EUROPEAN **POLICY BRIEFS** 2026

The IMPETUS consortium consisted of 7 partners from across Europe:

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European Science Engagement Association, Vienna, Austria
King's College London, London, United Kingdom
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PEOPLE-POWERED CHANGE - IMPETUS POLICY RECOMMENDATIONS & BRIEFS FOR CITIZEN SCIENCE

IMPETUS was a European initiative dedicated to advancing citizen science as a powerful force for societal change. Between 2022 and 2025, the project supported a diverse range of citizen science initiatives (CSIs) through innovative funding, training, mentoring, and recognition, with a strong focus on contributing to the European Green Deal and the United Nations Sustainable Development Goals.

Through three Open Calls, the IMPETUS Accelerator funded and mentored 129 CSIs across Europe, providing €20,000 to kick-start new projects and €10,000 to sustain existing ones, tackling pressing environmental and social challenges by collecting and using open, high-quality data. IMPETUS also launched the EU Prize for Citizen Science and actively shaped EU and national policy through horizon scanning, anticipatory research, and direct engagement with key stakeholders.

Building on the evidence and experience generated by these initiatives, the Nesta team has developed a series of policy recommendations and briefs to help shape the future of citizen science across Europe. These offer practical, evidence-based guidance for three key audiences: EU and national funders; cultural institutions and public bodies; and practitioners and researchers. Together, they reflect IMPETUS's ambition to lay the foundations for a more inclusive, impactful, and policy-connected citizen science ecosystem for years to come.

Funded by the European Union

IMPETUS is supporting our project. IMPETUS is funded by the European Union's Horizon Europe research and innovation programme under grant agreement number 101058677. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

How citizen science data can help public institutions and civil society organisations make better local decisions

INTRODUCTION

Citizen Science is an ever increasing, large scale and diverse approach that is crucial for public engagement due to its potential to support behaviour change at scale. It also helps generate good quality novel data and to generate such data in large quantities. For example, what started in 2016 as a competition between the two cities of Los Angeles and San Francisco, has developed into an international event, City Nature Challenge, motivating people around the world to document biodiversity and wildlife in their own cities. In 2023, over the course of one weekend, just under 2 million observations were recorded of over 57k species and over 66k people took part.[1] What does this mean for local decision making? It can help to fill data gaps; it bring perspectives of hard-to-reach groups to policy issues; it can enhance the geographical granularity of datasets; and combining citizen science data with existing official datasets to cross-validate findings can drive up data quality.

This policy brief makes the case for the use of citizen science data by local decision makers in cities, municipalities, regional environment agencies and civil society organisations. It aims to foster the use of citizen science data to inform evidence-based policies and to promote dialogue between stakeholders at multiple levels to promote better data management standards and interoperability. This policy brief will be of particular relevance to decision makers responsible for collecting, using and sharing new sources of data related to a broad range of activities spanning everything from public health to environmental monitoring.

THE BENEFITS OF CITIZEN SCIENCE DATA TO DECISION MAKING

Citizen science is an approach that involves members of the public in voluntarily contributing to research, including by asking research questions, collecting and/or analysing data, and using the results. Citizen science projects can be initiated with a range of goals and outcomes in mind. For example, in the CompAir project citizens collect air quality data across Europe using easy-to-use sensors supplied by the project.[2] This has helped to identify hotspots of poor air quality in specific neighbourhoods leading to. Citizens have celebrated many successes in using their air quality measurements to changes in local and regional policies.[3] The unique characteristics of citizen science mean it both engages people and empowers them, augmenting traditional monitoring as people become active in their local environment. Data generated by citizen science groups have become an increasingly important source for scientists, and those pursuing the 2030 Agenda for Sustainable Development. Citizen science data are used extensively in studies of biodiversity and pollution; crowdsourced data are being used by UN operational agencies; and citizen scientists are providing data relevant to monitoring the sustainable development goals (SDGs).

Using citizen science data can have multiple benefits:

- understanding an issue in a more nuanced way while also engaging and educating people
- monitoring and reporting on sustainability targets, in a context of constrained resources, and needing to do more for less;
- broadening the scope and coverage of existing datasets, adding depth, context and nuance where government data exists, and filling gaps in areas where it doesn't;
- validating or cross-validating data, or complementing existing data with larger samples; and
- improving public perceptions of government data initiatives, and helping to build public trust in governments and public institutions.

WHAT IS CITIZEN SCIENCE DATA?

As the field of citizen science gains recognition and momentum, more data is being created across a range of topics and sectors. As a result, there are an increasing number of opportunities to use data in policy. Different types of citizen science data include:

On-site observations where citizens describe sites/locations to collect new data or enhance existing information about places, physical infrastructure, environmental conditions, wildlife presence or events. Observations range from tracking wildlife via cameras for biodiversity monitoring, to documenting the status of water and sanitation infrastructure in public facilities. Example projects include many of those found on the Bürger schaffen Wissen (Citizens create knowledge) citizen science platform in Germany.[4]

Sample collection and measurement where citizens identify and collect different biological or environmental samples such as soil, water, or air samples, that cannot directly be observed (such as radiation) or cannot otherwise be quantified (such as temperature or noise). An example is the Isala project at the University of Antwerp to map the vaginal microbiome of healthy women.[5]

Audio-visual recording through active or passive sensing, where people make audio and video recordings, collected via stationary devices such as sensors and cameras, mobile devices such as drones or via people's consumer devices such as mobile phones and cameras. An example is the Urban Belonging project in Copenhagen using participatory mapping and photography to document local residents' relationship to the city.[6]

Classifying / tagging usually done remotely via online interfaces, means that people classify existing data sources such as images, sounds, video and other data, to extract meaning and add information, such as in the Koster Seafloor Observatory project in Sweden.[7] Some projects, such as Humanitarian OpenStreetMap[8], where volunteers map the impacts of natural disasters, combine an easy-to-use interface, task instructions, in combination with an accreditation system for contributors, and a peer-reviewed validation system to coordinate who classifies data and who validates it.

Compiling data helps to add meaning and insights to unstructured and structured data by providing a central access point, a database, or an API. Compiling is often a necessary step towards other analytical tasks that are not possible with individual datasets, such as data definition at the beginning of a project, pattern recognition, cross-verification or others. For example, citizen groups collect high resolution aerial imagery, and put it into OpenStreetMap to be able to annotate the images with digital building footprint data.

Triangulation refers to cross-verifying data with other data to improve the reliability and accuracy. Governments may use citizen science data as a control value to test the accuracy of its existing data and predictive models. In some cases, citizen science data can provide comparative data and first baselines that governments later verify by conducting their own data collection. For example, data from the UK Met Office's Weather Observation Website[9] has been used to fill observational gaps on rainfall data.

Pattern recognition involves citizens in potentially discovering spatial distributions of data, such where buildings with higher exposure to disasters are located in cities; or how many households can reach public services. In other cases, citizens may discover temporal distributions such as pollution spikes at certain points in time, or continuously high air pollution values. See for example, the Science in the City project in the Barbican Estate, in central London.[10]

COMMON BARRIERS TO AND POTENTIAL SOLUTIONS FOR USING CITIZEN SCIENCE DATA

1. Data quality - Quality assurance frameworks

There are many different quality assurance frameworks that local authorities and public sector organisations can draw on to assess the quality of citizen science data and whether it is fit for purpose. A good example is the UK Office of National Statistics' Quality Assurance Framework for non-official data sources.[11] The actual quality of data has significance only in the context of how it is used, meaning that for some applications, low-quality data may be acceptable. For example, in biological citizen science, many more amateur scientists can collect data over much larger areas and longer periods than would ever be possible by highly trained biologists alone. In some cases, lower quality is balanced by a wider scope, demonstrating that almost all data has value depending on the purpose for which it is used. Decision makers should define quality targets and thresholds for the minimum useful data required. This serves to not only define what data counts as accurate or to pre-define sampling approaches and protocols, but also to define when data is complete enough.

2. Data governance – Data Trusts

Issues around data governance, who uses the data and how, can be a limitation to making use of citizen science. Given the ethical imperatives around good data practices that enable open and Findable, Accessible, Interoperable, and Reusable (FAIR) data, citizen science can play a strong leadership role on data governance in the broader community of research and sustainability monitoring. One promising model for data governance is the concept of data trusts.[12] Data trusts are legal structures that provide independent stewardship of data. They are a useful way of increasing access to data while retaining trust. The organisations that collect and hold data permit an independent institution to make decisions about how that data is used and shared for an agreed purpose. The data trust becomes a steward of the data, taking responsibility to make decisions about the data and ensure they support the data trust's purpose.

