



Co-designed Citizen Observatories Services for the EOS-Cloud
H2020 programme: Research and Innovation action

**D6.4 Report to demonstrate the Cos4Cloud
engagement model**

2023/01/31, Version R1.0



Project funded by the European Commission within the
Horizon 2020 Programme (2014-2020)

Grant Agreement No.	863463
---------------------	--------

Type		
R	Document, report excluding the periodic and final reports	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, photos, etc.	
SOF	Software, technical diagram, etc.	
OTHER	Flyers, etc.	

Dissemination level		
PU	Public, fully open.	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified	

Revision history

R#	Date	Description/Reason of change	Deliverable contributors
R0.1	20221212	Define structure	Sonia Liñán (CSIC)
R0.2	20230123	Inclusion of contents and creation of the first version	Sonia Liñán (CSIC)
R1.0	20230126	Review and inclusion of contents	Sonia Liñán (CSIC), Maria Daskolia (NKUA), Ángela Justamante (CREAF)
R1.0	20230130	Review and inclusion of contents	Sonia Liñán (CSIC), Maria Daskolia (NKUA), Ángela Justamante (CREAF), Janice Ansine (OU)

Authors

ICM-CSIC: Sonia Liñán, NKUA: Maria Daskolia (NKUA), CREAM: Ángela Justamante, OU: Janice Ansine

Citation

Cos4Cloud consortium (2022). Liñán, S, Daskolia, M, Justamante, A, Ansine, J. Deliverable 6.4 Report to demonstrate the Cos4Cloud engagement model.

License and attribution: Copyright. All rights reserved.

Executive Summary

This report analyses the engagement strategy designed and implemented in the Cos4Cloud project, as well as its evaluation.

The main goal of this report is to demonstrate how the model of long-term and large-scale engagement in citizen science has been implemented, monitored and evaluated in the project.

Index

1. Background	5
2. Introduction	5
3. Cos4Cloud model for long-term and large-scale engagement	6
3.1. Target audience for engagement	8
3.2. Different types of engagement in Cos4Cloud	8
3.3. Evaluation of the engagement strategy in Cos4Cloud	10
4. Engagement for the Co-design and testing activities	11
4.1. Quantitative evaluation: KPIs	11
4.2. Qualitative evaluation: surveys feedback	13
5. Engagement for the Cos4Cloud dissemination activities	13
5.1. Quantitative evaluation: KPIs	13
5.2. Qualitative evaluation: post-event surveys feedback	14
6. Engagement for educational training activities	16
7. Engagement for the Demonstration events	17
7.1. BioBlitzs	17
7.1.1. BioMARathon and UrbamarBio	17
7.1.2. Mini BioBlitz with iSpot to capture a map of autumn's wildlife	22
7.2. Datathons	23
7.2.1. Bio-Datathon 'Trees for life, trees for learning'	23
7.2.2. Bio-Datathon: 'A unique validation event of biodiversity data!'	25
7.2.3. Datathon with the 'Escola Gravi' school's students	25
8. Citizen and stakeholder engagement in COs	26
8.1. iSpotnature case study	26
8.2. MINKA case study	30
8.3. Surveys for COs	33
Cos4Cloud CO Survey 1: understanding needs and differences (June 2020)	33
Cos4Cloud CO Survey 2: Experiences from the COs in Cos4Cloud (December 2022)	34
An analysis framework summarising best practice experiences of Cos4Cloud COs	35
9. Engagement with the EOSC community	39
References	42
Annex I	45
Annex II	48

1. Background

Cos4Cloud (Co-designed citizen observatories for the EOS-Cloud) is a project funded under H2020 by the European Commission. It has designed and developed 13 prototypes and implemented technological services that improve citizen observatories (COs).

The project is carried out within the framework of the European Cloud of Open Science (EOSC), a virtual space aimed at European scientific staff. Therefore, once created, the services have been made available via the EOSC. Cos4Cloud's ultimate goal is to render these platforms more global, sustainable and viable over time by integrating citizen science (CS) into the EOSC and bringing citizen science projects as a service for both the scientific community and society at large.

The innovative services for improving the data and information quality will be designed, prototyped and implemented using deep machine learning, automatic video recognition, advanced mobile app interfaces, and other cutting-edge technologies based on data models and data protocols validated by traditional science. The new services provide mechanisms to ensure the visibility and recognition of data contributors and the tools to improve networking between various stakeholders. The design of new services has been user-oriented and carried out within a broad spectrum of co-design and testing workshops, engaging a wide range of stakeholders from society, government, industry, academia, agencies and research, who will help to co-design the service's requirements.

2. Introduction

This document evaluates and demonstrates the engagement strategy used in different contexts within the Cos4Cloud project. But first, we want to clarify what engagement is and how to differentiate it from other concepts and processes, such as communication, outreach and dissemination. Outreach, dissemination, and engagement are related but distinct concepts in the context of a citizen science research project and in Cos4Cloud in particular.

Communication is the exchange of ideas, information and data between researchers, participants and other stakeholders to facilitate the successful completion of the project (1) and to ensure that project objectives are attained (2, 3). Communication aims to ensure that all parties have the information they need to participate in or support the project effectively.

Outreach is actively communicating and promoting the project to potential participants, typically through various forms of advertising, such as social media, flyers, or public presentations. The goal of outreach is to increase project awareness and attract participants. It

can support communications, dissemination, public participation in science and be part of the process of engaging the public in research activities, such as data collection, analysis, and interpretation. (4,5).

Dissemination refers to sharing information about the project and its results with a wide audience. This can include publishing articles in scientific journals, presenting at conferences, or creating educational materials for the general public. The goal of dissemination is to share the knowledge and results of the project with others who can use it. This includes the process of sharing the results of a research project with the public, stakeholders, and other interested parties. (6,7).

On the other hand, **engagement** is the active involvement of citizens and other stakeholders in the project or the research process. Engagement can include a wide range of activities involving the target public, such as collecting data, analysing results, evaluating and communicating findings, participating in surveys or attending workshops (8, 9). Engagement aims to involve the public in meaningful ways and make the project a shared experience.

In summary, communication and outreach are about reaching out to people and making them aware of the project, dissemination is about sharing the knowledge and results of the project, and engagement is about getting people involved and participating in the project. All three are important for a citizen science project's success and complement each other.

