An Ecosystem of Citizen Observatories for Environmental Monitoring

D2.7 WeObserve CoP Final Report

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Author(s)	Uta Wehn (IHE Delft), Joan Maso (CREAF), Dilek Fraisl (IIASA), Ane Bilbao and Mohammad Gharesifard (IHE Delft)
Reviewer(s)	Raquel Ajates (UNIVDUN)
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Abbreviations and acronyms

Abbreviation	Description
CitSciIE	Citizen Science Interoperability Experiment
CO	Citizen Observatories
COPs	Communities of Practice
COST	European Cooperation in Science and Technology
COWM	Citizen Observatories for Water Management
CREAF	Centre de Recerca Ecològica i Aplicacions Forestals
CS	Citizen Science
CSA	Citizen Science Association
CS-DS	Citizen Science Definition Service
CS DWG	Citizen Science Domain Working Group
CSGP	Citizen Science Global Partnership
ECSA	European Association of Citizen Science
EGU	European Geosciences Union
EO	Earth Observations
F2F	Face to Face
GEO	Group on Earth Observations
GEOSS	Global Earth Observations System of Systems
GPSDD	Global Partnership for Sustainable Development
IAEG-SDGs	Inter-agency and Expert Group on SDGs Indicators
IIASA	International Institute for Applied Systems Analysis
ICT	Information and Communication Technologies
IE	Interoperability Experiment
JRC	Joint Research Centre
LS	LandSense Citizen Observatory
MOOC	Massive Open Online Course
NSOs	National Statistical Offices
O&M	Observation and Measurements
OGC	Open Geospatial Consortium
PPSR	Public Participation in Scientific Research
SDGs	Sustainable Development Goals
SME	Small and Medium Enterprise
SOS	Sensor Observation Service

SSO	Single Sign-On
SWE	Sensor Web Enablement
SWE4CS	Sensor Web Enablement for Citizen Science
TC	Technical Committee
UN	United Nations
UNEA4	United Nations Environment Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organization
WMO	World Meteorological Organisation
WP	Work Package
WPS	Web Processing Service

Glossary of terms

Term	Description
Citizen Observatory (CO)	COs are community-based environmental monitoring and information systems, that invite individuals to share observations, typically via mobile phone or the web.
Citizen Science Global Partnership	A network-of-networks that seeks to promote and advance citizen science for a sustainable world.
CO Community of Practice	Community which works to consolidate practice-based knowledge of COs sharing information and resources as well as developing guidelines and toolkits for COs.
COST Action	COST Action is a network dedicated to scientific collaboration, complementing national research funds.
Data quality	A perception or an assessment of data fitness to serve their purpose in a given context. The quality of data is determined by factors such as accuracy, completeness, reliability, relevance and how up to date it is.
Digital Earth Symposium	The annual event organised by The International Society for Digital Earth
GEOSS	A central part of GEO's Mission is to build the Global Earth Observation System of Systems (GEOSS). GEOSS is a set of coordinated, independent Earth observation, information and processing systems that interact and provide access to diverse information for a broad range of users in both public and private sectors.
Impact	Within the WeObserve community, impact is considered the (widespread) changes over a longer period of time that result from an accumulation of outcomes and affect the wider economy and society beyond those directly affected by the intervention. They are strongly influenced by external factors.
Interoperability	Interoperability is a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, at present or in the future, in either implementation or access, without any restrictions.
CoP's Interoperability Experiment	An experiment aiming at demonstration how current ICT (Information and Communication Technologies)-based tools can be applied together to better enable citizens to participate in Citizen Science projects.
LandSense Federation	The LandSense Citizen Observatory aims to aggregate innovative EO technologies, mobile devices, community-based environmental monitoring, data collection, interpretation and information delivery systems to empower communities to monitor and report on their environment.
OGC	An international not for profit organisation committed to making quality open standards for the global geospatial community.
OGC standards	Technical documents that detail interfaces or encodings which have been produced by the Open Geospatial Consortium.

Scientific article	A publication that is based on empirical evidence. It can support a hypothesis with original research, describe existing research or comment on current trends in a specific field.
Sustainable Development Goals	A collection of 17 global goals set by the United Nations General Assembly to end poverty, protect the planet, provide education and ensure well-being.
Terms of Reference	Terms of reference (TOR) define the purpose and structures of a project, committee, meeting, negotiation, or any similar collection of people who have agreed to work together to accomplish a shared goal.
Tier III indicator	Tier III indicators require work plans to be developed outlining the methodological development of SDG indicators for approval by the IAEG-SDGs.
UN Environment Assembly	The United Nations Environment Assembly (UNEA) is the world's highest-level decision-making body on the environment. UNEA enjoys the universal membership of all 193 UN Member States and the full involvement of major groups and stakeholders.
UN Science Policy Business Forum	The UN Global Science-Policy-Business Forum on the Environment aims to identify and promote opportunities for green investment that are driven by advances in science and technology.
Vocabularies	The body of words used in a particular language, a range of artistic or stylistic forms, techniques, or movements.
WeObserve	An H2020 Coordination and Support Action to create a sustainable ecosystem of COs that can systematically address environmental challenges and help to move citizen science into the mainstream.
WeObserve Community of Practice	The (f2f and virtual) place where diverse stakeholders who share a joint (practice-oriented) interest in citizen science can work together towards concrete solutions, tangible examples and tools by collating their experiences and lessons learned.
We Observe Cookbook	Collection of information on how to build a Citizen Observatory.

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Executive Summary

One of the key objectives of the WeObserve project is to assess the latest citizen observatory (CO) knowledge base and strengthen it to tackle future environmental challenges using CO-driven science. WeObserve Task T2.2 has launched four Communities of Practice (CoPs) as a key mechanism for consolidating the knowledge within as well as beyond the WeObserve consortium:

Co-design & Engage,
Impact CoP,
Interoperability CoP and,
SDG CoP

The key role of the CoPs is to serve as the vehicle for sharing information and creating new knowledge on selected key thematic topics related to COs by bringing diverse CO and CS perspectives and experiences together. These fora have contributed to strengthening the knowledge base about COs in order to move citizen science into the mainstream of environmental management and decision making.

This report presents the status of the WeObserve CoPs at the end of the WeObserve project life time, reporting on progress to date, outputs and activities, CoPs Forums, and the sustainability of the CoPs. The report also takes stock of lessons learned from running these CoPs and how the WeObserve has responded to challenges related to CoP members' flow in participation.

At the time of writing, the WeObserve CoPs are well-established in the scientific community and are seen as a reference point for the knowledge they have consolidated. The CoPs have brought together >240 people from >40 countries in >70 CoPs meetings, 6 CoPs Forum and >25 events/conference sessions were organised virtually and in >10 countries. The CoPs have also received interest for the way they have been founded and developed, serving as a model and inspiration for the new CS & Open Science CoP, based on the WeObserve methods for demand-driven CoPs.

The consolidation of knowledge has been achieved by co-writing different CO publications and a joint paper by all four CoPs. In addition, the members of the Co-design and Engage and Impact CoPs have created the online glossary of terms and definitions, and the Interoperability CoP members have produced the OGC Citizen Science Interoperability Experiment Engineering Report.

The added value for members of the WeObserve CoPs are the knowledge consolidation and the networking opportunities that arise from being part of the CoPs, as indicated early on: in the second CoPs Forum in Venice, a working session explored the motivations of the CoP members for participating in the CoPs. In addition, the CoPs have established links with the EU-citizen.science platform to curate CoP outputs in the long run.

An evaluation process of the CoPs was initiated with interested CoP members during the CoP Forum #5 in October 2020 and rolled out as a survey to all CoP members during late November – mid December 2020.

In terms of the life time and long term management of the WeObserve CoPs, in principle, the CoPs will continue to exist for as long as they deliver value for their members, both in terms of achieving jointly set objectives, as per WeObserve CoP Terms of Reference (WeObserve deliverable D2.2) and in terms of the incentives for individual members. Each CoP has carefully considered options and reasons for its long term sustainability and members of all four CoPs have expressed strong interest to continue the activities of their respective CoP beyond the end of the WeObserve project (March 2021).

Moreover, a dedicated discussion during the WeObserve Forum #6 (15-16 March 2021) confirmed that all four WeObserve CoPs will continue their activities for the time being, setting up at least one meeting between March and May 2021 in anticipation of the evaluation results of follow up funding.

1 Introduction

WeObserve is a H2020 Coordination and Support Action which tackles three key challenges that Citizens Observatories face: awareness, acceptability and sustainability. The project aims to improve the coordination between existing Citizen Observatories and related regional, European and international activities. The WeObserve mission is to create a sustainable ecosystem of Citizen Observatories that can systematically address these identified challenges and help move citizen science into the mainstream.

One of the key objectives of WeObserve is to assess the current CO knowledge base and strengthen it to tackle future environmental challenges using CO-driven science. WeObserve Task T2.2 has launched four Communities of Practice (CoPs) as a key mechanism for consolidating the knowledge inside as well as beyond the WeObserve consortium. The key role of the CoPs is to serve as the vehicle for sharing information and knowledge on selected key thematic topics related to COs, strengthening the knowledge base about COs in order to move citizen science into the mainstream of environmental management and decision making. The WeObserve CoPs are, therefore, the place where diverse stakeholders who share a joint practice-oriented interest in citizen science can work together towards concrete solutions, tangible examples and tools by collating their experiences and lessons learned.

The purpose of this report is to present the latest status and achievements of the WeObserve CoPs before the end of the WeObserve project in March 2021, reporting on progress to date, main activities developed, the lessons learned from running these CoPs, how WeObserve has responded to challenges related to CoP members' fluxes in participation and future plans for the CoPs.

This report can be complemented with the previous reports about WeObserve CoPs such as *D2.2 Detailed terms of reference and guidelines for WeObserve Communities of Practice* and *D2.3 WeObserve CoP Mid Term Progress Report.*

This report is structured as follows: Section 2 presents a general overview of the WeObserve CoPs, Forums and joint activities of the four WeObserve CoPs. Section 3 to 6 present the objectives, progress and lessons learned across the four CoPs. Section 7 presents the challenges faced and lessons learned, Section 8 contains the evaluation of the CoPs, and Section 9 concludes this report with final reflections and next steps.

2. Communities of Practices

2.1 What are Communities of Practice?

Communities of Practice are a key and practical approach in knowledge management. Communities of Practice can be defined as '*groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.*' (Wenger et al., 2002, p. 4). The key aspect of CoPs that binds their members together is that they find value in the joint learning and outputs derived from their interactions. These interactions can consist of information sharing, problem solving, tool or standards creation or developing tacit understanding on the focal topic.

The three structural elements of a CoP are domain, community and practice (Wenger et al., 2002):

- Domain refers to the specific set of issues or topic. It is the raison d'être that brings the community members together and drives their joint learning.
- Community refers to the people who care about the domain.
- Practice refers to the specific knowledge the community develops, shares and maintains; the shared practice of the community members that they are developing in order to be effective in their domain (e.g. frameworks, ideas, tools, styles, stories).

These definitions highlight that a CoP goes beyond more than codified knowledge (e.g. a website, database or best practices), placing the focus on the knowledge holders, thus, a CoP can be defined as '*a group of people who interact, learn together, build relationships, and in the process develop a sense of belonging and mutual commitment*' (Wenger et al., 2002, p.34).

Practice-based knowledge on diverse aspects of citizen observatories is dispersed among various stakeholders. This was identified as a challenge by WeObserve, which in response proposed Communities of Practice as the vehicle for sharing information and knowledge on selected key thematic topics related to COs, strengthening the knowledge base about COs in order to move citizen science into the mainstream of environmental management and decision making.

2.2 Launch and Management of the WeObserve Communities of Practice

As explained in *D2.3 WeObserve CoP Mid Term Project Report*, the first three WeObserve CoPs (Co-design & Engage CoP, Impact CoP and Interoperability Cop) were set up and launched during workshops at the ECSA conference in June 2018. The fourth CoP (SDG CoP) was launched at a dedicated session at the conference 'Citizen Observatories for Water Management' on November 2018. For detailed information about the Call for Participation in the CoPs, the approach that was developed for the WeObserve launch workshop and the result of the respective launch workshops, the co-design process and management of the WeObserve CoPs see *D2.3 WeObserve CoP Mid Term Project Report*.

In July 2020, a 'sister' CoP, the Citizen Science & Open Science CoP (under the Citizen Science Global Partnership) was launched based on the WeObserve CoP model with 133 participants in two workshops. The inception report as well as a paper on 'Global Citizen Science perspectives on Open Science' were prepared to provide the CS perspective as an input for the UNESCO Recommendation on Open Science.

Table 1. Four WeObserve CoPs summary based on 3 dimensions (domain, community and practice)

CoPs	Domain/thematic focus	Community members	Practice
Co-design & Engage	1) Strategic engagement practices - efforts to engage different demographic and geographic target groups based on understanding incentives and barriers 2) Co-design methods, including co-design conditions, versions and tools	Citizen science practitioners from universities and research institutions, UNESCO, GEOScience Australia, GLOBE programme, NASA, JRC, GPSDD; local governments; NGOs; private companies	Producing effective CO knowledge resources on co-design and citizen engagement. For example, the WeObserve glossary of terms, template for inventorising engagement practices, WeObserve toolkit.
Impact CoP	1) Governance dynamics: understanding existing decision-making structures and the role of COs (and their data) in changing these to address societal challenges 2) Impact stories: capturing and demonstrating the impact and value of COs for governance	Citizen science practitioners from universities and research institutions, representatives from European Commission, GBIF secretariat members; local governments; NGOs; private companies.	Generating effective CO knowledge resources on the impact and value of COs for governance. For example, WeObserve glossary of terms, template for inventorising methods for capturing impacts and value of COs on governance, WeObserve toolkit.
Interoperability CoP	1)The use of OGC standards (e.g. Sensor Web Enablement for Citizen Science SWE4CS) to support data integration among CS projects, and with other sources, esp. authoritative data; 2) The integration of CS projects/campaigns in a Single Sign-On system (SSO) federation; 3) The relationships between OGC standards and data and metadata standards currently used by Citizen Science projects.	Citizen science practitioners from universities and research institutions, representatives from UNITAR, World Meteorological Organization, European Commission; private companies	Demonstrating the interoperability of Citizen Science projects and the way OGC standards can be applied to Citizen Science.
SDG CoP	1) UN Sustainable Development Goals (SDGs) and 2) Citizen Observatories (COs).	Active members include UN custodian or partner agency representatives (UN Environment, WMO, UNESCO, etc.), statisticians, policy makers at the EU level and broader, citizen science practitioners, academics, researchers, citizen-generated data specialists, etc. worldwide.	Exploring and demonstrating the value of citizen science data for SDG monitoring. For example, implementing the research results in the CS4SDGs project in Ghana.

