to:

1. "*Recognise Citizen Science as an evolving set of research methods, as well as its societal and educational benefits;*

2. *Consider creating, where viable, a single point of contact for Citizen Science within the institution, to advise scientists and ensure liaison with national and regional Citizen Science initiatives;*

3. *Raise awareness amongst researchers of criteria for successful Citizen Science, including community management, pedagogical practices, Open Science standards and social, intergenerational and gender diversity policy issues;*

4. *Ensure that proposals to granting bodies for Citizen Science projects include long-term commitment for infrastructures and data repositories, in line with other research projects with long-term scientific or societal benefits;*

5. *Ensure that project participants comply with ethical, legal and privacy regulations relevant to the scope of a given Citizen Science project, and have access to professional advice for this purpose;*

6. *Adapt research evaluation and reputation systems to include metrics that can characterise projects with a high societal impact, such as successful Citizen Science projects, and develop ways of assessing citizen participation*".[42]

In summary, across the discussions and the available recommendations, a set of common themes is emerging. These are in line with other recommendations for institutional transformation, while recognising areas that require special attention (e.g., Ethics).

5. Capacity Building & Networks

Discussions on capacity building often focus on the availability of skills training and ongoing education that is relevant for a specific field of practice. However, capacity also refers to the

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[40] 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

[41] Yankelevich, Tatsiana. (2021). Roadmap for Capacity Building on Open Science and Citizen Science for Research Libraries. Zenodo. https://doi.org/10.5281/zenodo.5636187

[42] League Of European Research Universities - LERU (2016). Advice Paper no.20. *Citizen science at universities: Trends, guidelines and recommendations.* October 2016. https://www.leru.org/files/Citizen-Science-at-Universities-Trends-Guidelines-and-Recommendations-Full-paper.pdf

systems of support for collaboration, networking, and securing the resources (both financial and operational) that are key to the success of Citizen Science projects. These can consist of dedicated roles within institutions for engaging with the public and societal actors, dedicated Research Support Centres with expertise in supporting Citizen Science research practices, or dedicated Data Stewards with knowledge of best practices for handling, storing, and sharing.

Additionally, national and regional level networks for Citizen Science practitioners and knowledge-sharing platforms to showcase best practice examples and resources are important aspects of capacity building in practice.

The MLE participants added the following enabling factors to the above, which they identified as also belonging in this category and relevant to their own context, or their own institution:

- Awareness raising on the needs & benefits of Citizen Science;

- Capacity building for citizens and not only for scientists;

- Capacity building for RFO agents & evaluators;

- Accessible training material (e-learning tools/platforms) for practitioners at an early stage;

- Dedicated Citizen Science support centres within universities or networks of universities/research programmes;

- Partnership with NGOs/Institutes with a similar community to build strength;

- Organising annual conferences, workshops and thematic events to facilitate networking and exchange;

- Following-up on the knowledge exchange initiated in this MLE by organising another such exchange in three years' time.

5.1. National Citizen Science Associations & Practitioner Networks

Section 3 of the Second Thematic Report '*Ensuring Good Practices and Impacts*'[43] contains a report of the examples gathered by the MLE participants of the Citizen Science networks and centres of expertise in their countries, displayed in Table 2 of that report. Of these, only Austria currently has a permanent long-term funding model in place for the coordination of the national Citizen Science network.

The Austrian Citizen Science Network (described in Box 3 below) was the first such organisation to be permanently established in Europe to connect Citizen Science practitioners with each other to further best practice and knowledge exchange. The network consists of members from a range of stakeholders in Citizen Science, from university and museums to public bodies and NGOs, and the work is organised through volunteer groups of individuals who select a goal to work on together, such as developing quality criteria for the platform, organising workshops and training events (25 such events so far), running local

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[43] Mutual Learning Exercise on Citizen Science Initiatives –Policy and Practice. Second Thematic Report: *Ensuring Good Practices and Impacts* https://op.europa.eu/en/publication-detail/-/publication/99c69553-e862-11ec-a534-01aa75ed71a1/language-en/format-PDF/source-259873087

and national symposia and conferences (29 such events between 2018 and 2021), or writing documentation and papers together (79 publications so far).

According to co-founders and coordinators Dr. Florian Heigl and Dr. Daniel Dörler, both Senior Scientists at the University of Natural Resources and Life Sciences in Vienna (Universität für Bodenkultur Wien, BOKU), the key to the success of the network lies in its 'do-ocracy' approach to sharing the commitment and investment of individual effort, while encouraging and supporting initiatives and ideas from members of the network. In response to questions raised by the MLE participants, they gave the following advice (*paraphrased*):

- **How to establish a Citizen Science practitioners network in your own country** - The most important thing is commitment, nobody had time to invest a huge amount of their workload in the network. As a result, the network grew slowly but very steadily over time. The first conference held in 2015 helped a lot to get to know other people already invested in Citizen Science. With every conference, we identify new people doing Citizen Science and those that have not heard of Citizen Science before.

