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Policy Brief

Citizen science and EU regulations – a new approach

AURORA, COMPAIR, GREENSCENT, I-CHANGE, ILIAD, SOCIO-BEE

Highlights

Citizen science offers a new and disruptive approach to support the policy goals of EU Directives and Regulations. It requires a new way of thinking from the European Commission in the way EU Law is drafted and in how regulators in Member States deliver their legal obligations.

The European Union is now a global leader in research into how citizen science can support the delivery of EU policy. To build on that leadership and harness the power of citizen science in the delivery of EU policy will require a shift in thinking by current DG policy leads.

Citizen science and crowd sourcing can accelerate the delivery of key EU policies that are addressing critical societal need. To make it happen requires action in the policy DGs supported by senior management, that will allow current citizen science methods to be scaled up within a common European framework from local to national and European programmes.

Summary

This policy brief outlines the opportunity available to the European Commission, The Council of the European Union and the European Parliament, to scale up and integrate proven citizen science research outputs into new implementation mechanisms for EU Environmental Law. It proposes a route map that would support this process and suggests a review of existing and proposed EU Environmental law to ensure that the opportunity is fully exploited. The brief also outlines the cost and data benefits for such an approach and indicates why involving citizens is likely to accelerate behaviour change in support of EU Environmental Policy.

What is Citizen Science?

Citizen science is the public participating 'in scientific research activities when citizens actively contribute to science either with their intellectual effort or surrounding knowledge or with their tools and resources' (European Commission, 2014)

Background

For the first time in our history, we have the technology to **interact with citizens** across the European Union and encourage them to **participate** in scientific research. The data generated by the citizen can be used and presented back to citizens as information that can be used to:

- (i) reduce health risks;
- (ii) improve economic well-being;
- (iii) improve quality of life;
- (iv) support personal decision-making.

Citizen-generated data can and should be added to official data sets held by National Statistical Offices to monitor the effectiveness of European Legislation at local, national and European level. Evidence is building from around the world that **between 10-15%** of the European population, some 67 million people can be encouraged to engage in citizen science when useful information is returned that has a direct benefit to an individual.¹

The first European Citizen Science Association was launched by the EU Environment Commissioner Janez Potočnik at EU Green Week 2013², in which the potential of **citizen science** to engage EU public authorities and support them in **implementing environmental regulation** was outlined³. Since then, a range of studies have supported the idea that citizen science should be a **fundamental part of EU research**, data gathering, and legislative policy formulation and delivery^{4,5,6}. The role of citizen science has been recognised by the EU Commission as a way to **improve compliance and governance**⁷ and environmental reporting⁸. The current Green Deal Programme Knowledge and Citizen Science cluster in the Horizon 2020 Research Programme is the latest example, **testing and piloting citizen research** projects tackling climate change, biodiversity loss and pollution.

The **Single Use Plastics Directive** was the first example where citizen science data provided much of the evidence on which the Directive was based. In other policy areas citizen science is not included in the legislation and a framework to encourage the uptake of this approach by national regulators responsible for implementation of EU legislation does not exist.

Gaps and needs

Virtually no agreed EU-wide methodologies are in place to support large scale citizen science programmes that could provide citizen science data for environmental reporting in support of EU Directives, despite recognition that the opportunity exists to substantially increase the granularity of data points, and cost effectiveness of environmental reporting by adopting citizen science techniques.

In fact, the scaling up of citizen science pilots to support implementation of EU legislation remains very difficult. Despite, for example, numerous EU-funded citizen science air quality pilots, only 1 EU Member State has integrated citizen science into its national air quality monitoring programmes⁹. This despite recognition by the European Environment Agency that such an approach can deliver ‘sound results when correctly used’¹⁰.

There is no review process of the pilot citizen science research programmes, to identify those that will support EU legislation. A support package of recommended and proven citizen science techniques, tools, data systems and skills training programmes are still required before regulators will test these new approaches, which are disruptive of established ‘top down’ regulation. This not just an issue for the EU but has also been recognised as an issue by UNEP seeking to fill data gaps in the reporting of the

SDGs¹¹. It is also being recognised in the drafting of Multi-Lateral Environmental Agreements (MEAs) and for the first time we see citizen science included in a global agreement¹².