3. Cos4Cloud model for long-term and large-scale engagement

The model for long-term and large-scale engagement in Cos4Cloud is used to engage members of the target public over an extended period and on a large scale. The model is based on the idea that engaging citizens in meaningful ways and building a sense of community and ownership around the project is crucial for achieving long-term success.

The Cos4Cloud engagement strategy has been designed and implemented using various key elements (Figure 1). Specifically, Cos4Cloud has based its engagement strategy on the following seven elements:

- 1) **Building a community of practice:** Cos4Cloud project built two communities of practice to implement the engagement strategy: Cos4Cloud Community for the co-design and testing activities (see section 4 of this document) and teachers and educators' community (see section 6 of this document).

- 2) Developing a strong partnership:** Cos4Cloud has established fruitful partnerships with the EOSC, ECSA, SciStarter and other projects and institutions. The complete list can be consulted in the “[Networking and synergies](#)” part of the Cos4Cloud website. These collaborations have helped to broadcast and amplify the reach of the outputs of the project through communication collaborations: cross-post in the blog, cross-posting in the social media network, co-organization of events, etc.
- 3) Providing training and support:** Several efforts have been made in this direction. Apart from the materials for stakeholders created during the project (collected in **D7.6 ‘Set of COS4CLOUD documentation per stakeholder audience’** (10)), several training sessions were organised to teach the use of the Cos4Cloud services and the COs involved in the project.

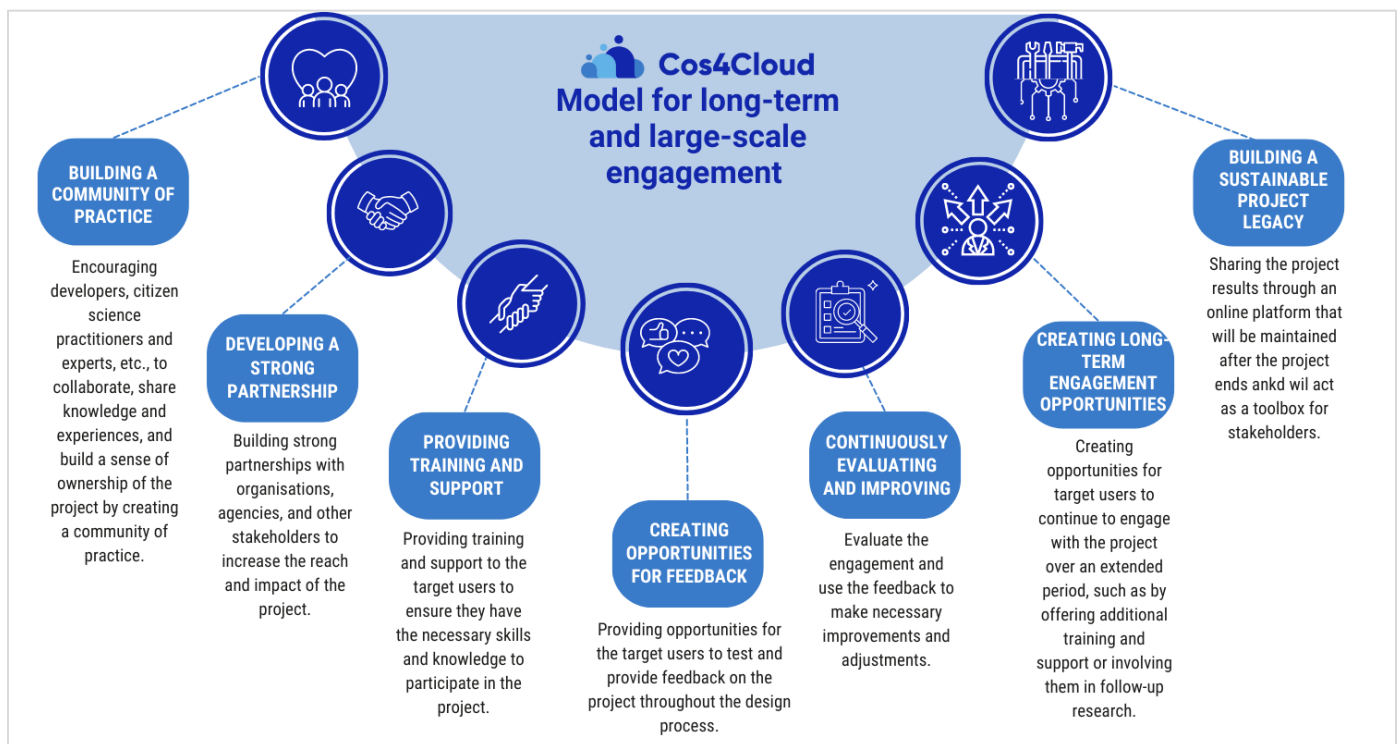


Figure 1. The key element of the Cos4Cloud engagement strategy.

- 4) Creating opportunities for feedback:** This point is one of the intrinsic elements of the project since co-design is a central part of Cos4Cloud. Other opportunities to collect feedback were the post-event surveys for participants that we sent after most of the Cos4cloud events.
- 5) Continuously evaluating and improving:** We have been keeping track of the results of the engagement strategy to implement changes as necessary.

- 6) Creating long-term engagement opportunities:** EOSC has been a great ally in creating long-term engagement after the end of the project. Cos4Cloud services and the Evidence Hub and Toolbox will be uploaded and linked to the EOSC marketplace and resources website. Also, a final event for the community of practice has been planned, and training activities are planned after the project's end to help keep the community engaged.
- 7) Building a sustainable project legacy:** A key part of the project has involved the process of capturing project results and sharing these through capacity-building training resources, educational materials, best practice guidelines, case studies, and success stories hosted in a space which will also develop evidence of impact. These are collated and demonstrated in **D6.3 'The Cos4Cloud Toolbox and Evidence Hub'** (11), one of the final legacy project outputs developed as a long-term online space for organisations, people and initiatives, etc., focused and interested in citizen observatories.