- **How to achieve public outreach in Citizen Science via the media** - Build partnerships with the media and various media channels. This helps with communicating about Citizen Science projects or topics to a broader audience, but also strengthens the Citizen Science network itself.

- **How to achieve inclusivity within the network** - Employ a whole-community approach where everyone can express their wishes and come forward if they want to take forward a particular task.

Box 3 National Citizen Science Associations, the Austrian Network

The Citizen Science Network Austria was founded in 2017 by active Citizen Science practitioners in the country, expanding on the "Österreich forscht" online platform to share Citizen Science projects in Austria that was launched in 2014. The network is made up of

institutions from the fields of science, research, education and practice, with active working groups of individual Citizen Science practitioners and researchers collaborating on specific Citizen Science-related topics such as the Quality Criteria being developed for the online platform. The network is coordinated by the University of Natural Resources and Life Sciences, Vienna (BOKU) and its goals are:

- To further establish Citizen Science in Austria,
- To promote the quality of Citizen Science in Austria, and
- To strengthen the profile of Citizen Science in Austria.

The Austrian network is the first permanently established Citizen Science network in Europe, has worked on 60 projects and has produced a number of peer-reviewed publications.

More information: https://www.citizen-science.at/en/

5.2. Outcomes of the Interactive Workshop on Capacity Building & Networks

The MLE participants explored this enabling factor in greater detail during the Topic 4 workshop sessions, the outcomes of which we share here.

5.2.1. Spheres of Influence

All of the participants of the MLE felt that capacity building activities can be implemented internally within any type of organisation, from governmental ministries to societal actors, but that some actors are better placed to develop such training courses (such as universities and centres of Citizen Science), and that national-level actors who can provide either funding or in-kind support are best placed to support national Citizen Science networks (such as funding bodies, research councils or universities).

The individual participants also felt that capacity building was within their own spheres of influence, within their own institutional roles, but at varying levels of scale and impact largely related to seniority within the organisation.

5.2.2. Needs at each Stage of the Citizen Science Project Journey

The capacity factors that come into play during the four main stages of a Citizen Science project or initiative, were felt to be:

Table 3 Capacity Building needs across the Citizen Science Project Journey

Initiation Phase	- Access to expertise, tech literacy, infrastructure, affordable technology and other tools needed during the project - Avoiding duplication of effort, by having access to work that has gone before, via the network - Capacity for communication and science communication expertise

	• Assistance with ethics assessments and planning review support within the organisation - increasing the capacity of organisational ethics committees to handle Citizen Science.
	• Support from colleagues with knowledge of how to start a project - interest amongst researchers may be high but they don't know where to start with Citizen Science practices
	• A different path needs to be set up for capacity building, such that doing research is combined and connected with developing spaces for dialogue, and up-scaling is given attention. These need to be in place for starting projects.
Recruitment Phase	• Assistance, planning, clear communications in jargon-free language ('translation' for non-scientists)
	• Dedicated support to run communication campaigns and maintain social media
Maintenance Phase	• A Citizen Science support office or support person should be embedded in each research institution and ministry department
	• Citizen Science support within big European networks such as the University Alliances, the ERC infrastructures, etc.
	• Citizen networks need support and training, know-how and knowledge exchange.
Outcomes Phase	• Planning for ongoing funding should start after the initiation phase of a Citizen Science project is over, to identify new sources of funding that can sustain the project over the long term or follow on from successful pilot funding.
	• Participants should get training on how to sustain the project, and assistance planning for the transition to new forms of support such as innovation funding.

5.3. Recommendations for Capacity Building and Networks

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- "*Include Citizen Science in research education and training on Open Science and vice versa and include both in general research education and training.*"

- "*Ensure means for science education and communication to accompany Citizen Science initiatives.*"

- *"Build Citizen Science and Open Science into teacher training".[44]*

- *"Be actively involved in establishing support programmes for researchers in HEI and research libraries.*

- *Make targeted Citizen Science training a part of the general Open Science 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".[45]*

- *"Organise sensitization, education and training initiatives for promoting the involvement of the public in research projects, also developing customised training material for specific target groups, establishing agreements with existing associations, groups or civil society organisations, collaborating with teachers and schools for attracting students or using social media for launching Citizen Science research projects".[46]*

6. Supportive Technological and Data Infrastructures

This category of enabling factors describes (i) the technical platforms and tools for data gathering and analysis in Citizen Science initiatives, (ii) the data infrastructures for data aggregation and data sharing that are needed to ensure that Citizen Science data are findable, accessible, interoperable, and reusable (FAIR), (iii) the integration of Citizen Science data with official data systems and frameworks, and (iv) research infrastructures that are inclusive of societal actors and support participatory and collaborative research initiatives in any given domain.

