

Beyond Participation: Citizen Science, Policy Impact and Economic Value

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Stefanie Schuerz | Barbara Kieslinger | Teresa Holocher | Mireia Ros

In this book, we illustrate how citizen science efforts create policy and economic impact on a regional, national and international level. The impact stories showcase what can be achieved when municipalities, ministries, (inter-) national funding bodies, and the private sector invest in citizen science, and how this is beneficial for European societies.

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Introduction



This book focuses on the tangible effects that citizen science has at various levels, from a global scale to local initiatives, on **shaping policies and creating economic value**. While our previous collection showcased 12 stories across from Europe¹ that illustrate the power of collective action and inclusivity, this publication highlights how citizen science is an important vehicle for driving policy change and socio-technical innovation.

Citizen science is a term that has evolved over time, with many definitions, nuances, and applications emerging from its practice. At its core, however, citizen science represents meaningful engagement of the public in authentic scientific work. This involvement is not only important for the individuals who contribute to it, but also for advancing scientific knowledge and eliciting societal challenges. It is this collaborative and participatory nature of citizen science that we seek to highlight and the ways in which citizens, researchers, policymakers and the private sector come together to address pressing global and local issues.

This book begins by examining citizen science from both the **EU and global perspectives**. Exemplarily, we explore the role of the European Commission's Joint Research Centre (JRC), followed by the OECD's global vision. At the **national and regional levels**, we delve into the benefits that citizen science offers to individuals and institutions, highlighting how it enhances problem diagnoses and provides access to previously inaccessible information, which in turn enables more informed policy decisions. Shifting

our focus to **impactful grassroots initiatives**, we showcase the significant influence of smaller-scale projects. From conserving remarkable trees, to developing new standards of measurement, affecting urban development, protecting vital ecosystems and cultural heritage and advocating for legislative changes, community-driven action has the power to create meaningful and lasting change.

In addition to its impact on policy and society, citizen science is increasingly **intersecting with the economy**. Through concrete examples, we explore how businesses are harnessing citizen science services and technologies to drive innovation, diversify their offerings, and stimulate growth. Here, citizen science shows its potential as a business model that fosters entrepreneurial ventures, supports economic development, and catalyses societal change.

As you delve into these pages, we hope you find inspiration in the stories shared here. From local initiatives to large-scale policy change, citizen science is proving to be an effective driver of progress. Participation creates impact by providing a two-fold value: advancing scientific knowledge that enables evidence-based policies and economic value for the benefit of society, and building community that enhances mutual trust and strengthens our democratic society.

Enjoy the read and get inspired! Together we create impact!

¹ Stefanie Schuerz, Teresa Schaefer, Barbara Kieslinger, *The impact of citizen science: 12 stories from across Europe*. 2024. DOI: 10.5281/zenodo.13644655



Section 1



**EU and Global
Perspectives on
Citizen Science**

To unfold its full potential, citizen science needs support on all levels of policy. International governance bodies like the European Union (EU) and the Organisation for Economic Co-operation and Development (OECD) play an important role in this – the former as a funding agency and legislative body, the latter as an enabling and advisory body that helps its member countries make strategic policy decisions and actively shape their future. The following two stories give insight into the transformative potential unleashed by such institutions supporting citizen science – and why it always pays to invest in it.

Citizen Science and Policy in Europe: From Environmental Monitoring to Systemic Integration

Over the past decade, citizen science has evolved in Europe from a largely participatory and educational practice into a recognised component of policy-relevant knowledge production. Sven Schade from the Joint Research Centre (JRC) illustrated this transformation in an interview, which was complemented by insights from a conversation on knowledge valorisation with Iphigenia Pottaki from the European Commission's (EC) Directorate-General for Research and Innovation (DG RTD). What emerges is not a single pathway of impact, but a layered process in

which citizen science contributes both to specific policy domains – most notably environmental policy – and to broader institutional frameworks such as open science, stakeholder engagement, and, increasingly, knowledge valorisation.

The JRC², as the EC's in-house scientific service, plays a central role in this development. Its mandate is to provide independent, evidence-based knowledge to support European policy-making. Within this context, citizen science has been incorporated as one of several participatory approaches to generating policy-relevant knowledge³. In the JRC, citizen science is embedded in a wider set of practices aimed at engaging stakeholders and improving the quality and legitimacy of evidence. This broader framing is reinforced by developments in European knowledge valorisation policy, where citizen engagement plays a key role in ensuring value creation for society and policy. The development of the European Code of Practice on Citizen Engagement for Knowledge Valorisation⁴ has drawn from a participatory, co-creation process with many stakeholders, including a strong contribution from the citizen science community. *"Engaging citizens in the valorisation process helps ensure that research results work for society, that knowledge is used to inform policy making, as well as that new innovative solutions are taken up in the economy. In that way, citizens' involvement plays a key role in all three dimensions of knowledge valorisation: market, society and policy"*, explains Iphigenia Pottaki, policy officer at the EC's DG RTD.

The earliest and most tangible impacts of citizen science on policy can be observed in environmental monitoring. As Sven Schade explains, this

2. JRC https://joint-research-centre.ec.europa.eu/index_en

3. See e.g. JRC reports on Using new data sources for policymaking <https://publications.jrc.ec.europa.eu/repository/handle/JRC109472> and Activity Report on Citizen Science <https://publications.jrc.ec.europa.eu/repository/handle/JRC123500>

4. Code of Practice on Citizen Engagement for Knowledge Valorisation https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L_202400736

domain provided a natural entry point because it requires large-scale, geographically distributed data collection that cannot easily be achieved through conventional scientific methods alone. Biodiversity monitoring offers a particularly illustrative example. Long-term bird population indices, largely based on volunteer contributions, have become essential indicators used in European biodiversity strategies, agricultural policy, and the monitoring of the Sustainable Development Goals. In such cases, citizen science is not merely complementary, it forms the backbone of the data infrastructure. Over time, this model also emerged in other environmental domains. Citizen science initiatives now contribute to monitoring pollinators or butterflies, tracking invasive alien species, assessing soil health, and collecting data on marine litter and water quality in general. In many instances, these activities go beyond data collection and actively influence behaviour, for example in projects that encourage citizens to create pollinator-friendly environments in urban areas. The integration of citizen-generated data into formal policy systems marks a significant step forward. Citizen-generated data on invasive species, for example, are combined with other sources and used in European policy processes, while marine litter initiatives are connected to broader environmental strategies. These developments indicate a shift from isolated projects to a more systematic incorporation of citizen science into policy-relevant data ecosystems.

A key moment in this trajectory was the development of a JRC technical report on citizen science and environmental monitoring⁵. This document synthesised existing practices and provided recommendations for integrating citizen science into environmental governance. *“Its uptake by environmental protection agencies across Europe represents one of the clearest*

5. JRC report on Citizens Science and Environmental Monitoring
<https://publications.jrc.ec.europa.eu/repository/handle/JRC117665>



examples of direct policy impact. In response, these agencies began to develop structured approaches to using citizen science in their activities, embedding it within their operational frameworks.” explains Sven Schade. This transition from experimentation to institutional uptake demonstrates how analytical work within the JRC can translate into concrete changes in policy practice. It also shows how the JRC clearly situates citizen science across the entire policy cycle, highlighting how citizens can be involved not only in data collection, but also in quality assurance, data analysis, and the communication and evaluation of policy outcomes.

As a consequence, citizen science can impact policy at different levels. At the local level, it enables communities to address concrete problems, such as environmental quality or public health concerns. Projects focusing on issues like odour pollution demonstrate how citizen-generated data can inform municipal decision-making and empower local actors. At the same time, these local initiatives can contribute to national and European policy frameworks, provided that mechanisms exist to aggregate and integrate the data. This interplay between local action and higher-level governance highlights its potential to connect different scales of policymaking, as will be shown in upcoming stories within this volume.

From the perspective of knowledge valorisation, it is particularly important that organisations develop citizen engagement strategies that also show how the engagement of citizens delivers value for society. While citizen science has traditionally focused on knowledge creation, knowledge valorisation policies emphasise the subsequent phases of validation, uptake, and use. Citizen engagement in this context helps ensure that research outputs are translated into societal and policy value. It can improve the adaptation of innovations to user needs, support their uptake in practice, and contribute to addressing societal challenges. Obviously there can be a continuum between knowledge production and its valorisation, which shows that citizen science and citizen engagement for knowledge valorisation can be closely linked. The Code of Practice on Citizen Engagement for Knowledge Valorisation provides practical guidance on how to engage citizens effectively in the uptake of research results. By codifying existing practices, many of which originated in citizen science and participatory governance models, it established citizen engagement as a standard and recognisable component of European valorisation policy.

While environmental policy provided the initial focus, citizen science has increasingly influenced research and innovation policy at the European level⁶. The transition from Horizon 2020 to Horizon Europe marked a turning point in this regard. Citizen science became embedded within the wider agenda of open science, which promotes transparency, accessibility, and participation in research. Looking ahead, the role of citizen science in European policy is likely to be characterised by further integration rather than expansion as a separate field. Its contribution to improving the knowledge base for policy-making remains central. By incorporating diverse

6. Book chapter on Citizen Science and Policy https://link.springer.com/chapter/10.1007/978-3-030-58278-4_18

data sources and local knowledge, citizen science enhances the robustness and relevance of evidence. At the same time, it plays an important role in citizen engagement. The European Commission has a formal obligation to involve stakeholders in policy processes⁷ and citizen science provides one pathway for fulfilling this requirement through participation in knowledge creation rather than consultation alone.

Importantly, this also has an impact on public trust in science and institutions. Involving citizens directly in the production and use of knowledge can help address perceptions of distance between European institutions and the public. Citizen science thus contributes not only to better evidence, but also to the legitimacy of policy processes. From the perspective of knowledge valorisation, this also implies a stronger focus on translating engagement into tangible societal value. While participation in itself has intrinsic benefits, policy frameworks increasingly emphasise the need to connect citizen involvement with concrete outcomes, such as innovation uptake, improved public services, or more effective policies. This requires new forms of collaboration, including living labs, citizen hackathons, and policy labs, which combine elements of citizen science, engagement, and innovation in more integrated formats. Given this overall situation, the impact of citizen science on policy in Europe is both substantive and structural. It is substantive in the sense that it provides data and insights that directly inform policy, particularly in environmental domains. It is structural in that it has contributed to reshaping how knowledge is produced, validated, and translated into societal value.

7. Treaty on European Union, Title II – Provisions on Democratic Principles, Article 11
https://eur-lex.europa.eu/eli/treaty/teu_2016/art_11/oj/eng

Citizen Science and Policy: International Perspectives from the OECD Global Science Forum



Citizen science has attracted increased attention in international policy arenas, including the work of the Organisation for Economic Co-operation and Development (OECD). As an enabling and advisory body, the OECD supports countries by providing analysis, recommendations, and platforms for policy exchange, supporting agenda-setting based on issues deemed relevant by member countries. In 2023, it launched the project “Citizen science: policies to promote citizen engagement in the production of scientific knowledge”, convening an expert group made up of representatives from 16 OECD countries, the European Commission, and the OECD. The result of this endeavour is the OECD report on Embedding Citizen Science into Research Policy⁸. Carthage Smith, Head of the Global Science Forum (GSF) at OECD, tells us about its development and provides a complementary perspective on how citizen science is perceived, discussed, and taken up across different national policy contexts.



8. OECD report Embedding citizen science into research policy <https://doi.org/10.1787/a1cfb1a8-en>

Filling in a blind spot

The project built on previous work done by the GSF on societal engagement in science and science policy, including the much more established concepts of open science, citizen engagement and transdisciplinary research. While awareness and recognition of citizen science practices vary significantly across countries, one of the most striking findings from this process was that many countries underestimate the extent to which citizen science is already taking place within their own borders. While activities are often widespread at the level of research projects, civil society initiatives, or local communities, they remain largely invisible in formal policy discussions. In countries such as Japan and Korea, for example, while there has been longstanding engagement with broader “science and society” agendas, citizen science as a distinct concept has not been incorporated into national strategies. As Carthage Smith explains: *“There's no policy discussion around citizen science, certainly not using that terminology. We actually had a workshop in Japan where there were some really great examples, some really interesting stuff that is ongoing that hasn't affected the core policy community and their thinking.”* The OECD report played a catalytic role in these contexts by making existing practices visible and providing a framework for discussion. It enabled actors already engaged in citizen science – sometimes outside traditional policy institutions, such as science museums – to initiate dialogue with ministries and policy communities: *“But the project, the report, enabled [the representative from Japan] to have discussions with the policy community,”* says Carthage.

Providing visibility and legitimisation appears to be one of the most important contributions of the OECD's work, helping to highlight and connect existing activities and thereby supporting their recognition at policy level. In several countries, this created opportunities for strengthening or expanding support for citizen science. In Switzerland, for instance, the report was circulated among the Swiss Academies at a time when budget

discussions were taking place, contributing to arguments for maintaining or increasing funding. In Belgium, it informed discussions among Flemish universities, while in Canada it contributed to the establishment of a cross-country working group and the emergence of a new transnational project.

The trouble of measuring impact on policy

At the same time, the OECD experience highlights the complexity of translating such work into measurable policy impact. Unlike academic outputs, policy reports are rarely cited systematically, and their influence is often diffuse. As Carthage explains: *"Impact assessment is very difficult. Policy stuff often isn't cited, particularly at the national level. They like to reproduce it themselves and don't cite sources. Or if they do it, it's very anecdotal which source they go for. And so the only way is to actually talk to individuals and for that you have to find the right individuals who were involved at that stage in the project."* Since influence in international policy advisory work operates through networks, dialogue, and incremental change, impact can be assessed primarily through dissemination activities – who received the report, where it was presented, and how it was discussed. But these were highly positive from the feedback Carthage has received: *"I was amazed how positive they were. In fact, they'd done blogs on it themselves. One country actually presented the report to the chief science advisor in a special session. Others were sending it around to the environment ministries as well as other ministries, but not just sending it, presenting it. It's hard to measure the actual impact, but from what we heard, at least the people who were involved in developing it, who were on this expert group that oversaw it, were using it. And hopefully our broader policy community that commissioned it also are using it. You know, anecdotally we get very positive feedback. It fed into discussions in the G20 as well, which was hosted by South Africa, so they were very pleased about it."*