3. Local data expertise - Accessible resources and capacity building

The main barrier to using citizen science data is local data expertise. There are some organisations and guidelines that provide useful resources for using non-traditional data. At a global level, the Global Partnership for Sustainable Development Data has published useful guidelines and practical resources for working with citizen generated data.[13] At an international level, the Ghana Statistical Service has paved the way in terms of building local citizen science data expertise by partnering with key stakeholders at a national and global level, including the local citizen science groups operating in Ghana and the UN Environment Programme to assess the feasibility of leveraging existing citizen science data for SDG monitoring and reporting, and for addressing the policy needs in the country.[14]

4. Data infrastructure and interoperability - Data sharing platforms and data standards

Supportive infrastructure - such as data-gathering tools, data analysis and visualisation tools, and platforms for data hosting and archiving do exist for citizen science. These include platforms such as Zooniverse, i-Naturalist, eBird, the and the Global Biodiversity Information Facility.[15] However, more work needs to be done to ensure these infrastructures are maintained and used, alongside investment in new infrastructure. Citizen science associations and other networks offer capacity building on interoperability, as well as support to facilitate the adoption of data and metadata standards. Achieving greater interoperability enables citizen science data to be more easily reused by different stakeholders, such as volunteers, researchers, and decision makers. It also means it can be combined with datasets of different scales (local, municipal, regional, national, global); and combined, exchanged and used together with different types of data. Hosting citizen science data on government portals can significantly broaden the scope and coverage of those portals, adding depth and context in sectors where government data exists, and filling gaps in sectors where it doesn't. The inclusion of citizen science data in these portals also implies that the data meets certain thresholds for methodological rigour and sustainability, either prior to inclusion, or through data cleaning and institutional

arrangements implemented during the inclusion process. Doing so also can also improve public perceptions of government data initiatives.

5. Lack of coherent strategies for data sharing - promoting multi-stakeholder dialogues

There is still no coherent strategy for the development of citizen science initiatives and at a time of financial pressure, it is not possible to maintain so many different data platforms. Government agencies are working together to share information and expertise, and are also working with NGOs to develop a data sharing framework to collate and combine data from a wide range of sources. Given the range in scales and the different topics that citizen science initiatives focus on globally, a one-size-fits-all strategy to data use will not work. For medium to large-sized data generating citizen science projects, efforts are being made to develop standards and to incorporate citizen science data into global research data infrastructure.[16] Equal efforts need to be made to enhance the utility and uptake of citizen science data into evidence for policy. As a first step, local decision makers, civil society organisations and citizen science projects should establish dialogue, map out common interests and agree on methods or standards of evidence. The Guidelines developed by the IMPETUS project on localising the Sustainable Development Goals set out a step-by-step guide for how to initiate these processes.

NEXT STEPS

Citizen science data can help to address the needs of decision makers as demonstrated by the benefits and opportunities listed above. However it is crucial to note that involving people in data collection and the methods for monitoring sustainability targets leads to a deeper engagement of the public in particular issues, such as marine litter and plastic pollution. This can then lead to action on the part of those involved and to a change in behaviour as a particular topic is delved into and explored in more detail. Recommendations for next steps include taking stock of data so that local decision makers can not only consider their internal use of data, but also how the public can work with it to gather new insights.

PROJECT IDENTITY

Project Name	IMPETUS
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Further Reading	◆ *Citizen science data to track SDG progress: Low-hanging fruit for Governments and National Statistical Offices* ◆ *Advancing sustainability together? Citizen-generated data and the Sustainable Development Goals* ◆ *Choosing and engaging with Citizen-Generated Data: A guide* ◆ *Citizen Generated Data and Governments: Towards a Collaborative Model* ◆ *Mapping the landscape of data intermediaries: Publications Office of the Union Editorial: Open Citizen Science Data and Methods*

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[16] This is already happening with ornithological data collected by the eBird platform which is deposited in the Global Biodiversity Information Facility which is a regular member of the World Data System.

THE ROLE OF CITIZEN SCIENCE IN EUROPEAN WATER MANAGEMENT AND POLICY

The role of citizen science in European water management and policy

INTRODUCTION

Sustainable water management is a global challenge. While the United Nations (UN) Sustainable Development Goal (SDG) 6 specifically addresses clean water and sanitation, water pollution is intertwined across many goals and has implications for food security, health, wellbeing, biodiversity, and ecosystems.[1] In Europe, despite increased awareness about the importance of sustainable water management, and legislation such as the European Water Directive Framework, a complete regional picture of water quality does not exist.[2] This is echoed at the global level. To address this challenge, the UN recognises the significance of incorporating non-traditional data sources, such as citizen science, into water monitoring practices.

This policy brief describes the challenges of sustainable water management and how citizen science and public participation can help. This is just one example of an issue within the environmental regulation and climate resilience agenda that could benefit from citizen science. The brief provides a set of very practical recommendations for national water regulators, for national level environment agencies and for the Directorate General for the Environment of the European Commission about how to support citizen science initiatives to address some of these issues in water management.

WHAT DO WE MEAN BY WATER MANAGEMENT POLICY AND HOW DOES IT WORK IN THE EU CONTEXT?

EU water policy takes place through the consistent implementation of the European Water Framework Directive (WFD),[3] which aligns with the UN SDG 6 on access to clean water and sanitation. The WFD requires Member States to identify river basins within their territory and assign them to River Basin Districts (RBD), the spatial unit for all planning and monitoring tools and activities under the WFD.

The WFD also recognises a key role for public participation in water management. Despite this emphasis, there is no practical guidance on the opportunities for effectively leveraging citizen participation.

The WFD helps to raise awareness and supports Member States to develop aligned policies. However, the institutions tasked with operationalising these policies often face several challenges for successful water management, such as:

a. Insufficient data for monitoring

Water quality is difficult to observe at high spatial and temporal resolutions; it is expensive and typically requires trained specialists in the field and in laboratories. Water quality monitoring by statutory bodies has declined to a point where the spatial and temporal frequency of the monitoring is insufficient to fully understand the complex range of pollution sources and their impacts.[4] Also, most small water bodies are not covered by the WFD monitoring,[5] meaning that small water bodies are the least monitored freshwater resources, with significant gaps in terms of spatial and temporal coverage. For example, in Ireland less than 10% of the river sites in the national water quality monitoring programme are on small streams.[6] The issue of severe data gaps for monitoring small water bodies in national water quality monitoring programmes is worryingly similar across other European countries.

b. Poor coordination and ineffective targeting of resources for water management

Ideas and practical knowledge about water management are often distributed between stakeholders and potentially difficult to access, or dispersed across geographic regions. This means localised actions are finding scaling challenging, and the longer term sustainability of actions and initiatives is called into question. Successful water management requires the active participation and commitment of all involved

stakeholders: citizen, decision and policy makers, and (private) data aggregators and scientists. This requires in-depth understanding of their motivations, incentives and barriers for participating.[7]

c. Lack of public trust in stakeholders responsible for water management

The lack of information and awareness surrounding mass pollution has caused a steep decline in public trust in water sector management, heavily damaging the relationship between consumers and suppliers.[8] Recent WFD assessments suggest that just 38% of European waters (rivers, lakes and transitional coastal waters) meet the required standard.[9] In the UK in particular, there is widespread dissatisfaction around waterbody pollution, with frequent media coverage highlighting this. In 2023, Ofwat, the UK's water sector regulator, released a survey based on the public's trust and perceptions in the water sector. The survey results suggest that over time, trust has fallen in water companies' abilities to perform a range of responsibilities, including ensuring good quality drinking water and providing a reliable service.[10]

d. Lack of awareness about practical opportunities for public participation in water management practice

Research on attitudes towards public participation suggests that there is a lot of appetite to participate in tackling big societal challenges, such as effective water management. However, it is a lack of awareness about these opportunities, not a lack of interest, that is a barrier to participation. The implementation of the European Flood Directive 2007/60/EC[11] requires the establishment of public participation mechanisms to ensure citizens' involvement in the flood management cycle. This raises challenges on how to achieve this goal and successfully translate the directive into meaningful and effective participation.[12]

WHAT IS CITIZEN SCIENCE?

Citizen science is an approach that involves members of the public in voluntarily contributing to research, including by asking research questions, collecting and/or analysing data, and using the results. Citizen science projects can be initiated with a range of goals and outcomes in mind. For example, in the CompAir project, citizens collect air quality data across Europe using easy-to-use sensors supplied by the project.[13] This has helped to identify hotspots of poor air quality in specific neighbourhoods leading to changes in local and regional policies.[14] For water-related examples of citizen science initiatives, see below.

The unique characteristics of citizen science mean it both engages people and empowers them, augmenting traditional monitoring as people become active in their local environment. Data generated by citizen science groups have become an increasingly important source for scientists working on biodiversity and environmental pollution, and institutions or agencies pursuing the 2030 Agenda for Sustainable Development.

HOW CAN CITIZEN SCIENCE BE USED FOR WATER MANAGEMENT?