2.3 WeObserve Communities of Practice Forums

Throughout the WeObserve project lifetime, six CoPs forums have been held with the purpose of discussing and addressing each CoP's topics as well as cross-cutting themes.

Figure 1. Forum #1. Co-design & Engage, Impact, Interop CoPs co-design and launch sessions, Geneva, June 2018

Forum #1 took place in Geneva where the first three WeObserve CoPs were set up and launched during workshops at the ECSA conference 2018, on 6 June (immediately following the main ECSA conference).

Forum #2 was held in conjunction with the conference 'Citizen Observatories for Water Management' in Venice, 27-29 November 2018. Half-day working sessions were held for the first 3 CoPs (each attended by ca. 20 people) and the SDGs CoP was launched at this event (23 participants). A considerable amount of time was spent 'ad hoc' on the participants' motivations for participating in the CoPs (see detailed information about the incentives and barriers to participate in *D2.3 WeObserve CoP Mid Term Project Report*).

Figure 2. SDG CoP launch during Forum #2, Venice, November 2018

Figure 3. Forum #3, Vienna, April 2019.

Forum #3 was held back-to-back with the 2019 General Assembly of the European Geosciences Union, a main cross-CoP (Co-design and Engage, Impact and SDGs) meeting spanning 12 to 15 April 2019. This created some opportunity for collaboration also with members of the Interoperability CoP which had held a separate F2F meeting concurrent with EGU 2019. Participants' incentives to participate in the CoPs and the evaluation of the third Forum are reported in *D2.3 WeObserve CoP Mid Term Project Report*.

Forum #4 took place from 25-27 November, 2019 in Barcelona with approx. 20 participants (5 online, 15 in Barcelona) from 8 countries and 3 continents. Furthermore, jointly with WP4 (T4.2, 4.4) and T2.1, the CoPs achieved progress on many important dissemination and publication activities. The Interop CoP organised the first Citizen Science Interoperability Experiment, which concluded in November 2019 and

produced an OGC Experiment Engineering Report. During CoP Forum #4 in Barcelona, possible topics for the second experiment (started in Nov 2019) were revised. The SDG CoP focused its discussions on capturing how citizen science and COs can catalyse change towards SDG implementation. The Impact CoP composed an analytical structure to consolidate knowledge on COs and citizen science impacts and collated impact stories. The Co-design & Engage CoP extended its work on the landscape of co-design approaches for CO and citizen science.

Figure 4. Forum #4 CoPs members in Barcelona, November 2019

Figure 5. Tweets showing the discussions during Forum #4 in Barcelona, November 2019

Forum #5 was held online, back to back with the WeObserve CS SDG conference (12-13 October 2020). In total, 30 people joined from Europe, and participants from Australia, Iran, Kenya, and the US also attended. There were new participants as well as regular CoPs participants. The forum was divided into short sprints, dedicated to capturing the 'WeObserve way' of consolidating knowledge on CS via Communities of Practice, to finalise collecting the findings of the Interop-CoP and compile them in the Engineering Report, and to strengthen the fertilisation of knowledge, ideas & insights on CS and Citizen Observatories across the four WeObserve CoPs. The production of a joint Cross CoPs paper was started.

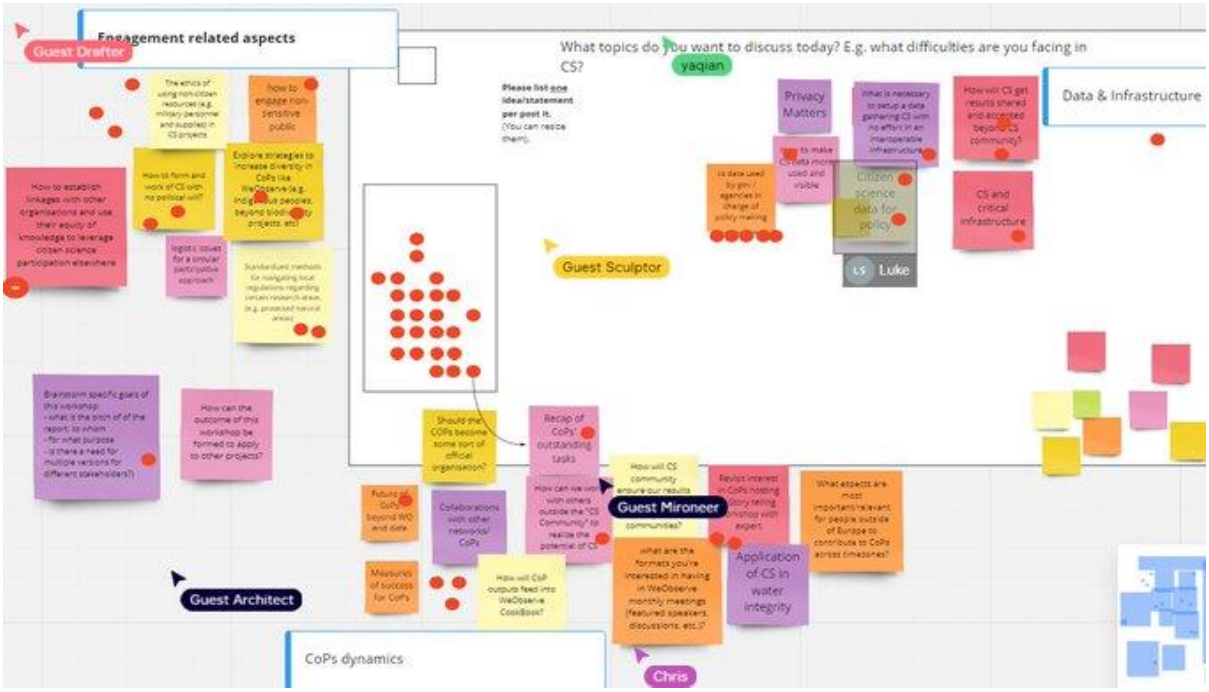


Figure 6. Inputs from the Cross CoPs Fertilisation session during CoPs Forum #5

In Forum #5 (online), the Miro platform was used during the cross-fertilisation session, so that CoPs members could table topics they wanted to discuss during the Forum, such as engagement related aspects, data & infrastructure, and CoPs dynamics. It was also a good opportunity to introduce the CoP members to this collaborative online tool, many of whom did not know it.

Figure 7. Some of the CoPs members in the online CoPs Forum #5

WeObserve CoPs Forum #6 took place online on 15-16 March 2021. The Forum consisted of plenary sessions, two parallel sessions and a dedicated Storytelling workshop run by external experts on the topic. In total, 32 CoPs members joined from 15 countries and five continents: mainly from European countries but also from Australia, Iran, United States as well as Ecuador. It was a diverse group of people in terms

of the field of expertise with experts on earth observation, agricultural and water innovations, ecology and volunteer monitoring, citizen science, SGDs, food policy, urban design, film, statistics and sociology, among other disciplines.

On the first day of the Forum, the results from the CoPs evaluation survey were discussed; the WeObserve Roadmap for the uptake of the CO's knowledge base by policy and decision makers was presented and feedback generated during an interactive exercise using the Miro platform. In addition, the beta version of the WeObserve Cookbook to guide CO leads and community managers through relevant resources was launched and feedback obtained from participants (from user and CO/CS practitioner perspective) went ahead. The second day, a dedicated Storytelling workshop took place to capture and articulate impact-related stories and better transfer information. Finally, dedicated parallel sessions focused on the WeObserve Cross CoP paper and the Interop CoP activities.

Figure 8. WeObserve CoPs Forum #6 group photo.

Table 2. Summary of the WeObserve CoPs Forums.

Forum #	Place & Date	Main Activities & Outputs
Forum 1	Geneva, June 2018	The first three WeObserve CoPs (Co-design & Engage, Impact and Interop CoP) were launched.
Forum 2	Venice, November 2018	SDG CoP was launched. Focused session on templates of the Co-design & Engage CoP and the Impact CoP. Interactive session on incentives for CoP members to participate.
Forum 3	Vienna, April 2019	Initiation/progress with work on several scientific papers: Co-design methods, Impact stories, Engineering report, Mapping paper and NSO paper.
Forum 4	Barcelona, November 2019	Working session on the Impact stories paper, Interop experiment, and dedicated sessions to SensorThings API and Definitions Server.
Forum 5	Online, October 2020	Start of joint Cross CoPs paper; progress with the Engineering report. Cross-CoPs fertilisation session.
Forum 6	Online, March 2021	Discussions on WeObserve Cookbook and WeObserve Roadmap; progress with the joint Cross CoPs paper. Discussion on CoPs sustainability. Dedicated impact storytelling workshop.

2.4 Cross-CoPs collaboration

The main collaboration activities across the four WeObserve CoPs are summarised below.

CoPs focus on understanding COVID-19 and its impact in society
In 2020, the COVID-19 pandemic outbreak became a cross-cutting theme across the different CoPs, which started to focus on understanding and identifying potential contributions to the COVID-19 crisis. Therefore, each CoP tabled the COVID-19 topic to consider how their activities could help mainstream citizen science efforts to understand the virus and its impact on society. For instance, the SDG CoP showed interest on the impact of the COVID-19 on progress towards SDGs, and how citizen science could help; Impact CoP focused on the role that Citizen Science could have in measuring the impact of COVID-19. See detailed information on a dedicated page of the WeObserve website about the specific activities that each CoP has been working on in relation to the COVID-19 pandemic.

Joint sessions at conferences
Apart from the joint WeObserve CoPs Forums attended by CoPs members, the CoPs have jointly taken part in events such as the ECSA conference with a dedicated CoPs session 'Practice what we preach: co-creating value with participants in Communities of Practice on Citizen Science', 7 September 2020; the CS & SDG Conference with the session 'Transformative potential of CS and COs' , 15 October 2020 and at the EuroScience Open Forum (ESOF) 2020 Conference in the session 'Combining forces: EO and Citizen Science', 3 September 2020.

Insights for the WeObserve Cookbook
The members of the Co-design & Engage CoP participated in a working session on the WeObserve Cookbook in December 2020, providing insights to produce the initial structure and the main sections of the Cookbook. In addition, during the WeObserve Forum #6, a dedicated joint session took place to obtain inputs and feedback of all CoPs members on the draft online Cookbook, from a user perspective and as experts in citizen science and Citizen Observatories.

Inputs to the WeObserve Toolkit
The members of all four CoPs gave detailed feedback and advice on the design of the WeObserve Toolkit survey instrument.

Scientific Paper
Moreover, a Cross CoPs paper has been initiated to consistently capture insights across all four WeObserve CoPs. This includes a thorough evaluation of the CoP members' experiences during the CoPs initiation and implementation via a dedicated survey, the results of which are presented in Section 8.

H2020 Green Deal proposal
Members of different CoPs collaborated on a H2020 Green Deal proposal on COs and behaviour change which will contribute to sustaining the CoPs and their activities.

3. Co-design & Engage Community of Practice

3.1 Objectives & participation

The envisaged overarching outcome of the Co-design and Engagement CoP was to become recognised as an effective CO knowledge resource on co-design and citizen engagement by the Co-design & Engage CoP members and other relevant constituencies by the end of the project. This objective was achieved through three core Co-design & Engage CoP objectives:

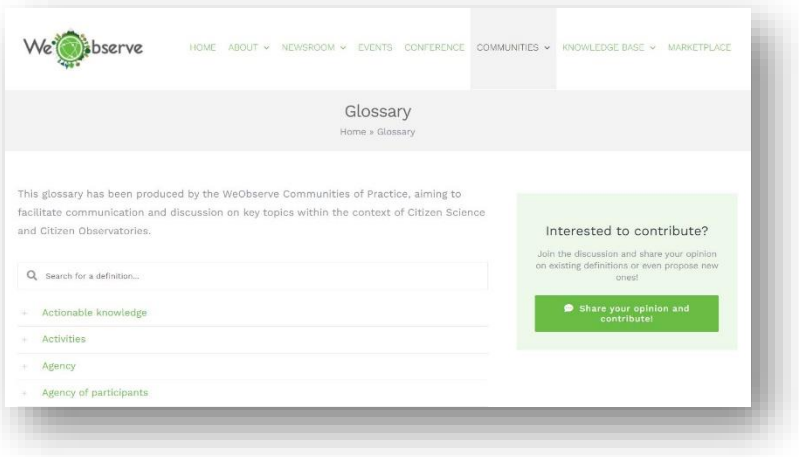
1. To identify and define strategic engagement practices and methods for CO co-design
2. To capture lessons learned from implementing strategic engagement practices and CO co-design tools in differing conditions
3. To share these methods and lessons learned in Co-design & Engage CoP, via the WeObserve Cookbook on Citizen Observatories and via other means

Since the beginning of the Co-design and Engage CoP, 24 online telcos have taken place. So far, 141 members have signed up for the Co-design & Engage CoP, of which 10-15 are active members (taking part in the telcos and Forum events regularly) and observers (who are included in the CoP's email communication and who have access to the workspace but do not participate in the regular telcos). Most of the participants are based in Europe, followed by participants from Australia and North America. Some members are also based in Africa, Middle East and Asia.

3.3 Activities and outputs

The activities undertaken by the Co-design & Engage CoP followed the agreed work plan (see detailed work plan in WeObserve deliverable *D2.3 WeObserve CoP Mid Term Project Report*). Below, we provide a summary of the main activities completed.

