Observing the Environment

Challenges & Opportunities in Citizen Science

Citizen Observatories – Conference Report
20 November 2019

LandSense
A Citizen Observatory and Innovation Marketplace for Land Use and Land Cover Monitoring

scent

groundtruth2.0
Environmental knowledge discovery of human sensed data

GROW OBSERVATORY

Introduction

The WeObserve project hosted a special event, "Observing the Environment: Challenges and Opportunities in Citizen Science", held on 9 Oct 2019 in Brussels in cooperation with the European Commission. It brought together four sister projects on Citizen Observatories (COs) for Environmental Monitoring, funded by H2020 and launched in 2016, and commission representatives working closely with citizen science initiatives. The participating CO projects (LandSense, GROW Observatory, Scent, and Ground Truth 2.0), which have either concluded their activities or are in their final year, showcased their achievements and shared best practices. The focus of the event was an exploration of the challenges facing COs to generate forward-looking solutions and recommendations that can help improve sustainability and increase impact for ongoing and future COs.

Programme and speakers

Links to the presentations can be found here.

https://www.weobserve.eu/the-cos-joint-event-took-place-on-9-10-2019-in-brussels/

- **Session 1**
  Welcome and Introductions
    Franz Immler – EC, EASME - B, Climate Action
    Steffen Fritz – WeObserve, LandSense
  Presentations
    Kim de Rijk – EC, DG Environment
    Dahlia Domian – WeObserve
    Uta Wehn – GroundTruth 2.0
    Drew Hemment – GROW Observatory
    Inian Moorthy – LandSense
    Valantis Tsiakos – Scent
- **Session 2**
  Break-out sessions
  Reporting back from the break-out sessions
- **Session 3**
  Presentations
    Sven Schade – JRC
    Marjan van Meerloo – EC, DG RTD
- **Session 4**
  Fishbowl discussion

Summary of the interactive sessions

The WeObserve project has identified three key challenges for mainstreaming COs that framed the interactive event discussions:

1. **AWARENESS** – Improving awareness of COs and citizen science activities
2. **ACCEPTABILITY** – Increasing quality and acceptability and showcasing the added value of COs
3. **SUSTAINABILITY** – Creating longer-term systems and transition processes that can sustain and scale up CO activities

Within the three key challenges, and based on their experiences in running COs, the attending project representatives presented obstacles facing COs. Following the presentations, in-depth discussion sessions further explored select obstacles and sought to formulate forward looking recommendations and solutions for the benefit of ongoing and future CO projects. A designated breakout group tackled each of the three challenges: Awareness, Acceptability, and Sustainability. Event participants were able to consecutively join two of the three topical discussion groups.

Main obstacles facing COs

AWARENESS

The following challenges were identified by CO practitioners:
- Onboarding participants and sustaining their engagement is a primary concern.
- The innovative nature of citizen observatories means few examples currently exist to demonstrate the potential value of COs to a community.
- Projects are not organizations; they involve individuals from multiple partner organizations. Therefore, building and sustaining community awareness and participation requires tremendous effort.
- COs are competing with mainstream advertising and entertainment for people's attention.
- Translating awareness into data contributions (in the case of mobile applications) is challenging.
- Multifaceted stakeholder reach is difficult but required.
- The co-design process is iterative and intensive. The journey requires significant commitment.
- Generating buy-in from public authorities involves overcoming resource shortages within city administrations.