Resistance in the community

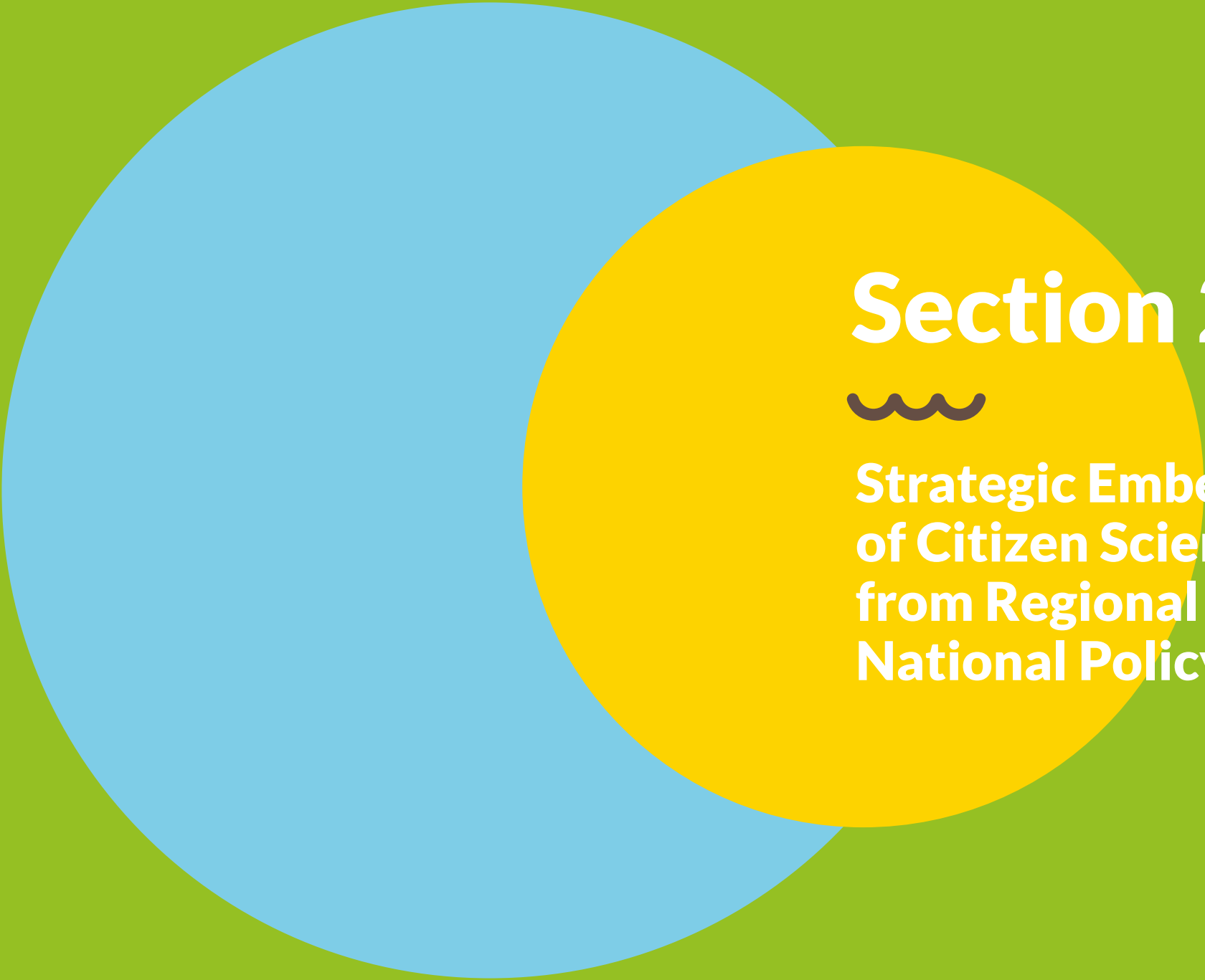
However, resistance within parts of the academic community remains a significant obstacle. One of the most persistent barriers to the policy uptake of citizen science and its results are concerns about the quality and usability of citizen-generated data – *“an argument that needs to be won in the academic community itself, as well as then in certain policy domains, including perhaps in science policy generally,”* as Carthage argues. A central element of the discussion is to challenge the assumption that such data are inherently unreliable. In some domains, particularly environmental monitoring and public health, there is already a growing recognition of their value. As such, the report also seeks to expand the target audience for citizen science policy discussions. While conversations around strategic investment in citizen science are often confined to science ministries and research funding agencies, the OECD emphasised the need to reach beyond science policy to other sectors, including environment, health, and innovation ministries. This mirrors a broader trend also observed in European contexts: the recognition that citizen science has relevance across policy domains and should not be limited to the research sector. As such, there is a need for continued cross-government dialogue, with the OECD suggesting that the integration of citizen science into policy is closely linked to broader transformations within the science system itself, part of a broader shift towards more inclusive and responsive science systems. This perspective is also reflected in the OECD Science, Technology and Innovation Outlook 2025⁹, which includes discussion of how science systems need to transform to engage more effectively with society. Citizen science is one component of this transformation, alongside science communication and other forms of public engagement.

9. OECD Science, Technology and Innovation Outlook 2025 <https://doi.org/10.1787/5fe57b90-en>

Infrastructures and investment into the future

Beyond its direct policy recommendations, the OECD has also contributed to building infrastructures for knowledge exchange. The STIP Compass platform¹⁰, for example, collects information on national policies related to open science, societal engagement, and citizen science. While not a monitoring tool, it allows countries to share experiences and learn from one another, creating a form of “soft” coordination through transparency and peer comparison. Looking forward, the OECD does not currently plan a dedicated follow-up initiative focused exclusively on citizen science. Instead, the topic is expected to remain embedded within broader work on societal engagement, open science, and science system transformation. This mirrors the trajectory observed in European contexts, where citizen science has moved from a distinct topic to a more integrated component of policy frameworks – and a mainstreamed methodological approach worth employing across disciplines. Its continued promotion is therefore likely to occur through these broader agendas rather than through standalone initiatives.

10. OECD STIP Compass <https://stip.oecd.org/stip/>



Section 2



**Strategic Embedding
of Citizen Science
from Regional to
National Policy**

With appropriate attention, citizen science can serve as an important policy intervention to achieve larger societal goals. The following stories show different ways how citizen science has been employed by ministries, funding agencies, and municipalities across Europe to strengthen the democratic process, elicit long-term procedural change, and integrate the perspectives of citizens into policy decisionmaking. They tell about Austria's early and sustained funding efforts for citizen science, the Dutch development of citizen science support structures, Camden Council's forays into citizen social science to get civic voice into policy in the UK, and Oeiras' efforts to counter fake news and anchor the scientific method among the population in Portugal.

Science and Society in Dialogue in Austria

Austria's public administration was an "early enabler" in terms of citizen science by investing strategically in school interventions that aimed to bridge socio-economic gaps and bring science closer to children. Sparkling Science¹¹, a dedicated citizen science funding programme targeted at

11. <https://oead.at/en/study-research-teaching/citizen-science/sparkling-science>

Mentioned Sparkling Science projects: This is (not) Rocket Science!, TRA:WELL, Es wird einmal..., Biodiversität der Elritzen, MAJA, Smart Sport Assistance

engagement with schools and other citizen scientists, was first set up in 2007 and is open to all disciplines. Since 2015, citizen science has been integrated as one cornerstone of Austria's Open Innovation Strategy¹² and is subject to a plethora of policy instruments including the LBG Open Innovation in Science Center¹³ and its activities, the ongoing initiative to strengthen trust in science and democracy¹⁴, VISTA¹⁵, and more recently LBI SOAP¹⁶, which focuses on the medical context. To understand the history and presence of citizen science in Austria, and what the Austrian strategy managed to achieve, we talked to four policymakers from the Austrian Ministry of Women, Science and Research (BMFWF) as well as the Head of Public Science at the Austrian Agency for Education and Internationalisation (OeAD): Stefan Duscher, Karin Müller-Magyar, Nikolaus Possanner, Julia Prikoszovits, and Petra Siegele.

Early beginnings and large-scale support

Austria started its first structured citizen science programme in 1856, collecting biodiversity observations for the Austrian Central Institution for Meteorology and Geodynamics. Today integrated into GeoSphere Austria, this institution has been reliant on volunteer contributions almost from its inception – although the naming conventions have only taken hold in the 21st century. Stefan Duscher, who heads the BMFWF department responsible for GeoSphere Austria and Science-Society Dialogue, gives an example during our focus group conversation: *"GeoSphere asks citizens to measure and report many different effects of natural phenomena. When you have*

12. Austria's Open Innovation Strategy

<https://www.bmfwf.gv.at/forschung/forschung-oesterreich/strategische-ausrichtung-beratende-gremien/strategien/ois.html/>

13. LBG OIS Center <https://ois.lbg.ac.at/>

14. BMFWF initiative to strengthen trust in science and democracy

<https://www.bmfwf.gv.at/wissenschaft/vertrauen.html>

15. VISTA Science Experience Center <https://www.vistascience.at/de>

16. LBI SOAP <https://soap.lbg.ac.at/>

strong gusts of wind, do trees fall over, do houses unroof? If we have a magnitude 2.7 earthquake, do you get a crack in your wall? With these data, we know better what outcomes we have to expect." A big push towards citizen science came in the early 2000s, as Nikolaus Possanner, who leads the strategic agenda on trust in science and democracy at BMFWF, explains. The Austrian higher education system underwent substantial transformation from the mid-1990s, which in the 2000s led to significant investments in the field of citizen science – earlier than in other European countries. The goal was to address two related challenges: raising a comparatively low rate of university graduates and making the boundary between academic research and society more permeable.

The pioneering Sparkling Science funding programme was born. Managed by the OeAD's Centre for Citizen Science, the programme ran from 2007 to 2019 and since 2021 continues with Sparkling Science 2.0. The second iteration alone is expected to reach more than 80.000 school children, involving more than 6% of the overall pupil population in Austria in dedicated citizen science projects. These projects aim to build strong and lasting collaborations between



Figure 1. Biodiversity monitoring in the Elritzen river for "Biodiversität der Elritzen" (credits: Naturhistorisches Museum Wien)

schools and research institutions, and often involve organisations like museums, libraries, NGOs, and SMEs. Thematically open to all disciplines, projects must be both scientifically sound and set up in ways that ensure young people and other citizen scientists make significant contributions to achieving the research objectives. Joint activities must continue for at least two years beyond the project duration to increase the sustainability of project results and their impacts. Since 2007, the Austrian state has funded 360 citizen science projects through this programme, almost equally covering SSH (Social Sciences and Humanities) and STEM (Science, Technology, Engineering and Mathematics) disciplines.

Awards and networks

Since 2015, Sparkling Science has been complemented by the yearly Citizen Science Award that mobilises schools, youth groups, families and individual citizen scientists, incentivised by monetary and material prizes. Then there is the Science Ambassadors initiative, which is coordinated and run by OeAD on behalf of BMFWF. These ambassadors visit schools – and now also kindergartens and libraries – in their capacity as researchers from various institutions. The ambassador initiative has been steadily growing since 2021 and has since gained national recognition, receiving considerable institutional support from higher education institutions across Austria. These activities act as anchors for later citizen science activities, strengthening both the partnerships between higher education institutions and schools while building engagement capacity among scientific staff.

On top of these activities coordinated by OeAD, Austria was also one of the first European countries to support an official citizen science network which provides a platform for projects to showcase their results, recruit participants, and exchange experiences. Beyond the financial support provided to the Citizen Science Network Austria (CSNA), the BMFWF

co-funds the yearly Austrian Citizen Science Conference that has been implemented since 2015, and strongly incentivises universities to include public engagement in its contractually obligated outreach activities, commonly known as the “Third Mission”.

From promotion of young people to science-society dialogues

Initially, Austria's science policy supported citizen science with the aim to get young people excited about science, to reduce barriers between science and schools, and in the long run barriers to society at large. The strategic focus broadened in the 2010s. A greater focus was put on showcasing scientific results to the public, to ensure it saw the benefits of public investment in science. In line with the EU Missions, citizen science and public engagement in science were considered helpful in securing buy-in from the general public. By now, Julia Prikoszovits from the strategic department for social sciences and humanities at BMFWF feels that a genuine interest developed within the sciences, and especially the social sciences, to include various publics in research. It turned into a somewhat basic principle, she explains: *“If you research societal challenges, it is important to practise public engagement.”* Even more, the dialogue between science and society has evolved into an approach to once again strengthen the disintegrating trust the public has in science.

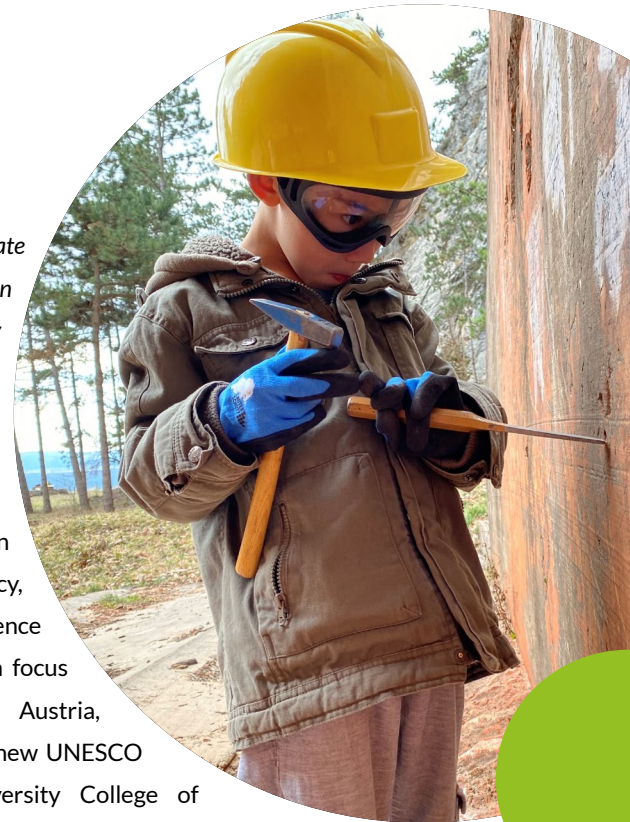
Citizen science has also been anchored thoroughly within research institutions and has developed into a recognized approach to research. Some fields are now even relying on citizen science in ways they didn't before this support. As Petra Siegele, head of Public Science at OeAD, explains: *“Boku University realised within one of its Sparkling Science projects that children are usually an object of transportation research but they were never taken into the field. After the project, they have created a separate field of research from this specific perspective. And we have a few examples of this type of institutional change.”* Nikolaus Possanner adds: *“Especially in the natural sciences, there are so many*

Figure 2. Marble mining with Weikersdorf primary school for “Es wird einmal...” (credits: Elisabeth Ecker)

fields that can't even operate anymore without citizen science. Counting insects, they couldn't do it if they didn't have volunteers.” There are numerous other examples of how Sparkling Science projects impacted Austrian education and science policy, by e.g. establishing space science as a research and exhibition focus at the Technical Museum Austria, triggering the creation of a new UNESCO professorship in the University College of Teacher Education Lower Austria, or enriching teacher education and training by new hands-on formats of bringing science to school and testing their scalability. Beyond these important scientific and institutional impacts, Sparkling Science also generates an abundance of co-created learning materials and guidelines that are all openly available and allow for their use in future initiatives. On top of this, the sustainable collection of data on e.g. natural ecosystems, initially triggered by Sparkling Science initiatives, can continuously serve for local decision making.

Missing connections

One of the biggest challenges that keep citizen science from realising its full potential is the missing pipeline from citizen science to policy. As Julia Prikoszovits puts it: *“I'm really missing the knowledge broker function.”* She



wants to see more community building that sustainably integrates citizen science into research, since it elevates research in a way that is also relevant to policy. Still, it needs a broader strategy to connect results to policy and make evidence available to decisionmakers. Nikolaus Possanner explains that on a broader basis, existing options for funding and support are not known to all relevant actors, and that a lot hinges on the motivation of responsible individuals. A lot of energy is spent preaching to the choir, while it remains difficult to reach those that need to be reached. Expectation management is key here, since turn-around times can be quite long: *“In the long run, LBI SOAP will do co-creation, but in the short- and mid-term, it’s primarily social work, making sure some children have someone to talk about in general, not just about science. Only when you build up this trust can you do citizen science and more. But to reach these groups, it is a very lengthy process.”*

On a positive note, Austria remains committed to citizen science also in the long run. Karin Müller-Magyar, who represented BMFWF in Austria’s *Task Force Citizen Science*, which contributed to the EU’s Mutual Learning Exercise (MLE) on Citizen Science¹⁷, explains that the MLE clearly showed Austria’s lead position: *“Austria has something of a forerunner role, exactly because of these many strategic documents, because of funding programmes like Sparkling Science and the Citizen Science Award, and because of many such activities. The MLE also allowed for international cooperation, where the expertise of Austrian actors was often drawn upon. For instance, CSNA was invited to support the development of the Slovenian citizen science network.”* As such, Austria can leverage its experience to shape the citizen science landscape across Europe – for the benefit of science and society at large.

17. MLE on Citizen Science <https://projects.research-and-innovation.ec.europa.eu/en/statistics/policy-support-facility/psf-challenge/mutual-learning-exercise-citizen-science-initiatives-policy-and-practice>

Building up Foundations: Funding Citizen Science in the Netherlands



In the Netherlands, efforts to support citizen science at the national level reveal both significant progress and persistent structural challenges. In 2022, the Dutch National Open Science Programme (NPOS)¹⁸ laid out a vision for Open Science that officially integrated citizen science in its ambitions and operationalised clear steps to achieve its anchoring in the Dutch research landscape until 2030. Building on these steps, Frederike Schmitz from Open Science NL¹⁹, which is part of the Dutch Research Council NWO²⁰, has been working hard to set up an enabling funding environment for citizen science. Rather than launching stand-alone funding schemes, this approach has focused on implementing the necessary infrastructures, networks and capacities that allow citizen science to grow sustainably. This story traces how citizen science has gained institutional recognition through strategic alignment with open science, while also highlighting the legal and organisational constraints that continue to shape what is possible in funding citizen-driven research.