Glossary of relevant terms
In order to facilitate communication and discussion on key topics within the Co-design and Engage CoP, the members developed a glossary with brief descriptions of, and links to, some 40 key terms relevant to co-design and engagement within the context of Citizen Science in general and COs in particular. Following permission to publish being sought from CoP members (May 2019), the glossary was published for reference - and future development - on the WeObserve platform/website and will allow for comments and additions from the wider CS and CO community. In the long run, the maintenance of the glossary can be taken over by ECSA.



Template for inventorising engagement practices and CO co-design conditions, versions and tools
In order to structure the CoPs work on identifying and defining strategic engagement practices and methods for CO co-design and to allow the capturing of lessons learned from implementing strategic engagement practices and CO co-design tools in differing conditions, a template was co-created by the CoP members to structure these efforts. This template allows various co-design practices to be categorised according to conditions (e.g. geographic, cultural setting, infrastructure, thematic scope), versions (type of stakeholders involved, extent of co-design, resources required), tools and SWOT (strengths, weaknesses, opportunities, threats). Similarly, for engagement practices, the template provides categories relating to e.g. specific engagement steps, types of stakeholders involved, level of participation, outputs and SWOT.

Collaboration with the WeObserve WP3 toolkit survey
The work on the template described above provided opportunities for collaboration with the activities related to a toolkit survey prepared by WeObserve WP3 which aimed to provide an overview of what exists in terms of tools, toolkits and current provision of instruments to support the activities of citizen observation. A literature review helped to form initial lists of steps for setting up and implementing a CO project, which were then presented and discussed during three consecutive Co-design & Engage CoP telcos. These discussions helped to develop and refine a collection of steps that encapsulate activities found in diverse CO projects. Moreover, the CoP gave detailed feedback and advice on the design of the toolkit survey instrument that was launched online in November 2018. (The results of the toolkit survey are presented in WeObserve deliverable D3.1 Develop infrastructure and WeObserve Toolkits and D3.3 WeObserve Toolkits for Building Champion Communities.)

Draft of scientific publication on co-design practices
The preparation of a scientific article had emerged as a priority activity and key incentive for CoP members from Forum #1. Given the thematic breadth of the Co-design & Engage CoP, it was decided to prioritise the production of an article on co-design practices. An outline of the co-design practices article was prepared by the CoP Chair prior to F2F writing workshop at Forum #2 in Vienna. The working sessions at Forum #2 were used to gather and discuss comments on the outline and to structure and gather data for the article. For that purpose, a matrix structure was created (based on the earlier template presented above) and filled in order to inventorise the co-design practices from the various CO projects presented by the CoP members. A combination of individual work and group discussions resulted in substantive progress and served to peer review the provided content. A timeline was agreed for further steps in article production (section writing, approach for analysing the inventorised practices, and finalisation of the article), with the overall aim of submitting the article in July 2021.

Thematic guest speakers
In the regular Co-design and Engage CoP telcos, a variety of guest and members speakers have presented their findings. The thematic focus of the presentations covered different thematic areas such as Australian Bushfire recovery and the involvement of Citizen Science; reflections on the engagements and applications around Citizen Science and Communities of Practise from the African continent, Lessons learned for co-design and engagement on two community-based monitoring initiatives in Kenya and the Netherlands; and how to engage indigenous communities in Citizen Science and activities in Sensor Community Campaigns.

The speakers who presented their work at different Co-design & Engage CoP telcos were:
- Balazs Kozak, Project Manager, Geonardo Environmental Technologies
- Rosa Arias, Founder, Science for Change
- Dr. Mark Graham, GroundTruth Director, Specialist Aquatic Scientist
- Dr. Mohammad Gharesifard, Postdoctoral researcher, IHE Delft
- James Rattling Leaf, Coordinator of Climate Partnership for the Great Plains Tribal Water Alliance, USA

- John Pring, Senior Project Manager at Geoscience Australia and Chair at Australian Citizen Science Association
- Lukas Mocek, Partnership Developer, Sensor.Community
- Sandra de Vries, Founder, Plusaqua

Abstracts submitted to several conferences

The Co-design & Engage CoP members jointly produced a number of abstracts and proposals that have been submitted and accepted by a variety of conferences and events, such as at the 9th Living Knowledge conference 2020, with presentations entitled 'Co-designing an ecosystem for impactful and sustainable citizen observatories' and 'Co-designing Citizen Science initiatives: a landscape of practices'. In addition, at the EU-SPRI conference 2020, a poster talk about the WeObserve Landscape Report was accepted. However, due to COVID-19, these conferences did not take place in 2020. Currently, efforts are underway to ensure their re-submission to future conferences.

H2020 Green Deal proposal

Members of the Co-design & Engage CoP have submitted a H2020 Green Deal proposal on COs and behaviour change which will contribute to sustaining the Co-design & Engage CoP and its activities.

Reporting from relevant events and webinars

In the Co-design & Engage CoPs telcos, members shared information about upcoming events and also reported back from events and webinars that they had attended and which are relevant to the community. For instance, the CS-SDG decades conference 14-15 October 2020, EuroScience Open Forum 2-6 September 2020, ECSA conference 6-10 September 2020, GEO Indigenous Summit 7-9 December 2020, European Week of Regions and Cities 12-15 October 2020, European Initiatives for GEO spatial data use 2020, Dubrovnik Hackathon 11 June 2020, and the following webinars such as AfriAlliance Webinar series October-December 2020, CSA webinar 'Citizen Science, Community Engagement, & the UN Sustainable Development Goals' 28 May 2020, the ECSA Characteristics of Citizen Science webinar 12 November 2020.

4. Impact Community of Practice

4.1 Objectives & participation

The Impact CoP aims to bring the knowledge of different stakeholders together on the impact and value of citizen observatories for governance. Ultimately, the resulting insights will be brought together in a WeObserve 'Cookbook' on citizen observatories. The envisaged overarching outcome of the CoP activities was to become recognised by the Impact CoP members and other relevant constituencies as an effective CO knowledge resource on the impact and value of COs for governance by the end of the project.

This aim was envisaged to be achieved via three core objectives:

1. To provide an inventory of 'tried and tested' methods for capturing the impacts of COs on governance
2. To capture and share CO impact stories/examples of best practice from citizens, public sector and policy perspectives
3. To provide guidance on CO impact assessment for the Impact CoP members and beyond

Since June 2018, a total of 21 telcos of the Impact CoP have taken place. 126 members are signed up for Impact CoP, with on average of 12 members actively participating in the regular monthly telcos, and Forums. Similar to the Co-design & Engage CoP, in the Impact CoP, most of the members are from European countries followed by participants from Australia and North America.

4.2 Activities and outputs

The activities undertaken by the Impact CoP initially followed the agreed work plan (see *D2.3 WeObserve CoP Mid Term Project Report*) and led to the production of the glossary of terms relevant for this CoP and templates for structuring the work of inventorising existing co-design and engagement practices. During Forum #1 in Venice, it emerged that most participants wished to focus on the production of a joint scientific publication. Below there is a summary of the main activities and outputs produced throughout the Impact CoP.

Glossary of relevant terms
The Impact CoP members contributed to the joint WeObserve CoPs' glossary with brief descriptions of, and links to, key terms relevant for capturing the value and impact on governance, of Citizen Science in general and COs in particular. Once permission to publish the glossary combining definitions from all four CoPs had sought from the CoP members (May 2019), this was published as a reference resource - and for future development - on the WeObserve platform/website. In the long run, the maintenance of the glossary can be taken over by ECSA.

Template for inventorising methods for capturing impacts & value of COs on governance and experiences with applying the methods
In order to structure the CoPs work on inventorising methods for capturing the impacts and value of COs on governance as well as experiences with applying the methods, an initial template was drafted by the CoP Chair and then further co-created by the CoP members. This template captures basic method-related details (e.g. title, reference), users and conditions for using the method as well as questions about the ways in which the method captures the impact and value of CS and COs on governance and its strengths and weaknesses.

This template was incorporated and enhanced in the joint collaboration among WeObserve Impact CoP members and partners of the MICS consortium. This collaboration resulted in a scientific paper which was submitted to the journal Sustainability Science (Wehn et al., 2021b).

Template for the CO impact stories/examples
A second template was developed for the dual purpose of a) capturing specific impact stories to gather empirical evidence on emerging impacts and b) to provide a service to the wider CS and CO community which is increasingly under pressure demonstrate its impacts but often lacks the methods and knowledge of how to go about capturing impacts. This template, entitled "Capturing governance impact stories of your Citizen Science initiative", was developed based on initial drafts by the CoP Chair and collaboration with the US sister initiative. The CoP members then elaborated and discussed this template at Forum #1 in Venice and further fine-tuned it. It captures the background of a CS/CO initiative, the problem/issue the CO is addressing, changes triggered by the CO, challenges encountered by the CO as well as wider impacts. This template has been turned into Impact Inquiry Instrument and shared on Zenodo[1] in order to reach a wider community of practitioners who may have developed or used methods and practices and wish to share their experiences with applying such approaches. Moreover, respondents will also be able to choose to complete their impact story via an interview with one of the Impact CoP members, which will be based on this template.

Submitted abstracts at several conferences
Similarly to the Co-design and Engage CoP, in the Impact CoP, a number of abstracts and were accepted in a variety of conferences such as at the 9th Living Knowledge conference 2020 the presentation titled 'Demonstrating the impacts of citizen science on policy: a storytelling approach' was submitted and accepted. However, due to COVID-19 the conference did not take in 2020 and it will take place online in 2021. For the International Symposium on Digital Earth ISDE11, Impact CoP members submitted an abstract that shared the WeObserve Impact CoP's methodological work.

Attendance at conference and events
At the ECSA Conference 2020, apart from the joint CoPs session titled 'Practice what we preach: co-creating value with participants in communities of practice on citizen science', the sessions entitled 'Developing metrics and instruments to evaluate the impacts of citizen science on society, governance, the economy, the environment and science' as well as the session 'Analysis of the contextual realities of community-based environmental monitoring initiatives in Kenya and the Netherlands' were presented. At the ESOF 2020 conference, a SDGs and CS session proposal was accepted (jointly with SDG CoP).
At the International Symposium on Digital Earth ISDE11 in September 2019, the Impact CoP featured its work. It showed the progress on the methodological work on a tool that was tested to capture governance impact stories from existing CO projects and can support ongoing and new projects to plan ahead and build into their project design the resources and information needed to capture any potential governance impacts their activities might achieve.

Scientific publication on impact storytelling approach
For the Co-design and Engagement CoP, the preparation of a scientific article had emerged as a priority activity and key incentive from Forum #1. The CoP members decided to prioritise the production of an article on capturing CS and CO impacts by means of impact stories; a subsequent article will focus on other methods and practices for capturing CS and CO impacts. An outline of the impact stories articles was prepared by the CoP Chair prior to the F2F writing workshop at Forum #2 in Vienna. The working session at Forum #2 was used to gather and discuss comments on the outline, identify suitable projects for inclusion in the empirical part of the paper and to select a suitable journal. However, throughout the WeObserve project lifetime, the Impact Stories Methodology paper was split into two papers: a methodology paper (about the template and process of capturing impacts) which was submitted in February 2021 (Wehn et al., 2021a) and the impact stories paper (including the analysis of impact stories collected) which is still under preparation.

[1] https://zenodo.org/record/4543603#.YCv1AZNKhTY

Paper on the AAWA Citizen Observatory in Italy
WeObserve partner AAWA represents one of the success stories in the CO field, with its citizen observatory pilot during the WeSenseIt project (2012-2016) having impacted regional policy for flood risk management. A Task Force of the Impact CoP was created to support AAWA in capturing its impact story by means of cost benefit analysis for a scientific article. A combined F2F and online meeting was used to make rapid progress with the production of a full article that was published in a scientific journal (Ferri et al., 2020).

Thematic guest speakers
Similarly to the Co-design and Engage CoP, in the Impact CoPs monthly telcos, there were several presentations from different guests on topical discussions and with relevant interest for the members such as a presentation titled 'The Characteristics of Citizen Science' and 'MICS: Measuring the impacts of Citizen Science': progress with IA framework & platform development.

Speakers that presented at different Impact CoP telcos were:

- Dr. Saskia Coulson, Researcher, University of Dundee
- Dr. Barbara Kieslinger, Senior Scientist, Zentrum für Social Innovation
- Margaret Gold, Researcher, Citizen Science Lab, Leiden University
- Dr. Luigi Ceccaroni, Senior Innovation Lead, EarthWatch Europe

H2020 Green Deal proposal
Members of the Impact CoP submitted a H2020 Green Deal proposal on COs and behaviour change (same as for the Co-design & Engage CoP) which will contribute to sustaining the Impact CoP and its activities.

Reporting from relevant events and webinars
In the CoPs telcos, members report back from events that they have attended and are relevant to the community. For instance, ECSA conference 6-10 September 2020, CS-SDG decades conference 14-15 October 2020, EuroScience Open Forum 2-6 September, UN World Data Forum 19-21 October 2020, GEO Symposium 15-19 June 2020, AGU Fall Meeting 7-11 December 2020, EuroSDR/IGN/LandSense Workshop 24-25 November 2020, CO-DATA International FAIR Convergence Symposium 27 November-4 December 2020, UN Global Compact webinars, CSA webinars on CS & SDG 28 May 2020, DubrovnikINSPIRE hackathon 11 June 2020, WO Open Data Challenge 15 May -31 July 2021 among other events and webinars.

5. Interoperability Community of Practice

5.1 Objectives & Participation

The Interoperability Community of Practice was initiated to demonstrate how current ICT-based tools can be applied together in a standard way to better enable citizens to participate in Citizen Science projects, as well as improve the reusability of the data gathered, in turn overcoming the isolation of individual initiatives.

The Interoperability Community of Practice started within Task 2.2 of the WeObserve project. The community agreed that the main activity should be the organisation of an interoperability experiment taking advantage of the OGC support to gain visibility. Interoperability experiments do not last more than a year, so the first one was organised and named OGC Citizen Science Interoperability Experiment (OGC CitSciIE). The lessons learned were written in an Engineering Report that was approved by the OGC as a public Engineering Report. After the finalisation of the first Interoperability Experiment, another was launched covering the last year of the CoP.