This policy paper explores how the existing citizen science research pilots contained in the EU Green Deal Knowledge and Citizen Science Working Group of the Green Deal Projects Support Office could be used to pioneer a pathway for future citizen science research outputs to be scaled up, and integrated into supporting EU legislative policy objectives in the fields of climate change, biodiversity and pollution.

It calls for **an EU Committee of Experts on Citizen Science (EU-CESC) to consider and recommend:**

- Which EU Regulations would benefit from citizen science programmes.
- Citizen science pilots suitable for scaling up to support Member States in the delivery of EU Environmental Directives.
- The development of a supportive skills framework to ensure that citizen science becomes part of the EU legislative approach.

To support these arguments, examples are outlined below that illustrate how the current group of citizen projects funded by the EU Horizon 2020 research programme could support EU Directives if they were integrated into implementation programmes at scale across the European Union.

Key findings from current projects

The following six projects are a sample of EU-funded research that illustrate the value of citizen science research to EU Directives. They include:

- **Pollution monitoring** – [COMPAIR](#) & [SOCIO-BEE](#)
- these two projects illustrate how citizen science can support the implementation of EU Directives tackling pollution at city and regional levels and contribute to tackling climate change and air quality issues. See the [final event video](#).
- **Climate change adaptation** – [I-CHANGE](#)
- shows how citizen science is critical to support the EU Climate Action Plan to be climate-neutral by 2050 and to adapt to the in-built global warming pressures now affecting Europe.
- **Climate change mitigation** – [AURORA](#)
- highlights how citizen science is critical to support the EU Climate Action Plan to be climate-neutral by 2050 and to adapt to the in-built global warming pressures now affecting Europe.
- **Digital twins of the ocean, adding citizen data** - [ILIAD](#)
- serves as an example of how citizen science can support the blue economy, the EU's Green Deal and Digital Strategy as well as the UN Ocean Decade's outcomes and Sustainable Development Goals.
- **Competency framework for citizen engagement in the Green Deal** – [GREENSCENT](#)
- outlines a competency framework that could be adopted to strengthen citizen science programmes across Europe to support the EU Green Deal.

These six projects are used to illustrate why an EU Committee of Experts is needed to consider and recommend how and which successful citizen science projects could be scaled up to support the EU regulatory policy agenda.

The current EU-funded citizen science research projects listed above are in themselves time-limited pilots that are too small to support EU-wide legislative programmes. They could however be scaled up to become an integral part of EU and Member State [implementation](#) programmes. They are bottom-up participatory citizen programmes designed to complement the traditional top-down command and control legislative programmes that dominate EU Regulatory Policy. Such programmes require different skill sets from National Regulators and EU policymakers. They have the power to accelerate the delivery of EU regulatory policy, change community behaviour and deliver core data sets in a cost-effective way that will track progress at a pace and data density that cannot be achieved by conventional approaches.

It is clear that the people who understand the impact of air pollution best are those citizens most affected by it and see the health benefits from tackling it. They can and should be at the heart of programmes to monitor the scale of the problem. The same arguments are true as we seek to mitigate climate change. Citizens make daily decisions that produce up to 30% of all carbon emissions from the way they heat and power their homes and from the transport decisions they take on a daily basis. Engaging citizens in collecting data on these issues is the first step towards the behaviour changes that must follow if the legislative targets in both policy areas are to be met.

Currently citizen science pilots funded by the **EU have no route map that allows an easy transition that would allow them to grow into European scale programmes that could and should support EU Directives.**

The EU has a global lead in citizen science and is already exploring how citizens can make a major contribution and accelerate the net zero carbon ambitions of the Green Deal through the EU Climate Pact. A framework is, however, needed that can be applied by all Member States that would facilitate national regulators to engage citizens through citizen science in support of the delivery of key EU Environmental Goals.

Such a framework was set up in the USA under President Obama, (see the John Holdren Memorandum for the Heads of Executive Departments and Agencies).¹³ This document also highlighted the considerable financial benefit of such an approach to the US and led to the adoption of the Crowd Sourcing and Citizen Science Act¹⁴.

Policy recommendations

Citizen science and crowdsourcing projects engage the public in addressing societal needs and accelerating science, technology, and innovation. Such projects can have significant economic value and can support and accelerate regulatory policy and EU objectives.