Also included in this category is funding support for the ongoing development of technological tools and platforms for Citizen Science.

The MLE participants added the following enabling factors to the above, which they identified as also belonging in this category and relevant to their own context, or their own institution:

- Exchange with national authorities to understand what data (and in which format) they need for their official uptake to facilitate interoperability and make data useful;

- Look at and learn from other networks like Biodiversity Monitoring GBIF;

- Development of freely accessible data services;

- Provision of technical equipment through lending ''tech pools'' and easy to use data management tools;

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[44] 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/

[45] Yankelevich, Tatsiana. (2021). Roadmap for Capacity Building on Open Science and Citizen Science for Research Libraries. Zenodo. https://doi.org/10.5281/zenodo.5636187

[46] http://grace-rri.eu/wp-content/uploads/2022/01/GRACE-D3.3_Guidance-document-on-RRI-oriented-grounding-actions.pdf

- Watch out for possible ''overtake'' by big publishing companies of data infrastructure.

6.1. Dedicated Platforms and Data Infrastructure for Citizen Science

The importance of drawing on Open Science practices, particularly those relating to the principles of FAIR data (i.e., that data are findable, accessible, interoperable, and reusable) are discussed in more detail in the Topic Three Discussion Paper: '*Maximising the relevance and excellence of Citizen Science*' in the section entitled "*Factor #3: From data management to policy impact[47]*".

The issue of interoperability is a serious one as the field of Citizen Science is at risk of becoming increasingly fragmented by the wide range of uniquely designed approaches - and this is being tackled in the EU-funded Cos4Cloud project (Co-designed Citizen Observatories Services for the EOS-Cloud). A segment of the '*EOSC in Practice*' profile of one of these services - Cos4Bio - is contained in Box 4 below.

Cos4Cloud is integrating the underlying platforms of nine citizen biodiversity observatories, four of which are the largest in Europe: Artportalen, iSpot, Natusfera and Pl@ntNet, and the data services they have developed are currently being tested on five environmental quality monitoring platforms. These services will ultimately be made available on the new European Open Science Cloud (EOSC) - a virtual space that enables the European scientific community to store, manage, analyse and reuse data for research, innovation and education.

Box 4 Cos4Bio - EOSC in Practice Story - Supporting knowledge creation and sharing by building a standardised interconnected repository of biodiversity data[48]

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[47] European Commission Policy Support Facility. (2022). Topic Three Discussion Paper: '*Maximizing the relevance and excellence of citizen science*':
https://ec.europa.eu/research-and-innovation/sites/default/files/rio/report/psf-topic3-discussion_paper_v2.pdf
[48] Martinez de la Riva, Santiago, Giuffrida, Maria, Willems, Marieke, & Justamante Rodríguez, Ángela. (2022). *Supporting knowledge creation and sharing by building a standardised interconnected repository of biodiversity data.* https://doi.org/10.5281/zenodo.6516724

The project - Cos4Cloud

Cos4Cloud (Co-designing Citizen Observatories Services for the EOS-Cloud) is a European Horizon 2020 project. The project aims at boosting Citizen Science technologies. One of the biggest challenges of Citizen Science is the **quality of data**, as well as maintaining the citizen observatories used to collect this data. Cos4Cloud is addressing these challenges by developing twelve technological services to improve Citizen Science platforms.

The Challenge

Citizen Observatories are currently faced with fragmentation problems. The collected data is heterogeneous and comes in varied formats. This is an obstacle for the users who have to dedicate massive resources to elaborate, standardise and aggregate data, thus making the data collection and management phases very long and inefficient.

These problems relate to the difficulty of practically implementing FAIR (Findable, Accessible, Interoperable, and Reusable) rules, which instead is a crucial feature for the integration of the services in the EOSC marketplace. To solve such challenges and support users when downloading and using the data, **a better dialogue between the different citizen observatories is needed.**

The solution

Cos4Bio is a co-designed, interoperable and open-source service that integrates biodiversity observations from multiple citizen observatories in one place, allowing experts to save time in the species identification process and get access to an enormous number of biodiversity observations. Co-design principles were followed in the creation phase to ensure a collaborative and interdisciplinary approach that could maximise the service quality and usability. Cos4Bio allows Citizen Science experts to view and identify all observations from a single place, interacting with the community and contributing their knowledge about each species. When an observation has been identified in Cos4Bio, this information is updated in the citizen observatory where it was published, awaiting final validation according to the algorithm defined in each observatory. Cos4Bio has a search system that allows it to consult the observations in a specific species or a specific location across different citizen observatories. It is also possible to apply criteria to filter information such as origin, type, quality of observation, licence or date. All the information can be downloaded in 'csv' format following Darwin Core, a widely known and accepted standard within the biodiversity community. Finally, Cos4Bio relies on Athenix to provide secure and federated authentication services to the users and GBIF Backbone Taxonomy to manage data classification.