The primary focus of the OGC CitSciIE experiment is to demonstrate the interoperability of Citizen Science (CS) projects and the way OGC standards can be applied to Citizen Science, including possible relationships to other relevant standards from the community. In particular, a subset of these topics are being addressed based on the participant organisations:

- The use of OGC standards (e.g. Sensor Web Enablement for Citizen Science SWE4CS and SensorThinks API) to support data integration among CS projects, and with other sources, esp. authoritative data;
- The integration of CS projects/campaigns in a Single Sign-On system (SSO) federation;
- The relationships between OGC standards and data and metadata standards currently used by Citizen Science projects.
- Data quality documentation for Citizen Science
- Semantic interoperability and Definition services

The desired outcome of this experiment is to:

1. Successfully demonstrate how OGC standards (e.g. SWE) are applicable to Citizen Science, document available supporting tools, identify the challenges of using OGC SWE standards (or Internet of Things equivalent solutions) within current Citizen Science projects, and propose a way forward.
2. Determine the security considerations and the available tools to support a SSO federation that helps users in participating in several projects by using a single user account.
3. Assess the possible relationships of OGC standards (e.g. SensorML) with other existing standards in the field (e.g. Public Participation in Scientific Research (PPSR) - Core, the ontology developed by the COST Action on Citizen Science, and the Citizen Science Definition Service (CS-DS) developed in the NextGEOSS project).
4. Satisfy the necessary requirements to integrate Citizen Science into Global Earth Observations System of Systems (GEOSS) by using OGC standards.

This IEs are promoted by the OGC Citizen Science Domain Working Group, the WeObserve and NextGEOSS H2020 projects, and The Earth Challenge 2020 project as supported by National Geographic Society. This IE contributes not only to the interoperability and possibly standardisation program of the OGC, but also to the Global Earth Observation System of Systems (GEOSS). This work is also relevant to the foundational objectives of the Citizen Science Global Partnership (CSGP). Regional and national Citizen Science Associations will equally benefit from the results of this OGC IE.

A total of 115 people have subscribed to the Interoperability CoP. Of these people, 21 are actively engaged in the discussions and eventually contribute to Technological Interoperability Experiments or to the Engineering Reports.

5.2 Activities and outputs

In order to start the activities as soon as possible, the Interop CoP prepared the description of the first interoperability experiment and proposed it to the OGC. In the first face-to-face CoP meeting, the interoperability experiment was already defined but not fully endorsed by the OGC. In the end, the first meeting was defined as the pre-kick off of the first Interoperability Experiment on Citizen Science, allowing for an early start of the activity while the approval process in the OGC continued in parallel.

The official kick off meeting for the OGC CitSciIE experiment was held on Friday 14th September 2018 at the OGC TC meeting in Stuttgart. Activities continued until March 2019. During the kick off meeting of the Experiment the following subgroups emerged, with the following objectives:

- Vocabularies for organising Citizen Science projects

The objective of this activity was to support the Earth Challenge 2020 research questions. The questions were defined during the first month of the experiment and now it is time to analyse them in terms of data needs and thematic vocabularies they are going to use. That is the reason this activity has not resulted in tangible outputs and will be reintroduced in the second interoperability experiment.

- Data sharing using OGC standards such as O&M and SOS

This activity has been the most active one. During the testbed the following servers have been deployed: MiraMon SOS server, Grow SOS, DLR istSOS SOS and 52north SOS. Three clients have also been produced: MiraMon SOS browser, Grow SOS data viewer and 52north Helgoland. In the last meeting at the EGU, the group was able to demonstrate interoperability by connecting the SOS clients to the SOS services and showing the data on clients, sometimes mixing data form different services and datasets in a single view. This is the most significant result of the experiment and will be extensively documented in the Engineering Report resulting from the IE.

- Connection between Landsense federation and JRC user system

Andreas Matheus SME (Secure Dimensions) was very active in providing demonstrations and information on how the LandSense federation works and how other projects can be included in the federation and use the single Sign on facility. Unfortunately, no other member of the CoP had the resources to apply the SSO on their services or clients and take advantage of the Andreas offering. The activity resulted in video demonstrations that are publicly available here.

- Data quality

Two quality vocabularies have been detected: an Australian work done by Peter Brenton team (https://github.com/tdwg/bdq) and the QualityML vocabulary developed by CREAF in the GeoViQua project. The intention was to do a comparison of both approaches but we were not able to do that in the timeframe of the first interoperability experiment. It is foreseen that the second IE will continue what was started here. In addition to these activities, another activity about quality annotating scientific documentation in a standard way was proposed by Lucy Bastin. A video was recorded that summarises the idea: https://portal.opengeospatial.org/files/?artifact_id=82544

The second Interoperability Experiment started in November 2019 during the CoP Forum #4 in Barcelona, with the following topics of interest:

- Experiment with the SensorThings API

In the first phase of the interoperability experiment we focused on the use of SOS as a standard service to distribute data coming from citizen science observations. OGC was increasingly experimenting with OpenAPI approaches and concluded that a new generation of services will implement web API based on

resources instead of the old web services paradigm. Actually, the OGC sensor world already produced a sensor API that has been around for 2 or 3 years that is called SensorThingsAPI. The interoperability experimented with SensorThingsAPI clients and services and demonstrate their applicability for citizen science. The final aim is to update the OGC discussion paper SWE4CS into a new version, explaining how to user SensorThingsAPI for Citizen Science.

- Design an architecture for a Cit Sci federation

In each topic there are myriad citizen science projects that are very dynamic in nature and require recruiting volunteers to run their campaigns. The heterogeneity of platforms, use accounts and data licenses can become a stopping factor both for data acquisition and exploitation. The H2020 Landsense federation offers a federation architecture based on single sign on technologies that provides uniform login on heterogeneous platforms and full control on personal data privacy. This topic aims to experiment on extending the Landsense federation to the cloud (in particular to the EOSC in the umbrella of the H2020 CO4Cloud project) where biodiversity projects and infrastructures should be integrated and in contributing to propose new elements that should complement the current GEOSS Platform to include citizen science data.

- Integration of the OGC definition server in Cit Sci projects

One of the main difficulties on combining small citizen science projects into large datasets is the lack of common vocabularies and acquisition strategies. The OGC definitions server is proposed as an open linked platform that will store definitions on variables and procedures done for capturing citizen science data. By publishing their definitions, projects will be more transparent to their users, other projects will be able to adopt the same definitions and procedures and scientist gain confidence on the data because they will be able to understand it.

- Lisbon Declaration

The Lisbon declaration summarised the status of citizen science in GEO/GEOSS and presented concrete steps way forward for integrating citizen science and Citizen Observatories into GEOSS. It was initiated during the EuroGEO conference 2019 in Lisbon. Although not formally initiated by the Interop CoP, there was a large overlap in terms of people involved in both initiatives (Lisbon declaration and the Interop CoP). The consolidated text was shared among the Interop CoP for review and contributions. The Lisbon Declaration was subsequently finalised (Masó and Fritz, 2020) and published and promoted via a dedicated WeObserve Policy Brief (Masó and Wehn, 2020).

In the Interop CoP, a Gitter chat has been created to follow up discussions.

The Interop CoP concluded the second phase of the IE. Now we are concentrated on producing the second Engineering Report (ER). This ER will also report on the experience of presenting the CoP's work at the 2020Earth Challenge 2020, where interoperability recommendations were taken very seriously.

Conference and events

At the EGU 2020 event, a session was accepted on Citizen Science and Open Science as an oral presentation (Interop CoP, SDG CoP).At the OGC Members Meeting (formerly known as TC meetings) happening every 3 months, the evolution of the interoperability is presented to the OGC membership.

Results and Reports

The result was positive allowing for some Technology Integration Experiments (TIE) where clients were able to visualize data coming from services from other vendors and projects alongside their own data. For example, three implementations have been developed including the STA data model and integrated to a single sign-on service. These developments and the SensorCitizenSTA proposal will be included in the 2nd Engineering Report.

The OGC Citizen Science Interoperability Experiment Engineering Report, a major output from the Interop CoP was published in 2020.

COs4Cloud collaboration
The Interop CoP will ensure its sustainability by becoming part of the H2020 project COs4Cloud which is interested in interoperability with the European Open Science Cloud and runs until 2023.

6. SDGs Community of Practice

6.1 Objectives & Participation

The thematic focus of the SDGs CoP is the research and practice that Citizen Science (CS)/Citizen Observatories (COs) can contribute to the UN Sustainable Development Goals (SDGs). The aim of the SDGs CoP is to connect citizen science practitioners and researchers; National Statistics Offices (NSOs) and government officials; UN and other international agency representatives; and the broader data and statistics communities to share and exchange knowledge, ideas and resources on how to demonstrate the value of citizen science data and impact for SDG achievement. It is widely accepted that CS/COs and citizen science in general, has great potential to contribute to SDG monitoring and implementation. They can complement the traditional sources of data and fill data gaps in the SDG indicator framework; enable active citizen involvement in the SDG processes and ensure government accountability as a transparent and participatory approach. As such, CS has a strong potential to leverage the SDGs as an active operator and monitor of change. During the SDGs CoP launch event that took place in Venice at the Citizen Observatories for Water Management (COWM) Conference on 27-30 November 2018, the foundational members of the SDGs CoP, in other words, launch event participants co-created the objectives and relevant activities of the CoP, which were then discussed with and confirmed by the wider CoP members that couldn't make it to the launch event. The objectives of the SDGs CoP, as per the inception report, are as follows:

1. Understand the opportunities for COs/CS in SDG monitoring and implementation, integrate these into the WeObserve knowledge base/community and learn from existing partnerships (i.e. projects and custodian agencies, national statistical offices)
2. Advance our knowledge of how COs/CS can help change behaviours towards achieving SDGs

The SDGs CoP currently has 149 participants. Participants choose whether they want to be an active member or an observer of the CoP. Active participants are expected to take part in the CoP telcos, F2F meetings, etc. as much as possible, and actively contribute to the CoP activities identified. Observers are included in the email communication and have access to the CoP online workspace. Active participants of the SDGs CoP (around 47 participants are actively engaged) includes UN and other international agency representatives (UNEP, UNSD, UNCTAD, UNITAR, WMO, UNESCO, etc.), National Statistical Offices (NSOs) and other government officials, broader data and statistics communities, policy makers at the EU level and broader and citizen science practitioners and researchers, among others.

6.2 Activities and outputs

Activities undertaken by the SDGs CoP followed the agreed work plan. The SDGs CoP has particularly been focusing on realizing its first objective on exploring and demonstrating the value of citizen science data for SDG monitoring due to the interest of its members and the impactful results of the activities carried out as part of this objective on the above-mentioned target groups.

The first concrete output of the SDGs CoP was a scientific paper, Citizen Science and the UN Sustainable Development Goals, which was published in October 2019 in the journal Nature Sustainability. The second paper, Mapping Citizen Science Contributions to the UN Sustainable Development Goals, that was published in July 2021 in Sustainability Science was another output produced by the SDGs CoP. Both resulted in great attention of the global data and statistics communities, including the UN. For example, the InterAgency Expert Group on SDG indicators (IAEG-SDGs), which is the group that consists of the NSO representatives from around the world that developed the global SDG indicator framework for SDG monitoring and responsible for its implementation, invited the SDGs CoP to its 10th meeting that took place in Addis Ababa on 21-24 October 2019 to present the initial findings of the SDGs mapping paper.

Additionally, the UN Statistics Division invited the SDGs CoP to present the same work to the countries that were preparing their Voluntary National Reviews (VNRs) to be presented at the UN High Level Political Forum (HLPF) in 2020. The chair of the SDGs CoP was also invited to the Working Group on Geospatial Information (WGGI) of the IAEG-SDGs as an observer - only the NSOs are allowed to be full members of the IAEG-SDGs and its working groups -. Another important outcome of the SDGs CoP activities is that the CoP chair was invited to the expert consultations of UNEP for developing a methodology for the SDG indicator 14.1.1 "Index of coastal eutrophication and floating plastic debris density". Citizen science has been agreed to be a primary source of data for monitoring marine litter as part of this indicator as a result of these consultations. Currently, thanks to the SDGs CoP activities, IIASA is currently working with the Ghana Statistical Service, Ghana Environmental Protection Agency, UNEP, and many others to implement citizen science approaches for the country's official SDG monitoring efforts for the identified indicators, one of which is marine litter. The project is called Citizen Science for the SDGs (CS4SDGs). A step-by-step guideline will be produced for others NSOs and countries that are interested in replicating the results of this project and using citizen science for their official SDG monitoring and reporting activities.

SDGs CoP is also very present at the global level. The SDGs CoP chair is a member of the UN Sustainable Development Solutions Network – Thematic Research Network on Data and Statistics (SDSN TReNDS); co-chairing the Citizen Science Global Partnership (CSGP) SDGs and Citizen Science Maximization Group and active members of other groups such as the Group on Earth Observation (GEO) Citizen Science and Crowdsourcing Community Activity (that is closely linked to WP4 of WeObserve), GEO Earth Observation for the SDGs initiative (EO4SDG), GEO Earth Observation Toolkit for SDG 11 Working Group, etc.