18. Dutch National Open Science Programme (NPOS) <https://share.google/OO9I4bMkNSjAD2TDw>
19. Open Science NL <https://www.openscience.nl/en>
20. Dutch Research Council NWO <https://www.nwo.nl/en>

Citizen science enters the open science agenda

In the Netherlands, the evolution of citizen science from a science policy perspective is strongly intertwined with the broader development of open science. After the term was explicitly included in the NPOS2030 Ambition Document it became part of the official open science agenda, making it eligible for dedicated support. Frederike Schmitz, head of the Citizen Science program at Open Science NL, explains why this formal embedding mattered greatly: *“If they wouldn't have written it in these documents, we wouldn't have dedicated funding at this point.”*

Open Science NL's first priority was to build the conditions that citizen science needs in order to grow. The first major investment was impulse funding for the Citizen Science Netherlands network CS-NL²¹, which has since become a crucial infrastructure for the field. CS-NL connects actors, maps ongoing activities, shares knowledge and provides a visible point of reference for ministries, universities and policymakers. As Frederike explains: *“I can now take colleagues from ministries to these events that CS-NL organises to show them what citizen science is. And that really helps me to talk to ministries about what citizen science does. And I already see that this has a big impact.”* In addition, CS-NL also became an important partner for NWO in understanding what is happening across the country and where support is needed most.

A second step was the development of capacity-building structures, which took the form of funding for the development of citizen science hubs that span universities and non-university research institutions. As Frederike says: *“I actually looked around at what other funding programs do, like in Austria, and some European countries have citizen science hubs. And that's how it started, to*

21. Dutch citizen science network CSNL <https://citizenscience.nl/>

establish that citizen science hub call to really focus on capacity building. So this is not funding for actual citizen science projects but the soft infrastructure around it.”

Open both to regional and thematic collaborations, these hubs are intended to support researchers and communities who want to start or improve citizen science activities, for example by offering expertise on engagement, monitoring, data practices, communication and project design. Importantly, the hubs are not built from scratch but are made up of consortia of institutions that already have experience in citizen science, leveraging existing expertise.

The third step is a strategic focus on the necessary research infrastructures. In 2025, Open Science NL launched an infrastructure call that was also open for citizen science related applications. Among the 45 funded proposals were six citizen science infrastructure projects that are now getting up and running²². There will be another call of this kind in 2027, and Frederike hopes that learnings from the RIECS Concept²³ project will help clarify the conditions of an open citizen science infrastructure. The main funding body NWO is also exploring options for a dedicated citizen science funding programme, although there are a lot of dependencies that still need to be addressed. NWO has commissioned a project, called a pre-call trajectory, to understand what can and cannot be done to set up such a funding instrument in a robust way²⁴. While Frederike is positive about the developments, she stresses: *“We have to address many bottlenecks.”*

Institutional recognition and early effects

Despite all challenges, the impact of this strategy is already visible. CS-NL has professionalised rapidly, developed a public presence, mapped projects

22. CSNL announcement on citizen science infrastructure projects <https://citizenscience.nl/blog/2026/1/22/os-nl-financiert-6-open-science-infrastructure-projecten/>

23. RIECS Concept project <https://concept.riecs.eu/>

24. Pre-call trajectory report <https://zenodo.org/records/17817531>



Figure 3. Participants collaborating in the pre-call trajectory to explore a possible citizen science funding programme (credits: Lize Kraan)

and training opportunities, and created a stronger identity for the field.

The call for citizen science hubs also helped reframe what citizen science meant to universities and universities of applied sciences both, as Frederike explains: *“A lot of universities have this narrative of impact in society, as in science and society, and they realise citizen science is actually science and society, so it fits their strategy.”* The call

required in-kind contributions from all participating consortia,

and Open Science NL was met with

a surprising willingness from research institutions and other organisations to invest

their own resources into citizen science. Receiving

Open Science NL funding, even if limited, has also helped institutions make the internal case that citizen science matters. As Frederike notes, receiving funding strategically *“works like an incentive.”*

The challenge of funding grassroots citizen science

At the same time, the Dutch case also shows the structural challenges that

funding agencies face when they want to support citizen science more directly. NWO is legally set up to provide subsidies to research organisations only. This means that citizen groups, neighbourhood collectives or institutions like patient organisations usually cannot be applicants unless their organisations have research as part of their formal mission. Money can be channelled to them through universities or research organisations, but this creates unequal relationships and does not fully solve the issue of recognising citizens and communities as genuine partners. This tension is particularly pertinent in the context of grassroots citizen science: while a traditional top-down model, where a university receives funding and involves citizens, is possible within the existing system, a truly bottom-up model, where citizen groups bring their own research questions and receive direct support, is much harder to realise. Frederike describes this as *“the really hard thing”* – finding ways *“to go straight where the citizens are”* and explore what kind of funding and support can work there.

Towards a more responsive funding system

To address these challenges, OpenScienceNL commissioned the aforementioned pre-call trajectory to identify barriers and possible solutions before launching dedicated citizen science project funding. This process revealed



Figure 4. Brainstorming what is important in a citizen science funding programme (credits: Lize Kraan)

a range of legal, administrative and financial bottlenecks, but also helped improve future programme design. One emerging pathway is cooperation with the Dutch Research Agenda (NWA)²⁵, another programme within NWO, which was itself originally based on questions submitted by citizens. A forthcoming call is expected to test ways of connecting citizen-derived questions with researchers, offering a possible bridge between public priorities and formal research funding.

The Dutch experience offers an important insight into strategic policy embedding and its operationalisation in practice. Through ambitious investments, citizen science has moved from scattered local initiatives and long-standing formats such as science shops towards increasingly connected and sustainable initiatives anchored by the NPOS strategy. It has gained visibility, institutional recognition and new support structures. At the same time, the Dutch case makes clear that meaningful citizen science policy cannot rely on project funding alone. It requires changes in funding cultures, legal frameworks, institutional incentives and long-term capacity building. In this sense, the Netherlands is building the foundations for citizen science as part of a broader transformation of the research system. The work is careful, structural and sometimes slow, but it addresses one of the central questions for the future of citizen science policy: how can funding systems support not only research about citizens or with citizens, but also research that genuinely starts from citizens' questions, communities and needs?

25. Dutch Research Agenda NWA <https://www.nwo.nl/en/researchprogrammes/dutch-research-agenda-nwa>

Getting Civic Voices into Policy: Citizen Social Science in Camden Borough, London



Camden is a Borough of London, home to around 217,000 people with highly diverse ethnic, socio-economic, and educational backgrounds. In 2019, Camden Council, the regional government, started to employ citizen social science as an approach to bring civic voice into the process and affect policy by gaining a better understanding of what actually matters to residents. The project emerged from a planned development project to rebuild Euston railway station as part of UK's largest infrastructure project HS2, and in turn "regenerate" the wider area around Euston station. Camden Council decided to capitalise on this by systematically engaging citizens in exploring what the components of a good life are for the people of Euston – and set up a durable citizen-to-policy pipeline in the process. The initiative was developed with experts from University College London (UCL)²⁶ and Lendlease²⁷, the developer of Euston station, as well as the independent charity Camden Giving²⁸, leading to a successful science-society-policy-industry collaboration. Dominic Murphy and Josef Thomas, who are part of the participation team at Camden Council, and Joseph

26. UCL Institute for Global Prosperity <https://www.ucl.ac.uk/bartlett/igp/>

27. Lendlease <https://www.lendlease.com/uk/>

28. Camden Giving <https://www.camdengiving.org.uk/>

Cook, who helps lead the Citizen Science Academy at UCL's Institute for Global Prosperity, told us the story of this ambitious project and its impact on the community.

An ambitious project

A core ambition of Camden Council's investment in participatory engagement is to develop a robust methodology for citizen social science that "counts the right things", and in doing so produces rich citizen-generated data that is useful, accurate, and understandable to politicians and developers. This is done with the utmost rigour, with UCL training participants in both theory and practice, focussing specifically on qualitative research methods like photo-elicitation interviews and walking ethnography, and covering aspects like project planning and research ethics. Explains Joseph Cook: *"We recruit local people who have strong connections within their community or are passionate about the community and [after training them], they go off doing their field work in Camden, looking into questions that they think are important. UCL ensures that the research questions will actually produce something that the council are interested in. But we also try to make sure that the council doesn't just dictate the questions, but is giving the citizen scientists the opportunity to help shape what questions they think are important."*

Among other things, this data operationalises progress over time through instruments like household surveys, and in turn gives an evidence base for the day-to-day work of decision-makers. As Dominic Murphy says: *"I think it's fair to say we're interested in seeing how far we can take this approach. We're very much committed to this method, that the data and the evidence we use need to be counting things that matter to residents rather than asking them to comment on things that have been measured by other people for other people's purposes."*

The citizen social science activities of Camden Council are embedded in the Good Life Camden (GLC) framework²⁹, which in itself was developed in a citizen science process in 2022, following the Good Life Euston research of 2019. GLC aims to understand and improve wellbeing in Camden in all its diversity. It covers nine overarching themes, which were translated into metrics and included in a household survey which will be implemented later in 2026 and produce citizen-generated data for different types of decisionmakers. GLC has so far been adopted by around 30 organisations and businesses that operate in the Borough, is still growing in scope, and is iteratively adapted through the experiences gained in its application. A dashboard with curated data is now in development.

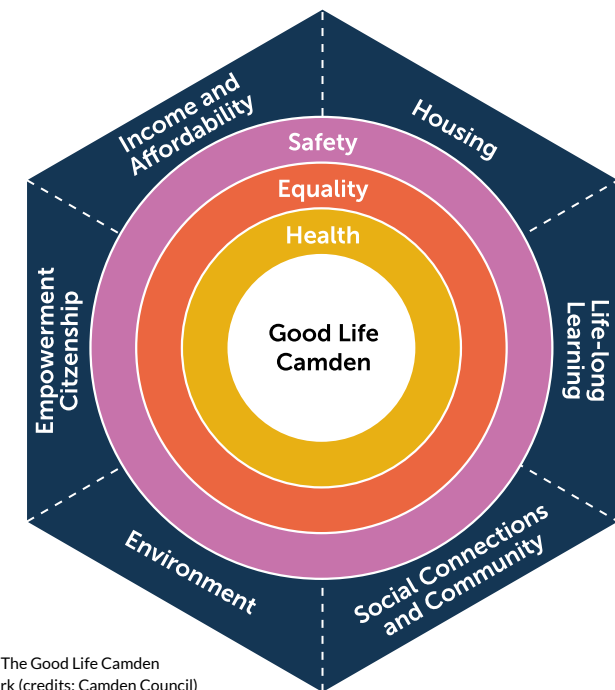


Figure 5. The Good Life Camden Framework (credits: Camden Council)

29. Good Life Camden Framework <https://www.wemakecamden.org.uk/good-life-camden/>

Individual and community benefits

Clear benefits of the citizen social science approach taken by Camden Council are already emerging, starting with the impact these interventions have on individuals and communities – on their employment status, their opportunities, and their confidence. For instance, the current cohort of citizen science training (focusing on violence against women and girls in public spaces) has a teaching assistant that had been a citizen scientist in a previous project. Two individuals from the Good Life Euston project are now employed at Camden Council, one as a social worker and one managing complaints to the council. And when the Institute for Global Prosperity had an exhibition at the London Design Biennale last year, two citizen scientists acted as tour guides to the public to explain their academic work. Another important impact is about citizen scientists' relationship to Camden Council, as Josef Thomas tells us: *"[...] all the untold benefits that we probably don't talk about enough in terms of their connection to the Borough, their feelings of confidence and how they feel they can influence policymakers where they live and pay council tax. We all know a lot of people don't like their local council too much, but this helps us bridge the gap between perceptions of council officers as an organisation and then the reality. That's one of the biggest benefits, I think."*

Training people in citizen science, engaging them directly in data production, and building a close relationship with the local government also works to directly counteract a trend across and beyond the UK, where the public increasingly doesn't trust data produced by traditional experts, doesn't trust their councils, and doesn't trust politicians of any party. And with robust and useful data elicited, traditional experts also trust community-produced data better. As such, these projects serve as a two-way exercise of improving trust. And it shows in the data: UCL implements a pre-post-survey with citizen scientists, rating a number of statements and looking for changes over time. The largest improvement here consistently comes

from the statement "Politicians listen to local people." – which cannot be replicated in its effectiveness with traditional engagement formats.

New insights, new instruments

The process also surfaced some issues in the area that people weren't aware of. For instance, the area, while diverse, is actually very stable. People, on average, have lived there for a long time and value its multicultural nature.



Figure 6. Citizen social science training session with participants (credits: Joseph Cook)

The household survey revealed that residents have incredibly low household incomes, making due with 17,400 pounds or less a year, which is less than the average new rent in the area, meaning that people cannot really rent anywhere else. This information was not visible in averaged statistics and new to economists engaged in the matter, showing how much people depend on social housing to ensure the stability of the population. *"So there's a story that emerges out of the Good Life Euston project that doesn't emerge out of the statistical quantitative work that we would ordinarily have done there,"* says Dominic.

Camden Council's investment in citizen social science already led to a robust research methodology that can be iterated on and transferred into different contexts – and that it plans to stick with for the foreseeable future. Research and policy instruments like Good Life Camden and the resulting household survey have been adopted by institutions within the Borough

and beyond: The Euston partnership for the regeneration of Euston station has adopted the model for its social value charter, and committed to adding social value when developing the new train station, giving a lot of credibility to the process. Good Life Camden has also been adopted by Lendlease, which is a very big, multinational development company based in Australia, impacting development policy at the far edges of the Commonwealth. The West London project Good Life North Kensington and the Kenyan project Mysa Bora – Swahili for Good Life – also repeated the methodology in ways responsive to the local contexts.

Most importantly, Dominic sees one significant benefit to citizen social science data that makes it essential for policy: *"I always present to politicians how odd it seems to me that we make important political decisions based upon objective evidence, evidence that has screened out the thoughts and the intentions of people. No company looking to develop and sell its product would do that. What's inherently good or in some ways superior, is that all the things that citizen social science uncovers*

are about the future, are forward looking. It's about how people are feeling and therefore about what their actions are likely to be in the future, rather than census data or administrative data at a given time. So I think those are really important arguments for having at least part of your evidence based upon citizen social science."

A community infrastructure levy

One important problem to solve is the long-term sustainability of these citizen social science initiatives. On the one hand, Camden Council has invested in the development of UCL's Citizen Science Academy. But securing funding for these successful projects into the future is key. Working with a consultancy, the Council arrived at using their Community Infrastructure Levy as a potential funding route. This levy is a local tax on housing development, mandating that developers building new housing must also invest in community infrastructure. The first year of citizen science funded this way is currently underway as a pilot, and the wheels have been set in motion to anchor this process and scale it as a robust citizen science-to-policy pipeline.

And although Camden Council's citizen social science initiative is still in its first decade, its benefits are clear to all involved. Most of all, it seems to serve as a remedy to one of the greatest problems facing modern societies: By bringing civic voice into policy by scientific means, it directly counteracts citizens' rising distrust of democratic systems and established institutions of knowledge and governance – from parties and politicians to universities and traditional experts.

Figure 7. Mapping Camden with participants (credits: Joseph Cook)

Changing Hearts and Minds in Oeiras Municipality, Portugal



Oeiras is a densely populated Portuguese municipality in the western part of the Lisbon metropolitan area, home to around 176,000 residents and marked by high levels of educational attainment, low unemployment and strong economic capacity. The municipality dedicates 1% of its annual budget to science. Within this framework, Oeiras has developed *Ciência + Cidadã*³⁰, a structured citizen science programme currently coordinated with ITQB NOVA³¹ and implemented in partnership with research institutions, schools, civil society organisations and local services. Elisabete Brigadeiro, Head of Oeiras' Science and Innovation Office, explains how the programme has become embedded in Oeiras Municipality's broader strategy for science and technology, as one of the ways in which the municipality links science, civil society and public policy while promoting active citizenship in science.