3.1. Target audience for engagement

Cos4Cloud has two target audiences: stakeholders and end-users. Stakeholders are individuals or groups who are interested in or are affected by the project (12). This includes researchers, participants, funders, policymakers, and the general public. End-users are those people actively participating in the project, such as volunteers, researchers, and other stakeholders. (13), they are in a position to apply the information or tools being produced. Target audiences for communication are described in **D8.2 'Communications Plan'** (14), and target audiences for dissemination and exploitation in **D7.3 'PEDR'** (15). Relevant audiences for engagement are:

1. Academia
2. Business and industry
3. Citizen-science community
4. Data analytics and developers' community
5. Education stakeholders
6. EOSC-related projects
7. European associations or similar entities related to citizen science
8. General public
9. NGOs
10. The press and media

3.2. Different types of engagement in Cos4Cloud

Engagement was used in Cos4Cloud with different purposes and applications. The engagement strategy has used communication, outreach and dissemination actions as tools to recruit and retain people in the project's core activities, such as co-design sessions and dissemination activities. But above all, the Cos4Cloud engagement strategy has been oriented to achieve

optimal involvement in the communities of practice. and the target stakeholders to achieve the project's objectives since user feedback is essential in Cos4Cloud.

In practical terms, the engagement strategy has been divided into large thematic blocks since the engagement's actions and implementation have been customised according to the target audience that was pursued and the final objective of involving this audience. According to this, we can say that the main thematic blocks for engagement in Cos4Cloud are:

- 1) Engagement for the Co-design and testing activities:** Different engagement actions were implemented to achieve a viable number of participants in the co-design and testing activities, as well as recruit all types of target audience needed and to study the participant's profiles and involvement in the project. (See section 4)
- 2) Engagement for the Cos4Cloud dissemination events:** Dissemination activities were essential so that the target audience could find out about the project's results and continue increasing the communities of practice, as well as retain existing users so that they continue to provide feedback. Different engagement actions were implemented to achieve an optimal number of participants in the dissemination events and to study the participant's profiles and involvement in the project. (See section 5)
- 3) Engagement for the education activities:** NKUA led most of the educational activities, including online training courses and webinars for teachers and educators to introduce citizen science and the citizen observatories of the project in school and university classrooms, and biodatathons and testing sessions/ events for some Cos4Cloud services (i.e. MECODA). Several engagement actions were conducted to get the participation and involvement of teachers and educators in Cos4Cloud. (See section 6)
- 4) Engagement for the demonstration events (BioBlitzs, Datathons):** One of the essential parts of BioBlitzs and Datathons is to get a relevant number of participants to have enough data derived from their participation. In the specific case of the BioBlitzs, the engagement strategy is also essential to achieve the involvement of citizens in the long term. Several efforts were made in Cos4cloud in this regard. (See section 7)
- 5) Citizen and stakeholder engagement in COs:** The Cos4Cloud project relied on the participation of a network of 9 citizen observatories (COs) and Do it Yourself (DIY) initiatives focused on biodiversity and the environmental domain. These platforms were responsible for testing various services with their users. Each CO (See **D6.2 'Guidelines**

on best practice for COs as part of the outreach methodology' (16)) implemented its engagement strategy with its communities of users and stakeholders both directly (i.e. developing and testing integrated services with user communities) as well as indirectly aligned with Cos4Cloud as part of their regular activity (i.e. using a service as part of the process of adding observations). Cos4Cloud also engaged with the CO leads and this involvement supported the delivery of targeted outreach and engagement strategies which were also influenced by the expertise and experience of these COs. Cos4Cloud also explored the impact on citizens and communities engaged in activities and learning through citizen science. (See section 8)

- 6) Engagement within the EOSC hub:** EOSC hub was a key factor in boosting engagement at Cos4cloud. Cos4Cloud has taken advantage of the EOSC hub to engage with the EOSC community. (See section 9)

The engagement efforts in Cos4Cloud were mainly oriented to the recruitment and retention of the participants in the co-design process, the educational activities and the demonstration events, as well as to finding out information about these participants, their background in citizen science and their desire to continue being informed about the project or to recommended it.

3.3. Evaluation of the engagement strategy in Cos4Cloud

Evaluating engagement in Cos4Cloud involves assessing the level of participation and involvement of members of the target audience in the project.

There is no common framework for evaluating an engagement strategy in citizen science-related projects. We have chosen an evaluation methodology that assesses the participation and involvement of members of the target audience in the project using qualitative and quantitative indicators. For each one of the typologies of engagement detailed above in 'section 3.2' of this document, we created a set of Key Performance Indicators (KPIs) for assessment purposes.

Additionally, we have gathered feedback from the participants in the Cos4Cloud events to gain a more comprehensive understanding of the success of the engagement efforts. After most of the events organised by Cos4Cloud, we sent all attendees a post-event online survey asking for their feedback. An example of these surveys can be found in Annex 1.

4. Engagement for the Co-design and testing activities

The engagement strategy for Cos4Cloud co-design and testing activities have been designed and implemented by the co-design team, made up of SfC, CREAF and CSIC members as well as through discussion and feedback with the wider CoNNect Group.

One of the main engagement strategies has been building a community of practice called the “Cos4Cloud community” that has been involved in the co-design and testing workshops, the sharing of knowledge and experiences and that have provided valuable feedback on the services.

To create this community and ensure their participation in the co-design and testing workshops, the co-design team used various engagement methods and actions explained in **D5.1 ‘Co-designed services for Cos4Cloud report’** (17). Section ‘2- Co-design Community’ summarises the engagement strategy used to engage the Cos4Cloud community in the co-design and testing activities. In addition, sections 4, section 5 and section 6 of **D5.1** present qualitative and quantitative indicators for the co-design and testing process, as well as the evaluation of the feedback provided by the participants with the post-event online questionnaires. In this document, we present the most relevant indicators for engagement based on those presented in D5.1.

4.1. Quantitative evaluation: KPIs

To evaluate the engagement strategy used in the co-design and testing workshops, we have selected some indicators from those presented in **D5.1** (See Table 1). The number of people involved in the co-design activities varied depending on the service. Although some had low participation, the number of inputs received to improve the service was high, which shows a high level of involvement on the part of the attendees. In addition, the number of inputs implemented in the services was high to moderate, except for STAPlus and Athenhix. Looking at these results, we can deduce that the engagement strategy was a success, given that we attracted the variety and number of stakeholders necessary to implement the co-design strategy.