Citizen science is growing in the area of water management, with increasing public involvement in monitoring water resources, climate variables, water quality, and in mapping and modelling exercises. Interesting ways in which citizen science has been used in water management include the following:

◆ *Identifying water pollution hot spots and river flow levels*

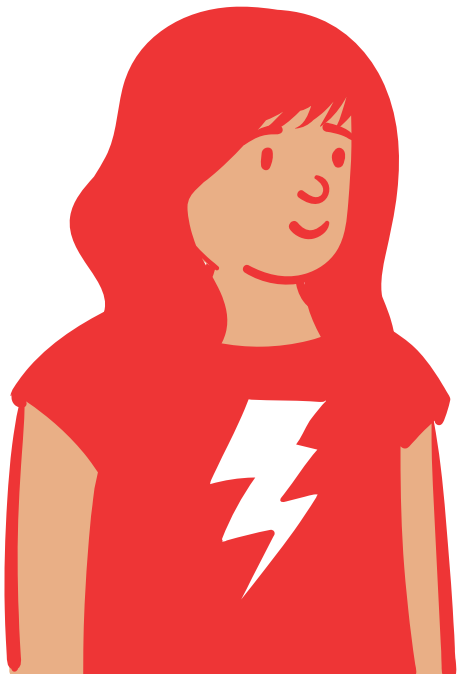
The rise in citizen science monitoring has generated opportunities to overcome many barriers and fill data gaps. Citizen science for water quality monitoring involves inexpensive and hands-on (manual) methods or visual (qualitative) observations, often accompanied by simple gauges, test kits, taking photographs using smartphones, or collecting samples that are then sent to a laboratory for detailed analysis.[15] However, a framework that captures the essential elements of effective citizen science is needed to ensure both the sustainability of volunteer engagement and data quality.

The community-led continuous water quality monitoring process of the UpStream project in the UK and Taiwan,[16] highlights how the use of cost-effective, open source, continuous sensors can be paired with citizen science activities involving the public to generate highly detailed data to improve water quality. The DRYvER project,[17] led by the French National Research Institute for Agriculture, Food and the Environment (INRAE), developed a unique open-source smartphone app: DRYRivERS to better understand flow intermittence in rivers. By January 2023, DRYRivERS had 1,277 users who had logged more than 4,200 observations on 1,900 waterways in Europe and around the world. Users came from 19 countries, of which 41% are in Hungary, 31% are in France, 6% are in Spain and 5% are in Czechia. Data collected from the DRY-RivERS app allows for real-time monitoring of rivers and supplies precious information to river managers. The Syndicat de la Rivière d'Ain Aval et ses Affluents (SR3A) is a public authority responsible for managing the river Ain catchment, in France. SR3A is using the DRYRivERS app rather than implementing water level in situ sensors. Without citizen science smartphone apps, SR3A would not have been able to closely monitor the hydrological states of the catchment, because of both time and budget restrictions.[18]

In another project using the DRYRivERS app, researchers modelled flow intermittency on the basis of 15,791 hydrological state observations across four catchments in four European countries (Finland, France, Hungary and Spain). Researchers wanted to assess whether complementing standard flow gauging station data with crowdsourced observations of hydrological state to calibrate a hydrological model improved the model's predictions of river flow intermittency. The study showed that crowdsourced observations improved the performance of the modelling of hydrological states of intermittent rivers and ephemeral streams, especially in catchments where hydrological stations are scarce or when field campaigns cannot be implemented.[19]

◆ *Co-creation of water management strategies*

The lack of public trust in effective water management has highlighted the need to be more transparent with the public, and keep individuals better informed on the actions being taken by suppliers. By providing clarity in engagement, the public can keep updated and help alleviate the chances of backlash when projects or actions take place. The continuous water quality monitoring process of the UpStream project fostered engagement with local people, raised awareness, and encouraged collaboration through co-design activities and some monitoring stewardship. Bridging the gap between data creators and data users not only makes processes more efficient but also offers an educational experience that engages citizens and other stakeholders who would normally remain excluded and helps to build trust. The Evenlode Catchment Partnership (ECP)[20] convenes a multi-stakeholder group to improve the river environment, deal with pollution in the river Evenlode, UK, and to co-create river management plans with local communities. Through monitoring activities, volunteers identified the locations and timings of negative impacts on water quality, including several related to water treatment plants along the river. They are now in direct dialogue with the water company, the Environment Agency and other stakeholders about developing potential mitigation actions.[21]



◆ *Reporting against international water monitoring standards*

Citizen science initiatives can help achieve effective stakeholder coordination and targeting of resources by enabling people to monitor the actions and follow-through of institutions, industry and government, increasing accountability and transparency of progress in relation to commitments. Digital tools are helping to shift the scale of action by supporting people to take more coordinated and effective actions. The Ghana Marine Litter project[22] generated locally-produced data for monitoring marine litter in Ghana, fostering more efficient data collection through the development of a standardised monitoring protocol. The data collection approach was developed in collaboration with staff from the National Statistics Office, helping to ensure that it could be used for official monitoring as part of Ghana's reporting on SDG targets.

◆ *Local stewardship, cleanup and oversight of water bodies*

The Marzenego River MICS project[23] in Italy used co-design workshops to build a common understanding of the problems related to the river and wetlands, and to identify priorities for citizen monitoring. "River contracts" - official contracts where citizens volunteer for water monitoring/stewardship - were key enablers for the success of the project. The project went to great lengths to ensure that participants were involved in multiple stages of the project, being offered different levels of involvement depending on their individual interests and availability. The Ghana Marine Litter project also contributed towards group level impacts such as increased community resilience and reduced local littering through beach cleanups.[24] The project Hello Environment Agency[25] has helped to enhance flood risk communication and community engagement across numerous locations in the UK. The platform provides real-time updates on flood defences and improvements, while also collecting valuable community feedback. By offering educational resources on flood risks, the digital assistant is helping residents and visitors stay informed and prepared, ultimately supporting the resilience and sustainability of the coastal area.

THE BENEFITS OF CITIZEN SCIENCE FOR INSTITUTIONS AND FOR PARTICIPANTS

The potential benefits of citizen science for institutions and individuals are manifold.

For institutions:

◆ Citizen science can provide improved data resolution for water monitoring, including the integration of traditional and non-traditional data sources, which can enhance hydrological modelling.

◆ Citizen science can play a key role in helping to fill key data gaps by mobilising citizens to generate real-time localised data from water bodies that aren't covered within River Basin Districts, by tapping into community observations to ground-truth findings from surveys and other data.

◆ Citizen science can assist with cost-effective environmental monitoring and engagement and improved time efficiency in monitoring tasks. Using digital tools can also help increase reach while reducing operational costs.

◆ Co-creating monitoring plans, and tailoring citizen science initiatives to address the priorities of a wide range of end users, can help to better understand public demands. It can also help to mitigate negative public attitudes and restore public trust in institutions, contributing to better and more sustainable long-term solutions to water management.

For individuals:

◆ Citizen science activities can provide opportunities for participation in water quality monitoring, can foster collaboration, and can integrate local knowledge about water bodies, leading to enhanced community resilience.

◆ Whilst engagement and participation levels may be different across projects, citizen science can facilitate connections between the public and experts on local water management issues, and empower people to more effectively take action in their immediate surroundings.

◆ Citizen science initiatives can increase knowledge and understanding of water science. They can also increase understanding of the complexities of water management issues, raising awareness of things citizens can do, individually and collectively, to tackle complex water quality and, for example, flood risk issues, together.

◆ By soliciting contributions from a diverse range of people, citizen science can help to uncover a wider range of insights for more informed decision making, and to help build collective understanding of effective water management.

RECOMMENDATIONS

Mainstreaming citizen science and citizen-led data can shift stakeholders at all levels towards more effective water management and environmental policies.[26]

Recommendations for local authorities and municipalities:

a. Promote opportunities to contribute to water management through media and advertising campaigns. Focus messaging on local and community benefits to drive participation. Collaborate with national level water sector actors to coordinate efforts.

b. Enhance the capacity of local governments (both in terms of staff and resources) to combine citizen-generated data and other non-traditional data sources with official datasets for environmental monitoring.

c. Collaborate and share learning so that local authorities and municipalities wishing to incorporate citizen science into their water monitoring and management practices, can receive data from citizen science projects run by third parties, and to run their own citizen science initiatives.

Recommendations for national level water sector actors and agencies:

a. Nominate a focal point within institutions and agencies to map the opportunities for citizen science to contribute to water management by identifying gaps in national monitoring and implementation capacity.

b. Focal points can liaise directly with citizen science initiatives and community organisations, highlighting existing data gaps and opportunities to influence decisions. This will help maximise the impact of these initiatives and to support the building of public trust in institutions responsible for water management.

c. Plan the resources needed for implementation. These include the scientific design of citizen science initiatives, strategies to promote engagement and collaboration with volunteers, and the overall framework that allows national authorities and citizen scientists to share data and work together.

Recommendation for the European Commission's Directorate General for the Environment:

a. Future funding mechanisms should foster institutional partnerships with municipalities, agencies and citizen science initiatives. These can help to enhance matchmaking between stakeholders, and to ensure that citizen science initiatives are specifically designed to meet the (data) needs of the partner organisations.