ACCEPTABILITY

The following challenges were identified and discussed:

- Trust in data and services generated by COs remains a hurdle for data uptake.
- Preconceptions exist of CO data quality, validity, and relevance. Different stakeholders, even citizens, doubt the quality of the data collected and question decisions based upon it.
- Addressing privacy & traceability issues of citizen-based contributions – dealing with sensitive data.
- Changes in communication paradigm – establishing new interactions between stakeholders who may be sceptical of the process.
- Trust in the project – citizens and scientists have different and sometimes opposing requirements that influence their expectations of a project and their level of trust towards it.
- Scientific protocols can be incompatible with community level experiments.
- Technology readiness – low costs sensing is improving but issues arise requiring ongoing support; sustaining citizen observations while troubleshooting many technical issues

SUSTAINABILITY

The obstacles highlighted by CO experts and practitioners included:

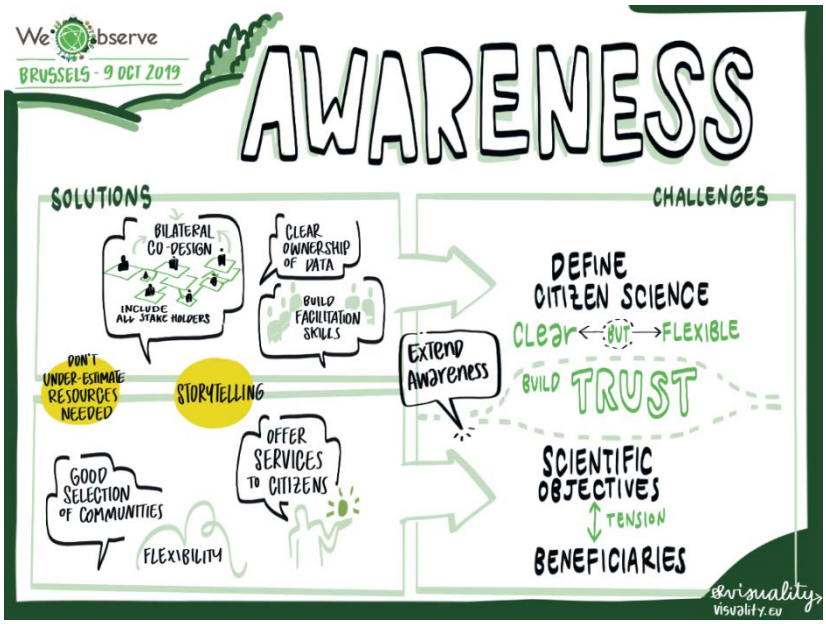
- The continuity of COs beyond the project lifetime is a major challenge.
- Creating mechanisms and partnerships for continuing project outputs (i.e. leverage NGOs with existing networks). The question of who will take the work forward is often a precondition for stakeholder participation.
- Community ownership – who will take the lead without compromising the CO purposes developed in the co-design process? What infrastructure, tools, and data skills does a community need to move forward?

- Delivering cost-effective solutions to data providers for SDG monitoring (i.e. untapped data sources to support custodian agencies).
- Modelling data types through different methods (e.g. moving sensors) requires novel standards and interfaces for harnessing the full potential of citizen generated data.
- A financial market is not established, therefore determining the real-world value of datasets when few users exist is challenging. This requires aligning the values of commercial exploitation with communities and volunteers, and linking with business model experts to create a sustainable CO.
- Environmental challenges exist in meeting inconsistent waste management standards when dealing with, for example, sensors in plastic packaging, e-waste, and recycling strategies.
- Technical sustainability includes the continuity of systems and services, data preservation and interoperability, low-cost sensor lifespans, and proprietary vs. open source, open data and design

Recommendations and best practices

AWARENESS: Recommendations

Two obstacles were further elaborated within the Awareness challenge in this discussion group:



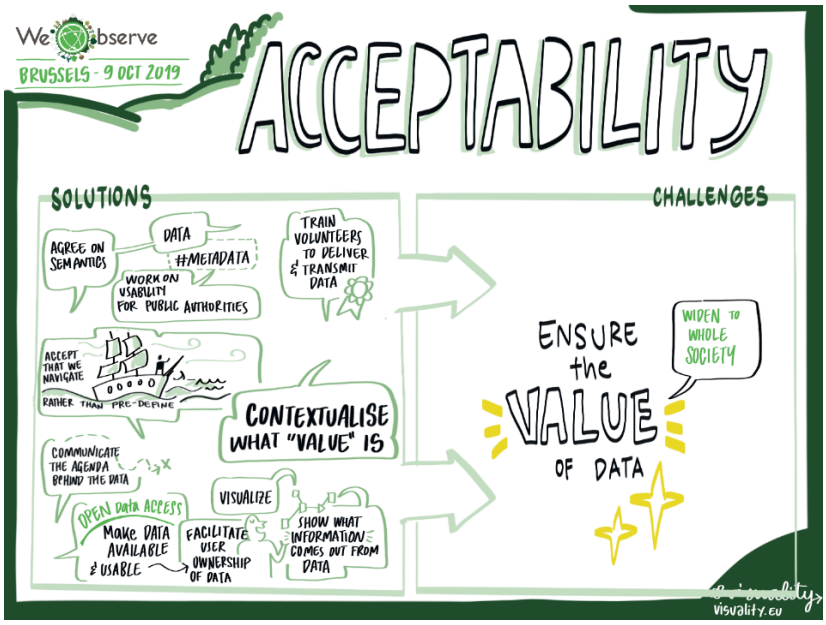
1. Tensions exists between sufficiently defining a citizen science initiative such that it becomes tangible and understandable to beneficiaries, while remaining flexible enough to allow for co-design. A lack of clarity discourages sustained citizen participation; however, an overly prescribed design undermines the co-design process. Since different stakeholders have different understandings of the CO requirements, the co-design is process should be not just between scientists and beneficiaries, but across all stakeholders.
2. The scientific objectives and research questions a CO seeks to address may not align with the interests of the beneficiaries. Attracting the right partners and choosing the right community is necessary but challenging, because it cannot be guaranteed from the outset.

Practitioners can take steps to address these concerns by carefully selecting communities and giving preference to those already engaged. Working with active communities is more likely to generate the success stories needed to attract other, less active communities, and scale up CO initiatives. Working with communities requires facilitation skills to translate and communicate information across stakeholders and create top down and bottom up links. However, practitioners tend to underestimate the resources needed for communication, co-design and facilitation skills. In their consortia and activities, therefore, practitioners should actively include facilitators, or partners with facilitation skills.

Good communication allows for more efficient co-creation processes and helps reinforce messages to citizens about the benefits and services the COs can offer. In addition, funders can support this by allowing for flexible work plans that may change as a result of co-creation efforts.

AWARENESS: Best practices
- **Creating data protection measures.** Trust issues can result from a lack of clarity and understanding of CO activities and objectives. Mitigate tensions through clear and simple protection measures (e.g. "your data is your data"). - **Using success stories.** Storytelling is a method to build trust by further clarifying CO objectives and making tangible the potential benefits to communities. - **Facilitating bilateral and all-stakeholder design discussions.** A bilateral co-design process helps to understand individual stakeholder needs. Discussions involving all-stakeholders help to address potentially contradictory needs. Multiple iterations of both methods increase transparency and facilitate cooperation among stakeholders. - **Linking to policy**. COs are not just about data collection and pushing technologies; they must link to policy. Awareness begins with the practitioners

ACCEPTABILITY: Recommendations



The question of data quality is central to the acceptability of citizen science data. The discussion within this group explored the meaning of data quality and sought to expand its implications beyond the scientific community and public authorities to a wider range of stakeholders. A conclusion was that a broader vocabulary is needed to acknowledge and navigate a wider spectrum of what quality might mean. A process should be established to adequately describe and define the purpose of any data, not only from scientific or community perspectives, but also to build alliances within a project and create a shared understanding of these alliances.