To ensure these benefits are delivered, the European Commission with the support of the European Parliament and The Council of the European Union **is recommended to:**

- 1. Set up a high-level EU Committee of Experts on Citizen Science (EU-CESC) to consider and recommend:**
 - a. Which EU Regulations would benefit from supporting citizen science programmes;
 - b. Citizen science pilots suitable for scaling up to support Member States in the delivery of EU Environmental Directives such as AURORA for climate change mitigation, PSLifestyle

- for climate change adaptation, COMPAIR and SOCIO-BEE for pollution monitoring, and ILIAD for the blue economy;
- c. A supportive skills framework for the EU Directorates General (DG) policymakers, building on project GreenSCENT, to ensure that citizen science becomes part of the EU legislative approach; and
 - d. An annual report on the value of citizen science to the European Commission, the European Parliament and the Council of the European Union.

2. Ensure all Directorates – General (DGs):

- a. Identify a coordinator to promote citizen science in the work of the DG, catalogue key projects, build capacity and skills, share best practices and promote citizen science as a key part of the implementation strategy for future and existing EU legislation;
- b. Identify and amend existing EU legislation where it acts as a barrier to citizen science programmes; and
- c. Annually report to the high-level committee on the value of citizen science to the work of the DG.

3. Review existing and future international agreements such as MEAs and COPs to identify where the EU could champion citizen science as part of implementation strategies, such as that adopted for the Kunming Montreal Framework for Biodiversity¹⁵.

Further details on the current batch of EU-funded citizen science projects and their potential benefits to policy delivery, citizen engagement and skills frameworks are listed in **Appendix 1**.

Appendix 2 provides an example from project AURORA to illustrate how the drafting of current legislation can inhibit citizen science programmes. Examples are given from GreenSCENT on how to develop and test a competency framework for citizen scientists and as an example of the need for a skills framework for DG Policy leaders.

Conclusions

Citizen science can improve the delivery of EU Law. To do so requires a fundamental shift in how EU law is drafted and implemented. This policy brief recommends a way forward in how the considerable investment in citizen science research can be harnessed for that purpose.

Appendix 1 – Examples of current Citizen Science Programmes that can support EU Regulations

1. Embedding citizen science in the local policy context for greater uptake and impact (COMPAIR)

Public authorities are more willing to use citizen science if it is made clear to them at the start of the project how the collected results can support their work. By talking to policymakers and asking, ‘What can we do for the city?’ COMPAIR was able to co-design policy-relevant citizen science experiments that directly addressed local needs:

- In the Flemish cities, the results helped to evaluate environmental and safety impacts of a school street (Herzele) and a new cycling bridge (Sint-Niklaas).
- In Berlin, the impact of redevelopment activities in Kiezblocks.
- In Athens, the implementation of the capital’s 2030 climate resilience plan.
- In Sofia, the performance of a new school bus route.
- In Plovdiv, the relationship between road traffic and air pollution was investigated in two school areas to raise awareness of the issue, along with the seasonal variation in particulate matter (PM10).

In addition to policy impact, the results have encouraged volunteers and their social networks to switch to more sustainable lifestyles. In Sofia, for example, many parents stopped driving kids to school and started using the municipality’s bus instead.

2. GreenSCENT project findings

GreenSCENT’s main objective is to contribute to operationalising the European sustainability competence framework (GreenComp) developed by the JRC. GreenComp is a reference framework for sustainability competences. It provides a common ground for learners and guidance to educators, advancing a consensual definition of what sustainability as a competence entails.

GreenSCENT aims at involving different target groups (experts, teachers, students, and citizens) to both receive continuous feedback on the GreenSCENT competence framework toward its finalisation in the last phase of the project, and to test and validate it on the field through education and ‘beyond-education’ activities. The participatory design methodology aims to create a collaborative and inclusive environment where stakeholders can contribute to the development of the competence framework and its implementation, ultimately take ownership and ensure its sustainability.

GreenSCENT’s approach is based on several assumptions, starting from the need of a shared understanding of the EU Green Deal principles among EU (and non-EU) population as a necessary condition for its actual successful implementation; to the consideration that active participation, experimentation, discussion and collaboration are more effective than traditional learning approaches for impacting on people’s beliefs; to the focus on young citizens as a driver for change for themselves and others they are in contact with.