Table 1. Compilation of the engagement indicators for the co-design of the 13 Cos4Cloud service

Services		Cos4Env	Cos4Bio	DUNS	Pl@ntNet-API	AI-Taxonomist	AI-GeoSpecies	Biodiversity-DL	FASTCAT-Cloud	FASTCAT-Edge	MOBIS	MECODA	STApplus	Authenix
Short description		Biodiversity experts portal	Environmental experts' portal	Data use notification	Pl@ntNet as a service	Similarity-search based identification	Location-based species prediction	Cross-platform training data aggregation	Pre-processing camera trap	Video stream processing service	Mobile Interface for Apps	Data analysis package	Extended data model for SensorThings API	GDPR compliance
Co-design performance	Number of co-design activities and testing	2	3	1	5	2	3	2	2	2	3	4	0	0
	N° people involved in co-design activities	16	45	6	332	85	129	85	41	41	270	102	NA*	NA*
Co-design impact	N° of co-design inputs	23	17	16	98	23	24	44	9	8	17	12	NA	NA
	Co-design impact (Accepted or in progress / total)	Very high	Very high	Medium	Very high	High	High	Very high	Very high	Very high	Very high	Medium	Low	Low

4.2. Qualitative evaluation: surveys feedback

As previously said, the communication team gathered feedback from participants of the co-design workshops through post-event questionnaires. The response rate varied between 8-55% depending on the session, but the data collected was useful for evaluating the performance of the co-design session and gathering valuable information for future sessions. One important indicator used in the questionnaire was the Net Promoter Score (NPS) of the co-design session, which had a mean value of 8.1, indicating that participants were satisfied with the activity. Additionally, the questionnaire also included questions about the length of the sessions, with 81% of participants finding it about right but 9.1% considering it too short.

5. Engagement for the Cos4Cloud dissemination activities

The engagement strategy for Cos4Cloud dissemination activities has been designed and implemented by the communications team, made up of CREAM and CSIC members, jointly with the dissemination and exploitation team, made up of Earthwatch members, as well as through discussion and feedback with the wider CoNnect Group.

Most of the tools and actions used to engage the Cos4Cloud's dissemination events are discussed in detail in **D8.2 'Communications Plan' (Table 5)** (14) and in **D7.3 'PEDR' (Section 3.3)** (15) and will not be reiterated here.

5.1. Quantitative evaluation: KPIs

To evaluate the engagement strategy used in the dissemination activities, we have selected a set of Key Performance Indicators (KPIs) (Table 2). Those KPIs are often used to evaluate the communication strategy since communication is one of the tools to get engagement.

Table 2. Compilation of the engagement indicators for dissemination activities in Cos4Cloud

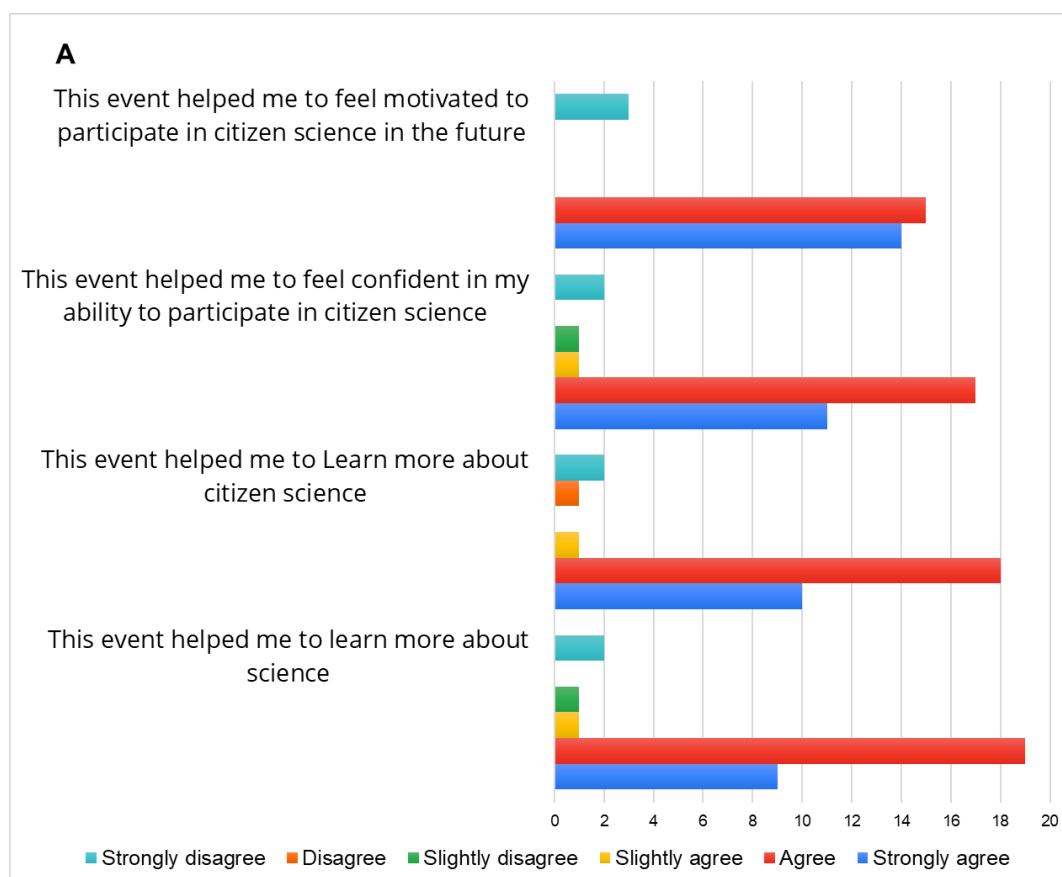
Engagement KPIs: Dissemination	Value
Number of conference & workshops presentations	133
Number of media coverage (including newspapers, radio & TV)	43

Number of news published on other websites	153
Number of social media shares	Almost 10.500
Number of attendees to the activities organised by Cos4Cloud	
Organised activities	37
Number of attendees to the activities organised by Cos4Cloud	1373

5.2. Qualitative evaluation: post-event surveys feedback

As previously said, the communication team gathered feedback from participants of the dissemination events through post-event questionnaires. Specifically, questionnaires were conducted after the following events:

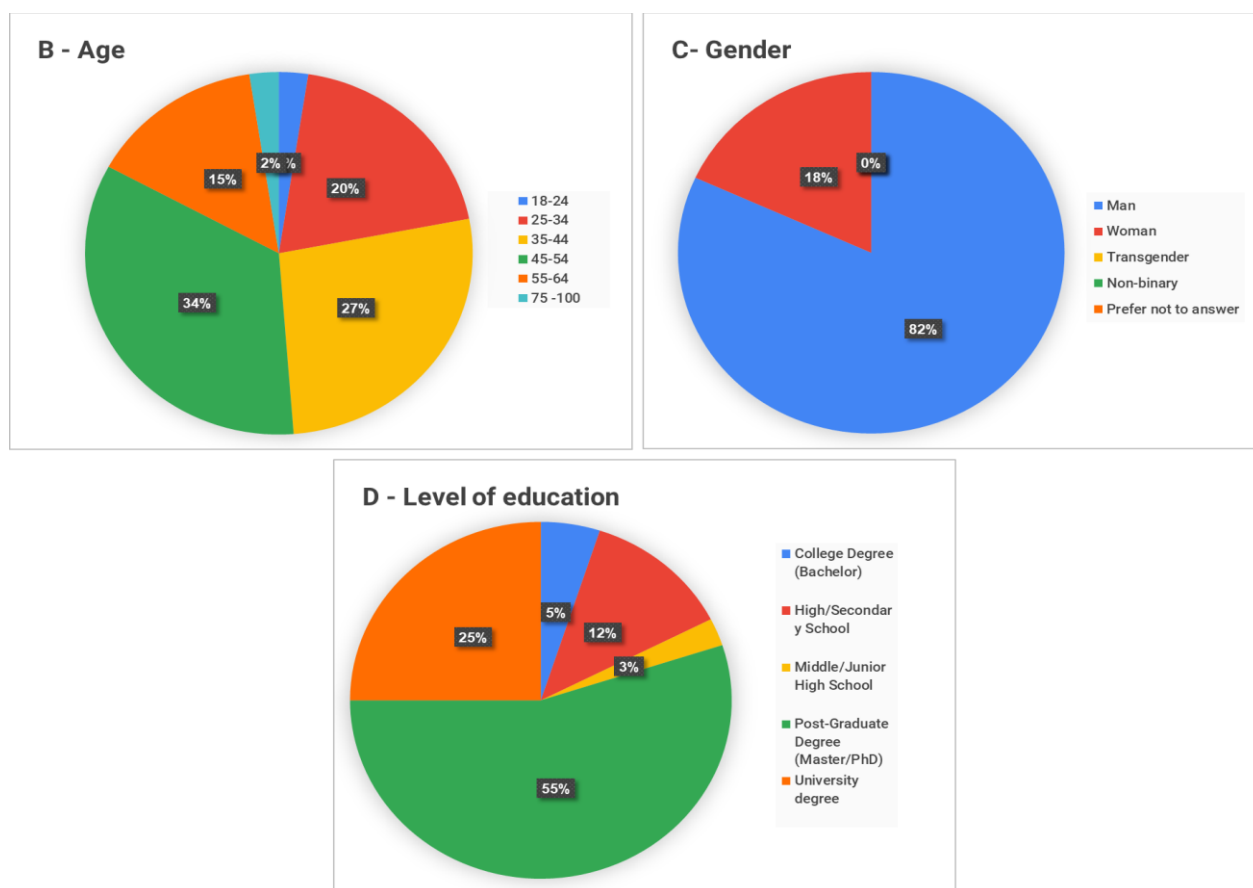
- [‘Let’s talk about citizen observatories!’](#) to explain the Cos4Cloud project and share lessons learned about the challenges of citizen observatories.
- [‘Introducing Cos4Cloud: how will it benefit the citizen science community?’](#): This workshop was co-organised with ECSA and aimed to explain the Cos4Cloud project and some of its services to the citizen science community.
- [‘Engaging the society beyond data collection’](#): Cos4Cloud organised this workshop as a Satellite Activity of the Event “A Predicted Ocean”, an Ocean Decade Laboratory organised in the framework of the United Nations Decade of Ocean for Sustainable Development.
- During the ECSA Conference 2022, the Cos4Cloud team organised the workshop [‘Co-designing solutions for the sustainability and governance of citizen observatories’](#). The aim was to (1) teach participants how to apply the co-design methodology and (2) co-design solutions to increase sustainability and contribute to the governance of citizen observatories.
- [‘How to create your own air quality sensor with CanAirIO?’](#): The aim was to explain to attendees how citizen science can contribute to air quality monitoring and the step-by-step instructions on how to build and use the low-cost sensor that the project uses.
- [‘Tackle odour pollution with OdourCollect’](#): The workshop aimed to explain to participants why it is important to measure odour pollution, how citizen science can be an ally to monitor it and how to participate in Cos4Cloud and OdourCollect projects.



Graphic A: Responses of the participants in the Cos4Cloud dissemination activities regarding their learning process and implication in the project.

The response rate was low and varied between 3-7% depending on the session, but the data collected was useful for evaluating the engagement strategy for the dissemination events and helped us make data-driven decisions about how to improve it in the future. One of the most important indicators used in the questionnaire was the Net Promoter Score (NPS) of the dissemination events. The Net Promoter Score (NPS) is a user loyalty and satisfaction measurement taken by asking users how likely they are to recommend your product, service or event to others on a scale of 0-10. For the dissemination events, the NPS was 38%, with 53% being promoters (their rate was between 9 and 10) and 15% being detractors (their rate was a 6 or less), indicating that most of the participants were extremely satisfied with the activity.

Additionally, the questionnaire also included questions about demographics. Besides, during the training sessions about the Citizen Observatories (CO) OdourColect and CanAirio and the webinar presenting Cos4Cloud, participants were asked whether the event had served them to learn about citizen science or be interested in citizen science in the future. The main results are presented in graphic A.



Graphic B-D: Responses of the participants in the Cos4Cloud dissemination activities regarding demographics.

The results reflected in graphs A-D show that the dissemination events have served the participants both to learn about science and citizen science. They also show a very positive response to how these events have helped them have more self-confidence in their participation in citizen science projects and their desire to participate in the future. On the other hand, graphics E to G show that more than half of the participants had a high educational level (university degree, master's degree or PhD) and that most of them were men between 35 and 65 years of age.