PROJECT IDENTITY

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WHY INCLUSION NEEDS TO BE AT THE FOREFRONT OF CITIZEN SCIENCE

Why inclusion needs to be at the forefront of citizen science

INTRODUCTION - THE IMPORTANCE OF INCLUSION IN CITIZEN SCIENCE

Citizen science involves the active participation of members of the public in voluntarily contributing to research, including by asking research questions, collecting and/or analysing data, and using the results. The data generated by citizen science groups have become an increasingly important source for researchers, as well as for institutions and agencies pursuing the 2030 Agenda for Sustainable Development. Citizen science aims to bring the broader public into research, with benefits ranging from increased efficiency compared with traditional data collection methods, to the growth of science capital[1]. However, it is often the same people who participate in citizen science initiatives - those who are highly educated, and who can afford the time and effort to engage in participatory activities[2]. Most citizen science initiatives struggle to engage underrepresented or vulnerable groups.

This policy brief:

- Sets out the key benefits of more inclusive citizen science initiatives.
- Presents an overview of the key barriers to implementing inclusive citizen science, whilst maintaining a focus on the practical implementation of inclusive citizen science.
- Makes recommendations for practitioners, local decision makers and funders about what can be done to further enhance inclusion in citizen science.

Throughout, we draw on examples from the IMPETUS accelerator programme, which supports new and existing citizen science initiatives to address the issues around inclusion and diversity in citizen science more broadly.

WHAT IS INCLUSION IN CITIZEN SCIENCE?

The United Nations (UN) defines social inclusion as the process of improving the terms of participation in society, particularly for people who are disadvantaged, through enhancing opportunities, access to resources, voice and respect for rights. Inclusivity in citizen science refers to the equitable involvement of diverse societal groups in research. This means ensuring that people of different ages, genders, sexual orientations, disabilities, ethnicities, socioeconomic statuses, legal statuses and educational backgrounds have the opportunity to participate[3].

Inclusivity in citizen science initiatives can manifest in several ways:

◆ **Engaging underrepresented groups:** efforts are made to actively involve communities and individuals who are traditionally excluded from scientific endeavours. This includes marginalised communities and those from lower socio-economic backgrounds.

◆ **Co-design and participatory approaches:** inclusivity is also achieved through co-design, where community members are not just participants but co-creators of the research process. This participatory approach ensures that the research addresses the concerns and needs of diverse groups.

◆ **Methodological inclusivity:** the tools, methods, and outputs of citizen science initiatives (such as data collection methods, technology, creative outputs, and research impacts) are designed to be accessible and beneficial to a broad audience.

THE BENEFITS OF INCLUSIVE CITIZEN SCIENCE

Citizen science approaches are not only more efficient compared with traditional data collection methods, but can also benefit all participants through building participants' confidence, providing opportunities to learn new skills and deepening participants' understanding of research. Inclusive citizen science has cascading impacts:

◆ **Inclusive citizen science can generate more complete, richer datasets.** For example, the Heat Watchers in Action initiative in Barcelona[4], Spain, sought to shed light on the unequal effects of climate change, with a particular focus on heat and thermal discomfort in urban low-income households with children. The project used citizen science to understand and disseminate the urban impacts of climate change, working with over 100 children, 33 families, 11 teachers and 145 other stakeholders in low- income neighbourhoods to co-create solutions to foster resilience. Five new datasets were published at the end of the project, generating a rich source of data on urban indoor heat stress that includes a child- oriented perspective.

◆ **Inclusive citizen science can tackle specific knowledge gaps around the experience of underrepresented groups that may have previously been excluded.** In the case of the London Borough of Islington's Accessibility Audits[5], the project sought to integrate the lived experience of 12 residents with reduced mobility, generating essential information on obstacles found on streets and pavements, taking a pan-disability perspective. The initiative co-designed the accessibility audits with the participant group and embedded residents with reduced mobility's lived experiences into urban planning in Islington. This ensured future audits are more effective and genuinely take into consideration residents' needs.

◆ **Inclusive citizen science can generate data with and for groups affected by an issue, making them more visible in research.** For example, Obstetric Coevolution[6] sought to address the lack of data and resources on the mental health of postpartum women, particularly the need to rethink the birth experience, in Barcelona, Spain. The initiative developed a new tool - the birth diary (carnet de Salut)-specifically tailored for mothers and perinatal professionals to collect data on all the processes needed to foster continued assistance throughout the birthing process. The data generated with participants was used to help predict and reduce the risk of post-partum depression or post-traumatic stress disorder.

◆ **Citizen science initiatives can be transformative for those participating in them, building understanding and cohesion between groups with different experiences.** The benefits to participants include psychological and cognitive skill development through hands-on activities, social skill development through collaborative activities, improved physical and mental health, higher well- being and life satisfaction, and increased tolerance and understanding towards other individuals[7]. The new knowledge and skills, social capital and empowerment can lead to longer lasting behaviour changes. For example, the Acting4DHH[8] initiative was

initiated by Web2Learn[9] and the Deaf Association of Northern Greece (EKVE) to understand and promote interactions between deaf and hearing individuals, and to address accessibility issues in public urban spaces in Thessaloniki, Greece. Deaf and Hard of Hearing (DHH) citizens are often excluded from participatory initiatives that affect their quality of life and wellbeing in urban settings. 30 DHH participants produced 25 videos of their experiences of DHH-Hearing interactions, mapping challenges and opportunities in DHH-hearing collaborations and communication in everyday settings. A collaboration of 20 DHH and Hearing participants also mapped 10 public spaces through a public urban monitoring app (IMC). The collaboration between the DHH participants and Hearing participants, facilitated throughout the initiative activities, created community bonding and solidarity between the two groups, with the outcome of helping to overcome social biases and barriers.

◆ **Inclusive citizen science fosters meaning, social purpose and connection.** This can lead to increased environmental stewardship and climate resilience. For example, Map4Rec[10] engaged Ukrainian refugee children in the active exploration and mapping of informal places for sports and recreation in 6 cities in the Twente region of the Netherlands. Through indoor workshops and neighbourhood walks, the initiative co-designed location-based games to map the perceptions and use of urban green spaces. Participants used the Epicollect app, documenting their perceptions, and suggesting improvements resulting in a map with 152 locations[11]. Their tailored methodology engaged children in missions related to environmental mapping, biodiversity monitoring, sports and health, which fostered connection to urban recreational spaces, promoting well-being and environmental stewardship.

◆ **Inclusive citizen science also provides opportunities for different stakeholders to interact, going beyond the usual networks of collaborators and participants.** Collaborations between researchers, public sector organisations and the public in citizen science activities can lead to the improved management of local and context-specific issues, more effective participation of the public, in particular underrepresented groups, in local decision-making processes[12]. For example, Oeiras Experimenta[13] set out to study and identify climate resilient crops through the restoration of a secular farm and the implementation of a multi-disciplinary research hub in Oeiras, Portugal. The initiative is a collaboration between researchers and the municipality, with a representative of the municipality being part of the core project team. The initiative involved the public in activities on the farm around crop sowing, harvesting and field maintenance to raise awareness about climate resilient crops. The initiative also collaborated with two social inclusion organisations and the local educational centre for institutionalised youth, integrating underrepresented groups in the research hub, and giving them greater visibility in the research activities.

◆ **Inclusive citizen science can support more inclusive policy and decisions.** Dear Green Place[14] - an initiative focussed on the mental health of young people in urban green spaces in Edinburgh, Scotland - engaged 55 young people, in collecting data on urban green spaces using the Our Outdoors app, as well as generating evidence on how local shared outdoor spaces affect health and well being. The initiative worked with a smaller number of young people (8-10 people) to meet the needs of those with neurodiversity and lower levels of digital literacy, who needed more support using the app. The initiative also connected the young participants with local policy makers at Edinburgh Council to have their say on their local green space developments. The initiative continues to work with the Council as they develop other urban green space initiatives to ensure that young people's voices are heard in every stage of that process.

CHALLENGES TO ACHIEVING INCLUSIVE CITIZEN SCIENCE AND HOW TO OVERCOME THEM

◆ **Inclusive citizen science is time and resource intensive, more so than a typical citizen science approach. Successful engagement strategies require time and flexibility to meet communities where they are.** Too often, citizen science initiatives underestimate what is needed to meaningfully engage under-represented communities. This includes raising and managing differing expectations, and managing competing timeframes, as well as managing the follow through at the end of a project, and after a project has formally ended. This goes beyond taking time to implement good citizen science. For example, the first iteration of the Acting4DHH project tried to engage the Deaf and Hard of Hearing (DHH) community in undertaking biodiversity monitoring using the iNaturalist platform[15]. However, there were low levels of engagement in the project activities and few members of the target group attended events and activities. The project activities were not tailored to the interests of the target group. In the second iteration of the project, during the IMPETUS accelerator, the project team took a much more flexible approach, using citizen social science to better adapt to the requirements of the DHH community, adjusting the project activities to accommodate the needs, interests, and motivations of participants. This involved reducing the number of proposed activities, slowing down the overall cadence of the project, and spending more time and effort to ensure that all those involved in the project were aligned on objectives and terminology. In particular, since written outputs are not a direct translation of sign language, more time was needed to develop appropriate materials for the project.