Uniting for a common purpose in a post-truth society

Oeiras Municipality's investment in citizen science kicked off during the pandemic with early projects addressing issues such as air quality, health, and science in everyday life, and grew from there into an ambitious and

30. *Ciência + Cidadã* citizen science programme <https://www.itqb.unl.pt/science-and-society/ciencia-cidada>

31. ITQB NOVA <https://www.itqb.unl.pt/>

continuous support structure. One goal of the programme was to open pathways for scientists that struggled to reach relevant populations, while raising citizens' awareness of the science produced in Oeiras – which had a large international echo that wasn't really seen by the population. Even more, Oeiras Municipality was confronted with the same rise in fake news and the downstream problems of a post-truth society plaguing the rest of the world, eroding societal relationships and trust in institutions. Oeiras wanted to actively counter this through an investment in participatory science, and in turn building trust and stronger relationships within the community while bringing science to the people.

Uniting different societal actors for a common purpose was key here, with the municipality setting up a structured participation programme that both connected scientific agendas between research institutions, schools, civil society organisations, and local services, and aligned them with local needs. And while this programme does not provide extensive funds, it is set up as a continuous investment that allows for stable collaborations to develop and for the impact of these interventions to maximise. In practice, Oeiras Municipality provides a platform³² and funding to support mutual exchange between institutions, like scientists visiting schools and school classes in turn visiting universities. While this collaboration serves the purpose of a mentorship programme, it also allows for new research questions to emerge and lead to new citizen science projects.

A primary goal of this municipal investment is to promote active citizenship in science both for the benefit of science and the community. It is also about “mainstreaming” the scientific method for residents of Oeiras to explore topics they find important or engaging, and in turn

32. Oeiras Educa platform <https://www.oeiraseduca.pt/>



giving them the means to decide what is relevant information, which sources to trust, and how to check their facts. As Elisabete Brigadeiro explains: *"We use territory as a place of experimentation, as a way to strengthen the trust between institutions and citizens and bringing knowledge production within our research partners to the realities people live in. So they get the chance to not only know about it, but really participate in it."*

Figure 8. Participants exploring sustainable agricultural practices for Oeiras Experimenta (credits: Oeiras Municipality and ITQB-NOVA)

A huge portfolio of projects

To this end, Oeiras Municipality, together with ITQB NOVA and other partners, has set up an extensive multilateral framework process, allowing residents, researchers and local institutions to explore topics of interest and research questions together, while connecting scientific institutions with different populations to make their engagement in research easier. This approach has led to a portfolio of currently eleven citizen science projects covering many different subject matters and societal problems: Carbon Tree³³, for instance, emerged in the early pandemic from a school science club that was wondering about the air quality pupils faced throughout their day, while Micro Mundo Oeiras³⁴ involves students as citizen scientists in search for new antibiotics and in mapping antimicrobial resistance. Oeiras

33. Carbon Tree project <https://www.rpcc.pt/project/35>

34. Micro Mundo Oeiras project <https://www.rpcc.pt/project/36>

Experimenta³⁵, which received funding from the EU-project IMPETUS³⁶, promoted sustainable agriculture and addressed critical issues at the intersection of climate change, food security, and social inclusion. Sombra Para Todos³⁷ ("Shadow for All") focuses on sun exposure, skin cancer prevention and behavioural change, while projects like SeaMic³⁸ and BioMarCO explore coastal and marine ecosystems and local sustainability. As Elisabete puts it: *"I would say that citizen science for us is more like a method in connecting knowledge, institutions and public action. And in the last five years, we have learned that through it, we reach people in a much deeper way than we could ever imagine before having this programme structured."*

Diagnosing problems and breaking silos

This broad approach to citizen science support has borne fruit in multiple ways. For one, it actually helped the municipality itself to work better by connecting different departments and different areas of expertise and responsibility in finding solutions to complex problems. *Sombra Para Todos*, mentioned above, not only raised people's awareness on how to protect themselves, it created the means for Oeiras Municipality to inform and follow through with concrete preventative action – in line with both the science and the community. As a result of this, the municipality is now installing monitoring systems to measure ultraviolet radiation levels and environmental air quality in local libraries and on beaches throughout the municipality. Therein lies a key strength of the

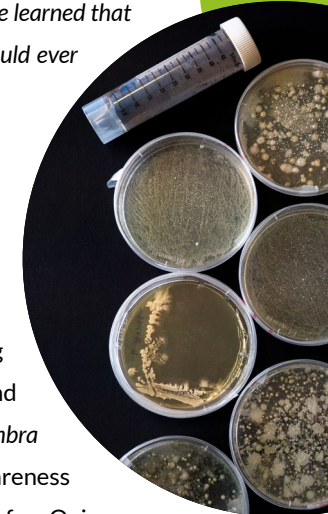


Figure 9. Microbial samples taken for Micro Mundo Oeiras (credits: Oeiras Municipality and ITQB-NOVA)

35. Oeiras Experimenta project <https://www.rpcc.pt/project/33>

36. IMPETUS project <https://impetus4cs.eu/>

37. Sombra Para Todos project <https://www.rpcc.pt/project/39>

38. SeaMic project <https://www.rpcc.pt/project/40>

approach taken by Oeiras Municipality: *“You can support one or two projects, but without continuous action and sustained policy support, they risk remaining isolated good practices. That is why we see our citizen science programme as a public policy, something we want to continue over time, because it creates the conditions for lasting impact.”* explains Elisabete.

One part of the recipe for success followed by Oeiras is to directly involve politicians as participants in citizen science processes and empower them in their role as responsible representatives of their communities. Elisabete shared the example of one politician who reacted with great enthusiasm to a project, participated in every step along the way, understood the method, and through this process got a better understanding of why his work was actually important. Having been convinced of the value of this approach, he took this enthusiasm to municipal meetings, sharing his experiences with his colleagues and expressing strong support for citizen science as an approach. As such, the process itself is both a profound innovation in governance and an attraction in itself, providing broad benefits to participants and the broader community alike. And while the municipality is looking to provide a platform³² that makes data accessible to everyone, Elisabete stresses that the data itself is only one part of the picture: *“What citizen science really does for us, it helps us improve the problem definition. It enriches the diagnosis and reveals other unconventional dimensions, and through this process we change the way we do things. And it gives a little bit more legitimacy to our action.”*

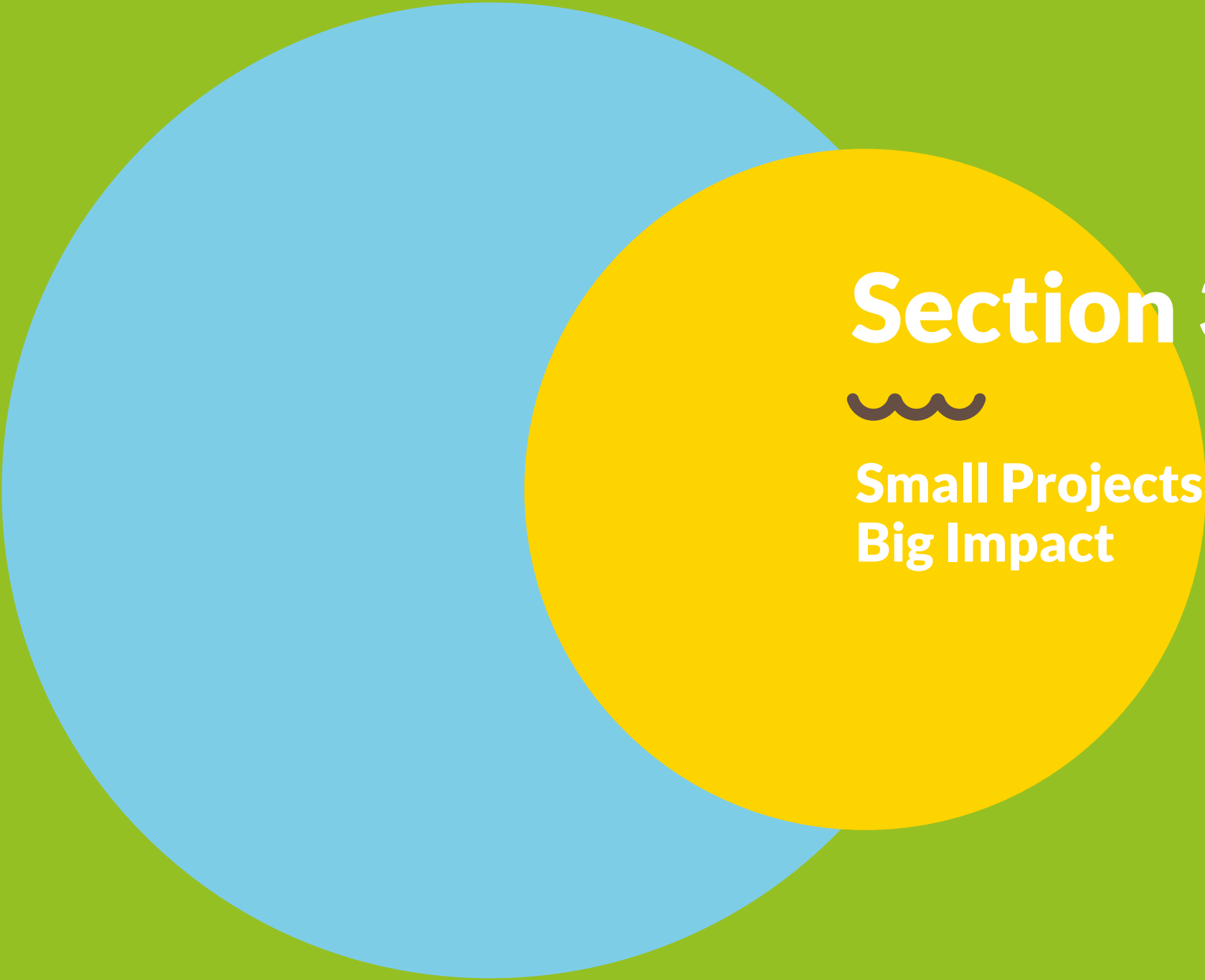
Changing hearts, minds, and ways of working

Over time, even small changes add up to make a big difference. However, on top of money, what is really needed is time that is put into the process and

that allows for change to occur and for processes to grow. That is why Oeiras came up with a dedicated science desk as an instrument, to be located in the new Citizen Shop opening in Oeiras, allowing residents engaging with public services to also get informed and involved with citizen science, and to provide their inputs and share their needs. This approach also serves to broaden the horizon of scientific endeavours, sharing perspectives between wildly different groups and allowing for new ideas to emerge. It also leads to the development of new infrastructures – Oeiras now has science clubs in schools across all school clusters in the municipality. Focused on different subject areas, these clubs can leverage partnership programmes to connect to research institutions with relevant expertise, further strengthening the relationships between science and society.

While Oeiras Municipality supports both thematically and methodologically ambitious projects, it is also attentive to the diversity of the groups involved – including, for instance, a project developed with young people in an educational detention centre. When work with this group first started, they needed to adapt their approach to be able to bring the project to them, designing it based on what the young people were able to do inside the detention centre and what they were actually interested in doing. Elisabete is convinced of the value of this approach: For one, the project led to the creation of a new and creative output that allows the municipality to reach new audiences in the form of a rap song. But beyond that, they found ways to do science in a place that is seen as very far removed from science, with people whose perspectives could contribute to the process and whose participation was treated as meaningful. As Elisabete says: *“In the long run, what really matters, it's the capacity of durable change in the way people work with each other, not only with research institutions, not only with students, but within ourselves. And that is something amazing.”*

32. Oeiras Educa platform <https://www.oeiraseduca.pt/>



Section 3



**Small Projects,
Big Impact**

This chapter tells the tale of how individual projects can initiate change, growing from small undertakings to recognised policy support structures. We present four regionally anchored initiatives that achieved impact on policy and society: Remarkable Trees documents and protects old trees across Romania; D-NOSES made odour pollution tangible through a standardised measurement methodology in Spain and beyond; URBANOME explored the environmental stressors affecting cyclist in Ljubljana and other European cities; and Greenhouse helps the Environmental Resource Authority in Malta fulfil its reporting duties on biodiversity data. Through these efforts, citizens can channel their voices into political action and are empowered to act as stewards of their lived environments.

From Citizen Mapping to National Law: Protecting Romania's Remarkable Trees



In 2015, a small but ambitious initiative set out to document a largely overlooked part of Romania's natural heritage: its old trees. What began as a citizen science project has since evolved into one of the most compelling examples in Europe of how citizen-generated data can directly shape environmental policy. Viorel-Ilie Arghius, lecturer at the Babeş-Bolyai University, Faculty of Environmental Sciences and Engineering

introduced us to the Remarkable Trees of Romania³⁹. Hosted at Babeş-Bolyai University, the project was initiated by ecologist Tibor Hartel, and invites volunteers to identify, document, and map old, large trees across the country. These often centuries-old trees play a disproportionate role in biodiversity conservation, climate resilience, and cultural identity. Yet, until recently, they remained largely invisible in legal and policy frameworks.

A pioneering project

Remarkable Trees was set up as a pioneering citizen science platform and was officially launched in the presence of Prince Charles in 2015, who recorded the first tree in the database. The project builds on a simple and accessible project structure that allows for considerable impact to unfold: citizens act as “tree hunters” and contribute observations through a shared methodology via a digital platform. Since its launch, the initiative has grown into a national effort, with more than 600 contributors and over 5.000 documented trees. Some contributors show striking commitment and have mapped hundreds of trees, demonstrating how even single individuals can have a large impact and show strong civic dedication when given the right tools and purpose. As Viorel-Ilie Arghius says: “Without civic capital, we have nothing.”

Figure 10. Bătrânul Carpaților – The Old Man of the Carpathians. An ancient oak discovered by children after a contest launched with support of Prince Charles (credits: Viorel-Ilie Arghius)



³⁹. Remarkable Trees <https://arboriremarcabili.ro>

Beyond data collection, the project has generated scientific outputs, including peer-reviewed publications and educational materials, helping to establish a robust evidence-base on the ecological value of large old trees. However, what makes the project so remarkable is its significant impact beyond science, in its transformative potential on a societal and policy level.

Making the invisible visible in policy

Before the project's emergence, large old trees in Romania were only sporadically protected. As Viorel puts it, *"They were often invisible to the law."* Individual trees could be designated as natural monuments, but this process was slow, fragmented, and provided insufficient cover to systematically preserve these important ecosystems. As a result, thousands of ecologically valuable trees were lost to logging, urban development, or neglect. The citizen-generated database changed this dynamic fundamentally. By systematically documenting the distribution and characteristics of large trees, the project provided for the first time a national-scale evidence-base. This data, combined with sustained advocacy and collaboration between researchers, civil society, and policymakers, laid the groundwork for legislative change.

In 2021, the project team and other colleagues contributed to the scientific foundations of a new legal framework for the protection of remarkable trees. Two years later, in 2023, Romania enacted a dedicated law for their protection, making it the first country in Europe to introduce legislation specifically targeting large old trees as a distinct category of natural heritage. Even more, Viorel explains: *"Our team efforts contribute to extending the protection of large trees in the forest, because our law only protects the large old trees outside the forest. Through the new Forestry code in Romania, we ensure that all remarkable trees are preserved, even within the production landscape in the forest."* This represents a clear and direct pathway from citizen science

to policy: citizens collect data, scientists validate and interpret it, and policymakers act on the evidence.

Challenges of implementation

Despite this success, the story of Remarkable Trees also highlights a common challenge in policy innovation: the gap between legislation and implementation. While the law came into force in 2023, it remains only partially operational due to the absence of detailed methodological guidelines. These guidelines are essential to define responsibilities, enforcement mechanisms, and penalties. This administrative bottleneck underscores a critical lesson: policy change is not a single event, but an ongoing process that requires sustained engagement between science, citizens, and policymakers. Nevertheless, awareness among authorities and the public has increased significantly. The existence of the law itself has already shifted perceptions, creating a foundation for future enforcement. Viorel is hopeful: *"The people and authorities are now aware about the importance of these trees."*

Another challenge is tied to the remoteness of some of the trees, some of which are located in steepy areas that are themselves neglected by authorities and necessitate field trips to be discovered. And because Romania has a lot of ancient forest, there are not enough volunteers yet to map all the remarkable trees. *"And if we don't know where they exist, we have nothing to protect,"* explains Viorel, who describes himself as a deeply committed naturalist that has mapped 1000 trees and validates many of the data entries himself.