More information: https://cos4cloud-eosc.eu/services/cos4bio/

6.2. Outcomes of the Interactive Workshop on Supporting Infrastructures

The MLE participants explored this enabling factor in greater detail during the Topic 4 workshop sessions, the outcomes of which we share here.

6.2.1. Spheres of Influence

A smaller number of MLE participants felt that their organisations can play an influential role when it comes to developing and implementing technical support and data support infrastructures, and this time it was the non-academic research-performing institutions and museums who placed themselves at the centre of the sphere of influence. The participants,

representing private companies, research agencies and universities, clearly felt that their organisations were outside the sphere of influence in this case.

6.2.2. Needs at each Stage of the Citizen Science Project Journey

The infrastructural enabling factors that come into play during the four main stages of a Citizen Science project or initiative, were felt to be:

Table 4 Supportive technology needs across the Citizen Science Project Journey

Initiation Phase	- Knowledge of the requirements around data management - Support for data management planning - Communication lines established with key stakeholders to identify the needed data formats and data points to achieve intended outcomes - Efficient and maintained data storage should be secured in advance - The infrastructure needs to be developed and in place before the project can start.
Recruitment Phase	- Need existing infrastructure to be in place so that it is easier to recruit participants and support the user-journey - It is important to consider at the outset how websites and databases will be maintained and kept up to date after the project finishes
Maintenance Phase	- In order to maintain the project well, infrastructure is often needed for both involving participants but also involving other key stakeholders who can build capacity across the project - Infrastructure is a key touchpoint between the initiation and maintenance phases of the project as they underpin the whole journey for participants - There is an additional need for platforms that enable the sharing of insights and best practices between Citizen Science practitioners - Maintaining the technology infrastructure that supports the research (platforms, tools, etc) includes keeping systems updated, adapting to new needs from participants, and ongoing development to make improvements
Outcomes Phase	- Ongoing maintenance of any technological infrastructures - Use community of practice networks to present project results - It can be difficult to keep track of outcomes - structures for this also have to be in place

6.3. Recommendations for Supportive Technological and Data Infrastructures

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- "*Improve data management and stewardship for Citizen Science*", and "*Recognise and support the integration of Citizen Science and Open Science as or within research infrastructures. In some sectors, there is a need for specific research infrastructures for Citizen Science, such as the Atlas of Living Australia, which supports biodiversity data collection through Citizen Science projects*",[49]

- "*Enhance the legitimacy and acceptability of Citizen Science data by adapting standardised data management techniques and using an array of statistical techniques to increase the representativeness of Citizen Science data and to make them useful for wider policy and science uses*",[50]

- "*Acknowledge different types of contributions to science and find adequate ways of making them visible, traceable and reusable, regardless of whether the Citizen Science outputs are data, software or project platforms or something else. (In two places - also in column B)*",

- "*In other cases, Citizen Science 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*", and

- "*Citizen Science and Open Science can be understood as providing a sociotechnical research infrastructure in their own right*".[51]

- "*Develop appropriate technologies and procedures for engaging people in research processes, including online platforms, tools and procedures to offer two-way communication channels between researchers and participants, or technical procedures and technological devices for collecting data*".[52]

- "*Establish procedures in order to provide for data quality assurance and comply with the basic principles of openness, so as to make the results of the projects fully accessible to everyone*".[53]

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[49] 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/

[50] 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

[51] 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

[52] http://grace-rri.eu/wp-content/uploads/2022/01/GRACE-D3.3_Guidance-document-on-RRI-oriented-grounding-actions.pdf

[53] Ibid.

Figure 4 Recommendations for Citizen Science Data Quality and Data Management from the White Paper Citizen Science Strategy 2030 for Germany (2021)[54]

6.3 Recommended actions for area data quality and data management

6.1
Scientists and participants should work specifically on **advancing automatic methods and tools for quality assurance and control. Funding must be made available** for the necessary methodological research, implementation of the tools, maintenance and user support.

6.2
Funding institutions should **promote the sustainability of project results, including the data collected**. At the same time, it should be **mandatory to publish data generated in Citizen Science projects, as per the FAIR principles**.