Here is a list of some of the outputs that the SDGs CoP produced and/or contributed to:

- Mapping Citizen Science Contributions to the UN Sustainable Development Goals (Fraisl et al., 2020) -Scientific Paper
- Citizen Science and the UN Sustainable Development Goals (Fritz et al., 2019) - Scientific Paper
- The role of combining national official statistics with global monitoring to close the data gaps in the environmental SDGs (Campbell et al., 2020) - Scientific Paper
- Citizen Science Data Integration for Understanding Marine Litter (Campbell et al., 2020) - Conference paper
- Counting on the World to Act Report by the UN SDSN TReNDS (Espey et al., 2019) - Report
- Citizen Science and the UN Sustainable Development Goals (Fraisl et al., 2020) - Story Map

Conference and events
Below are some of the conferences and events that the SDGs CoP organized or presented at:

- 52nd Session of the UN Statistical Commission, 1-3 March, 2021: **Side event** on the "Contribution of Citizen Science Data to SDG Monitoring"
- UNEP Science Policy Business Forum (SPBF), 18-20 February 2021, Online: **Presentation** at the "Opening of the UNEP Science Policy Business Forum and the Expert High Level Session on Big Data and Frontier Tech*"s*ession
- UNEP - Understanding the Contributions of Citizen Science to Plastic Pollution Monitoring through the SDG Framework Workshop, 16 December 2020, Online: **Presentation** on "Citizen Science Contributions to the SDGs" and **Co-organizing** the workshop
- CO-DATA International FAIR Convergence Symposium 2020, 27 November – 4 December, Online: **Session** on "Synergies between Citizen Science Data and the UN Sustainable Development Goal (SDG) Indicators"

- UN World Data Forum, 19-21 October 2020, Online: **Session** on "Integrating Citizen Science into the Official SDG Monitoring Mechanisms and a Proposal to Use Unofficial Statistics for SDG Reporting (to Deal with Crises)"
- UN World Data Forum, 19-21 October 2020, Online: **Presentation** on "Potential of Citizen Science for SDG 11" at the "Earth Observation SDG 11 Toolkit Session"
- Citizen Science and the SDGs Conference, 14-15 October 2020, Online: **Session** on "Contribution of Citizen Science Data to Monitoring the SDGs"
- European Citizen Science Association Conference, 6 – 11 September 2020, Online: **Session** on "Citizen Science and the UN Sustainable Development Goals"
- Americas Symposium 2020, 7 September 2020, Online: **Presentation** on "Citizen Science and the SDGs"
- European Open Science Forum, 2-6 September 2020, Online: **Session** on "Citizen Science for the UN Sustainable Development Goals"
- 6th International Conference on Big Data for Official Statistics, 31 August – 2 September 2020, Online: **Presentation** on "Mapping Citizen Science Contributions to the SDGs"
- COST Action on Citizen Science Final Event, 29 June – 1 July 2020, Online: **Presentation** on the "SDGs and Citizen Science"
- European Geosciences Union (EGU) General Assembly 2020, 4-8 May 2020, Online: **Presentation** on the "Potential Role of Citizen Science for Addressing Global Challenges and Achieving the UN Sustainable Development Goals"
- UN Statistics Division (UNSD) Workshop on Data and Statistics for Evidence-based Voluntary National Review, 9 - 12 December 2019, Vienna, Austria: **Presentation** on Mapping Citizen Science Contributions to the SDGs
- UN Geneva Forum - 4th Annual International Conference on Participatory Research, Citizen Sciences, Crowd-Innovation and Fab Labs for Peace and Development, 11 December 2019, Geneva, Switzerland: **Presentation** on Citizen Science and the SDGs
- Geo Week 2019, 4-9 November 2019, Canberra, Australia: **Presentation** on "Citizen Science and the SDGs"
- UNEP Science Policy Business Forum (SPBF), 6 – 8 November 2019, Canberra, Australia: **Participation** in the meetings of the UNEP SPBF
- IAEG-SDGs, 10th Meeting, 21 - 24 October 2019, Addis Ababa, Ethiopia: **Presentation** at the "10th Meeting of the IAEG-SDGs"
- UN Environment Assembly (UNEA4), 9 – 15 March 2019, Nairobi, Kenya: **Presentation** on "Citizen science and its potential to monitor marine litter for SDG 14"
- UNEP Science Policy Business Forum (SPBF), 8 – 10 March 2019, Nairobi, Kenya: **Participation** in the closed meetings of the "UNEP SPBF Working Group on Big Data and Digital Ecosystems for the Planet"
- Citizen Observatories for Water Management (COWM) Conference, 27 – 30 November 2018, Venice, Italy: **Session** for the "launch of the SDGs CoP"
- Citizen Science and the SDGs CoP Soft Launch and Paper Writing Workshop, October 2018, IIASA, Laxenburg, Austria: **Organising the 2 full day event**

COST action proposal

The SDG CoP has submitted a COST action proposal on CS & the SDG to sustain the SDGs CoP and its activities.

Thematic focus speakers in the SDG telcos

The SDGs CoP has a member presentations section in the monthly telcos, where CoP members talk about their recent activities in the field of "SDGs and citizen science" to spread awareness on relevant work, engage with other CoP members and learn about the latest developments in the field.

Some of the speakers of this section included the following SDGs CoP members:

- Christopher Wood, Director of e-Bird, Cornell Lab of Ornithology
- Danny Lämmerhirt, Research Associate at the University of Siegen, Germany
- Elena Proden, Senior Specialist, UN Institute for Training and Research (UNITAR)
- François Grey, Professor, University of Geneva, Coordinator of the Crowd4SDG Project
- Heidi Taylor, CEO Tangaroa Blue Foundation, Australian Marine Debris Initiative (AMDI)
- Jessie Oliver, International Liaison, Australian Citizen Science Association
- Jillian Campbell, Head of the Monitoring, Review and Reporting Unit, Secretariat of the Convention on Biological Diversity, UNEP (UNEP CBD)
- Karen Bett, Global Partnership for Sustainable Development Data (GPSDD), Policy Officer
- Katrin Vohland, Director, Natural History Museum (NHM) Vienna - Coordinator, Citizen Science COST Action
- Omar Seidu, Head of Demographic Statistics and SDG Coordinator, Ghana Statistical Service (GSS)
- Raquel Ajates, University of Dundee, WeObserve Project
- Rosa Arias, CEO & Founder of Science for Change, Coordinator of the D-Noses Project
- Steve McFeely, Chief Statistician, UN Conference on Trade and Development (UNCTAD)
  Sven Schade, Team Leader on Citizen Science in the Digital Economy unit of the Joint Research Center (JRC)

7. Reflections on challenges faced & lessons learned

Engagement of participants
In line with the focus of the Co-design & Engage CoP on how to engage citizens and other stakeholders in CO activities, all four WeObserve CoPs struggled themselves with a certain ebb and flow of participation in their respective activities. The F2F meetings (launch, Forum #1 and Forum #2) were generally very well attended, while the monthly telcos suffered from lower levels of participation at times. The CoP Chairs and WeObserve team responded by timing the Forums as frequently as possible and paying particular attention to the participants' interest in terms of thematic focus of these meetings (i.e. co-designing the agendas). The consensus reached during Forum #2 (Venice) on using the joint production of scientific publications as the main vehicle and incentive for participation meant that initial CoP work plans had to be adjusted slightly accordingly. This preference was correlated with the large percentage of research and academic participants in the Co-design & Engage, Impact and SDGs CoPs. In the Interop CoP, for instance, there were difficulties to find the right technical people to participate, as some of them were too busy with their regular activities, so they were forced to contribute during their own free time. In this respect, the overarching aim of the WeObserve CoPs to consolidate knowledge dispersed across various stakeholders was not completely met and will require additional efforts to engage different stakeholder types.

Moreover, the evident preference for F2F interactions in the WeObserve CoPs is in line with the literature on CoPs and knowledge management (Wenger, 2002). Moreover, the feedback obtained following Forum #2 about the nature and length of F2F meetings was taken on board for the organisation of subsequent for a, including three days of Forums – the first and third day (half-day) and second day (full day). Future surveys among the CoP members will be used to capture evolving preferences, so that the coordinating team can respond accordingly.

Resource constraints
The budgets allocated to each CoPs (for travel, Forums, etc.) were rather limited, which means that attendance of some key events by the CoP Chairs for representation of their CoPs was often not possible.

One of the key objectives of WeObserve was to develop communities of practices around key topics to assess the current CO knowledge base and strengthen it to tackle future environmental challenges using CO-driven science. In the first year of the project, a total of four CoPs were launched, three as initially envisaged (Co-designing citizen observatories and engaging citizens; Impact and value of citizen observatories for governance and Interoperability and standards for citizen observatories) plus a forth one on the highly current subject of the United Nations Sustainable Development Goals and Citizen Observatories.

Having gone through the launch process four times and sustaining four CoPs, the consortium has learned several lessons. For one, we now understand much better all that is involved in launching and sustaining these CoPs. Moreover, the themes currently addressed by the CoPs provide a sound thematic spread of issues that need to be addressed in order to enhance the knowledge base on COs, namely social, technical and political aspects. Finally, adding another CoP would not only drain resources from the project team but also potentially lead to thematic duplication and overlaps across the CoPs (as is partly already the case between the current CoPs).

In order to use the available resources efficiently and effectively, we therefore proposed to limit the total number of CoPs to these four CoPs, rather than five as envisaged in the proposal. This approach has the advantage of using project resources for the CoPs most effectively, keeping the four CoPs running at the current intensity while covering key thematic aspects of the CO knowledge base. Nevertheless, as reported in section 2.2, the 'sister CoP' CS&OS CoP was launched in July 2020, based on the approach to CoPs produced by WeObserve and using the expertise of WeObserve partner IHE to co-lead the CS&OS CoP.

Fluctuation of people
The fluctuation of CoP members is one of the recurrent issues that arise in keeping the WeObserve CoPs going. At the beginning, there was a lot of interest to participate, but then the number of participants decreased slightly. It is important to develop strategies to overcome that situation and to have new people coming in, and to reach out to people who are interested in joining this type of activity. Continuous recruitment was done actively by all Chairs of the WeObserve CoPs (e.g. promoting the CoPs in relevant project interactions, conference sessions) as well as by CoP members (e.g. word-of-mouth).

In some cases, fluctuations on membership also has positive effects. New members join the CoPs, and it creates fertilisation among the ideas that are already in the community and the new ideas that new members bring. In the WeObserve CoPs, to facilitate this integration, minutes were co-created, and anybody can refer back to the previous minutes to understand and see what was discussed before. In addition, there is an online collaborative workspace for each of the CoPs.

Type of stakeholders
All four CoPs are inclusive and have tried to engage all types of stakeholder groups; however, it has not been easy to involve practitioners from civil society and the private sector in the CoPs. Many of the CoPs members are CS practitioners from academia. Overall, there is a strong emphasis on writing papers together, as this is how academics consolidate their knowledge. There is a small number of SMEs, NGOs and CSO members joining the CoPs and for them, writing scientific papers is not a major incentive. In the future, having co-chairs from different stakeholder groups could be considered to foster activities attracted to diverse members.

Setting up a Community of Practice online
As mentioned earlier in this report, the WeObserve CoPs were set up using a consistent co-design approach. During the COVID-19 pandemic, a spin-off activity was launched, resulting in the Citizen Science & Open Science CoP under the CSGP. This CoP was initiated online and is a truly global CoP where participants are based in all time zone across the globe. In order to set up this CoP, two online workshops were organised on the same day, one in the early hours of the European working day and the other at the end of the European working day. This allowed people as far apart as Australia to Latin America and the US to join one of these two workshops. Subsequently, all findings were put together in a joint inception report. The regular plenary telcos are set up alternating between early and late hours of the European working day. Detailed minutes are co-created by the CoP Co-Chair and members, allowing CoP members unable to participate in any given telco to catch up with the discussions.

Demand-driven approach

One of the lessons learned was that it is essential to be open and flexible while running a CoP. It is important to co-design the objectives, activities and timeline at the start of a CoP together with the members to ensure engagement and keep interest, but it is equally important to be able to adapt along the way based on the developments in the field and interests of the CoP members and target groups. For example, in the SDGs CoP, the first objective (contributions of citizen science data to SDG monitoring) raised so much attention and awareness within the global data and statistics and citizen science communities, the SDGs CoP prioritised the topic and keep engaging with new stakeholders to realise the potential offered by citizen science data. This led to changes on the timeline and uptake of the objective 2 on the behaviour change aspect of citizen science, as this was what the data landscape and dynamics in the field of data and statistics required, which was acknowledged and well-received by the CoP members. Similar dynamics were at play for the Co-design & Engage CoP and the Impact CoP. Moreover, defining a single outcome in the form of a written report or a paper (such as the OGC Citizen Science Interoperability Experiment Engineering Report) creates an additional motivation that made the outcomes of the CoP tangible.

Balancing members' needs

It is important to always keep in mind the diverse needs, expectations and requirements of the CoP members and their organisations. Some members are interested in producing scientific papers, while others want to implement the research and results produced. Additionally, there are members interested only in hearing what is happening in the field. Some wanted to be more active and join the activities and tasks, and others just wanted to join meetings and listen or receive emails and have access to presentations and meeting minutes. Therefore, one of the learnings was that it is essential to create an atmosphere where everyone feels comfortable with their contribution and time they could allocate for the CoP and its activities. The chair of the respective CoP needed to provide not just coordination, but also steer the work and contribute a good percentage of the overall amount of work to ensure the continuity of the activities.

The positive impact of increasing visibility

Another important lesson learned was that increasing the visibility of the CoP activities, e.g. for the SDG CoP in both, data and statistics and citizen science communities, through conferences and events was very useful to sustain the increased attention to the CoP and to implement the research results produced, which led to piloting some of the results of the SDGs CoP activities, such as the CS4SDGs project in Ghana, as mentioned above. This was really important in terms of realizing the "practice" part of the "Community of Practice" rather than focusing purely on producing scientific papers. This way, bigger impact is expected to be achieved thanks to the SDGs CoP work and the key partnerships it created.

Avoid duplications

The connection of the CoP with other collectives such as the OGC increased its visibility but created duplications because, some discussions were repeated both in the CoP and in the OGC meetings. Sometimes it was difficult to find the space where the CoP has its own identity and specific objectives.