Who benefits?

The introduction of the law marked more than a regulatory milestone and signalled a broader paradigm shift in how trees are valued. Traditionally, trees

were primarily assessed in economic terms, as timber resources. Even worse, old trees even had to contend with negative connotations, as Viorel explains: *“Remarkable trees unfortunately are sometimes wrongly perceived by authorities and some part of the ordinary people as unhealthy, useless, or dangerous to the public.”* The new framework approaches these trees much more holistically, and recognises their multiple roles as biodiversity hotspots, climate regulators, genetic reservoirs, and cultural landmarks that embody local histories.

The impacts of the project are thus multi-layered.

Biodiversity stands to gain the most, as many species – including insects, birds, and fungi – depend on large old trees for survival. At the same time, local communities benefit from the preservation of culturally significant landmarks, while researchers and students gain access to an unprecedented national dataset. Crucially, the project demonstrates that citizen science can fill gaps where state capacity is limited. Mapping thousands of trees across remote and mountainous regions would have been impossible without volunteer contributions. In this sense, the initiative not only informs policy but also complements public sector capabilities.

Figure 11. Well preserved wood pasture with large old trees at Mercheaşa, Braşov County, Romania (credits: Viorel-Ilie Arghius)

Viorel explains how they took Oliver Rackham, one of the most legendary ecologist of the last century, as an inspiration, who said that *“10.000 oaks of 100 years old are not a substitute for one 500 year old oak.”*⁴⁰ Remarkable Trees could extrapolate this to all large old trees. Says Viorel: *“The value of one ancient tree cannot be replaced even by 10.000 planted saplings.”* As such, it is essential to protect these old large trees.

Looking ahead

The future of the *Remarkable Trees* initiative depends on two parallel developments: expanding citizen participation and ensuring full implementation of the legal framework. There is also growing urgency linked to climate change, as extreme weather conditions are already affecting tree survival. As Viorel explains: *“Last year I discovered about 10 trees had died, because of thermal and hydric stress. It was a crazy summer in 2024 and had long-term effects.”* Yet, the core lesson of this story is already clear. By mobilising citizens, generating credible data, and maintaining a long-term commitment to advocacy, a grassroots initiative succeeded in reshaping national policy. In doing so, it offers an important example for Europe and beyond, that citizen science is a powerful tool for knowledge production that can be an effective driver of systemic change.

⁴⁰. The trouble with trees <https://www.independent.co.uk/news/uk/the-trouble-with-trees-1576326.html>

The D-NOSES Project: From Citizen Science to Policy Innovation Across Continents



D-NOSES⁴¹, was an EU-funded project coordinated by Rosa Arias that led to the foundation of her company Science for Change. The project tackled an environmental issue that is often deeply felt but largely overlooked: odour pollution. Unlike more straightforward pollutants like noise or particulate matter, odours are more difficult to measure and depend significantly on a human sensorial component. Standard scientific approaches, such as olfactometry, require expert panels and controlled testing, which get expensive especially when field studies are employed, and might underestimate the overall impact of different sources of odour pollution. D-NOSES pushed for new scientific and legislative standards by placing citizens at the centre of environmental monitoring who bring their own sensors to the table – their noses.

A multi-level governance strategy for policy impact

While air pollution is a problem that is measurable in relatively straightforward ways, perceptions of smells cannot be replicated through

41. D-NOSES project <https://scienceforchange.eu/en/project/d-noses/>

chemical measurements alone and need to take human perception into account. As a result, odours are under-regulated globally, yet the impacts of odour pollution can be severe, ranging from respiratory diseases to headaches and insomnia, but also entail economic ramifications like affecting the value of homes or the tourism sector. D-NOSES directly tackled this disparity through scientific and policy action. From its inception, the project embedded multi-level policy engagement into its research design to go beyond data collection and both validate a new methodology⁴² and produce policy outcomes. Employing a multi-level governance strategy, D-NOSES worked simultaneously at the local, national, and European level to engage key policymakers from day one and contribute to lasting change.

D-NOSES implemented pilots across seven European countries, Chile, and Uganda. Each region faces distinct odour sources, from waste management facilities in Spain to wastewater plants in Chile,

Figure 12. General Assembly of the D-NOSES project (credits: Science For Change)

42. A New Methodology Based on Citizen Science to Improve Environmental Odour Management <https://www.cetjournal.it/index.php/cet/article/view/CET1868002>



and is subject to different regulatory regimes and other socio-economic constraints. Yet environmental perceptions vary between different cultural contexts. As Rosa Arias explains: *“The annoyance and the health implications that you may have from the frequent exposure to ambient smells is different also between countries.”* To remain responsive to these differences, the project first analysed each country’s regulatory context and governance competencies, then worked with authorities, NGOs, and citizen groups to co-design monitoring approaches appropriate to each setting.

Pioneering citizen science in environmental standards

One of the project’s most significant achievements was the development of a technical standard for odour monitoring employing a citizen science methodology⁴³ – worldwide the first of its kind to explicitly incorporate citizen science as a valid methodological approach. Unlike traditional standards that assume expert-only measurement, this new framework outlines how citizen engagement, data collection, and data validation can be conducted scientifically and reliably. Published in Spain in 2023 by the national standardisation body (UNE) as an official Spanish standard, this framework has already influenced other standardisation efforts. Italy has begun work on a similar national standard informed by the D-NOSES approach. Chile has expressed interest in adopting the Spanish model as part of its regulatory strategy. And cities and regions throughout Europe now have a benchmarked methodology for scientifically valid odour monitoring that goes beyond traditional laboratory-based measures or field studies, the original standardised methodologies to measure odour impact. As Rosa Arias explains, *“This standard is a breakthrough. It’s the first*

43. Spanish technical standard for odour monitoring employing a citizen science methodology: UNE 77270:2023 Building collaborative odour maps through citizen science <https://tienda.aenor.com/p/norma-une-77270-2023-n0071920>

time citizen science has been formalised in a standard methodology anywhere in the world. It validates citizen-generated data and opens the door for regulators to actually use it and protect affected communities.”

This innovative standard was accompanied by an ambitious policy engagement strategy. At the European level, D-NOSES organised a high-profile event in the European Parliament to present its *Green Paper on Odour Pollution*⁴⁴ and a strategic roadmap for governance⁴⁵ at national level. The event, sponsored by a Member of the European Parliament, brought together policymakers, scientists, citizens and stakeholders from multiple countries. The Parliamentarian even quoted the project’s findings directly in her opening speech, lending visibility and legitimacy to the message. Following this event, the Committee of the Regions included a paragraph in the *Zero Pollution Action Plan*⁴⁶ amendment that explicitly recognises odor pollution as a concern and highlights the use of citizen science as a methodology for environmental monitoring. As Rosa notes, *“This paragraph is included in the amendment and it’s published officially everywhere. Getting this paragraph into a major EU policy is, for me, our biggest policy impact.”*

National and global reach

At the national level, D-NOSES helped lay the groundwork for policy action in Portugal, where a national odour regulation working group was established with project support. In Spain, the project informed improvements to municipal odour ordinances, helping local authorities move toward more scientifically grounded regulatory tools. In Chile, the project successfully informed the first Chilean regulation on odour pollution by engaging

44. Green Paper on Odour Pollution <https://zenodo.org/records/6044964>

45. Strategic Governance Roadmap <https://zenodo.org/records/6074278>

46. EU Action Plan: ‘Towards Zero Pollution for Air, Water and Soil’ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0400>

Figure 13. Presentation of the D-NOSES project pilots (credits: Science For Change)

directly with the Ministry and local partners, and the government expressed interest in regulating odour pollution in a targeted manner, sector by sector. This included adopting best-available technology recommendations, and in the long run opens the door for the Spanish citizen science standard to be adapted as a national reference. D-NOSES was especially successful in Uganda, since people were much more aware of odour pollution than of air pollution in the country. Both the Ministry and the city of Kampala engaged enthusiastically with the project and amended the country's air pollution regulation to include odours, directly influenced by the experience and data generated by D-NOSES.

The effects of D-NOSES are also seen beyond formal regulation. In London, a local council hired a dedicated staff to monitor odours using methodologies promoted by the project. In scientific communities, collaborations with institutions such as the *Politecnico di Milano* and other D-NOSES partners have produced comparative studies that validate and refine odour monitoring techniques worldwide. Throughout the project, Rosa emphasised the importance of long-term engagement and relationship-building. She explains that while citizen science data can strengthen



evidence, its influence depends on sustained dialogue, trust building, and strategic engagement with decision-makers: *“Coordination, travels, work on the document, get agreements between all the stakeholders involved, involve the right stakeholders, etc. These four years it took us are quite average or even quite good. We have a partner who has been working for six years and their standard isn’t out yet. So it’s intensive work.”*

Building a legacy for citizen science in policy

Looking ahead, the D-NOSES team continues to advocate for broader recognition of citizen science methodologies in environmental regulation. Science for Change is still compiling data, doing studies, and talking to the competition to raise the profile of the developed standard and showcase its effectiveness among relevant stakeholders from science, policy, and communities, as well as within the open market. With ongoing efforts to update policy documents, extend standards internationally, and co-design new pilot studies, the project shows concrete pathways for citizens to become active partners in environmental governance. And Rosa still has plans to build on the legacy of the project: *“Currently, we are connecting again with the government ministries and other involved actors that are rethinking existing regulations or trying to push for new ones and offer them the methodology, to show them the validity and usefulness of the standard. And from there, let’s see.”*

The URBANOME Project: Influencing Urban Mobility in Ljubljana



URBANOME⁴⁷ was a Horizon-funded project that explored environmental health and the impacts of urban environments by implementing living labs across several European cities. One of these living labs was set in Ljubljana, Slovenia, and aimed at enhancing urban cycling infrastructure while reducing cyclists' exposure to environmental stressors such as air and noise pollution. The project's "Urban Cycling Lab" involved over 200 local cyclists who wore low-cost sensors to track their exposure to these stressors and provided biological samples to capture biomarkers of stress while cycling through the city. For two weeks, the participants followed their usual cycling routes while a GPS tracked if these were following either large arterial routes or "green corridors", which are streets with reduced traffic, lower noise levels, and more greenery. In our interview with Rok Novak, one of the lead researchers from the Jožef Stefan Institute, he explains how citizen science can successfully support the many voices driving alternative ways of mobility in a city.

Collecting exposure data of urban cyclists

The primary aim of the URBANOME living lab in Ljubljana was to investigate how exposure to air pollution and noise affects cyclists, and



⁴⁷. URBANOME project <https://www.urbanome.eu/>

whether greener, quieter routes could mitigate these urban stressors. Early results revealed that while there were statistically significant differences in exposure levels based on route choice, the benefits were more pronounced in summer, while winter showed more uniform exposure across the city, since heating systems contribute to air pollution.



Figure 14. A volunteer wearing low cost sensors (mic with blue foam on helmet to measure noise, PM sensor hooked to belt, activity tracker on wrist) to measure exposure to air-pollution and noise, and collect biometric data (credits: Rok Novak)

A community's desire for sustainable urban mobility

However, the impact of the URBANOME project extended beyond data collection and scientific analysis. While the project did not directly translate into specific policy actions, it played a noticeable role in supporting local urban cycling initiatives with information regarding environmental health and wellbeing. The project became a part of the conversation around making Ljubljana's streets more cyclist- and pedestrian-friendly. Some streets that were initially designed for one-way cycling traffic were transformed into two-way bike lanes, improving access to green corridors. Additionally, a petition emerged calling for the redesign of a major arterial road to make it more bike- and pedestrian-friendly, with the campaign gaining important momentum during the project.

The project's outreach efforts, including interviews, podcasts, and science slams, helped raise awareness among the public and local policymakers. Through collaborations with NGOs, the project's results were used to support advocacy for urban design changes. While it is difficult to pinpoint the exact influence of the project on specific policy outcomes, the fact that local policymakers referenced the project in their discussions speaks to the power of citizen-driven data in shaping urban policy. Rok highlights: *"We can*



Figure 15. Discussing "green corridors" for cyclists in Ljubljana (credits: Rok Novak)

be a part of these many voices in the city, in the sciences, in the NGOs, and all of these other people and organisations working on it, providing concrete evidence related to environmental health and mobility." The biggest impact of the citizen science initiatives can be observed on cyclists since they started to think more about air pollution and noise in the city. And *"if people are more aware, they also work more in advocacy. So the political candidates have to address these issues in one way or another,"* explains Rok.

A wish for the future

Rok shared an optimistic perspective on the potential for future collaboration. He stresses that the project has successfully added to the ongoing discussion about how to support environmental health aspects in urban cycling and local policymakers supported the URBANOME project. *"We're hopeful that this can lead to even more collaboration with local decision makers in the future. We would wish that policymakers would proactively reach out to us asking, if we have any interesting conclusions while seeking evidence for their policymaking,"* he adds. Although the URBANOME project did not immediately result in sweeping policy changes, it has helped to elevate the conversation around environmental health aspects in sustainable urban mobility, cycling infrastructure, and environmental stressors. By contributing valuable data and fostering dialogue among stakeholders, the project has laid the groundwork for future urban policy changes, especially in cities where cycling is still a niche rather than a mainstream mode of transportation. Looking ahead, the hope is that future projects like URBANOME will inspire more proactive interactions between researchers and policymakers, creating a pathway for evidence-based, citizen-driven urban transformation.

Setting up Malta's EU Pollinator Monitoring Scheme



Over the past 18 years, a committed citizen science community has been cultivated in Malta, channeling naturalist interests, scientific inquiry, and environmental activism into a robust data collection scheme for environmental monitoring. This initiative supports the Maltese Environmental Resource Authority (ERA) in fulfilling its reporting duties to the European Union. Through these efforts, citizen science has become essential for comprehensive biodiversity monitoring, enabling the collection of vital data that might otherwise go unnoticed. Currently, the development of a national citizen science strategy is underway, further embedding this collaborative approach in Malta's environmental management and policy. Simone Cutajar, an educator and researcher at the University of Malta, explains why the future of citizen science in the country holds great promise for advancing ecological understanding and shaping environmental policies.

A slow beginning

Simone Cutajar started her first activities adjacent to citizen science 18 years ago as an undergraduate, together with a few other motivated students at the University of Malta. This quickly developed into the Greenhouse NGO, a student activist organisation that over time pivoted towards citizen science and became more data-driven, aiming to provide a robust evidence-base on

resident flora and fauna to support nature protection and restoration actions. Driven by the interests of involved people, the first structured monitoring action crystallised around wild orchids. With support from an environmental fund, the group was able to put together a seminal book about wild orchids in Malta. And while it was not a lot of money, for Simone, the funding still was important: *"It was also enough to start building a substantial group of people who got to know about citizen science and got training on orchids in Malta. That kept going throughout the years, so every year we were training new people in citizen science."*

Figure 16. A field trip with citizen scientists (credits: Daphne Agius)



Quality control and alignment with international standards

The ambitious orchid training contributed to both, effective science education and community building. Always, a rigorous methodology in line with national and international standards was key, ensuring that the data was useful as Simone stresses: *"We always made sure that we collect data in a way that is going to be accepted by ERA, we made sure that we fell in line with the Global Biodiversity Information Foundation GBIF, we were aligned with the European Commission data and collection. So even the mapping, we*

were using their mapping system. And we implemented quality control from the very beginning.” While additional campaigns were built

along the way, for instance on bats and pollinators, and people continued to collect orchid data for the Epicollect platform⁴⁸, Greenhouse lost steam over time and almost dissolved.

It was reinvigorated in 2023 through EU-funding obtained via the IMPETUS project⁴⁹, which was when ERA really started to take note. Following the ramp-up of the EU Pollinator Monitoring Scheme⁵⁰ (EU-PoMS) and the revised 2023 EU Pollinators Initiative⁵¹, ERA looked for ways to realise its mandate to mobilise society and promote strategic planning and cooperation at all levels, thoroughly integrating citizen science into environmental monitoring.