3. ILIAD

The Iliad project has a dedicated work package focused on ‘Citizen engagement & integration of data from citizen science’. Its key aims are to explore how citizen science can contribute to creating Digital Twins of the Ocean (DTOs), and to demonstrate how citizens and society can benefit from and engage with DTOs.

Most of the activities in this work package directly support citizen science and engagement within the Iliad pilot DTOs, providing support for both social (engagement, training) and technical (semantics, interoperability) aspects.

Specific deliverables have been prepared tackling many issues that have been identified. In one of those deliverables, it presents a training plan, materials, and sessions, mapping and addressing citizen needs across stakeholder groups to ensure effective use of project outputs. The Iliad manuals for pilot data collection highlight the project's importance and the regional need for enhanced ocean literacy. Best practices for in-person and remote citizen training were identified and reported, including citizen science needs (scientific and operational), project mission and relevance, training materials and user guides, reporting procedures, data management plan, and development of innovative forecasting tools.

In the first year of the project Iliad had prepared a semantic framework. In the second year based on user feedback, a new feature was added to help track changes in the co-created ontologies, including a colour scheme and annotated comments. Additionally, in this period two citizen science apps were developed: ICC (I See Sea) for collecting data on hazardous events, and 'Lemon', an Android app for risk assessment of non-native harmful organisms in shellfisheries due to ballast water pathways.

4. Climate change and citizen science – project AURORA

Project AURORA has set out to prove citizen science can be used as a key tool in both the energy transition and in reducing personal carbon emissions. In the developed world roughly 30% of all carbon emissions result from decisions that citizens make in the way they heat and power their accommodation and from the transport decisions they make. Experience suggests that roughly 15% of the population are prepared to take part in citizen science programmes, which can deliver data and change faster and at lower unit cost than conventional central-based top-down programmes on climate change.

The project is targeted at universities as centres for learning and innovation, as they can play a relevant role in serving as education hubs for citizens in energy, promoting individual and collective behavioural changes among community members. By collaborating with their own communities on the energy transition, universities can become more sustainable while providing first hand experiences that can trigger new attitudes in their students and employees. Four public universities in Aarhus, Évora, Ljubljana, and Madrid have been challenged to explore the avenues for turning this vision into reality.

In addition, universities can reach out and work with their surrounding municipalities to test these ideas further with their local communities. In the project, this is taking place in Madrid and Évora, whilst in the Forest of Dean in the UK a municipality is itself providing this leadership.

The AURORA project has developed a citizen science energy tracker app to provide participants with a way to track and peer-review their carbon emissions. It will provide them with personalised guidance on how those emissions can be reduced and benchmark their performance against a carbon labelling scheme that illustrates where they stand in efforts to decarbonise modern life. Uniquely the project is linking the work of energy communities to the app, so that investments made in renewable community energy programmes can be offset against their carbon emissions.

The exploitation plan is set to target the growth of the programme across the European university and municipality sectors and is keying into programmes such as Net Zero Cities and the EU Climate Pact. Beyond Europe, the project is exploring whether it can become the basis for a global citizen science programme mitigating climate change emissions and has engaged with the Global Covenant of Mayors, C40 Cities and the United Nations Science Policy Business Forum (UNSPBF) to explore these ideas.

5. SOCIO-BEE

SOCIO-BEE aims to encourage participants to take an active role to tackle climate change and air pollution through citizen science, using emerging technologies such as drones and wearables.

The SOCIO-BEE project is collecting high-resolution air quality data through opportunistic sensing to ensure replicability. The project believes that citizens, policymakers, voluntary sectors, and businesses all have a role to play as stewards of air pollution reduction policies.

- After the first successful pilots the project has proved the core SOCIO-BEE technology works effectively (mobile app, web app, backend and Wearable Sensor Device).
- The citizen engagement proposition (and the beehive metaphor) works; volunteers could be found, recruited and showed considerable enthusiasm for the project.
- The citizen science loop must be fully closed to maintain engagement i.e. the citizen scientists must have full access to their data and receive information about the level of pollution detected. This is vital to drive behavioural change and actionable next steps.