8. CoPs members' evaluation

This section presents the evaluation of the WeObserve CoPs by its members. The evaluation process was initiated with interested CoP members during the CoP Forum #5 in October 2020 and rolled out as a survey to all CoP members during late November – mid December 2020. In total, 28 CoP members responded to the survey (21 Co-design & Engage per CoP, 18 Impact CoP, 10 Interop CoP and 21 SDG CoP). Among them, 13 respondents were involved in more than one CoP. The evaluation results are presented below, covering the process of CoP facilitation (section 8.1) and the results of each CoP (section 8.2) as perceived by their respective members. The design of the survey instrument for collecting data across the WeObserve CoPs was based on a tailor-made conceptual framework, composed of frameworks previously proposed by Meessen & Bertone (2012), Wenger et al. (2011) and Gharesifard et al. (2019). However, in order to better formulate survey questions, additional publications from peer-reviewed journal papers, books, reports and dissertations were included. The proposed conceptual framework for the design of the suvey was based on aspects such as inputs (resources), process (participation and facilitation dynamics), results (achievement of goals and objectives, individual/organisational outcomes and emerging impacts). The full conceptual and methodological details of this evaluation approach are included in a scientific paper about the WeObserve CoPs, the so-called 'Cross CoPs paper, co-written by members from all four CoPs, currently under preparation.

8.1 Process

CoP facilitation

The respondents to the CoP evaluation survey provided very positive feedback on the facilitation of interactions during the regular (typically monthly) CoP telcos. Almost all respondents who expressed their views on this, rated the facilitation of the CoPs as very good or good. The respondents believed that the regular CoP telcos were very well-organised, the CoP leads were very active, and the discussions in the regular CoP telcos were moderated in an effective way.

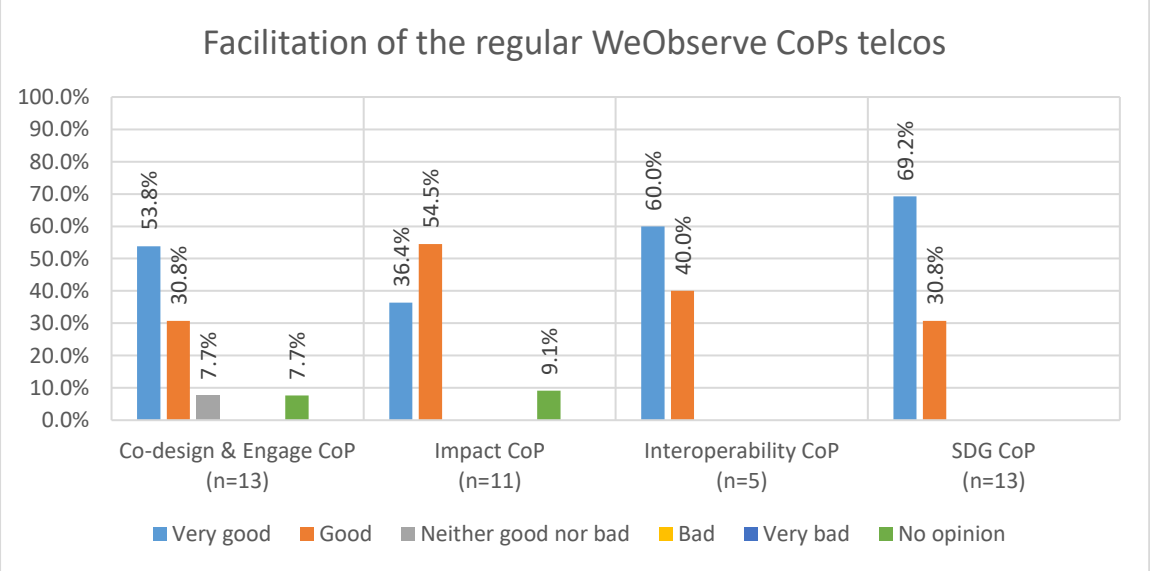


Figure 9. Facilitation of the regular WeObserve CoPs telcos

In addition, with respect to setting up CoPs, a respondent mentioned that "*the Citizen Science Global Partnership CS&OS CoP was founded in accordance with WeObserve principles. I found the WeObserve*

framework extremely helpful, more so than (e.g.) Citizen Science Association working groups, for setting up a CoP".

8.2 Results

8.2.1 Achievement of goals and objectives

Level of achievement of CoP objectives

The majority of the respondents who expressed their views about the achievement of the objectives in all four CoPs indicated that the CoPs have achieved their objectives to a large extent. Only a few respondents from the SDG and Interop CoPs believed the objectives of these CoPs have been completely achieved. Respondents found the regular meetings, presentations on particular topic, connections created (or strengthen) among member, synergies with other working groups (e.g. the GEO Citizen Science Activity and the OGC Citizen Science Domain Working Group) and continuous update on events, papers, etc. very helpful for achieving the CoPs' objectives.

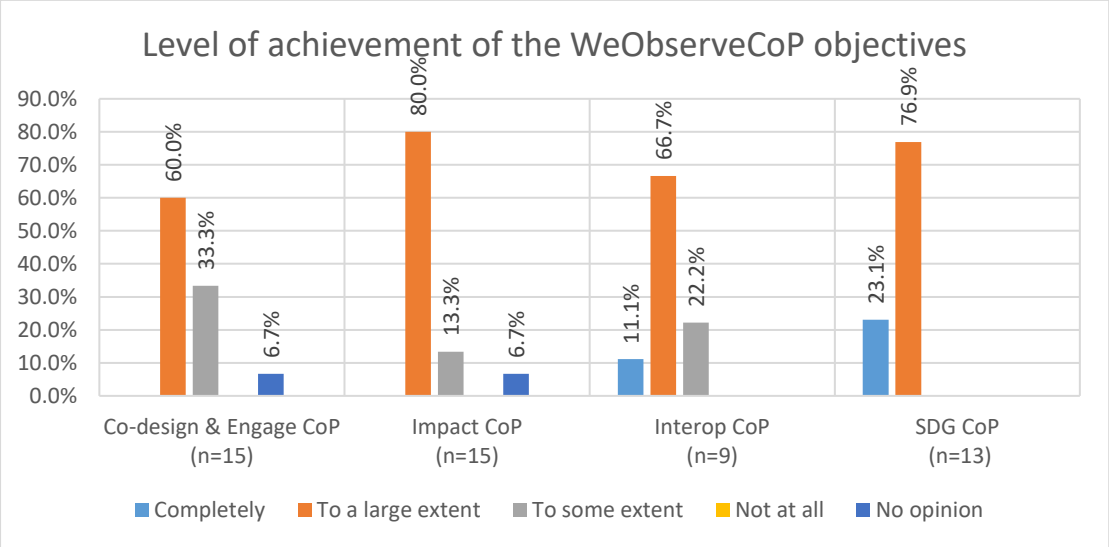


Figure 10. Level of achievement of the WeObserve CoP objectives

Level of achievement of participants' goals

The main expectations of the CoP members from participating in the four WeObserve CoPs are illustrated in Figure 11. As the diagram shows, expectations such as networking with relevant practitioners and/or other networks were frequently mentioned by members of all four CoPs. However, expectations such as helping to improve citizens science activities in the projects that the members were involved in, and making citizen science expertise available to others were more prominent among the Interop CoP members and less so among the SDG CoP members.

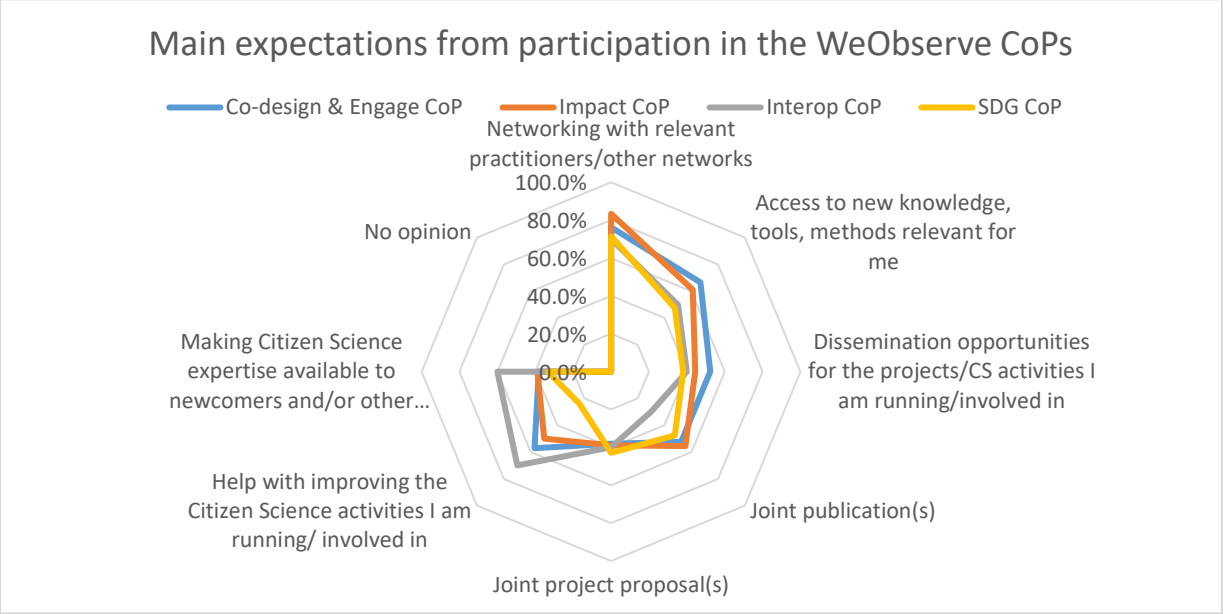


Figure 11. Main expectation from participantion in the WeObserve CoPs

The respondents also reflected on the realisation of their expectation from participating in the WeObserve CoPs. Among those who were able to answer this question, the majority indicated that their expectations had been met to a large extent. In a very specific example, a respondent from the Interop CoP mentioned that "*my expectations were that the WeObserve Interoperability CoP would largely be a second venue to carry forward OGC-led work on data interoperability, and this expectation has been met*". The only respondent who indicated his/her expectation for participation in the Engage & Co-design CoP and the Impact CoP was not met at all elaborated this response by adding "*this is largely explained by my own personal capacity to be able to contribute meaningfully within my working hours/the objectives of my current paid employment*".

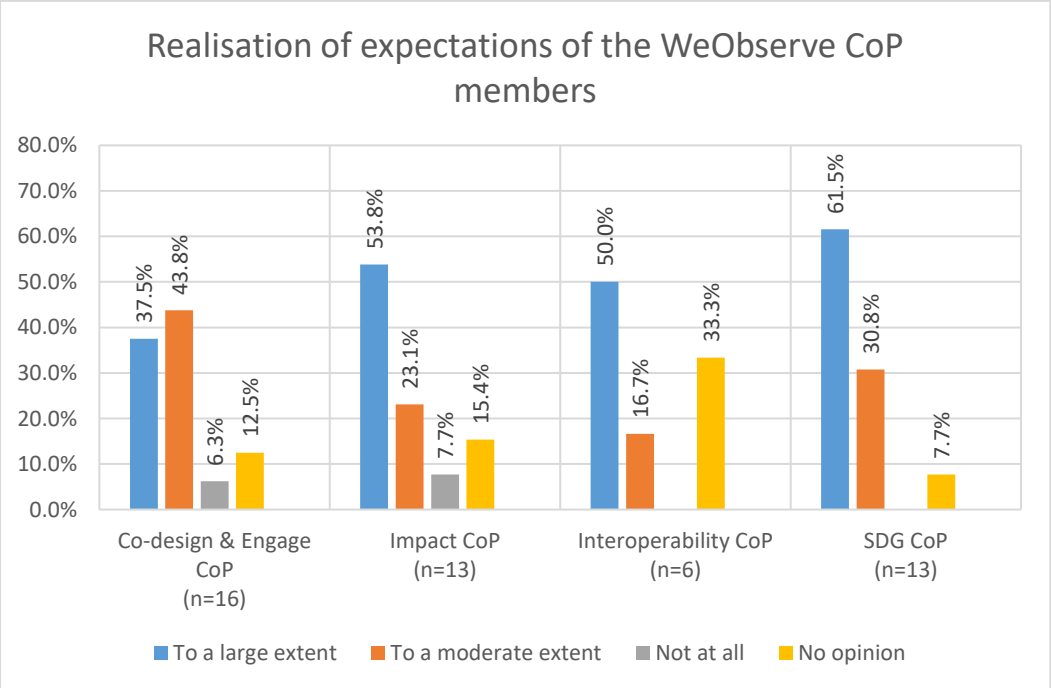


Figure 12. Realisation of expectations of the WeObserve CoP members

8.2.2 Individual/ organisational outcomes

Personal assets (human capital)

The respondents also rated the personal usefulness of participation in the WeObserve CoPs, e.g. for developing new skills or knowledge, change in understanding of a specific topic, finding out what others are doing on the topic, and/or getting inspired. For the Co-design & Engage CoP, the rating was an equal split between respondents who found the activities very useful and those how rated it moderately useful. In case of the other three CoPs the responses were also a split between the two choices 'moderately useful' and 'very useful', with the latter being slightly higher. Specific examples mentioned by the respondents included usefulness of finding new information, connections and websites; learning about the design of impact templates and data collection approaches; interesting presentations in the SDG CoP; learn more about specific projects e.g. SCENT and GROW.