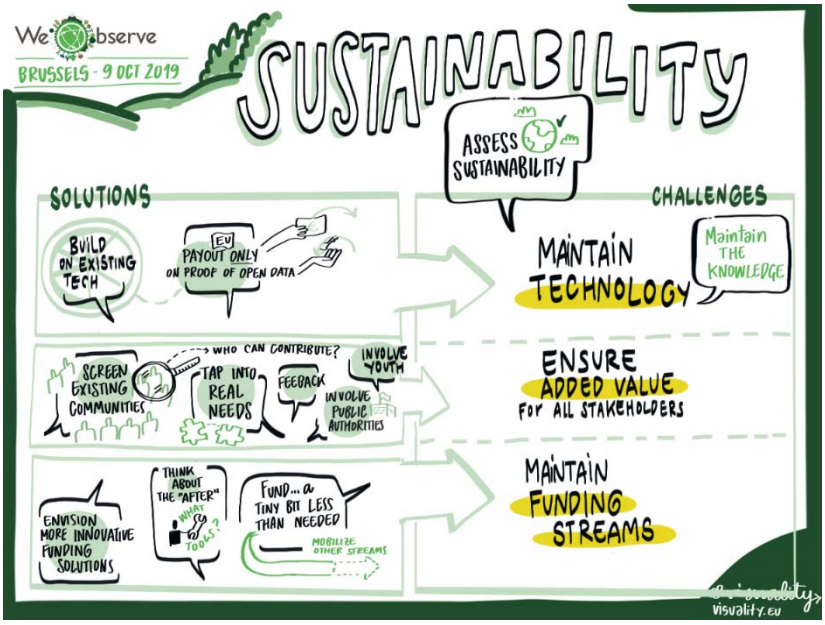
Data heterogeneity within citizen science should also be recognized and seen as an opportunity. This requires practitioners to move away from the need for clear data standards based on high scientific methodologies, and towards grasping the relevant contexts and diverse stakeholders the data is intended to serve. Discussions on data quality should therefore include the wider purposes for the collected data and allow for the development of semantics for data compilation. Related to this is the importance of elevating metadata such that citizen science data becomes more useful.

From the discussion within the Awareness group, wider societal recognition of the value of citizen science data and activities becomes an important challenge also for Acceptability. Citizen science data should not only serve scientific communities or policy makers, but also be a means to raise citizen science and COs as a methodology for wider societal acceptance. New projects engaging in EU calls should therefore plan their activities with an objective to elevate the field of citizen science and boost acceptability.

Finally, the group discussed the importance of open data access for acceptability, stressing that, while there is an obligation within EU projects to provide open access data sets, this should be an absolute core principle of such projects. Creating data access means allowing a broader audience to communicate and create insight from the data generated, rather than to privilege only select groups. Therefore, not only policy makers but a variety of stakeholders should be able to access, generate insights and create perhaps different meanings from the same data sets.

ACCEPTABILITY: Best practices
- **Implementing iterative co-design processes.** Creating value comes from understanding stakeholder needs and motivations, matching enabling technologies with identified needs, and addressing acceptability issues by bringing stakeholders together in an iterative process. - **Prioritizing CO community building.** Community building is as important as co-designing platforms and tools. It requires engaging existing communities and networks and involving decision makers from the start. - **Training users to gain trust.** Some data quality concerns can be addressed through training. For example, training users in the relevant tools to gain their trust and buy-in. - **Setting up a common open data policy.** For clear agreement on what data can be shared, when and how, setting up a common data policy across the observatory is necessary. - **Establishing data quality assurance measures.** It is important to establish citizen science data quality assurance measures that can be harmonized with traditional sources.