◆ **Inclusive citizen science involves navigating both doing science (Citizen Science) and meaningfully engaging participants in activities (Citizen Science).** Consideration needs to be given to when decisions are made about the direction of the project, and at what point in the project cycle, and who gets to make the decisions. Working with schools can be effective for developing in-depth co- design approaches. However, there is a risk of compromising on the scientific outcomes in favour of engaging target participants in activities. For example, the Museum of Food Waste[16] engaged 6 schools across 2 municipalities in northern Portugal to collect data on the quantities of food waste generated in school canteens. The initiative co-designed the data collection approach with students, canteen staff and school teachers to facilitate both meaningfully engaging target groups and also creating replicable protocols for data collection on food waste. The protocols enabled quantitative data collection on 3 types of food waste, and qualitative data collection on the behavioural aspects of food waste prevention. The toolkit for data collection has been adapted to a wider public of children aged 10-15 years old to ensure it is accessible and replicable in other schools and municipalities across Portugal.

◆ **Citizen science relies on people contributing in their free time, for free, which isn't possible for many people, particularly groups who are typically underrepresented.** Initiatives need to think about remuneration or other incentives to support engagement. For example, the Luna project[17] was developed in Ljubliana, Slovenia to address the lack of scientific data on phenomenology throughout the menstrual cycle. Luna engaged 87 citizen scientists with menstrual cycles to collect real-time data, reporting daily reflections. Whilst the initiative didn't offer remuneration, it did offer participants access to their own data on their own menstrual cycles, and the opportunity to investigate personal research questions in a supported environment.

◆ **There is a risk of reifying differences by only working with 'vulnerable groups'.** If citizen science initiatives claim to engage "everyone", it is often only the most privileged and dominant groups that engage. It is crucial to purposefully involve people who are not the (social) majority in citizen science initiatives. The Austrian Citizen Science platform Österreich Forscht[18] has developed transparent criteria for projects wishing to be listed on the platform to maintain and further improve the quality of the projects presented on the platform. The check list of quality criteria enable citizen science initiatives to consider which groups they are excluding in their work. Instead of asking how inclusive they are, they ask who is left out and this stimulates a reflexive process in which the limits of a project can be better understood and tackled. This has been crucial for project leaders to acknowledge the limitations of participation in citizen science initiatives.

HOW CAN WE ACHIEVE MORE INCLUSIVE CITIZEN SCIENCE IN EUROPE?

Citizen science has significant potential to contribute to stronger social inclusion and social sustainability but is currently failing to live up to this. Programmes like the IMPETUS accelerator and associated projects are starting to make headway in addressing this issue. IMPETUS has funded over 120 citizen science initiatives, supporting them to be more inclusive both through the funding selection criteria, specific training on engagement and communication strategies, tailored mentoring and also through the tracking of diversity statistics in the target groups and project teams. However, more work is needed if citizen science is to fulfil its potential. This section sets out some clear recommendations for both citizen science practitioners, as well as local decision makers and funders to achieve more inclusive citizen science in Europe.

Recommendations for practitioners and citizen science project leaders:

◆ Collect demographic data on project participants, whilst being mindful of the data minimisation principle, and make the anonymised data publicly available to enhance the wider understanding of different participant profiles,

◆ Consider the context specific requirements of inclusion taking into account local social realities. While it is not possible to make every citizen science project accessible to everybody, project organisers should aim for an inclusive design by taking into account the local context of the issue they are trying to address. Working with intermediary organisations can help with this.

◆ Design initiatives in a way that is open to underrepresented groups, even though the specific target audience depends on the scope of the project and is highly context specific. If this mindset is adopted and shared among all stakeholders from the outset, every step of an initiative can be designed inclusively or corrected along the way.

Recommendation for local decision makers:

◆ Collaborate with local citizen science initiatives to make use of the data they have generated to inform local priorities and decision making.

◆ Take a citizen science approach to tackle different knowledge gaps and gaps in evidence for policy making, such as accessible mobility in urban planning, by having a specific social inclusion dimension.

◆ Any targeted focus on engaging underrepresented groups needs to factor in time and flexibility to build up relationships and adapt engagement strategies to the target groups, especially if they are vulnerable.

Recommendations for funders:

◆ Develop funding calls tailored to underrepresented groups and that necessitate inclusion within the application criteria - see the IMPETUS programme for a successful example. This could include micro- grants with simplified application procedures and reduced reporting obligations (potentially through a cascading grants mechanism).

◆ Funding programmes should also factor in additional time allowances for participants to build connections with key stakeholders and develop good working relationships with aligned expectations before the engagement in research activities. Additional time allowances may also be necessary for relationship management and fading out after the research phase.

PROJECT IDENTITY

Project Name	IMPETUS
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Acknowledgements	We would like to thank our collaborators from the European Citizen Science project - the ZSI-Centre for Social Innovation GmbH - and particularly Dr. Barbara Kieslinger and Stefanie Schuerz - for all their input and review of this policy brief.

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AI AND CITIZEN SCIENCE: BUILDING TRUST, TRANSPARENCY AND HYBRID INTELLIGENCE

AI and Citizen Science: Building trust, transparency and hybrid Intelligence

INTRODUCTION - THE IMPORTANCE OF INCLUSION IN CITIZEN SCIENCE

Artificial Intelligence (AI) and Citizen Science (CS) are increasingly intertwined in the European research and innovation landscape. Both represent collaborative, data-driven approaches to knowledge production, but they differ fundamentally in their relationship to public participation and trust. While AI is often perceived as opaque and centralised, citizen science is rooted in principles of open science, inclusion, and collective agency. Integrating the two offers a path to both creating more efficient and scalable CS initiatives and more democratic, transparent, and human-centred AI systems.

Europe faces an urgent policy challenge: ensuring that AI technologies are developed and governed in ways that reinforce democratic legitimacy and social trust rather than eroding them. The EU AI Act, alongside Horizon Europe's Cluster 2 – Culture, Creativity and Inclusive Society, explicitly calls for public engagement and transparency in AI development. Citizen science provides a proven mechanism to achieve this through involving citizens in the co-creation, monitoring, and ethical oversight of AI technologies.

This brief introduces a framing for how to conceive the relationship between AI and Citizen Science (Citizen Science for AI) and leverage AI tools to improve citizen science practice (AI for Citizen Science). It also provides insights into how citizen science projects are currently making use of these technologies, drawing on insights from the IMPETUS Accelerator. Throughout, it highlights the benefits and challenges, as well as providing recommendations for next steps.

WHAT IS AI AND CITIZEN SCIENCE?

While there is no singular definition of AI and Citizen Science, how the two approaches intersect can be defined in two primary ways:

1. AI for Citizen Science: Using AI tools to automate and enhance delivery within citizen science projects. This can include using AI throughout a project's lifecycle from proposal writing, through to citizen engagement and analysis or reporting.

2. Citizen Science for AI: Engaging citizens through citizen science in the creation, auditing, and ethical evaluation of AI systems to ensure fairness, transparency, and accountability.

Both approaches share a commitment to openness and of collective intelligence, where humans and machines collaborate to generate knowledge that is socially informed and democratically governed.

Key methodologies emerging in this space include:

1. Hybrid Human-AI Workflows: Combining algorithmic pre-processing with human verification to optimise accuracy.

- One of the most prominent examples of this is the *Zooniverse, Galaxy Zoo* initiative. Here, AI models trained on volunteer classifications pre-sort astronomical images, allowing human participants to focus on ambiguous or novel findings. This partnership between human insight and algorithmic efficiency accelerates discovery and maintains engagement through shared agency.

- Another example is the *iNaturalist project,* where AI-powered image recognition tools assist volunteers in identifying biodiversity observations in real time. This both helps increase participation and improve data accuracy and coverage.

2. Participatory Data Governance: Involving communities in decisions about data ownership, consent, and reuse.

- *"The Call"* was an exhibition and participatory data project by Berlin-based artists Holly Herndon and

Mat Dryhurst. They proposed a voice AI trained on the voices of choristers. To collect data, the artists composed a songbook for fifteen community choirs across the UK. The choristers also participated in a Choral Data Trust experiment, collaboratively defining the governance framework for the use of their training data and the resulting AI model.

◆ *DeepTime* is a citizen science platform with thousands of contributors mapping heritage and ecology run by Dig Ventures. They are involving their volunteers in deciding the governance processes for their data platform. Their aim is to create a data commons where communities retain meaningful control over data they help create, ensuring technology serves local environmental needs.

3. **Algorithmic Co-creation:** Citizens helping to design or train AI models, particularly in underrepresented language, societal or cultural contexts.

◆ One example of using CS to inform the design of algorithms is the *Masakhane Project*. A grassroots citizen science initiative that trains natural language models for African languages, addressing data inequality and broadening the use and diversity of languages in AI systems.

◆ Exploring a similar challenge, *Indigenous Protocols and AI Lab* has set up a collaborative initiative between technologists and Indigenous communities that use participatory research to embed cultural values and ethical norms into the design of AI solutions.