Appendix 2 – Detailed policy recommendations

1. GreenSCENT – The development of a competency framework

Introduction

The GreenSCENT Competency framework has been developed as a structure describing competences, knowledge, skills and attitudes that citizens must possess in order to perform a task or understand a set of information, skills required for citizen science projects. The framework concerns all the elements needed by European citizens to understand the eight areas of the Green Deal: climate change, clean energy, circular economy, green buildings, smart mobility, from farm to fork, biodiversity and zero-pollution. It is suggested that a similar competency framework is needed for DG policy leads if citizen science is to be effectively integrated into EU Law.

Coupled together, such competency frameworks would ensure that DG policy leads drafting citizen science into EU Law and citizens seeking to support the implementation of the Law would be aligned. The work of GREENSCENT has started this process for citizens but work is still required on what the competency framework would look like for DG policy leads.

Competency Framework for Citizens

GreenSCENT's concrete steps related to policy recommendation are two-fold in the direction of: citizen science and co-creation. The baseline of the project contribution is toward 'citizen engagement' or 'beyond education' with two concrete representations: the 'Youth Assemblies' and the 'Open Innovation Challenges'.

Youth Assemblies, organised in four panels of 14 members, coming from seven different countries, in the 15-25 age range, served as a design and discussion panel for both contents and technologies in GreenSCENT. They were introduced and provided feedback on the Competence Framework, the Knowledge Graph, the GreenVerse platform, the AR/Gamified mobile app, the CleanAir@School app and in several assemblies implemented in the first 18 months of the project.

The first Open Innovation Challenge, which involved hundreds of young citizens in Europe and beyond in developing project ideas on the ‘sustainable food’ production, packaging, distribution processes, implementing the ‘From farm to fork’ set of competences beyond education contexts, and a lighter version of the Competence Questionnaire protocol.

In the end a final policy recommendation is related to the development of a format for skill cards and certification that is the foundation for the European Certification for Climate and Environmental Literacy (ECCEL) certification which foresees the deep review of the eight sub-competence frameworks developed (one per competence area), both in terms of summarisation/simplification, and in terms of compliance to Bloom’s Taxonomy verbs and standards. The mentioned certification foresees various levels of proficiency, from school kids to adult EU citizens with a possibility to be also used beyond European boundaries (i.e. MENA countries).

2. AURORA – An example of legislation blocking citizen science programmes

Within Europe the AURORA project has discovered an unexpected policy blockage that is preventing three of the pilot universities from developing and implementing Citizen Energy Communities (CECs). Two pieces of EU Legislation designed to encourage the development of Renewable Energy Communities and Citizen Energy Communities are at the heart of this unexpected legal barrier.

Directive (EU) 2018/2001, on the promotion of the use of energy from renewable sources—known as Renewable Energy Directive II (RED II)—which develops the framework for Renewable Energy Communities (RECs),^[3] and Directive (EU) 2019/944 on common rules for the internal market for electricity, which develops the framework for CECs. The EU Legislation put in place to foster the development of Energy Communities is drafted in such a way as to exclude Universities from becoming CECs. Both laws assume public participation will be through local authorities including municipalities. Universities are administered through National and Regional Government and are not therefore local authorities as defined in the legislation and in the view of legal advisors to the participating Universities are not provided for in this legislation.

This lack of clarity needs to be challenged and corrected as an urgent policy change. Full details of the arguments have now been [published as a research article](#). Also see [The Term ‘Local Authority’ in the European Charter of Local-Self Government](#).

References

References may include sources used throughout the policy brief as well as further readings on the topic or the research carried out (in that case, a split between consulted and recommended sources). Please follow the referencing style as shown below.

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² File Note – Early regulatory champions of the European Citizen Science Association included the following: Professor Jacqueline McGlade, then Chief Executive of the European Environment Agency; Professor James Curran, then Chief Executive Scottish Environment Protection Agency; Ninni Borén, Swedish Environmental Protection Agency; Richard Walmsley, and Martin Brocklehurst (former) Environment Agency, England and Wales, Meeting on the Development of the European Citizen Science Network, 16th November 2012, European Environment Agency, Copenhagen, Denmark.

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