Sustainability: Recommendations



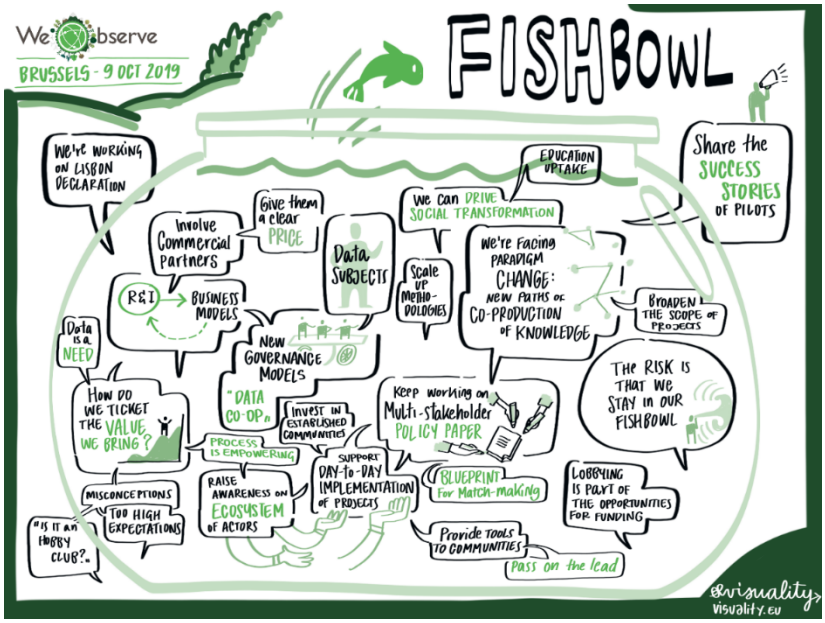
The discussion on sustainability began by establishing that knowledge gained within the current COs will be carried into future initiatives, and therefore already provides a basis for sustainability. Additionally, sustainability is strongly linked to demonstration; if practitioners can demonstrate the success of their CO or related activities, they are making strides towards sustainability. The discussion then explored key aspects related to sustainability: technology; added value, and resources, as well as environmental concerns.

Overlaps with Acceptability were immediately evident, especially related to technology, as data acceptability and usefulness are in some cases preconditions for sustainability. A resounding conclusion was the need to establish sustainability elements in the initial project design to guarantee some degree of sustainability in the future. Below are recommendations for each aspect discussed.

- *Technology:* Practitioners should build upon existing technologies and reuse what already exists. While this may be obvious, mobile applications constantly appear and disappear. Additionally, funders can help promote data flow within Europe by better enforcing open source data requirements. Data openness is only partially occurring in practice, since practitioners are not always willing to provide data freely. Funders could decide to distribute payments only once data has indeed been made free and open.
- *Added value:* The systems and facilitation processes set up to meet stakeholder needs must be maintained and build on existing communities. A challenge is to identify communities willing to engage with data and technology. A screening process with resources is needed to identify and maintain the right communities. Maintaining communities involves identifying champions who can drive the success of a project and involving institutions to connect to communities and develop an ecosystem of community driven observatories.
- *Resources:* Project funding is limited to a certain amount for a certain duration. There is a low probability that initiatives will be taken up after the project ends. Innovative funding streams exist or can be developed to carry forward the work of successful COs, such that they can be picked up and ultimately maintained by a public authority (e.g., cascading funding, post-project subcontracting for data maintenance and community facilitation). Involving public authorities can pose its own challenges as some prefer to restrict or even avoid citizen empowerment out of fear. COs funded with business partners have a better chance to develop their commercial potential. A commercial partner may be needed to turn CO efforts into tangible products or services beyond the project funding by maintaining and further developing the technology with a revenue model. A mixed model is needed whereby a proof of concept can be turned into a launchable business concept and funded by start-up, seed, or VC funding. In short, links and handovers to the next support mechanism are needed.
- *Environment:* Waste produced by COs (e.g., the packaging, distribution, and disposal of sensors) must be dealt with. Guidelines are need especially where country regulations are inconsistent. Grassroots communities want reassurances they will not be left with a substantial e-waste problem at the end.

SUSTAINABILITY: Best practices
- **Creating feedback loops.** Sustainability should be embedded from the start in the CO by creating value for all stakeholders through feedback loops in co-design. - **Demonstrating the CO.** Decision makers need to see the potential of COs. Demonstrating CO capabilities creates opportunities for collaboration and the re-use of data and platforms. - **Engaging the media.** The media tends to be interested in citizen science, and less so in science. Engaging media outlets leverages the appeal of citizen science. - **Transferring business models.** Handing over CO business model scenarios and roadmaps allows for continuity, so initiatives are not dropped at the end of the project. - **Serious gaming.** Citizen science data collection campaigns can be designed to empower, motivate, and engage citizens through serious gaming. - **Linking to GEOSS.** A connection between citizen science and GEOSS helps promote the uptake of resources at global scales.