6.3
Scientists and practitioners should create **standards for Citizen Science data documentation**. To do so, appropriate metadata standards for Citizen Science data must be developed. These should build on existing metadata standards for scientific data, such as domain-specific standards, and extend them to include aspects specific to Citizen Science if necessary. Scientists and practitioners should also develop guidelines and tools facilitating the selection of suitable metadata standards and the standardised description of Citizen Science data.

6.4
In order to achieve sustainable usability of Citizen Science data, sponsors, scientists and practitioners must **create structures for data archiving, data publication and access to Citizen Science data**.
This requires advancing methods, tools and guidelines to anonymise Citizen Science data with personal references as a prerequisite to publish the data. Scientific institutions should offer uniform possibilities for archiving Citizen Science data by opening existing or emerging structures (e.g. long-term scientific repositories such as the NFDIs) or by creating new structures. Access opportunities to Citizen Science data (e.g. data portals) must also be created or expanded for citizen scientists.

6.5
Scientists and practitioners should **advance methods and tools for citizen scientists to visualise and explore Citizen Science data**.

6.6
Scientists and participants should **establish effective Citizen Science data management** to ensure data quality. This can be achieved by opening established support and advisory structures for data archiving, data management and quality assurance, such as points of contact for research data management, to citizen science projects (including projects that are not linked to an institution). This can also be done by establishing and strengthening an exchange network on data-related issues in Citizen Science projects, and by creating guidelines and tutorials on data management and quality assurance for Citizen Science written in easily understandable language and suitable for the target group. Additionally, re-usable and configurable tools should be created to support the collection and provision of Citizen Science data.

6.7
Funding agencies should provide **financial resources for data management and quality assurance when funding Citizen Science projects**.

Addressees
Practitioners | Civil society | Science | Educational organisations | Policymakers | Funding bodies

The extensive consultations with the German Citizen Science community that resulted in the White Paper Citizen Science Strategy 2030 for Germany, showed that the Citizen Science

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[54] Ibid

community has not yet consistently engaged with Open Science practices, such as applying the FAIR Data principles.

"*Citizen Science data should be sustainable and usable by large parts of science and society to ensure the long-term impact, visibility and acceptance of Citizen Science. The principles of findability, accessibility, interoperability and reusability for research data formulated in the FAIR data principles [77] (www.go-fair.org/fair-principles) set the standard for sustainable usability. Descriptive data about the data (metadata) play an important role. They ensure that the data can later be interpreted and is interoperable. ... Only around 65% of the respondents to the Citizen Science Survey 2020 (n=309) stated that the data collected in their projects had been published or would be published in the future".[55]*

The recommended actions in the German White Paper for data quality and data management are shown in Figure 4 above.

In summary, we can see that Citizen Science requires specific and appropriate technical support, an aspect that is impacting both the procedures and planning around the data and the day-to-day management of the data.

7.   Societal Dialogue

This category of enabling factors describes the organising, enabling and supporting of societal dialogue or public fora, to promote (i) the participation of both public and private stakeholders, (ii) national research agenda setting in collaboration with the public and Citizen Science and Open Science, (iii) impactful alliances between Citizen Science and Open Science, NGOs and community-based organisations to promote dialogue and knowledge exchange, and (iv) supportive infrastructure for public-private collaborations.

The additional enabling factors that the MLE participants thought of as being relevant for themselves, their own context, or their own institution within the category of capacity building and networks, were:

- Strengthen the third mission activities of RPOs;

- Create a clear step-out strategy for policy makers or governments;

- Cooperation between NGOs, foundations and universities (e.g., producing press releases and publications together).

7.1. Outcomes of the Interactive Workshop on Societal Dialogue

The workshop sessions to explore the various enabling factors with the participants were for logistical reasons split out into four break-out groups and did not include a dedicated break-out table for the Societal Dialogue factor.

The investigation of this factor therefore did not reach the same depth as the other factor categories. Nonetheless, this factor was a topic of discussion throughout, and a structure was

provided for participants to still contribute their thoughts to this topic as well. These are shared below.

7.1.1.   Spheres of Influence

Most of the participants within the MLE felt that they have a role to play in helping to promote and enable societal dialogue. In particular the funding bodies, ministries, and research councils felt that this lies within their sphere of influence. But some funding bodies and also the universities felt they were on the periphery of being able to influence this factor, and a few research councils and the small businesses felt themselves entirely outside this sphere of influence.