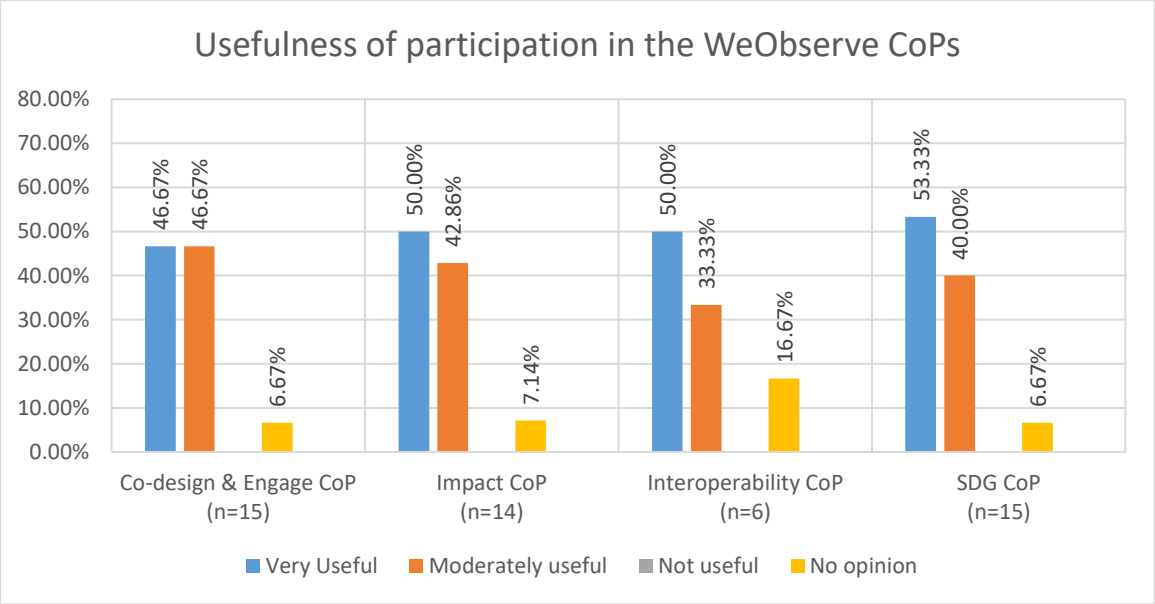


Figure 13. Usefulness of participation in the WeObserve CoPs

Relationships and connections (social capital)

The respondents were invited to reflect on whether or not they agree that participation in the WeObserve CoP(s) had created new collaboration opportunities for them. Overall, except for one case of disagreement in the Co-design & Engage CoP, respondents either (strongly) agreed, or could not decide if such collaboration opportunities had been created for them. In the case of the Co-design & Engage CoP, Impact and SDG CoPs, the percentage of (strongly) agree responses was much higher than neutral answers. Opportunity for working with new people in writing joint papers and project proposals were two of the explicit examples mentioned by the respondents.

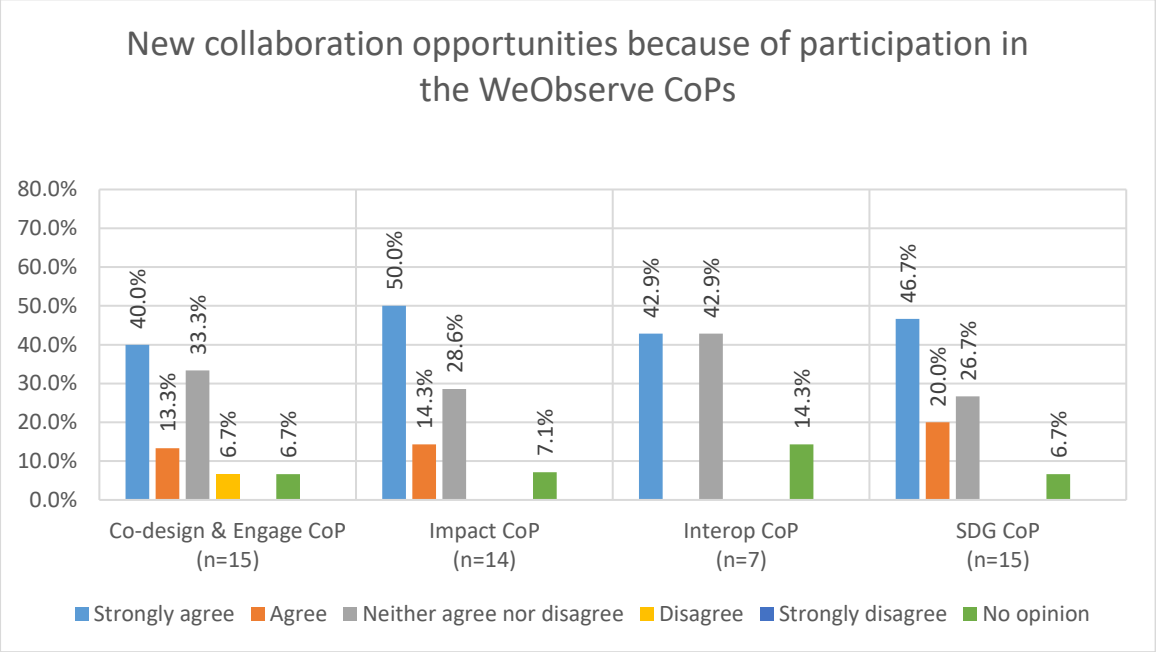


Figure 14. New collaboration opportunities because of participation in the WeObserve CoPs

Resources (tangible capital)

Through participation in the WeObserve CoPs, members of the CoPs could potentially access (new) resources (e.g. tools, methods, and processes). The following chart summarizes the respondents' opinion about the extent to which this access to (new) resources had materialised. In case of the Impact CoP, the majority of the respondents who had an opinion about this subject believed that this increase in access to (new) resources has been to a large extent. In particular, the templates produced in this CoP were mentioned as useful resources that ha applications beyond the CoP activities. For the other three CoPs, the majority of the respondents who had an opinion about this subject indicated moderate increase in access to (new) resources. Learning about tools/methods from other disciplines, links to conferences and access to the SensorThings API were among the explicit examples mentioned by respondents.

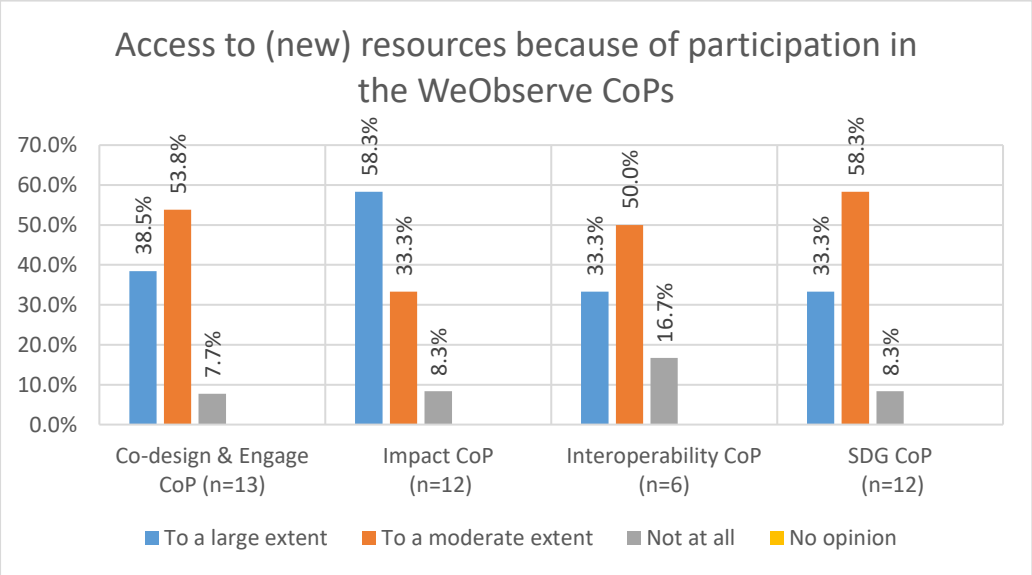


Figure 15. Access to (new) resources because of participation in the WeObserve CoPs

Collective intangible assets (reputational capital)

As illustrated in the following chart, perceptions about peer-recognition gained by different WeObserve CoPs varied across the four CoPs. While the collective expertise of the Interop and SDG CoPs were perceived to be largely recognised by the peers in the field of citizen science, respondents had varying ideas about such recognition for the Co-design & Engage and Impact CoPs. With this regard, a respondent mentioned, "The SDG COP had outcomes quite quickly and then additional concrete milestones completed some time ago, which has given the time needed for such recognition. The impact cop may have such outcomes too, but they are too early in development to evaluate peer recognition".

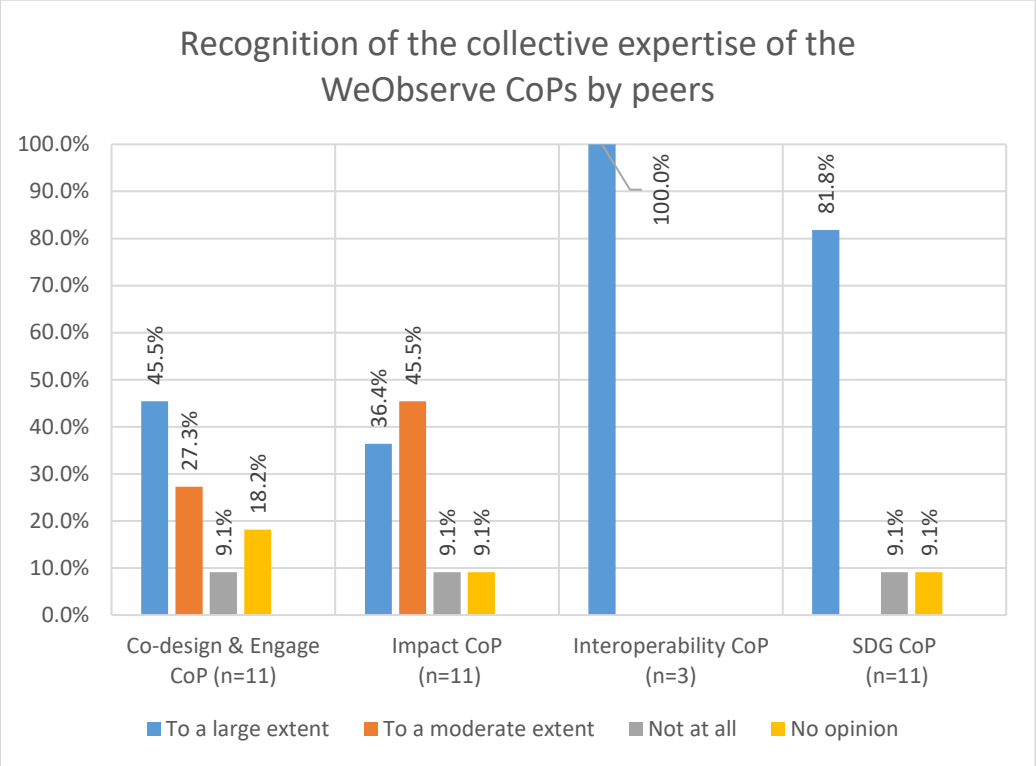


Figure 16. Recognition of the collective expertise of the WeObserve CoPs by peers

Transformed ability to learn (learning capital)

Several respondents across the CoPs believed that their ability to learn was not transformed because of participation in the WeObserve CoPs. For example, one respondent mentioned "*I don't think it has transformed how I learn but opened opportunities to learn new things*". Moreover, for many of the respondents it was difficult to judge whether or how such transformation had happened. In this regard, a respondent highlighted that it is "*difficult to evaluate given complexity with ways of knowing*". Nevertheless, some respondents (from the four CoPs) believed that their ability to learn had transformed (moderately or to a large extent) because of participation in the WeObserve CoPs. An example was a CoP member who indicated that "*greater exposure to social science (and methods) has been enlightening*".

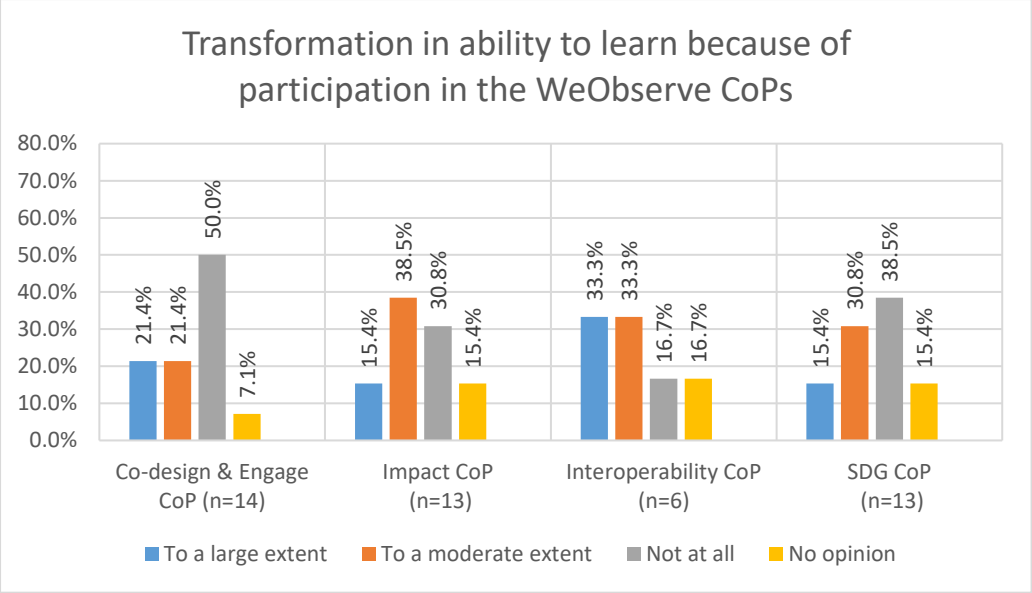


Figure 17. Transformation in ability to learn because of participation in the WeObserve CoPs

Implementation of advice/solutions/insights

For the majority of the respondents from the Co-design & Engage and Impact CoPs, the extent to which the insights, advice or solutions generated in the WeObserve CoPs had been applicable so far was considered moderate. In case of the SDG CoP, a higher percentage of the respondents believed that the advice/solutions/insights generated in this CoP had been implemented to a large extent and has application for further UN works, for example.