6. Engagement for educational training activities

Engagement of teachers and educators was led by NKUA and its design, implementation and evaluation can be found in **D6.5 “Design and Evaluation of School-based Citizen Science Activities’** (18) and will not be repeated here. In terms of engagement, it is worth noting:

- The creation of an educational network of primary and secondary schools/ teachers/ educational stakeholders, not only eager to participate in co-design activities for the Cos4Cloud technologies and new services but also willing and competent to support the integration of citizen science into the regular school practice and the engagement of school students and communities.
- The evaluation of the school case studies in terms of their learning potential and educational impact in cultivating an environmentally and scientifically literate and active citizenry based on the analysis of qualitative data.
- The compilation of the evaluation findings into a meaningful, evidence-based input for European and national policymakers about a new citizen science paradigm aligned to the EOSC idea and implementation.

7. Engagement for the Demonstration events

The engagement strategy for Cos4Cloud Demonstration events has been designed and implemented mainly by the communications team, composed of CREAM and CSIC members.

The BioBlitzes, Hackathons & Datathons organised during the project lifetime are further explained in the **'D5.3 Service performance challenges report'** (19), including the description, results and evaluation. The following sections of the present document will explain complementary information focused on the engagement strategy to recruit and retain participants.

7.1. BioBlitzs

7.1.1. BioMARathon and UrbamarBio

The [BioMARathon](#) was a friendly competition from the beginning of April until the end of September in 2021 and 2022. It was organised by the ICM-CSIC with the aim for participants to photograph as many living creatures of the Catalan Coast (Spain) as possible, including birds, seafront plants or aquatic species and to share these observations on the citizen observatory Natusfera in 2021 and MINKA in 2022. The regions of the Catalan coast were divided between Costa Brava, Costa Dorada and the Metropolitan Area of Barcelona. The winning region was the one with the highest number of marine observations registered, detected the most invasive and rare species, or had the highest number of participants.

For the Metropolitan Area of Barcelona, Cos4Cloud established a partnership with the project UrbamarBio (also organised by the ICM-CSIC) to add the 2021 and 2022 UrbamarBio data to the BioMARathon. UrbamarBio is BioBlitzs that consists of the long-term high-resolution spatiotemporal participatory monitoring of coastal biodiversity in 20 urban beaches in three cities (Barcelona, Badalona and Sant Adrià del Besòs). From 2016 to 2021, volunteers reported observations (photographs) of coastal and marine living organisms on the CO Natusfera, now MINKA. In addition, Cos4Cloud established a partnership with the European-funded project MINKE to organise also the BioMARatò in Italy, specifically on the island of Tremiti, during June, July and September 2022.

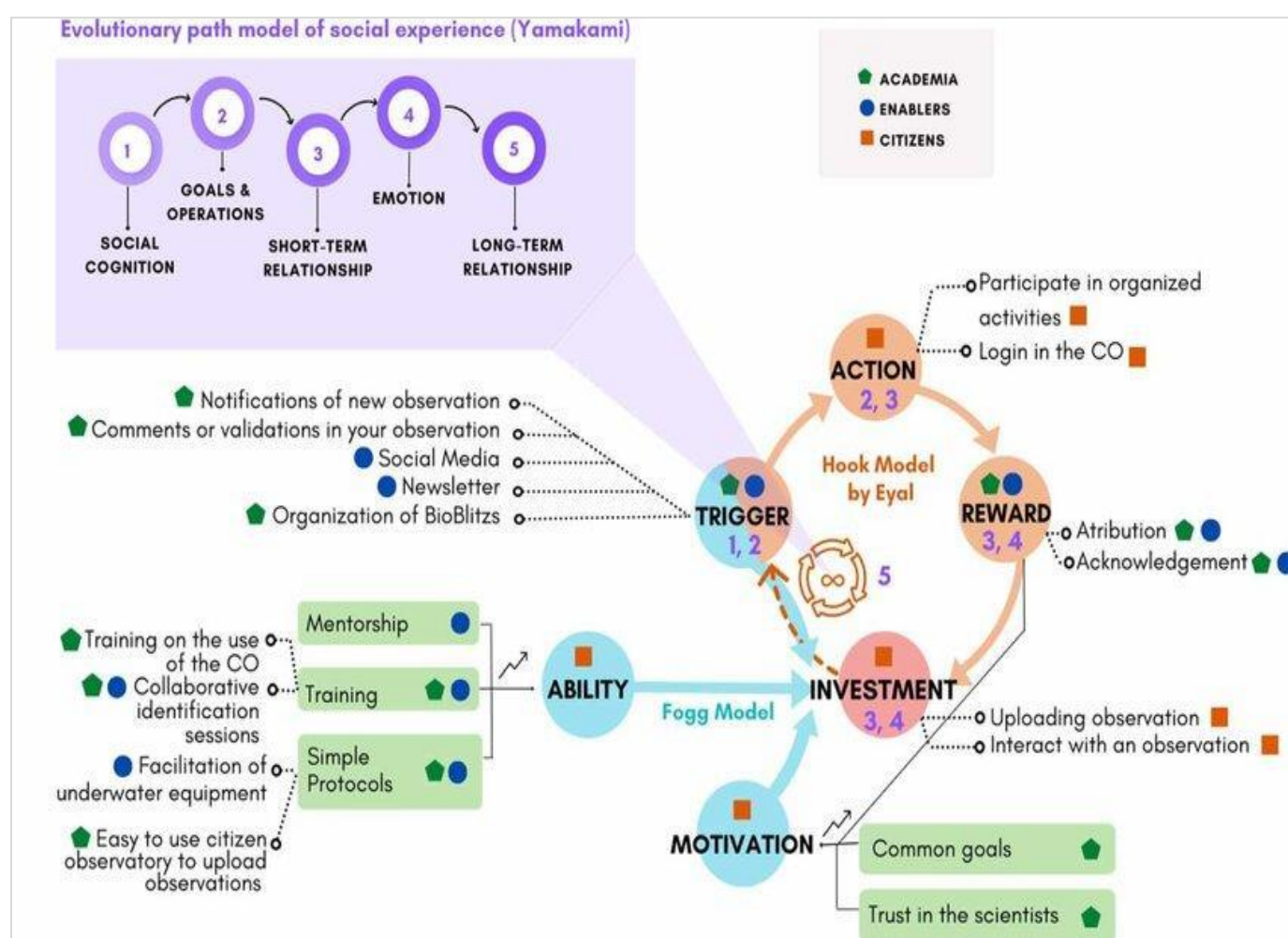


Figure 2. Janus Engagement Framework for citizen science with implementation examples in UrbamarBio and the BioMARathon. Each proposed engagement and recruitment strategy is annotated with the stakeholder who should carry out the activity. Original Source: Sonia Liñán et al 2022 Environ. Res. Lett. 17 105006.