4. **Deliberative AI Oversight:** Citizen panels, deliberative polling or juries are used to evaluate the ethics, social impacts, and fairness of AI deployment.

◆ *Public AI Task Force:* Nesta's Centre for Collective Intelligence conducted public deliberations where people voted on which AI tools are acceptable for use in the UK's public sector. The Centre designed a process known as the AI Social Readiness Assessment, where members of the public (the Public AI Task Force) learn about a specific AI tool, how it works, including its potential benefits and risks. The groups then develop practical guidelines for public sector organizations and AI developers on how to use these tools responsibly and for the public good.

Systemic benefits: From data ethics to policy innovation

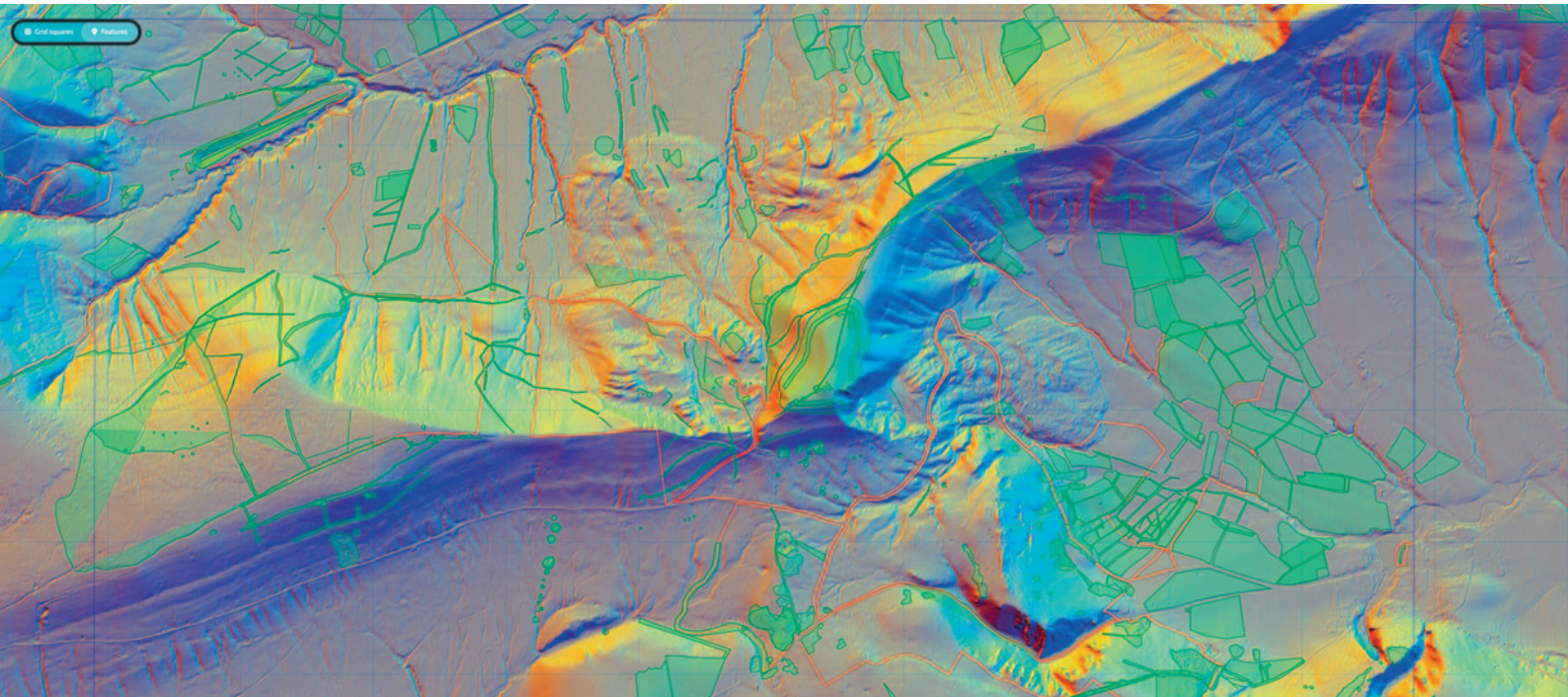
When combined, AI and CS form a hybrid intelligence ecosystem that can deliver distinct systemic benefits:

◆ **Transparency:** Shared data governance models ensure visibility into how algorithms operate and whose knowledge informs them.

◆ **Equity:** Participatory datasets reduce bias and expand cultural representation in training data.

◆ **Democratic legitimacy:** AI developed through open, participatory processes enjoys higher public trust and greater policy durability.

These benefits directly align with Europe's strategic objectives under Horizon Europe and the Digital Europe Programme, fostering responsible, human-centred, and trustworthy AI ecosystems.



HOW CITIZEN SCIENCE PROJECTS IN EUROPE ARE USING GENERATIVE AI

Over the last cohort of the IMPETUS Accelerator, we documented the reported uses of AI by our projects. During this period, generative AI tools such as ChatGPT, Claude, Gemini and Copilot have become increasingly ubiquitous. We found a range of uses from routine administrative support to sophisticated data analysis and participant-led digital engagement, alongside a notable undercurrent of methodological caution.

1. Routine Administration, Translation, and Communication

The most prevalent use of generative AI is as a digital assistant for operational and communication tasks. Numerous projects reported using tools like ChatGPT to refine English phrasing, adjust text formality, and overcome language barriers.

- For instance, the *NEYSA* project used LLMs to translate or check materials, while the *Unique* project relied on AI translation when bilingual personnel were unavailable.
- AI is also used to adapt scientific outputs for public audiences - the *Disaster Risk* and *GV-CLIMA* projects used ChatGPT to tailor social media messaging to specific demographics.
- Several projects, including *Living Soils Lab* and *CollFacts* used automated transcription for focus groups and communication videos.

2. Ideation and Protocol Development

Several projects use generative AI to navigate bureaucratic bottlenecks and structure early-stage research.

- *Waste-Free Wantage* successfully used an LLM to draft provisional survey structures required for a university ethics application, which later informed their participatory co-design sessions.
- Similarly, *Waste to Wealth* used ChatGPT to outline an experimental protocol and summarise literature, though the research team was careful to double-check all AI-generated outlines against scientific literature.

3. Data Analysis and Custom Tooling

While many projects restrict AI to text generation, a small subset have used generative AI for data processing or developing customised deployments.

- *The Observatory* project in Spain applied Gemini, Copilot, and ChatGPT to process vast amounts of qualitative citizen narratives; they extract geographic coordinates, detect hate speech, attempt sentiment analysis, and even simulate population segments using AI personas to test communication campaigns.
- In the *Regenerative Tides* project, a participant developed a custom "bad boats GPT" programmed with scientific guardrails to provide the public with accurate information on marine pollution.

4. Participant-Led Digital Participation

In certain projects, AI is an active tool placed directly in the hands of volunteers and participants.

- The *City Layers* project asked school children to use generative AI (such as Gemini) to create visualisations of their suggested urban improvements, and the team is currently prototyping a conversational, AI-driven mapping tool.
- The integration of AI into everyday digital participation was highlighted by the *CollFacts* project - an initiative studying how the public navigates misinformation - which discovered that multi-generational participants, including 80-year-olds, were independently using AI to fact-check folk sayings during workshops.

Methodological Caution: Despite the utility of these digital tools, we also noted that several projects intentionally avoided or limited their use of AI due to ethical concerns. The reasons given by project teams included issues with data privacy risks and concerns that AI tools often pull from biased, outdated sources and fail to produce universally inclusive outputs.

BARRIERS TO RESPONSIBLE AI AND POSSIBLE SOLUTIONS

Despite promising pilots, better integration of AI and Citizen Science (CS) presents significant methodological and ethical hurdles that must be addressed to ensure these technologies serve the public good.

1. Low awareness of data bias and exclusion: A significant knowledge gap exists regarding how AI can perpetuate biases or exclude specific demographics, often due to pulling from outdated or non-inclusive sources. To mitigate this, practitioners should prioritise the creation of participatory datasets through open, community-led infrastructures. This would help ensure that training data is more representative of diverse linguistic, cultural, and geographic contexts and help to raise awareness about the limitations of these tools.

2. Lack of transparency in AI systems: The 'black box' nature of many AI technologies can erode social trust and hinder democratic legitimacy particularly if models are used to provide analysis within projects that have significant public interest or social impact. To address this opacity, dedicated EU programs should be established to support the development of open-source models. More emphasis on algorithmic accountability for funded projects could further ensure that the logic behind AI-driven decisions remains visible to the public

3. Skill and literacy gaps: There is a documented need for increased capacity among both the researchers deploying these tools and the volunteers interacting with them. Funding should be directed toward training on AI literacy and participatory data practices for citizen scientists. Established European citizen science networks such as the European Citizen Science Association (ECSA) should invest in developing these resources to build cross-sectoral capability and foster a culture of responsible innovation.