They took a leap in financing the first citizen science campaign of the Maltese Pollinator Monitoring Scheme, M-PoMS, led by Simone on behalf of the University of Malta.



Figure 17. The giant orchid *Himantoglossum Robertianum* hosts a white-spotted rose beetle (credits: Nina Gatt)

48. Epicollect platform <https://five.epicollect.net/>

49. A Wild Future for Orchids project <https://impetus4cs.eu/a-wild-future-for-orchids/>

50. JRC Refined proposal for an EU pollinator monitoring scheme
<https://publications.jrc.ec.europa.eu/repository/handle/JRC138660>

51. Revision of the EU Pollinators Initiative
<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0035>

Bitten by the bug

Beyond coordinating the citizen science element of the Maltese pollinator initiative, Simone provided a citizen science crash course to ERA, always ensuring that data quality was in line with international standards and proving that biodiversity monitoring can be done well with citizens, if the work is put in. As a result of this successful collaboration, Simone was contracted by ERA to coordinate the development of a new citizen science strategy for environmental monitoring. “ERA is now so open to citizen science because they lived it and they were bitten by the bug. They were excited to see people so excited and willing to put in the hours,” says Simone. A targeted multi-stakeholder process was launched to clarify the scope of the citizen science strategy and gain a better understanding of existing concerns and potential pitfalls of this endeavour. The overarching citizen science strategy aims to explore how ERA can access reliable, continuous biodiversity data and identify gaps that could be addressed through citizen science efforts. It also seeks out existing citizen science campaigns that might be well-suited to fill these needs, either directly or with modifications. The end-product will be a concrete action plan, finalised in 2026 and funded by ERA to ensure its implementation to collect comprehensive data on both terrestrial and marine flora and fauna and fulfill its reporting duties to the EU.

Building a strong community

In 2025, ERA subcontracted Greenhouse to provide its existing orchid dataset, curate it according to ERA’s needs, and to model orchid distribution for EU reporting. ERA also deeply integrated citizen science into the Maltese Pollinator Monitoring Scheme M-PoMS. The programme is built up with leaders from the citizen science community, and participants receive special training that gives them unique expertise

in species identification that even goes beyond that of trained academics. For instance, a few especially motivated citizen scientists were sent to Spain to receive expert taxonomic training in hoverfly identification, a unique expertise in Malta. The campaign is also cross-pollinating with other citizen science initiatives, supporting the development of a strong citizen science community across Malta that produces important scientific results. For instance, citizen scientists rediscovered an orchid species thought extinct, and found many other orchid species beyond the area where it was thought endemic.

Interestingly, while citizen and participatory science are a part of Malta's National R&I Strategy⁵², they have also turned into an electoral promise by parties running for election in Malta, indicating the broad public and administrative awareness the approach could gain. True to its original vision, Greenhouse collects data for positive action, making the data available to actively combat illegal development on Malta's islands. The data has been used as evidence in court cases and for scientific reports when land development permits are sought. Since the blooming season for orchids in Malta is rather short, Greenhouse is continuously broadening its scope and building the expertise and data sets to identify and conserve other protected species of flora and fauna. Simone sees this as a contribution to keeping Malta a livable place for its residents and preserving the vulnerable natural resources the country has left. In the upcoming years, her goal is for the data she helped build over the years to serve as a basis for legislation: *"Once the citizen science strategy is in place, we will go to the relevant people and submit legislative changes. But even now we are seeing that they are taking notes. Judges are quoting our work in their judgments."*

52. Malta's National Research and Innovation Strategic Plan 2023-2027

<https://xjenzamalta.mt/wp-content/uploads/2024/09/National-RandI-Strategic-Plan-24.pdf>

Why we need citizen science

Simone has a clear vision of the benefits of citizen science, which is clearly not data collected for the sake of data: *"If all you want to do is bring in the data, then use the experts, it's gonna be cheaper, it's gonna take less time. But the added value of citizen science is huge."* To Simone, citizen science is very much a means to build community, especially in a day and age where we are losing our connection to the world around us. And these strong in-person networks are essential to function as a country. Beyond that, Greenhouse is working with a team of diverse people with diverse expertise, diverse interests, and diverse ways of doing things. This leads to new methodologies, new research questions, and more interested and engaged people. Says Simone: *"The value is inherent because it builds up. It allows you to grow instead of being stagnant. It makes you think of better ways to do things. It helps the science and makes it more robust and allows it to evolve. And we are passing around a huge amount of skill sets."*



Section 4



**And What About
the Economy?**

The role of citizen science is also growing in the private sector, where it can serve as a valuable tool to drive innovation and tackle real-world problems. Large companies like Google and Microsoft provide funding support for and collaborate with citizen science efforts, e.g. as part of corporate social responsibility (CSR) investments⁵³ and, presumably, because it helps refine their algorithm⁵⁴. At the same time, a more specialised business sector has been growing around citizen science as a service. Here, small and medium-sized enterprises (SMEs) shine: socially minded companies that use citizen participation to improve research, develop better services, create trusted data, and connect communities with issues that directly affect them.

The companies featured in this chapter are at different stages of their citizen science journey. For some, citizen science is the core of the business model; for others, it is an emerging practice, a new service, or a first experiment within a research and innovation process. In practice, businesses may count on citizens' help to identify exoplanets from large datasets, monitor biodiversity in marine environments, explore soil and water health, track pollution levels, contribute to archaeological research, and detect bacterial contamination. Through these efforts, businesses make valuable societal contributions far surpassing their economic value, leveraging their insights and data to shape public policymaking. These initiatives have a far-reaching impact, directly influencing local policy and creating lasting change for communities and the environment.

Companies active in citizen science are still heavily dependent on public funding. However, since securing long-term funding remains a challenge,

53. Microsoft investment in ChangeX Austria

<https://local.microsoft.com/de/blog/providing-a-variety-of-education-for-young-people-in-austria/>

54. Google grant for iNaturalist

<https://www.inaturalist.org/blog/113184-inaturalist-receives-grant-to-improve-species-suggestions>

particularly as public funding tends to come in cycles, many companies have overcome this by creating hybrid business models. They combine public grants with consultancy, paid services, tourism, data services, digital infrastructure, subscriptions or commercial partnerships. EU funding, in particular, serves as an entry point for many, providing the initial resources to get these important initiatives off the ground. An example of this is the OdourCollect tool⁵⁵, which emerged from the EU-funded project D-NOSES and nowadays is at least partially used to run campaigns and studies as a service. As they grow, these companies have learned to balance public and private funding, ensuring their work remains sustainable and impactful long after the grant cycles end.

As you read through this chapter, you will see companies turning citizen science into a force for innovation, sustainability and real-world change. Their work shows how business activity can be built around responsible and participatory values: trust, careful design, local ownership, digital safety, education, conservation and citizen feedback. Across coastal ecosystems, farms, rivers, digital platforms and biotechnology, these cases show how economic value and public purpose can reinforce each other when communities are part of the process.

55. OdourCollect tool <https://scienceforchange.eu/en/project/odourcollect/>

MMOS: Citizen Science Inside the Attention Economy



Founded in 2015, the Swiss SME MMOS⁵⁶ (Massively Multiplayer Online Science) coordinates the development of minigames that support scientific research. It aims to address the recruitment and long-term engagement problems faced by online citizen science projects in the wider attention economy, where social media and video games serve as direct competition. To reach participation at scale, MMOS understood that it had to work with platforms that already knew how to capture attention and keep people engaged over time. Teaming up with “the masters of engagement” – video game designers and developers – MMOS embeds citizen science problems into existing video games with a large user base. MMOS founder Attila Szantner and scientific lead Jérôme Waldispühl explain how scientific tasks can become part of the gaming experience and reach millions of players to solve complex scientific problems.

A meeting of two worlds

MMOS operates at the intersection of two quite disparate worlds: scientific research and video game development. On the scientific side, Jérôme Waldispühl helps ensure that the research questions are valid, maintains

56. MMOS <http://mmos.ch/>

contact with the scientific community and supports the interpretation of results. Jérôme stresses the importance of this role: “Many scientists see it either as a way to make side projects, a bit like a hobby. Or like a science communication exercise. But they don't see it as a scientific tool.” On the gaming side, developers value the idea, but dedicating senior teams to something beyond core gameplay diverts limited resources. Despite these challenges, in MMOS' experience, people often love the idea. As Attila explains: “I see this sort of intrinsic motivation on all levels of decision making. When we convince these game companies, it's almost impossible to justify it with exact numbers, why they're allocating resources to such a project. The people we convinced, they really believe that it's important. They want to help science and want to contribute.”

Innovation in science and game design

Bringing these disparate worlds together is no easy task. For it to work, the mechanism of scientific discovery must be translated into meaningful gameplay in a way that neither impairs scientific validity nor risks breaking

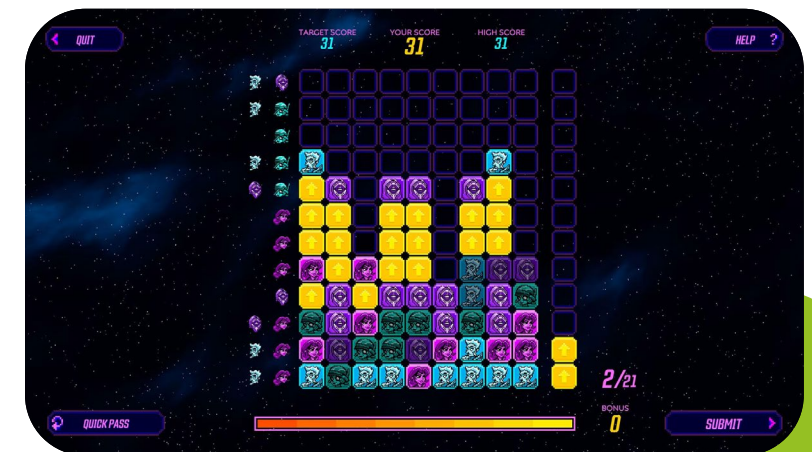


Figure 18. Screenshot from the Borderlands Science minigame inserted into Borderlands 3 (credits: Gearbox Software)

immersion in the game, while finding the right fit for a gaming environment and its target group. Both organisational champions and mutual trust between stakeholders are important here, drawing on developers as key collaborators for translating scientific material into enjoyable player experiences. MMOS has two impressive examples for major collaborations that were successful in this endeavour.

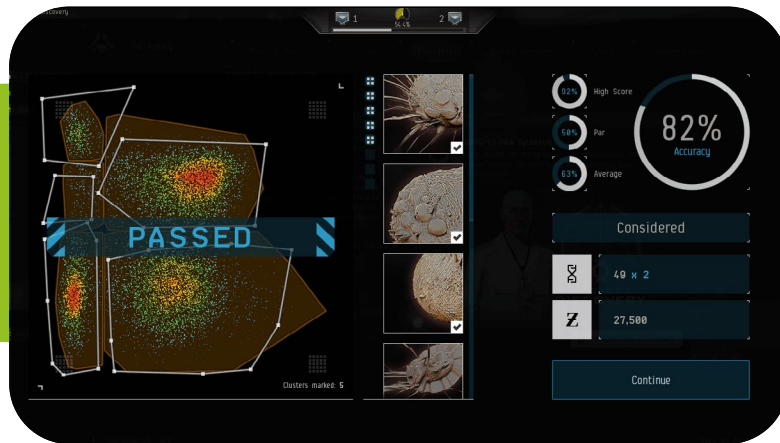


Figure 19. Screenshot from one Project Discovery minigame inserted into EVE Online (credits: Fenris Creations)

The first is Project Discovery⁵⁷, a series of scientific minigames inside the long-running online multiplayer role-playing game EVE Online⁵⁸. Players were invited to classify immunofluorescent microscopy images of cells, analyse lightcurves of stars to identify exoplanet candidates, and cluster cell populations in high-dimensional flow cytometry datasets to support immunologists. The second example is Borderlands Science⁵⁹, which was included as a minigame in the first-person shooter Borderlands 3. Set up with support from Borderlands developer Gearbox Software and input on

57. Project Discovery <https://www.eveonline.com/discovery>

58. Eve Online <https://www.eveonline.com/>

59. Borderlands Science trailer https://www.youtube.com/watch?v=L_mH6Ak_Ny0

the scientific method by Rob Knight, one of the leading names in human microbiome research, the minigame engages players in comparing DNA sequences from different human intestinal bacteria to better understand how they relate to each other⁶⁰.

Together, these projects mobilised over 8 million players, who submitted over one billion data analyses. As Atilla puts it: *“These are crazy numbers. We reach hundreds of submissions per minute even after several years of launching these projects. This is the kind of sustained activity that anybody would dream of in citizen science.”* These figures also show the benefit of bringing science into spaces where people are already active, curious and engaged: participation continued for years, turning these video games into a gateway for sustained contribution to research. These projects are not only a treasure trove of high-quality human-curated data for researchers, but created unique opportunities to do science outreach, communication, dissemination of scientific results and spark interest in different scientific topics.

The trouble with funding

Despite its innovative potential, MMOS faces a research funding landscape that is not particularly supportive of this kind of work. As Atilla explains: *“It’s really hard to align these type of projects with the rather inflexible logic of scientific grants. Diverting from these plans can be problematic, especially for such small entities as ourselves. Because our projects are often highly experimental and in the gaming space major decisions can take place almost overnight, we must remain flexible and adaptive in this environment.”* Nevertheless, the project was able to secure significant support from funding programs such as Horizon2020, Genome Canada and Genome

60. Borderlands Science results published in Nature Biotechnology <https://www.nature.com/articles/s41587-024-02203-5>

Québec. The work done by MMOS depends on timing, trust, technological development and the priorities of gaming partners. A more flexible funding framework would help, as Atilla puts it, *“to scale it, to make it more robust, secure and future-proof.”*

An app for all purposes

MMOS' next step to further develop citizen science within the video game industry is an independent mobile-based platform⁶¹ that works as a unified space for tens of millions of gamers, connected to several scientific and game industry collaborations, and keeping the incentive loop that already works in games to maintain players' long-term engagement. Players would take part in citizen science minigames on the app and still receive rewards in the main games, such as in-game currency, skins or unique items. The backbone of all of MMOS' services is an API that makes it easier to interface with different types of games and allows developers to focus on player experience. For game developers, this lowers the barrier to collaboration since the MMOS services don't need to be integrated quite as deeply in the core game experience, while gamer communities can still connect to these scientific research endeavours. MMOS has successfully filled a niche that provides specific research fields with an opportunity for significant scaling, while enabling video game developers to play a part in major scientific advancements.

61. MMOS mobile platform announcement <https://www.twitch.tv/videos/1932027428?t=02h49m10s>

Anèl·lides: Making Room for Science by the Sea



Barcelona's beaches are widely associated with recreation and tourism, but Anèl·lides⁶² has helped reveal another side of the city's coastline: a living space for marine education, biodiversity monitoring, and conservation. Founded in 2016 by biologist Andrea Comaposada, this Spanish SME brings people into direct contact with the sea through activities such as snorkelling, diving, school programmes, beach clean-ups, and participatory monitoring. Andrea tells us how her company invites participants to observe, photograph and document the marine species and environmental impacts they encounter during these activities, turning a day at the beach into a contribution to scientific knowledge.

Everyone can take part in marine conservation

Andrea's motivation comes from a strong belief in open science and a commitment to science communication. As a researcher, she rejects the idea of science as something closed, distant or

Figure 20. Citizen scientists preparing to monitor marine biodiversity while snorkelling along the Barcelona coastline (credits: Anèl·lides)

62. Anèl·lides <https://anellides.com/>



reserved for specialists. For her, people do not need to be experts to help understand and protect the marine environment – the evidence is what matters: “We need data to know what’s going on. Anyone can grab an underwater camera. Anyone can grab a cell phone, take a photo, and share it.”



This approach has allowed Anèl·lides to involve thousands of people in multiple marine citizen science projects along Barcelona’s coastline.

Through UrbamarBio⁶³, participants have contributed more than 50.000 marine observations to the MINKA platform⁶⁴, documenting over 1000 species. The project has also generated educational materials, including a participatory guide to marine biodiversity in the Barcelona area, helping schools, families, and the wider public recognise the species that live close to the city. Other initiatives have expanded this work into specific conservation challenges.