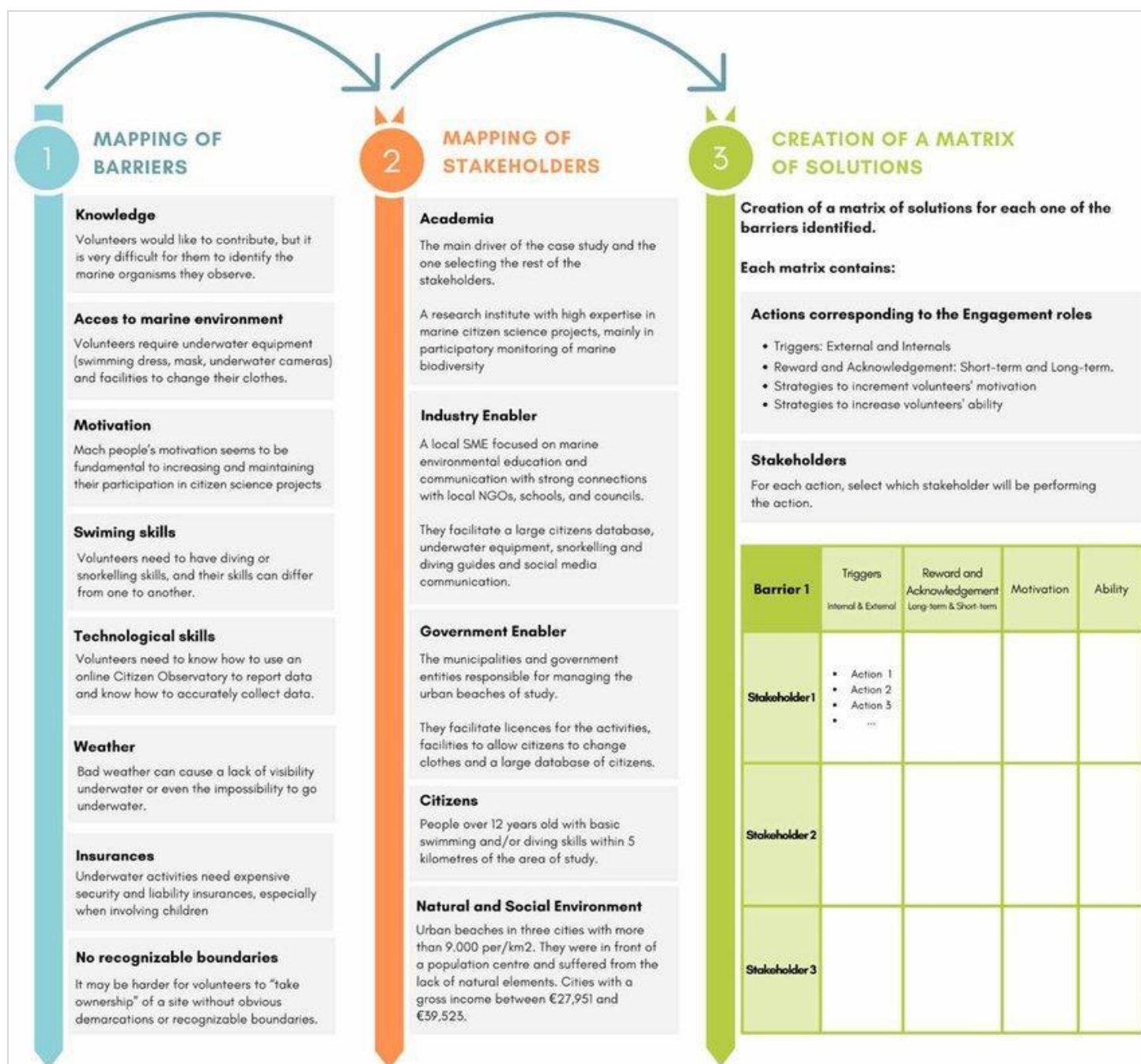


Figure 3. Implementation guide of the Janus Engagement Framework using UrbamarBio and the BioMARathon as an example. Original Source: Sonia Liñán et al 2022 Environ. Res. Lett. 17 105006.

For creating the engagement strategy for the BioMARathon and UrbamarBio, CSIC developed and implemented Janus Engagement Framework (20). This framework was created by Cos4Cloud members of the CSIC and was published as a research paper led by the Cos4Cloud partner Sonia Liñán from CSIC. The Janus Engagement Framework is based on four

interconnected pillars that feed each other: theoretical engagement models for behavioural change; social design for citizen science platforms; strategies for maintaining volunteer motivation; and strategies to increment the volunteers' ability. The combination of these four pillars results in a framework that integrates both short-term and long-term interaction mechanisms. This multi-temporal approach ensures keeping volunteers motivated and engaged for long periods. Figure 2 and Figure 3 show how the framework was implemented in UrbamarBio, but equivalent actions were planned and implemented in the BioMARathon. All the detailed engagement actions designed for UrbamarBio and the BioMARathon are described in Annex II. The implementation of these actions, including the communication and outreach actions performed to obtain engagement, are detailed in **'D5.3 Service performance challenges report'** (19).

Quantitative evaluation of the BioMARat6

We evaluated the engagement strategy by considering quantitative indicators to measure the assessment of the scientific project goal (to monitor the biodiversity of the coast) and recruitment of participants. The reporting of the KPIs can be found in Table 3.

Table 3. Proposed KPIs to measure the engagement strategy for the BioMARathon, 2021 and 2022 editions.