4. Ethical and legal uncertainties: The integration of AI into data-driven research often outpaces current regulatory clarity, leading to concerns regarding data privacy and consent. Establishing formal EU guidelines for participatory data ethics and consent management would provide the necessary safeguards for citizen rights. Furthermore, adopting participatory governance models, like the Nesta's Public AI Task Force, can help projects navigate these complexities while enhancing ethical compliance.

NEXT STEPS: RECOMMENDATIONS

For EU and National Funders

- Mainstream AI and citizen science integration: Embed AI-enabled citizen science in Horizon Europe, Digital Europe, and the New European Bauhaus. Create funding calls specifically linking AI ethics and participatory governance.
- Invest in data equity: Fund participatory dataset creation and community-led data stewardship projects, prioritising linguistic, cultural, and geographic diversity to help make these projects open source and freely accessible.
- Support open and explainable AI: Mandate transparency and algorithmic accountability for AI systems funded through EU research programmes. Open these up for research through citizen science based approaches.

For Institutions using AI and CS

- Adopt Participatory AI governance: Establish citizen panels or advisory boards to oversee AI projects, enhancing legitimacy and compliance with ethical standards.
- Build skills and capacity: Develop tailored training for researchers and citizen scientists to understand the potential of AI tools and its risks to foster shared understanding and responsible innovation.

For Practitioners and Researchers

- Design for co-creation: Develop hybrid workflows which optimise for human and algorithmic complementarity. Involve volunteers and communities in decisions about how AI is integrated into the project.
- Document ethical impact: Evaluate AI+CS projects using metrics of social value, inclusion, and trust, not only efficiency or accuracy.
- Scale good practice: Share experiences, what works and what doesn't openly to accelerate replication across Europe's research and innovation ecosystem, working with established networks like ECSA.

PROJECT IDENTITY

Project Name	IMPETUS
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Acknowledgements	We are grateful to our CSIs for sharing their stories and our partners at T6 Ecosystems for reviewing this policy brief.
Citation	*European Policy Brief: AI and Citizen Science: Building trust, transparency and hybrid Intelligence*. Baeck, P., Berditchevskaia, A. and Albert, A. (2026)

CITIZEN SCIENCE IN THE ARTS & HUMANITIES

Citizen Science in the Arts & Humanities

INTRODUCTION

Arts-based citizen science can be a powerful tool for engaging citizens not just as data contributors but as co-creators of knowledge and culture. By leveraging arts-based practices such as visual, performative, embodied practices, Arts & Humanities Citizen Science (A&H CS) can help reach groups often marginalised by conventional research and generate new forms of insight rooted in lived experience.

This brief explores what A&H CS is and the potential benefits or added value it brings to citizen science, providing illustrative case studies. As a nascent field within citizen science, there is still some way to go to unlock the full potential of arts-based practices for citizen science within the European research, cultural and innovation policy. Our recommendations are aimed at helping institutions to make use of these approaches more effectively in the years to come.

WHAT IS ARTS & HUMANITIES CITIZEN SCIENCE?

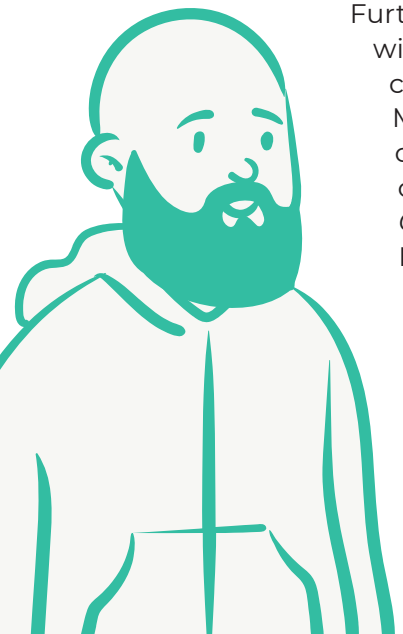
A&H can broadly be defined as collaborative knowledge production using citizen science with and through art. It combines methods from the arts and humanities with citizen participation and adheres to the core principles of citizen science while broadening the knowledge base to include:

◆ Tacit and embodied knowledge such as memory, sensory perception, performance is used to enhance data collection on a given topic. For example, community participants might use sound walks, storytelling, or performative re-enactments to capture how local histories are felt, remembered, and experienced in place.

◆ Participatory art initiatives such as photography, theatre, sound mapping, visual design. For example, citizens might co-create photo exhibitions documenting environmental change, produce site-specific theatre exploring local narratives, or generate sound maps capturing the acoustic landscape of their neighbourhood.

◆ Co-curation and co-design such as citizens as active shapers of heritage interpretation and governance. For example, community members might collaboratively design museum exhibits, curate local archives, or participate in decision-making around the preservation of cultural landmarks using citizen science data.

The *COSEA initiative* illustrates these different dimensions. The project mobilises coastal communities to collect seaweed specimens and create art-based herbarium specimens that are simultaneously authenticated as cultural artifacts and digitally anchored to their exact geographical collection location. It embraced arts-methods and co-creation of what it calls Seaweed Poetry, where citizens write an 11-word poem based on a specimen and their emotions about the ocean. This helps transform a subjective, sensory experience into formally documented data.



Furthermore, the growing interest in and experimentation with A&H CS is part of a wider movement using arts-based approaches to shift and expand the methodological toolkit for how people are involved in decision making on issues that matter. Methods such as legislative theatre which uses interactive theatre shows where community members act out solutions to situations of oppression, then work with officials to transform them into new laws or changes to existing laws. For example, *Greater Manchester Legislative Theatre* in 2020 was used to co-create the city's Homelessness Prevention Strategy 2021-2026.

By embracing diverse methodologies, A&H CS enhances methodological inclusivity and strengthens accountability, aligning directly with EU objectives for socially just and inclusive transitions.

THE BENFITS OF ARTS & HUMANITIES CITIZEN SCIENCE

Europe faces urgent challenges of declining trust in democratic institutions, growing social fragmentation, and the demands of a just, green and digital transition. Conventional top-down research frameworks alone cannot deliver the local legitimacy and public trust required to mobilise collective action. Within the broader opportunities in citizen science, A&H CS provides a particular opportunity to restore trust, empower inclusive participation, and integrate diverse cultural and intellectual perspectives into decision making.

Arts & Humanities CS is grounded in the fundamental participatory values and approaches of citizen science, but it also explores how to both apply these approaches in arts and humanities projects or enhance traditional environmental/natural sciences-based CS through arts-based methods that prioritise co-creation, dialogue, and trust. If done well it can lead to several different types of impact, including operational, efficiencies, social inclusion and resilience. These benefits can be understood through three broad models.

Mural by Pilar Alonso located at the "Senda Verde"/ old train station in Chapela (Pontevedra), Spain. Photo taken by Diego B.

Contributory models – efficiency and scale

Contributory A&H CS projects enable cultural and research institutions to unlock large volumes of data quickly and cost-effectively, while engaging wide volunteer networks. They are particularly effective for digitisation, transcription and classification tasks that would otherwise require significant institutional resources.

- *Birmingham Museums Trust Documentation Detectives* project helped transcribe over 60,000 archival records in one year by 2,700+ volunteers using the Zooniverse platform.
- *Senses of Stories* is a project run by universities in Canada and Europe to uncover how writers use sensory language to create immersive experiences. It is supported by 1,650+ volunteers using the Zooniverse platform.

Participatory models – inclusion and trust

Participatory approaches build mutual learning and strengthen the relationships between institutions and local communities through involving citizens in the design, analysis and this, they generate richer, more contextual knowledge and can contribute towards fostering long-term trust. Examples of this include:

- *National Maritime Museum's (NMM) Sea People Gallery:* This project undertook co-curation with under-represented communities which led to permanent gallery artworks and institutional reforms embedding co-creation in future exhibitions. As part of the development of four new galleries, the NMM incorporated extensive community consultation and co-curation into the development of its "Sea Things" gallery. One project, Sea People, involved working with underrepresented communities, local schools, colleges, and community groups to create new artworks for the gallery.
- *Serpentine Gallery's Choral Data Trust:* This project engaged 14 choirs across the UK to create a choral dataset which was used to train an AI voice model central to the art exhibition. Alongside contributing to data collection, the choirs were invited to take part in a collective data governance experiment, where they decided the rules for future sharing and re-use of the data.

Transformative models – systemic change

Transformative models engage citizens throughout the full research cycle, enabling them to both identify challenges and opportunities using CS based methods, but also use these insights to develop projects that

generate change and impact on their own communities. These projects can help institutions reform and change their practices, empower marginalised groups and generate sustainable solutions to complex societal challenges (see Case Study: Oeiras Experimenta Living Lab). An example of a transformative programme is:

◆ *PartArt4OW:* A European project deploying cascade funding supporting participatory art & science initiatives across Europe that build emotional connection to oceans and mobilise collective action on water sustainability.

IMPETUS CASE STUDY: OEIRAS EXPERIMENTA LIVING LAB

Topic: Sustainable Food Systems, Resource Management

Country: Portugal

Communities engaged: More than 2,000 local people from diverse generations and social backgrounds through participatory visits, public events, and collaborative activities.