7.1.2.   Needs at each Stage of the Citizen Science Project Journey

The MLE participants primarily had ideas about how societal dialogue would come into play during the initiation phase of a Citizen Science project or initiative:

Table 5 Dialogue needs across the Citizen Science Project Journey

Initiation Phase
- If you want to co-create with societal stakeholders from the outset of your project, do you have contacts and ways to reach them?   - Building a stakeholder group that includes researchers and those who can help co-define the underlying problem or research questions   - How do you find your stakeholders - and which stakeholders are relevant

7.2. Recommendations for Societal Dialogue

Recommendations from the policy briefs and project reports funded by the Horizon 2020 '*Science with and for Society*' Programme include:

- *"Favour mutual learning processes inside and outside the organisation on how Citizen Science projects can be successfully designed and implemented and how to reinforce public participation".[56]*

- *"Missions should include civic aspirations, values and goals and avoid focusing predominantly on technology innovation or deployment".[57]*

8.   Enabling Factors co-designed by the MLE Participants

As the final step during the Vienna-based workshops, the MLE Participants were invited to co-create an idealised enabling factor that is within their own sphere of influence to put into place, which also addresses one or more of the enabling factors discussed during the break-out sessions, such as (1) legal & policy frameworks; 2) institutional and policy culture; and 3)

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[56]http://grace-rri.eu/wp-content/uploads/2022/01/GRACE-D3.3_Guidance-document-on-RRI-oriented-grounding-actions.pdf
[57] RI-Configure project, policy brief 4 http://riconfigure.eu/publication/policy-brief-4-0/

capacity building activities. A summary overview of the co-created enabling factors is provided below and will be further analysed in the following sections:

1. Supportive legal & policy framework: A strategic plan to form two working groups with key stakeholders:

    - with funding bodies/ministry (people with a mandate); and

    - with practitioners and civil society.

2. Institutional policy frameworks, operational structures and management cultures:

    - to establish a working group at a RFO/RPO; and

    - to create a bridge between Citizen Science practitioners and policymakers to raise awareness, communicate needs and educate on the benefits and challenges of Citizen Science through e.g., conferences or working groups.

3. Capacity building: Establish a national network of Citizen Science hubs.

The final interactive sessions on the second day of the workshops in Vienna were spent at break-out tables organised according to where the MLE participants were sitting within their sphere of influence for a particular enabling factor, with consideration for the implementation or operational barriers that might be faced, and how these might be addressed. Each table was asked to invent something from scratch to address the needs of that category of enabling factor, describe how it might be put into place, and what would be needed in order to do so. A total of three enabling factors were selected and co-created during this workshop session, which are presented in the following sections.

8.1. Co-created enabling factor related to supportive legal and policy framework: Design and Implement a National Directive to incorporate Citizen-gathered Data in Policy Making

The group that focused on policy planning, suggested the development of a strategic plan to form two working groups with key stakeholders (i. working from the top-down with funding bodies and ministries (people with a mandate) and ii. working from the bottom-up with practitioners and civil society) to design and implement a national directive to incorporate citizen-generated data in policy making. To do that, the group suggested the identification of three key challenges for implementation including:

1. The ownership of the policy and the problem of "not invented here" where there is no notion of ownership and agency about an issue.

2. Secondly, lack of urgency ("why now?") and failure as a result of competition with other demands on the budget.

3. Finally, there is a need to address the reluctance of the scientific community to endorse Citizen Science.

To address the first challenge, potential solutions include the need to start with informal coalition building and personal connections between people who are interested in the issue. Considerations of institutional culture and learning from success stories can be helpful here.

In addition, it is possible to identify needs and benefits of different actors and ensure that the entity that is in charge of driving the Citizen Science policy is not only owned by one major actor, while having a clear home.

The "why now?" challenge can be addressed with ensuring that data is available, including analysis (potentially through subcontracting with the appropriate knowledgeable consultant). It is also important to have sources of information to support discussions with different parts of the government - for example, using the material from the evaluation of the Austrian programme, which was mentioned before, or working with suitable actions to create an attractive document such as "101 reasons to support Citizen Science".

Finally, for gaining the support of the science community, this can be addressed by figuring out how to convince the majority of those in the scientific community who are active in interaction with policy to at least not block the development of this new area. Identification of additional and dedicated funding at the early stages can be effective, and finally interacting with philanthropic foundations who might be interested in supporting the dedicated funding streams to progress their mission can also help.

Based on this analysis, the group suggested that a good approach will be the development of a strategic plan. To do that, a working group can be formed with participants from different ministries and research funding bodies. The interaction with stakeholders needs to be in two parts. First, with the people who have control over budgets and decisions, including political actors. Second, with practitioners and civil society actors. The initiation of the process and the interaction with stakeholders is needed for the preparation of a suitable outline that is ready for the appropriate policy window.

In terms of materialising the plan, there are two options - a top-down approach from the ministry or the funding body, or a bottom-up approach from stakeholders and philanthropic bodies with support from the ministry.