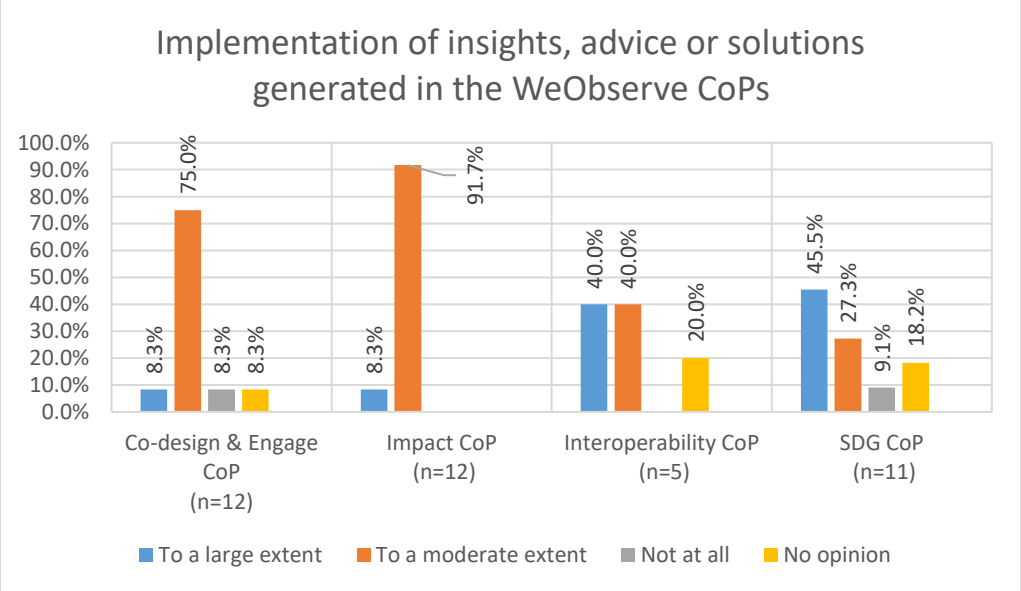


Figure 18. Implementation of insights, advice or solutions generated in the WeObserve CoPs

Innovation in practice

The following chart illustrates the perception of the respondents regarding the extent to which their participation in the WeObserve CoPs has resulted in innovation in practice, e.g. new ways of doing things,

new perspectives and/or new concepts in the field of Citizen Science. The majority of the respondents across all four CoPs indicated that the respective CoP had contributed to innovation in practice to a large or moderate extent. As an example, a member of the Impact CoP identified storytelling and impact stories as "totally new approaches" for capturing impacts of citizen science.

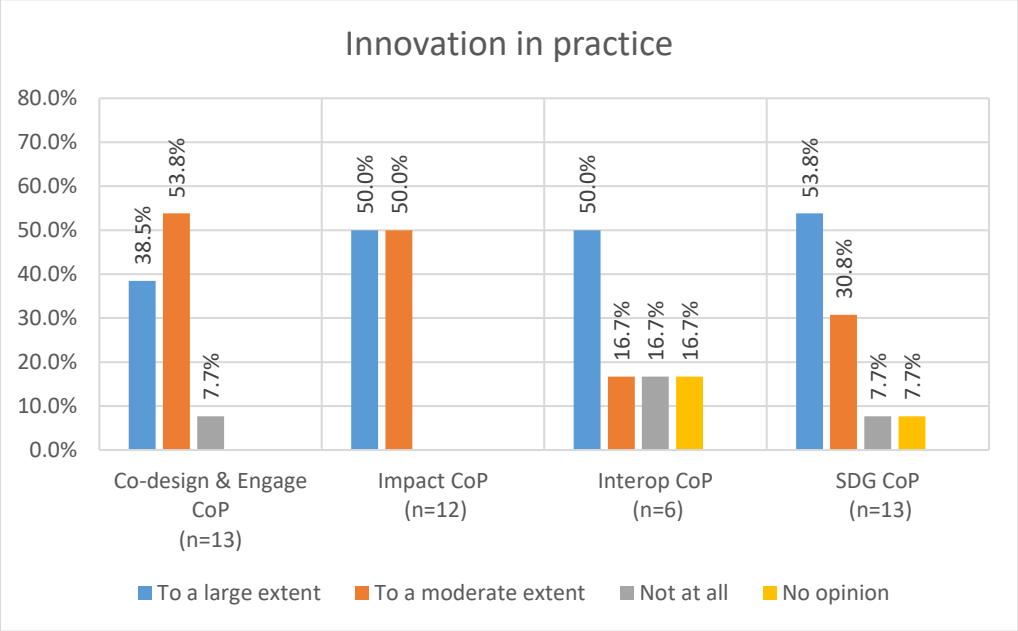


Figure 19. Innovation in practice

Use of tools and documents to inform practice

Participants in the survey were also asked to express their opinion about the extent to which the outputs or methods produced by the WeObserve CoPs had been used or applied, including outside the WeObserve CoPs. A large proportion of the respondents who expressed their views on this subject for the SDG and Interop CoP believed that the use of tools and documents produced in these CoPs has informed practice to a large extent. It was mentioned that the outputs of the SDG CoP that were captured in the "Mapping paper" (Fraisl et al., 2020) have been referred to frequently by range of stakeholders in various settings. For the Co-design & Engage and the Impact CoPs, however, the majority of the respondents indicated moderate use of CoP outputs and methods. In this regard, a respondent mentioned "*Impact CoP outcomes likely will [be] more, but [it is] too soon to say*".

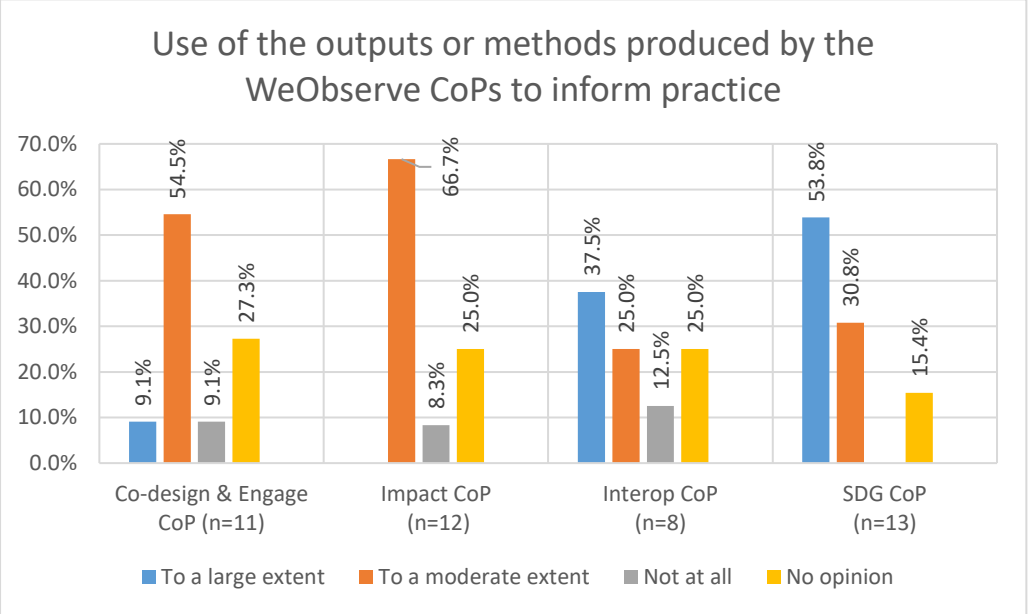


Figure 20. Use of the outputs or methods produced by the WeObserve CoPs to inform practice

Use of social connections

The extent to which CoP members have you leveraged the relationships /network(s) in the WeObserve CoPs varied across the four CoP and among the members of each CoP. Nevertheless, leveraging personal connections made with individual during the telco and joint proposal writing activities were mentioned as examples of using social connections made through WeObserve CoPs.

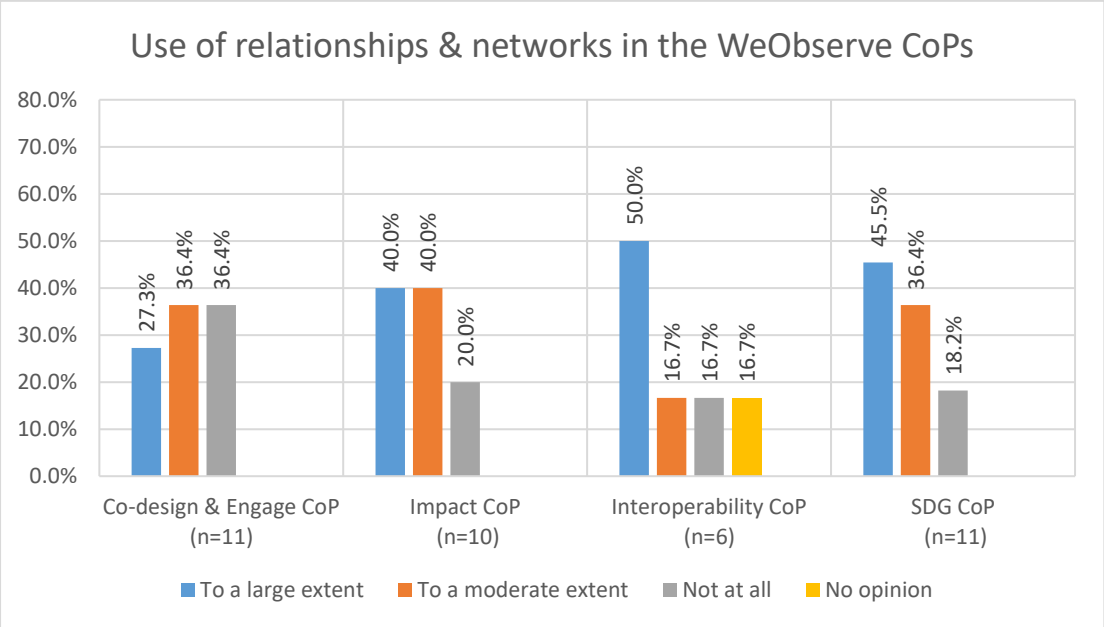


Figure 21. Use of relationships & networks in the WeObserve CoPs

9. Conclusions

The Communities of Practices developed by WeObserve were well established by the end of the project and well-regarded by the scientific community as well as other key communities, such as UN agencies and international organisations. They are seen as a reference point for consolidating knowledge as well as for establishing new CoPs, as has been the case for the new CS & Open Science CoP which has been established based on the WeObserve CoP method.

The CoPs have brought together > 240 people from >40 countries in > 70 CoPs meetings, 6 CoPs Forum and > 25 events/conference sessions were organised virtually and in >10 countries and 5 continents.

Consolidation of knowledge has been achieved by co-writing different CO publications and a joint paper by all four CoPs. CoPs members have contributed (and is contributing) to the following outputs, scientific/conference papers, story maps, glossary and impactful reports:

- Joint Cross CoPs – Scientific Paper (ongoing),
- Co-design Landscape – Scientific Paper (ongoing),
- Impact Stories Methodology – Scientific Paper (ongoing),
- CS Impact Assessment Methods – Scientific Paper (under review),
- OGC Citizen Science Interoperability Experiment Engineering Report (published),
- The 2nd Engineering Report (upcoming),
- Mapping Citizen Science Contributions to the UN Sustainable Development Goals – Scientific Paper (published),
- Citizen Science and the UN Sustainable Development Goals – Scientific Paper (published),
- The role of combining national official statistics with global monitoring to close the data gaps in the environmental SDGs – Scientific Paper (published),
- Citizen Science Data Integration for Understanding Marine Litter – Conference paper (published),
- Counting on the World to Act Report by the UN SDSN TReNDS – Report (published),
- Citizen Science and the UN Sustainable Development Goals – Story Map (published),
- WeObserve CoPs glossary (published),
- WeObserve Toolkit (published).

Challenges identified and addressed

As discussed in section 7, the WeObserve CoPs have encountered several challenges during their lifetimes. The main challenges refer to the engagement and the fluctuation of the members as well as to the profile of stakeholders which are predominantly from the academia and research institutions followed by NGO/NSOs. Another aspect discussed was the resource constraints due to the limited budget allocated to the CoPs activities and forums. However, since the COVID-19 outbreak, all the CoPs events took place online.

Plans for sharing the approach and lessons learned for setting up CoPs

A joint paper (the so-called Cross CoPs paper) has been initiated to capture insights from all four WeObserve CoPs on how to set up and implement communities of practice for citizen science and CO practitioners. This effort includes a thorough evaluation of the CoP members' experiences during the CoPs initiation and implementation via a dedicated survey. Completion and submission of the paper are planned for May 2021.

Continuation of the WeObserve CoPs

In terms of the life time and long term management of the WeObserve CoPs, in principle, the CoPs will exist for as long as they deliver value for their members, both in terms of achieving jointly set objectives, as per WeObserve CoP Terms of Reference (WeObserve deliverable D2.2) and in terms of the incentives for individual members. Each CoP has carefully considered options and reasons for its long term

sustainability and members of all four CoPs have expressed strong interest to continue the activities of their respective CoP.

Moreover, a dedicated discussion during the WeObserve Forum #6 (15-16 March 2021) confirmed that all four WeObserve CoPs will continue their activities for the time being, setting up at least one meeting between March and May 2021 in anticipation of the evaluation results of follow up funding.

- AH2020 WeObserve & Change Green Deal proposal led by IHE Delft was submitted in January 2021, and, if awarded, the **Co-design & Engage CoP**, the **Impact CoP** and the other WeObserve CoPs, plus an additional CoP on behavior change, will receive additional funding. Discussions on the continuation of these WeObserve CoPs will take place following the evaluation of the proposal around the end of May 2021. Alternatively, the Co-design & Engagement CoP and the Impact CoP may join the GEO Citizen Science Community which helps GEO to achieve impact, or form and converge with ECSA working group(s).
- The **SDG CoP** is awaiting the evaluation of a COST Action proposal, led by IIASA, that was submitted in October 2020 for which the result will be announced in May 2021. If the SDG CoP cannot be funded via this COST Action, it can be integrated as an ECSA working group, under the Citizen Science Global Partnership (CSGP) umbrella or under the GEO CITSCI Community Activity. As part of the COST Action, there are some tasks/activities that also refer to impact on policy, behaviour change, engagement and interoperability, thus, some of the other WeObserve CoPs could be funded too.
- Following the end of the WeObserve project, from April 2021 onwards, the **Interop CoP** will become part of the H2020 COs4Cloud project which is interested in interoperability with the European Open Science Cloud. At the same time, it will remain open to exploring additional opportunities, including those mentioned above.

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Linked WeObserve deliverables

Deliverable	Status
D2.2 Detailed terms of reference and guidelines for WeObserve Communities of Practice	Public
D2.3 WeObserve CoP Mid Term Progress Report	Public
D3.1 Develop infrastructure and WeObserve Toolkits	Public
D3.3 WeObserve Toolkits for Building Champion Communities	Public

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