What they did: This citizen science initiative focused on researching and promoting climate-resilient crops adapted to drought and changing environmental conditions, such as grass pea, sorghum, millets, cereal hybrids, and dryland rice. Implemented through a partnership between ITQB NOVA and the Oeiras Municipality under the Ciência + Cidadã Program, the project brought together scientists, citizens, policymakers, artists, chefs, and local organisations to co-create sustainable and inclusive food systems. Citizen scientists actively participated across research tasks, from sowing and harvesting crops to field maintenance, data collection, protocol improvement, and decision-making, strengthening the social relevance of scientific research. By providing a range of creative and social activities alongside the Living Lab, the project established deeper connections with local residents and gained visibility across a range of forums, ultimately attracting interest from media and decision makers.

Focus on arts and creativity: The Oeiras team undertook a range of creative cooking activities to contextualise the relevance of sustainable food systems to people's daily lives. Researchers and citizen scientists collaborated in the co-creation of sustainable recipes and showcased the ingredients (gathered through the activities of the Living Lab) through culinary workshops at public events.

Systemic benefits – policy durability and transdisciplinarity.

By creating open spaces for dialogue, A&H CS can strengthen the perceived legitimacy of knowledge and improve the durability of policies built on it. It also integrates diverse knowledge forms, tacit, embodied, sensory and scientific, helping policymakers address complex transitions with a more comprehensive evidence base. Arts-based approaches can offer more accessible means to engage the public in complex public and societal challenges. This may be particularly important for working with vulnerable communities or young people (see Case Study: Nature in our Hands).

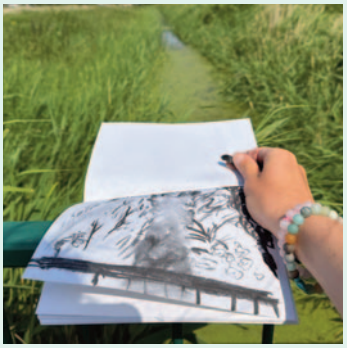
IMPETUS CASE STUDY: NATURE IN OUR HANDS

Topic: Biodiversity, Public Trust, Education and Empowerment

Country: United Kingdom

Communities engaged: The project brought together 649 primary school students, 98 staff, 5 local environmental groups/individuals, 2 local creatives /groups, 3 academic researchers as well as local and national policy makers and education professionals.

What they did: The Nature in Our Hands project engaged young learners in environmental stewardship through citizen science. It facilitated students to observe, record, and interpret biodiversity data within their local ecosystems, fostering both scientific literacy and a sense of responsibility for nature. The sessions have not only weaved in elements of the Key Stage 1 and 2 English National Curriculum across Science (Identifying plants and animals, habitats and working scientifically), Geography (Local ecosystems, observation skills and map use), Art and Design (creative expression to represent observations), but cover cross curricular topics such as Citizenship (developing responsibility for the environment) and encouraged critical thinking, collaboration, communication and STEM integration with real-world application. As a result of their creative awareness raising and cohesion building activities within the local community, representatives from the local council are exploring legal arrangements to secure the future of West Rise Marsh under the new East Sussex Unitary Council structure, ensuring long-term protection of this green space.



Focus on arts and creativity: To foster more engaging and deeper connections with the local environment for the young people involved, the project involved students in producing different creative outputs including posters, papier mache sculptures and drawings. Overall, 1214 creative pieces were produced by students during the project.

GROWING A NASCENT FIELD

The intersection of arts, culture, and citizen science is a nascent field with significant potential, but its systematic adoption is hampered by institutional inertia, lack of collaboration and experimentation and policy criteria developed primarily for quantifiable hard scientific research. To accelerate the integration of A&H CS into the European Research Area (ERA), policy must focus on creating the structural conditions necessary for greater experimentation and validation of non-traditional knowledge outputs.

1. Judging value beyond traditional science metrics

A significant barrier to integrating Arts & Humanities Citizen Science is the conflict between the evidence generated and the way traditional science is often judged by funding bodies. Reproducibility and quantifiable data are standards which are, in many cases, ill-suited for creative projects that rely on cultural or social outputs.

Because artistic and performative projects are sensory input, or lived experience), they are at risk of being excluded when evaluation criteria demand primarily numerical data forms or hard evidence. This creates a validation/assessment challenge, where the social, democratic, and trust-building value generated by A&H CS cannot be officially captured or legitimised by policy. Likewise artists and creative practitioners could benefit from the more systematised methods of measuring and reporting impact that have been developed within the citizen science community.

To overcome this, there should be wider recognition of more comprehensive assessment frameworks that also emphasise social impact. This requires funding bodies to attribute value to alternative success metrics, for example: participatory validity (the extent of stakeholder involvement), empathic validity (the degree to which mutual understanding and trust increased), and most critically, catalytic validity (how useful the research was in presenting new possibilities for social action). By adopting these broader evaluation methods and funding tools to document social impact, policy can ensure that research quality, such as that done by A&H CS initiatives, is judged by its ability to foster real-world social and policy change, rather than scientific publication counts alone.

2. Strategic support for experimentation and collaboration

As a new field, A&H CS requires focused policy mechanisms to foster interdisciplinary collaboration and overcome fragmented resources and expertise.

◆ **Mandate collaborative formats:** funding instruments should explicitly mandate and resource the integration of the S+T+ARTS approach, in relevant funding calls and other EU initiatives. This could ensure that artistic and cultural methodologies are viewed as essential R&I drivers, not just outreach.

◆ **Leverage Creative Europe:** utilise Creative Europe's Cooperation Projects (which offer high co-funding rates and support transnational collaboration) and mobility schemes (like Culture Moves Europe) to fund the community building, knowledge transfer, and rapid co-creation phases of A&H CS projects. This provides the flexible financial support necessary for experimentation and cross-border learning.

◆ **Incentivise and increase visibility of interdisciplinarity:** promote interdisciplinary co-creation through prizes and events like Ars Electronica. This can accelerate the transfer of expertise between artists, researchers, and citizens, as well as encouraging wider uptake of these approaches due to associated prestige.

RECOMMENDATIONS FOR INSTITUTIONS AND PRACTITIONERS

Systemic integration requires a coordinated effort, targeting financial structures, institutional culture, and practitioners.

EU/National Funders

◆ **Promote Arts&Humanities Citizen Science through existing funding schemes:** Embed A&H CS explicitly within instruments like the New European Bauhaus and Horizon Europe Cluster 2, which already fund projects connecting inclusion, design, and local democracy.

◆ **Clarify IPR and open licensing requirements:** Require that Creative Commons licensing (CC-BY) be a mandatory condition for all publicly funded A&C-CS data and co-created outputs. This could help ensure public reuse and the long-term legacy of institutional cultural data assets.

◆ **Fund methodological capacity:** Dedicate funding streams (e.g., through Coordination and Support Actions and cascade funding opportunities) to develop standardised training and tools that improve methodological awareness and establish communities of practice.

Cultural Institutions and Public Bodies

◆ **Shift to co-creative models:** Incentivise and resource the institutional transformation from viewing citizens merely as data transcribers (contributory models) to co-creators of cultural and research knowledge.

◆ **Streamline compensation:** Reform internal financial and procurement protocols to reduce the bureaucratic friction involved in compensating citizen participants (e.g., payment, travel reimbursement). This is vital to uphold Equity, Diversity, and Inclusion (EDI) principles and ensure participation is accessible to marginalized or low-income groups.

◆ **Leverage CS to build trust:** Position citizen science as a core component of institutional strategies aimed at strengthening accountability, transparency, and trustworthiness with local communities to reinforce democratic principles.

Practitioners and Researchers

◆ **Raise methodological awareness:** Actively adopt and promote the principles of participatory research, focusing on providing clear, concise project descriptions that emphasise volunteer benefits and actionable outcomes to increase recruitment and retention.

◆ **Document non-traditional outputs:** Systematically document and disseminate outputs generated through embodied and tacit knowledge processes, explicitly articulating how they meet catalytic and ethical validity criteria, thereby setting new standards for policy evaluation.

PROJECT IDENTITY

Project Name	IMPETUS
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Acknowledgements	We are grateful to our CSIs for sharing their stories and our partners at T6 Ecosystems for reviewing this policy brief.
Citation	*European Policy Brief: AI and Citizen Science: Building trust, transparency and hybrid Intelligence*. Baeck, P., Berditchevskaia, A. and Albert, A. (2026)

The IMPETUS project's legacy lives on in the initiatives we supported and the communities they inspire, which continue to make a meaningful difference. It has been a privilege to witness citizen science grow and flourish throughout the lifetime of this project.

We are deeply grateful to the citizen science community for their dedication and generosity, and to all those who entrusted their causes to us.

https://impetus4cs.eu

Funded by the European Union

IMPETUS is supporting our project. IMPETUS is funded by the European Union's Horizon Europe research and innovation programme under grant agreement number 101058677. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.