The particular steps for the development of the plan can include: collecting examples of plans from other countries; establishing the motivation and justification for the plan, including the identification of needs and benefits for the different actors; informing and interacting with key actors with ability to make or break the plan; and identifying other policies in development or in existence that can have an impact on the development of the Citizen Science support policies (for example, Open Science policies; a repository on related policies can be created).

To develop the plan, it is a good idea to identify a core group that will drive its development and to be in touch with a wider reference group that will provide feedback and comments. It is also important to identify the mandate and agree on the key areas of impacts and goals.

8.2. Co-created enabling factor related to institutional policy frameworks, operational structures and management cultures: Create a dedicated Working Group for Citizen Science within your RFO/RPO

The group of participants who considered the institutional support to Citizen Science within the policies, operational structures and management cultures of an RFO/RPO, identified the need to bridge Citizen Science practitioners and policy makers as the critical element that requires attention and investment. The interaction can assist the process of raising awareness, communicating the needs, understanding the benefits and the challenges, raising acknowledgement and finding solutions to address the challenges. This bridging function can be achieved by identifying the appropriate body that can operate as the intermediary - such as funding bodies or a government agency with an operational capacity

(e.g., in the environmental area). Suitable opportunities for exchange, such as events, seminars, and working groups can be used for this bridging function.

The group identified several challenges and solutions for the development of this idea. On the challenges, they identified:

- The existence of silos, which limit the interactions between disciplines and institutions.

- The lack of time and commitment of different actors - from practitioners to decision makers, which can limit interactions to a single event and not recurring activities.

- There is also a risk of overdemands towards policy makers that do not take into account resource limitations of the different actors and may hinder impact.

In terms of solutions, several ideas where identified, including:

- Having a clear responsibility through the appointment of a specific person to coordinate and enable the exchange (this can be a new function or an additional function to an existing role).

- Formulate concrete goals to reach tangible outcomes.

- Consider different formats: 1 day kick-off meeting to enable networking, or creating a pilot phase to prove impacts through the establishment of a working group to convince management.

- Establish a follow-up mechanism to ensure achievement of impacts and continued involvement.

A few other aspects were recognised by the group, including the need for legal/policy support at the national or European level to make Citizen Science a priority with a sense of urgency, which can be created from peer-pressure among Member States of the ERA. There is also a need to identify and allocate the needed financial resources to create and maintain the bridging role and activities to implement the identified solutions. Finally, in terms of infrastructure, it is possible to utilise and rely on Citizen Science networks to facilitate interactions between practitioners and policy makers.

8.3. Co-created enabling factor related to capacity building: Establish a National Network of Citizen Science Hubs

The third group considered the development of national networks of Citizen Science hubs as a way to support practitioners and advance on the challenges already identified in a cross-cutting manner, while building capacity.

In terms of the challenges and related solutions, they identified the following:

First, the need to increase the recognition of the practice of Citizen Science, both for researchers and involved citizens, which can be addressed by asking the community of practitioners to provide evidence. The creation of powerful communication campaigns targeting the involvement of quadruple helix stakeholders, which contribute to provide the required evidence and to demonstrate the achieved impacts in an easily understandable way, will also help.

Secondly, there can be a lack of a national strategy and an official mandate for the development of such a network. This can be addressed by an effort to encourage the ministry to develop a national strategy involving institutions, NGOs, active citizens, SME & industry, and media, as well as other suitable stakeholders, encouraged by peer work with other Member States and by European support policies. At the same time, the effort put by practitioners to provide evidence and to encourage universities to support career recognition to Citizen Science efforts (as seen in the previous point) can contribute to creating the need for the ministry to develop a national support strategy.

Thirdly, and linked to the last point, there is the challenge of engaging the appropriate people to develop and maintain the network. This will also require institutional support, and change. This can be achieved by making changes such as research assessment practices, and considering legal issues such as who may use laboratories.

The fourth challenge is the issue of budget and financing the network. This can be addressed by identifying new sources of funding (from the quadruple helix or crowdfunding) and also by building links to the finance ministry in a way that they understand and see the value in this activity. European support of the practice is also key in this regard.

Finally, there is the challenge of lack of time and knowledge - for example, to communicate results to the general public, or to interact with the public and the media. This can be addressed by a specific effort of capacity building through the Citizen Science hubs. This effort needs to be decentralised, recognise the plurality of scientific disciplines, should include ongoing Citizen Science projects, and promote the co-creation of new Citizen Science projects to address challenges raised by citizens and other quadruple helix stakeholders. The hubs should provide training, coaching, networking activities, dialogues and exchanges between projects, and promote mutual learning and the re-use of existing knowledge, best practices and resources.