PosidoniaActiva⁶⁵ focuses on the conservation of Posidonia Oceanica meadows, vital habitats for marine life in the Mediterranean. Blue Action Barcelona works on marine litter through regular beach clean-ups, collecting information that can support better beach and waste management. The Save the Seahorses⁶⁶ project works with fishermen and fisherwomen to rescue seahorses caught in fishing nets, reintroduce them

Figure 21. Andrea Comaposada helping a citizen scientist prepare for snorkelling (credits: Anèl·lides)

63. UrbamarBio project <https://anellides.com/en/urbamarbio/>

64. MINKA platform <https://minka-sdg.org/>

65. PosidoniaActiva project <https://anellides.com/en/blog/portfolio-items/posidonia-activa/>

66. Save the Seahorses project <https://anellides.com/en/save-the-sea-horses/>

into suitable habitats, and monitor their presence. More recently, Sepia Lab has focused on recovering cuttlefish eggs that become entangled in fishing nets, allowing them to hatch before being returned to the sea.

A hybrid funding model

As these initiatives expand, so do the practical demands behind them. Marine research and monitoring require specialised equipment, careful coordination, participant guidance, data management, and sustained resources. Anèl·lides has addressed this through a hybrid model that combines public grants with paid services, including school programmes, eco-tourism activities, diving experiences, and corporate activities. Public funding has been essential for projects with strong educational and conservation value, while paid services help the organisation maintain continuity beyond individual project cycles.

Anèl·lides found a model that sustains the organisation both financially and in terms of its mission. Citizen science feeds into blue education, and blue education gives the projects a wider social life. The observations, photographs and reports produced through scientific activities become learning materials, classroom resources, guides, and public awareness tools. In this way, the organisation keeps education, conservation, and participation closely connected. Anèl·lides shows us how a coastline can become a shared space for learning, evidence, and care. A snorkelling activity can generate biodiversity observations, a school workshop can introduce young people to open science, and a beach clean-up can produce data that supports public management. Through these actions, participants begin to see the sea differently: as a place they can understand, document, and help protect.

Tenuta di Paganico: Healthy Food Starts with Healthy Soils



Located in Grosseto, in the heart of Tuscany, Tenuta di Paganico⁶⁷ has transformed its 1.400-hectare farm into a place of sustainable agriculture, tourism, and community. Jacopo Goracci shares the research and innovation approach developed within the farm's silvopastoral system, where livestock, forests, and pastures are integrated into a balanced farming environment, thanks also to the reciprocal support and collaboration of farm manager Alessio Del Tongo and CEO Maria Novella Uzielli. With heritage breeds such as Maremmana cattle and Cinta Senese pigs, and the production of organic meat, olive oil, and wine, Tenuta di Paganico shows how farming can still create economic value while offering a space to learn about the relationships that sustain food systems.

The connections that make our food

For Jacopo, food production is deeply rooted in the management of an agro-ecosystem that depends on a strong relationship between nature and people. Over time, he has seen how much the context he operates in has changed. Twenty years ago, the same environmental concerns we grapple with today were already present, and Jacopo advocated for the same approach

⁶⁷. Tenuta di Paganico <https://www.tenutadipaganico.it/en/>

towards more sustainable food systems. But, as he puts it, the surrounding world was “less inclined, less receptive, less interested in our vision.” Today, he sees more people, organisations, and European networks aligned with the farm's mission. Rather than building everything alone, Tenuta di Paganico is choosing to be part of something bigger, drawing on the skills and knowledge in its network.

Citizen science fits naturally into this path because it helps “reinforce the link between people, animals, and ecosystem,” which Jacopo describes as the foundation of everything the farm tries to develop. Through initiatives such as the SoilBlitz, RiverBlitz, and Beneath Our Feet projects, participants are invited to explore soil health, biodiversity, and the living systems beneath the surface of the land. In Beneath Our Feet, developed with local middle schools and supported through the ECHO Soil⁶⁸ Horizon Europe



Figure 22. Participants scrutinising the soil (credits: Tenuta di Paganico)

project, students moved from the classroom to the field and learned about soil fauna, collected samples, uploaded data through an app, and saw their observations appear on a map.

The value of networks

Bringing citizen science into the daily life of a working farm requires careful balance. Tenuta di Paganico has a small team and regular farming responsibilities, so activities need to be practical, well supported, and aligned with existing work. European projects such as ECHO Soil, educational kits, local schools, and networks of like-minded organisations like the Natural History Museum of Maremma⁶⁹ – under the direction of Andrea Sforzi, who strongly guided and supported this approach – have helped to make this possible. For Jacopo, peer-to-peer learning between farms and institutions could strengthen this path further, allowing people to visit each other, learn from real practice, and bring ideas back to their own contexts. Tenuta di Paganico aims to further expand its citizen science work by developing and adapting tools that are simple, useful, and replicable by other farms. Its experience shows how farms can become places where people learn directly from the land, where scientific observation grows from everyday agricultural life, and where communities better understand the ecosystems behind the food they consume.



Figure 23. Exploring invertebrates in a SoilBlitz (credits: Tenuta di Paganico)

68. ECHO Soil project <https://echosoil.eu/>

69. Natural History Museum of Maremma <https://www.museonaturalemaremma.it/>

DigVentures: Sharing the Moment of Discovery



DigVentures⁷⁰ is a participatory platform involving citizens in archaeological, ecological, and landscape-based research. Crowdfunding and crowdsourcing archaeological digs across the UK and Ireland, the social enterprise was a direct response to a frustration with the way archaeology often reaches the public. Brendon Wilkins, co-founder and co-CEO, finds that because people usually enter the story very late – once the excavation is over and the discovery has become a report, a book, an exhibition or a documentary – they are missing the most exciting part: the uncertainty, learning, and emotion of discovery as it happens. As he puts it, “the public don’t get to see the moment of discovery until way, way after.” Founded in 2012, DigVentures set out to change that by creating a model where citizens could help fund digs, join excavations, learn from trained experts, and take part in archaeological research from the inside.

The COVID-19 pandemic: a turning point

DigVentures’ early work opened archaeology to new people and brought new energy to excavation sites, but participation still depended on being physically present. When the pandemic stopped fieldwork, the team moved

70. DigVentures <https://digventures.com/>

its courses online and opened a free virtual dig. They imagined a small group would join. Six weeks later, 11,000 people from 90 countries had taken part. From that unexpected crowd came a discovery no

one had seen coming: a furloughed wedding photographer, looking at the landscape on Google Earth, identified a Neolithic henge monument in the Midlands.

Brendon describes it as “the stuff of archaeology dreams.”

That moment changed what DigVentures thought was possible. If someone could make a meaningful archaeological discovery from home, participation no longer had to depend on who could travel to a site, take time off work or stand in a trench. The next step was to create Deep Time⁷¹, a participatory

mapping platform where citizens work with satellite imagery, Earth observation data, and Light

Detection and Ranging (LiDAR) to identify archaeological sites.

Participants follow a four- to six-week course and practise in a sandbox area to gradually develop the skills needed to create high-quality data. The spirit of the platform is deliberately collaborative, as Brendon explains: “We all learn together, and we all improve together.”

Figure 24. Deep Time's recent visit to the 'Spotlight on Space' day at the Life Science Centre in Newcastle, engaging children and families with Earth observation data and nature recovery (credits: Life Science Centre)



⁷¹. Deep Time platform <https://digventures.com/projects/deep-time/>

Crossroads between archaeology, nature recovery and public legitimacy

Deep Time soon moved beyond archaeology. The same skills used to read traces of the past in satellite imagery, Earth observation data, and LiDAR could also help identify habitats, map environmental change and support nature recovery. This opened the door to work with organisations such as the National Trust, Wildlife Trusts, National Landscapes, and local government bodies, using citizen participation to map landscapes and monitor restoration over time. To date, many thousands of trained citizens have mapped over 5,300 km² of UK landscape across nine missions. The participants mapping traces of the past become Pastronauts, while those mapping present-day habitats become Futureonauts. More experienced participants can become mission leaders, supporting others as they learn.

For DigVentures, archaeology and ecology turned out to be very different rooms. In archaeology, the idea of citizens producing professional-grade data was often met with scepticism, even from organisations the team was working with. In nature recovery, the reaction was the opposite: ecologists, already living with a documented loss of 19% of UK species since 1970, treated citizen participation as a resource rather than a threat. Organisations needed data, but they also needed people to understand the changes being proposed around them. Brendon gives the example of Northumberland National Park, where restoration plans cover land owned by farmers, organisations and individuals. When local people help map their own area, the work becomes more than a baseline: it gains legitimacy, local understanding and public buy-in. That distinction matters commercially as well as ethically. As Brendon puts it, organisations “need data and they need it now”, but data alone is something AI providers can supply more cheaply, if not always reliably. What DigVentures offers alongside the data – a trained, locally rooted community willing to stand behind the evidence – is what makes a nature recovery scheme credible to the people whose landscapes are changing. The team

is now involved in HS2⁷², the UK high-speed rail project – and tied to it, the largest archaeological project ever delivered in the UK. There, DigVentures is helping bring citizen science into large-scale commercial infrastructure, turning excavation results into knowledge that can be shared more widely.

Building a sustainable and ethical model

In terms of sustainability, public and innovation grants have allowed DigVentures to build their participatory science model, test it through successful pilots and prove that citizens can generate valuable data for heritage and nature recovery. The next step is a blended model, where grants remain part of the picture, but revenue from citizen-generated data also helps sustain the platform. That shift comes with an important responsibility. Citizen-generated data can help sustain DigVentures' work, but only if it is used in ways that are transparent, fair and aligned with the expectations of the people who contributed it. This is especially important in a time when data can be copied, reused, and absorbed into commercial systems with little friction, particularly by generative AI companies. Participants contribute because they care about landscapes, heritage and nature recovery, and because they trust DigVentures to steward their contributions properly. Brendon explains that this is a fine line to walk: *"That trust is something that we guard meticulously. And what we're trying to do is encourage the private sector and these NGOs that we work with to think of it as a reciprocal arrangement. If we want to grow and to build, we need to find a way for finance to flow back into the model."*

In DigVentures' journey, participating in the EU-funded IMPETUS⁷³ project has been especially valuable for connecting with a wider European

72. HS2 <https://www.hs2.org.uk/>

73. IMPETUS project <https://impetus4cs.eu/>

community working on participation, trust and sustainability. IMPETUS opened doors that a UK-only innovation pathway could not have. Building on that foundation, DigVentures is now working with Nesta's Centre for Collective Intelligence Design on a three-tier deliberative governance programme that has produced a Data Commons Charter⁷⁴, a Data Licence with a Reciprocity Schedule⁷⁵, and a forthcoming Governance and Evidence White Paper⁷⁶. Taken together, these instruments show how EU-funded community-building and national-level governance design can reinforce one another, helping initiatives like DigVentures build a fairer, more participatory future for citizen science in Europe.



Figure 25. A family-friendly introduction to Earth Observation archaeological feature identification (credits: Life Science Centre)

74. DigVentures & Nesta Centre for Collective Intelligence Design – Data Commons Charter (publication forthcoming 2026)

75. DigVentures – Data Licence V2.0 with Reciprocity Schedule (publication forthcoming 2026)

76. DigVentures & Nesta Centre for Collective Intelligence Design – Governance and Evidence White Paper (publication forthcoming August 2026)

PULSAQUA: Creating Momentum for Water Citizen Science



PULSAQUA⁷⁷ is a Rotterdam-based company that works on water, climate and environmental issues at local, national, and international levels. PULSAQUA's founding principle, reflected in its name, is that *"the citizens are the mass and Puls aqua brings the speed"*, as explained by its founder Sandra de Vries. Sandra describes Puls aqua's work as *"a sort of stakeholder science"*, because water problems rarely sit in one place. They involve citizens, governments, NGOs, knowledge institutes and communities facing the consequences of environmental change.

A place to begin

Sandra is aware of how environmental problems can feel too large, too technical or too overwhelming to address, and she believes citizen science can offer a tangible place to start tackling them. As she explains, *"there are quite a lot of issues nowadays that we put on the map, and either you are an ostrich and you put your head in the sand, or you are overwhelmed by it. And it's often not in between, and something in between is nice."* The Drinkable River Programme⁷⁸ puts this idea into practice by inviting communities to monitor the health of rivers and reflect on what *"drinkable"* water means in their own context. It

⁷⁷. PULSAQUA <https://www.pulsaqua.com/>

⁷⁸. Drinkable Rivers Programme <http://citizenscience.drinkablerivers.org>

gives people a shared set of tools to observe water quality, collect data and better understand the river or stream they live with. Some participants join because they are invited while others arrive with a local concern already in mind and use the methods to investigate what is happening in their own area.

Pulsaqua helped build this process from the ground up, designing the monitoring methodology, the manuals, and the way people are recruited, trained and engaged. The programme does not ask every group to care about the river in exactly the same way. Instead, it leaves space for each community to define what matters locally and how they want to use the tools available. This is why Sandra often turns the usual project logic around. *"When citizens ask what they can do for the project, I tell them: No, we have made this for you. What do you want to achieve locally?"* The tools are there, but the purpose has to belong to the people using them. For Sandra, the strongest outcome comes when communities make the methods their own, adapt them to their questions and eventually go beyond what Puls aqua can offer. As she says, *"What you should aim for is that you actually become unnecessary."*

Innovation without reinventing the wheel

Sandra has a pragmatic and sustainable approach to technology. Puls aqua does not build new tools just to add another product to the field. *"I mainly reuse, because I really believe in not duplicating efforts,"* she explains. If a tool already works, Puls aqua builds on it; if something is missing, Puls aqua develops a method that fills the gap. That is how the team has worked on microplastic sampling, infiltration measurements, manuals for Drinkable Rivers, low-cost water quality sensor kits, and plug-and-play systems using accessible technologies such as Arduino⁷⁹, among others. Among Puls aqua's

⁷⁹. Arduino <https://www.arduino.cc/>

specialised technological services we can find data recording, data visualisation, dashboards, training materials and sensor-based methods. They use tools such as ArcGIS⁸⁰ and Survey123⁸¹, and have built dashboards for organisations monitoring macroplastic pollution in rivers. They are also developing *Monitor4Impact*⁸², an e-course that teaches citizens how to set up their own environmental monitoring project when they see “a local issue that [they] want to put on the map.”



Figure 26. Getting familiar with the Drinkable Rivers measurement kit (credits: PULSAQUA)

80. ArcGIS Online <https://www.arcgis.com/index.html>
 81. ArcGIS Survey123 <https://survey123.arcgis.com/>
 82. Monitor4Impact course <https://www.thesciencecitizens.com/>

Turning momentum into continuity

The company works with NGOs, municipalities, knowledge institutes and consortia, while also applying to local, national and EU funding calls. Sandra is clear that “funding is still really necessary in this topic,” but she also sees a future where more organisations directly invest in the expertise needed to make citizen science work well. Partnerships are central to this journey. Through project consortia, PULSAQUA can act as a connector between people, methods and institutions, bringing citizen science expertise while others contribute networks, resources or access to communities. Sustainability also comes in more human forms: through a Dutch environmental organisation’s societal traineeship programme⁸³, PULSAQUA regularly welcomes volunteers bringing fresh perspectives and energy to the team. This mix of collaboration, adaptability and purpose is what allows PULSAQUA to keep creating momentum where water issues need it most. Looking ahead, she describes what she sees as “two very contradicting dreams”: making PULSAQUA financially sustainable and continuing to support grassroots groups that need accessible tools but cannot always pay for them.



Figure 27. Demonstration of a sensor kit (credits: PULSAQUA)

83. Milieu Defensie’s Fair Future Generators programme <https://milieudefensie.nl/actie/fairfuturegenerators>

SPOTTERON: The Digital Backbone for Citizen Participation



SPOTTERON⁸⁴ is an app developer that provides a modular platform where people can document sightings and observations in the wild and turn them into useful information for science, environmental protection, and public action. SPOTTERON's story begins on a hike in the outskirts of Vienna, where Philipp Hummer, one of its founders and CEO, was walking through meadows full of buzzing bees and butterflies when the path suddenly led to a pile of waste dumped in the forest: a rusty refrigerator, gravel, and construction debris. While it was possible to pick up some of the smaller litter, the refrigerator was another story. But what was possible was to take a photograph, mark the place on a map, and make sure the information reached someone able to act.