Fishbowl Discussion



The fishbowl was a moderated, concluding conversation among the four CO representatives, the commission representatives and audience participants. The session began with a look at the extent to which the current COs have contributed to the mainstreaming of citizen science within the commission and its outlook. Citizen observation was acknowledged as one of the main sources of information alongside, for example, space-based observation, thereby securing its place in future funding programs. Opportunities may also exist for CO components within projects not primarily dedicated to COs. In this way, citizen science is becoming increasingly mainstreamed with a potential to gain prominence in future research and innovation programs.

Beyond the mainstreaming of citizen science lies the potential for a paradigm change in the co-production of knowledge that addresses societal challenges. The four CO projects were able to explore the methodologies and tools needed to do this. How can their achievements lead to a paradigm change in how we do things? How can the immense knowledge, tools and methodologies developed within these COs be diffused to create a paradigm change in future COs and projects? What conditions can the commission provide to support this? With the new mission-oriented approach of Horizon Europe, there may be opportunities to better match large missions with work on the ground.

One of the main challenges remaining for practitioners is to reach out to broader audiences and extend the concepts created by the CO projects to ensure they are injected into future knowledge. CO practitioners still risk advocating the same ideas to proponents of citizen science and COs. What are the necessary linkages to increase the reach and impact of citizen science? The focus to date has been on utilizing knowledge, for example, to pursue scientific publications. This information, however, should also be directed at SMEs with the potential to use such resources in real life scenarios and applications. Environmental protection agencies have also demonstrated interest in citizen science but are missing direct links or mechanisms to engage. The potential to support and involve such institutions is higher for projects with strong facilitation capabilities between science institutions and environmental agencies. While ad hoc connections with EPAs have been occurring (e.g., working with NGOs and communities), opportunities exist to develop guidelines for policy makers, EPAs, and local authorities, and for matchmaking between policy and institutional needs and COs.

For public authorities, a primary concern is the cost of services provided by COs. Cost is an important factor affecting uptake among public authorities whose budgetary issues tend to be complex. It is therefore critical to calculate this cost, but not many projects do. The maintenance costs of a CO –

after it has been set-up by a project that has ended, and the technologies and methodologies have been created – should also be considered separately from the CO development costs. Although cost estimates are indeed important, value estimates of CO products and services also need to be carefully considered and provided. Putting a value on the benefits of a CO, however, is often even more difficult than tagging its costs. A robust cost/benefit analysis has wide implications for both the acceptability and sustainability of COs in that it can create a basis for decision-making and a good case for incurring uptake and maintenance costs.

Conclusion

This event resulted in some key recommendations that will contribute to further assessments of persistent challenges and best practices among COs. Several insights emerged from the meeting. It highlighted the importance of selecting active communities aligned with CO scientific objectives, while committing to an iterative co-design process that integrates the needs of all stakeholders. It emphasized the role of data quality assurance measures, while insisting on a broader approach to defining data that considers their diverse contexts and potential uses. Discussions also examined the future of COs by stressing the need for institutional and community linkages to carry forward the work and its added value, establishing a common knowledge base and practice of COs and citizen science. The event also raised questions of innovative funding mechanisms to help the transition of COs beyond the project cycle. Importantly, this event brought together practitioners and commission members to jointly reflect on challenges, share best practices, and generate forward looking solutions. This and other such exchanges are essential to help establish and support the development of new strategies to further improve the implementation and impact of future COs.

List of participants

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26	Maso	Joan	CREAF
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28	Moorthy	Inian	IIASA
29	O'Brolchain	Niall	Citizens Science Ireland
30	Paleco	Carole	Royal Belgian Institute of Natural Sciences
31	Popescu	Ioana	IHE Delft
32	de Rijk	Kim	European Commission-DG Environment
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