9. Conclusion

This chapter shortly reflects on what the wealth of activities and information means to the three main challenges described in Section 1.3.

Sustaining Citizen Science projects and initiatives over the mid to long-term: The fact that funding in Section 2 is listed as the first and a separate enabling factor is important. There are sufficient recommendations and pilots to build upon and to transfer Citizen Science from a dedicated community to the broader R&I system.

Sustaining the wider uptake of Citizen Science data and multi-stakeholder engagement practices: Infrastructures, tools and policies alike need to change in a concerted way to move Citizen Science forward. Strong ambassadors and focused approaches will help to further the wealth of best practices. Capacity building through national networks and specific Citizen Science hubs is also key.

Sustaining Citizen Science as a research practice within RPOs and HEIs: As for RRI policies that have embraced Citizen Science, it is clear that many RPOs and HEIs struggle to advance their policies, research and education. The Coalition towards the reform of the research assessment (CoARA), the ERA action plans, and the support of the European universities will help support the further development of Citizen Science.

10. Next Steps - preparing for the Final Report

The five topics covered during the MLE on Citizen Science are being discussed and explored across a series of workshop meetings being hosted by the participant countries, slightly out of numbering order for logistical reasons, four of which have now taken place.

1. **Topic 1** covering an "Introduction and Overview of Citizen Science" took place virtually at the beginning of 2022,

2. **Topic 2** on "Ensuring Good Practices and Impacts" took place virtually in the spring of 2022,

3. **Topic 3** on "Maximising the relevance and excellence of Citizen Science" took place in Ljubljana in October 2022,

4. the two workshops exploring **Topic 4** - as described in this report - took place at the beginning and end of the summer 2022, in Vienna and Budapest respectively, and

5. The final workshop on **Topic 5** "Scaling up Citizen Science" will take place in Berlin in November 2022.

Some of the questions that have been raised by the MLE participants and not yet addressed will be covered in the remaining workshop session and in the Final Report:

Initial Questions	Topic 4 Questions
• What should we expect from Citizen Science projects/initiatives and how to properly integrate them into the overall science policy priorities?	• What are the most relevant and efficient policies/actions/strategies for supporting the development of Citizen Science at national level taking into account that the transition process towards Open Science is at the beginning and the fact that Citizen Science is at the early stage of development.
• How can we best support the exchanges (in time and financially) between citizens and scientists?	
• How could we develop and sustain Citizen Science research in the social sciences and humanities?	• What are examples of successful Citizen Science funding schemes / programmes / calls for proposals existing at European level – developed by other European RFOs (e.g objectives, what activities were funded, types of projects funded).
• What are the needed infrastructures (IT-tools, applications, recruitment and best practices) for relevant, ethically sound and successful Citizen Science?	
• How can results from Citizen Science projects be implemented in policy decisions more easily?	• What are the basic activities that should be taken into consideration within capacity building for Citizen Science?
• Funding is a big issue. Sometimes it is very challenging to convince RFOs to support a Citizen Science project. How	• How can Citizen Science projects be (financially) supported over a longer period (more than three years) since many Citizen Science initiatives are pursuing long-term goals?

could Citizen Science be more efficiently promoted for funders?	• How can I normalise/make clear what my (institution) mandate for Citizen Science is?

Further research into emerging best practice with regard to building and growing national enabling environments for Citizen Science, along with guidance on how to do so, will be contained in the Final Report.

The MLE Participants have also requested the following for the contents of the Final Report:

- Concrete examples of capacity building activities including programmes and training existing at European level;

- A clear set of recommendations, policy support and country examples (e.g., repository);

- Recommendations for national Citizen Science strategies and funding programmes to strengthen existing Citizen Science initiatives;

- Convincing case studies or rationale to convince federal governments of the need for structural funding for Citizen Science projects and national Citizen Science centres;

- Criteria for choosing Citizen Science projects to scale-up at EU level.

Further research into emerging best practice with regard to building and growing national enabling environments for Citizen Science, along with guidance on how to do so, will be contained in the Final Report.

The MLE will conclude with a Final Meeting to present the findings of the full Mutual Learning Exercise, along with the Final Report, to a wider audience - currently planned for the beginning of 2023 in Brussels.

This Thematic Report focuses on enabling environments and the institutional and governance arrangements that can support Citizen Science, with a particular focus on the role of different stakeholders, including research institutes, funding bodies, public authorities, businesses and civil society organisations in promoting Citizen Science. It provides the outcome of the discussions of two separate two-day workshop sessions on recommendations on enabling environments, good practices, lessons learned and success factors identified to implement new enabling factors for Citizen Science.

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