The creative layer of digital participation

Since its first app releases in 2015, SPOTTERON has grown into a platform used by universities, NGOs, public bodies, and research projects across Europe and beyond. More than 60 projects currently run on it, collecting data in the fields of biodiversity, animal roadkill, amphibian migration, water and coastal monitoring, rainforest protection, human migration

84. SPOTTERON <https://www.spotteron.net/>

routes, and wider social science. Its early collaborations included the Roadkill project⁸⁵ in Austria which focused on street ecology and animals killed by cars, including mammals, amphibians, and other vertebrates. Over time, the platform expanded to projects such as CrowdWater⁸⁶, Nature's Calendar⁸⁷, and CoastSnap⁸⁸, and also into other scientific fields like social science studies and medical research.



Figure 28. Citizen Science Apps running on SPOTTERON on various Devices (credits: SPOTTERON Citizen Science App Platform, www.spotteron.net)

Philipp's philosophy about the digital experience of citizen science projects is that it has to respect the time, attention and curiosity people bring to the table. Participation should not feel like "filling out an Excel sheet". SPOTTERON therefore works carefully on the visual and social layers of each app: icons, buttons, notifications, comments, feedback between users and ways of seeing what others are contributing.

As a consequence, setting up these platforms involves much more than software development, as each one needs its own language, visual identity,

85. Roadkill project <https://roadkill.at/en/>

86. CrowdWater app <https://www.spotteron.com/crowdwater/>

87. Nature's Calendar app <https://www.naturkalender.at/>

88. CoastSnap app <https://www.spotteron.com/coastsnap/>

and way of inviting people into the community. The modular platform provides the structure; the design work gives each project its own personality. Scan the QR code to explore the SPOTTERON Citizen Science App Platform and see how its tools support different citizen science projects.



Responsibility behind the interface

Behind the SPOTTERON App Platform's friendly interface for Citizen Science and engagement projects, there is a firm stance on digital responsibility. Philipp speaks openly about privacy, data protection, and the need for European digital independence, especially when public-interest science relies on digital tools. He is also cautious about using platforms such as commercial social media or big-tech corporation services in publicly funded projects, particularly when schools or communities are involved. If people are asked to share observations, locations, comments or images, the project has a duty to protect them. For SPOTTERON, this starts with a simple principle: before inviting citizens into a digital space, projects need to have a basic understanding of *"how the internet works"*, or a trustful and professional partner with the expertise and practice present.

This is why SPOTTERON does not include user tracking or software from platforms that appear to be free while collecting user data, behaviors, and all personal information in the background. Philipp refers to Meredith Whittaker, President of the Signal Foundation, who has said: *"We won't participate in the surveillance business model."*⁸⁹ He explains the responsibility with a very clear

⁸⁹. Interview with Meredith Whittaker
<https://www.derstandard.at/story/2000138831199/meredith-whittaker-we-wont-participate-in-the-surveillance-business-model>

image: *"If I invite somebody to my home, and my home has electric cables hanging everywhere that are dangerous, then it's not a good invitation."* Using cheap or "free" tools without understanding what sits behind them creates the same kind of risk. SPOTTERON's team brings the same care to AI.



Figure 29. SPOTTERON's AI Image Recognition for Citizen Science Apps with Carl Linnaeus (credits: SPOTTERON Citizen Science App Platform)

Philipp prefers to call it "artificial machine learning" when that is what the tool is actually doing, distinguishing useful machine learning from the highly negative impacts around generative AI. SPOTTERON uses AI-related features when they have a clear purpose, such as species identification in an invasive species app. But the tool has to be honest with users. In one of their applications, the identification system openly warns that it can be wrong, reminding participants that science still depends on checking, questioning, and verifying.

Beyond the funding cycle

SPOTTERON works closely with the organisations behind each project. Philipp avoids the word "clients" because the relationship is rarely a simple

transaction or one-sided. Research teams, NGOs, universities, and public bodies bring the questions, field knowledge and communities; SPOTTERON brings the platform, design, technical care, and what he calls “*the digital mindset and the engagement mindset*.” In Horizon Europe projects, this often means joining the consortium directly, helping shape how participation happens from the inside.

Then comes the harder question: what happens when funding ends? Many citizen science projects are full of life during the grant period, with active communities and valuable data, and then suddenly lose the support needed to continue. SPOTTERON’s Co-Use Programme⁹⁰ is one way to fight against that pattern. Instead of creating a new app for every project, different partners can share one collaborative digital toolkit while keeping their own language, login, data access and geographical focus, and even using integrated communication and outreach tools on a per-country basis. Sharing infrastructure lowers costs, reduces fragmentation, and gives projects a better chance of lasting beyond a single funding cycle.

⁹⁰ Co-Use programme

<https://www.spotteron.net/custom-citizen-science-tools/co-use-programm-for-project-collaboration-in-citizen-science-apps>

STAB VIDA: Citizen Science as an Innovation Asset



STAB VIDA⁹¹ is a Portuguese biotech SME working mainly in genetics, providing services such as DNA and RNA sequencing, while also developing its own products through an internal research and development laboratory. One of these products is a point-of-care testing device – the Doctor Vida pocket test⁹² – first designed during the COVID-19 period for SARS-CoV-2 molecular detection and later adapted to other targets. Through the European Horizon project DxHub⁹³, STAB VIDA began exploring citizen science as part of the validation process for a new test for the detection of *Legionella pneumophila* in water samples.

First forays into unfamiliar territory

For STAB VIDA, citizen science was unfamiliar territory. As Gonçalo Doria, Head of R&D, and Eduardo Coelho, R&D Scientist, explain: “*It was not our initial intention*”. Rather, the idea came from consortium partners with previous experience in the field. The concept itself required some unpacking at first, but the turning point came when the team saw that citizen scientists were not passive sample providers: they were testing, giving feedback,

⁹¹ STAB VIDA <https://www.stabvida.com/>

⁹² Doctor Vida pocket test <https://doctorvida.store/product/doctor-vida-pocket-pcr-equipment/>

⁹³ DxHub project <https://dx-hub.eu/>



and helping improve how the protocol worked in practice.

In Eduardo's words: *"The citizens are the ones that are doing science, and generate valuable data for the test validation."*

That shift helped STAB VIDA to see citizen science as a useful tool for its innovation process. It could help the company collect more data, access real world samples, improve the test instructions, and connect with people and organisations outside its usual environment. This was especially important for the *Legionella pneumophila* test. To validate this kind of test, laboratory artificial samples are necessary, but they are not enough. The company also needs to see how the device works with real samples, in everyday conditions. That is difficult, because, as Eduardo explains: *"Nobody wants to give you samples if the result might show that a place is contaminated"*. Citizen science offered a practical way to bring the test closer to the environments where it will actually be used.

Figure 30. Introducing students to the DxHub methodology (credits: STAB VIDA)

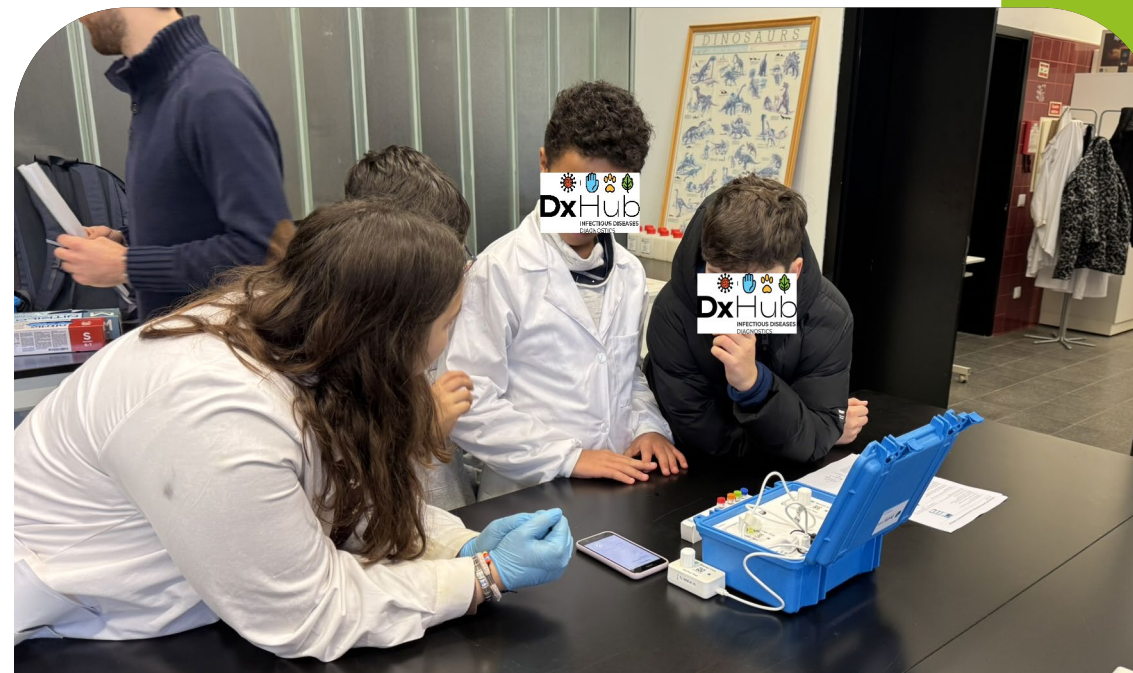
Leveraging networks for new opportunities

DxHub played an important role in making this first experience manageable for STAB VIDA. The project already brought together partners with citizen science experience, local connections, and the practical capacity to organise the activity. This allowed STAB VIDA to focus on the device, the test, and the technical preparation, while partners helped connect the work with schools, the city council, and the laboratory responsible for municipal

water testing. For companies approaching citizen science for the first time, this kind of consortium can reduce the effort of starting from zero and create a safer, more supported way to explore how participatory research can contribute to innovation.

The experience has opened new possibilities for STAB VIDA, creating new networks and helping the company understand how citizen science can operate in its own context. STAB VIDA also highlights its educational value, especially for students and young people who can gain direct contact with biotechnology and scientific experimentation, sparking curiosity among the next generation of scientists. STAB VIDA plans to keep exploring where citizen science can bring value to its work: helping develop better technologies, strengthening scientific literacy, and bringing environmental and public health innovation closer to the people and places it is meant to serve.

Figure 31. Exploring a DxHub test kit (credits: STAB VIDA)



The Future of Citizen Science in Europe



Looking ahead at the European citizen science landscape, we stand at a critical moment in time, where the future we once saw ahead is in jeopardy and the progress we made is no longer leading us to a world where decisions are guided by evidence and human wellbeing is prioritised over profit.

What does this mean?

This outlook is more than a vision, it's a strong pledge to invest in a future with less polarised views and a more wholesome co-existence between humans and the planet. If I have learnt anything in the past years, it is that change comes from those with the capacity to work collaboratively, inclusively and equitably while sharing a vision of a future where everyone has a place. Through citizen science we can certainly take crucial steps in that direction.

This book, as well as its predecessor, are a testament to the role citizen science can play in strengthening the relationship between science and society, ensuring that we invest in democratic knowledge systems driving us towards the solutions we need to not just survive, but thrive on a finite planet. They tell stories of researchers who open their laboratories, citizens who dedicate their time and expertise, business-owners who create economic value by providing citizen science services, and policymakers who recognise the value of inclusive knowledge production.

Citizen science in Europe is on its way to becoming a mainstream research approach that fundamentally reshapes how knowledge is created, validated, and applied. The stories documented here demonstrate the immense potential of this expansion from isolated projects to systematic integration across policy domains, from local initiatives to global networks, and from participatory exercises to co-creative partnerships that redefine the relationship between professional expertise and local knowledge. They showcase how citizen-generated data can directly inform legislation, a model that should be replicated across sectors as governments recognise the value of distributed knowledge collection and the legitimacy that comes from inclusive evidence generation. Perhaps most importantly, this booklet demonstrates that citizen science can be a powerful tool for rebuilding trust in institutions. In an era of misinformation and polarisation, the authentic engagement between scientists and citizens (and, in many cases, political stakeholders) that characterises citizen science provides a pathway for reconnection, creating more responsive and legitimate institutions.

To achieve lasting impact, citizen science needs to move beyond project-based support to become embedded in institutional structures. We need dedicated citizen science offices within research institutions, standardised methodologies for data quality assurance, and formal pathways for citizen engagement throughout the research and policy cycle. Education systems must fully embrace citizen science as a valuable pedagogical approach, with young people actively participating in research and knowledge creation to contribute to a more scientifically literate and engaged society. Transnational citizen science infrastructures are needed to ensure that knowledge, tools and resources are consolidated and shared and can thus more effectively contribute to tackling both local and global challenges, when used together in sustainable and fit for purpose ways. Technological development for better tools is very important but can only take us so far.

Technological advancements are key to humanity's success, but their development and application needs to be responsive to the realities of our natural and cultural world. Citizen science both draws on new technologies and ensures their sustainability and applicability, ensuring that they are broadly beneficial instead of damaging and extractive. We must also keep in mind that technologies alone can't solve all our challenges; it is the relationships built between citizens, scientists, industry, and policymakers that create viable solutions to achieve a healthy planet hospitable to human life and thriving societies across the globe.

What began with passionate individuals documenting the flowering dates of cherry trees has evolved into coordinated global networks working together to address complex challenges. Imagine a European-wide infrastructure with citizen observatories monitoring climate change impacts, transnational health research initiatives, and distributed innovation ecosystems where local knowledge is shared globally and can thus contribute to solving both local and global problems.

With adequate support, citizen science can become a staple of our collaborative problem-solving on all levels – from the local to the global. At ECSA, the European Citizen Science Association, we are committed to support the community in working towards this future, one collaborative project at a time, building a Europe where science serves society and society shapes science to mutual benefit. We can't do it alone, will you join us?

Carolina Doran

Project officer at ECSA

Coordinator of ECS

Meet the authors



Stefanie Schuerz

Stefanie Schuerz studied sociology and science and technology studies at the University of Vienna and works as a researcher and project manager at the Centre for Social Innovation (ZSI). Her primary focus is on evaluation and impact assessment, multi-stakeholder engagement and citizen science, as well as research ethics and integrity. Stefanie has coordinated processes for the co-design of R&I policy recommendations and has collaborated with funding agencies in the development and evaluation of participatory activities. In addition to her work at ZSI, Stefanie also acts as a mentor to citizen science initiatives.



Barbara Kieslinger

Dr. Barbara Kieslinger is a senior scientist and project coordinator at the Centre for Social Innovation (ZSI) in Vienna, Austria. She has been engaged in and studying citizen science for many years, working on evaluation and impact assessment and co-authoring the first whitepaper on citizen science in Europe. Her research is concerned with citizen science and citizen innovation, open science, and the relation between technological/digital and social innovations. Barbara is a guest editor of the Citizen Science in Theory and Practice journal.



Teresa Holocher

Teresa Holocher (formerly Schaefer) studied Economics at the University of Vienna. Her research work at the Centre for Social Innovation (ZSI) focuses on participation processes in digital social innovations and the assessment of their impact. Teresa was co-author of the Citizen Science White Paper for Europe, she contributed to the elaboration of an impact assessment framework for citizen science and has led the work on evaluation and impact assessment in numerous citizen science projects. She has many years of experience in participatory methods for design and evaluation, involving a broad range of citizens in research projects.



Mireia Ros

Mireia Ros holds a degree in Human and Health Sciences, with Master's degrees in Migration Studies and International Health and Cooperation. With experience in rare diseases, interculturality, and health inequalities, she now applies her expertise at Science for Change. Mireia uses participatory processes to ensure programs and research align with the realities of those they aim to support. Through the design, implementation, and evaluation of inclusive citizen science initiatives, she fosters community engagement and works towards advancing social equity.

In this book, we illustrate how citizen science efforts create policy and economic impact on a regional, national and international level. The impact stories showcase what can be achieved when municipalities, ministries, (inter-)national funding bodies, and the private sector invest in citizen science, and how this is beneficial for European societies.



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