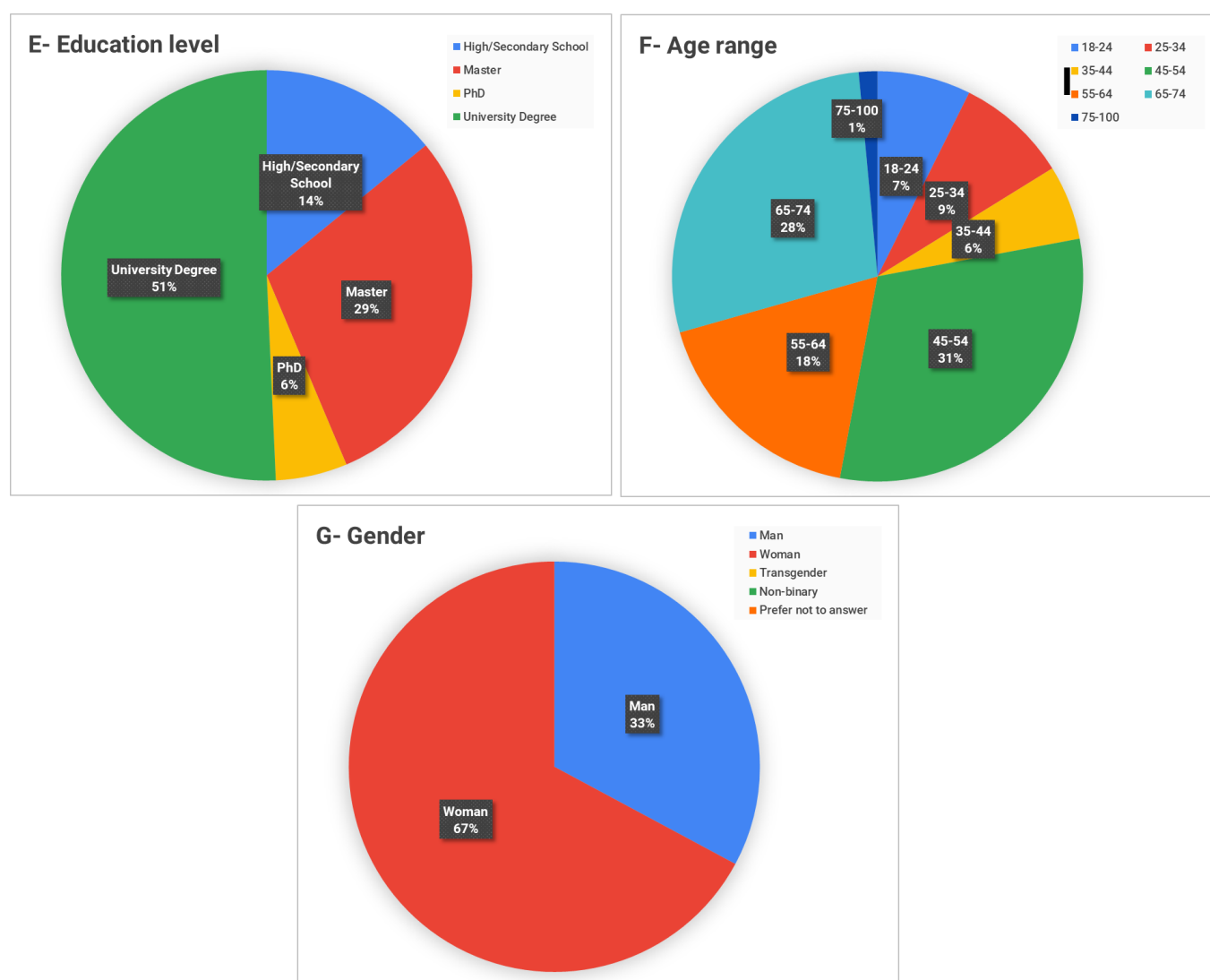
Engagement KPIs: BioMARat6	2021	2022
Number of observations uploaded to MINKA or Natusfera	20494	43406
Number of species reported	2403	3439
Number of participants registered to the guided snorkelling and scuba diving activities	741	511
Number of participants uploading observations to the CO	253 (34%)	288 (56%)

Looking at the results, we can see that even though the participation of attendees was lower in 2022 than in 2021, the number of users who finally uploaded observations rose from 34% to 56%. With this result, we see that although recruitment fell, involvement in the project increased.

Qualitative evaluation of the BioMARathon

In the same way that it was done with other activities, we sent post-event online survey events to the BioMARathon participants (2021 and 2022 editions) with different goals, one of them being the evaluation of the engagement strategy. For doing that, the post-event questionnaire collected feedback on the Net Promoter Score (NPS) and Demographics.

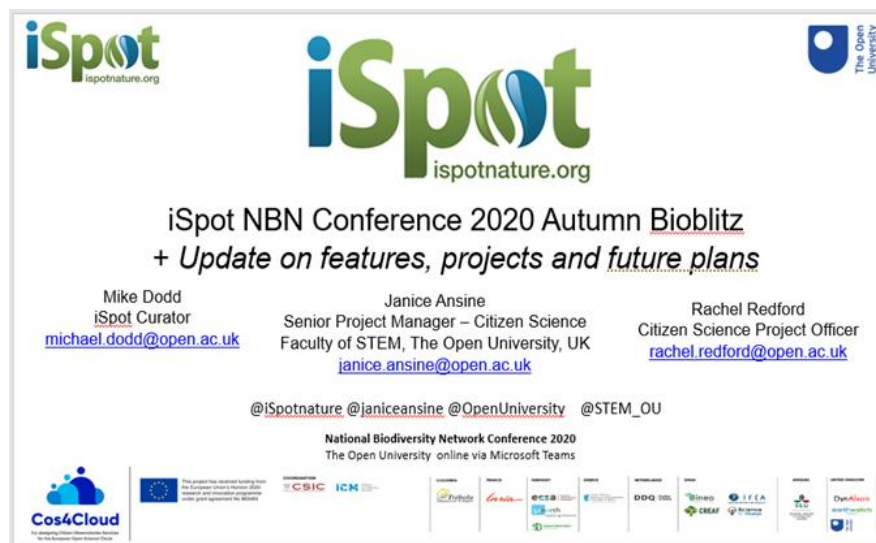
The value of the NPS was 85% so most participants will recommend the activity to other persons. Analysing some data about the participants, we realised that 67% of the participants were women, that most of the participants were highly educated and that there were mostly older than 45.



Graphic E-G: Responses of the participants in the Cos4Cloud dissemination activities regarding demographics.

7.1.2. Mini BioBlitz with iSpot to capture a map of autumn's wildlife

With an aim to strengthen links between Cos4Cloud, citizen science observatories and biological recording in the UK, in 2020 the OU co-hosted the [National Biodiversity Network \(NBN\) Conference](#). Highlights included an introduction to Cos4Cloud, and ways for participants to get involved in the project. A key engagement activity integrating practical use of iSpot as a CO through a mini BioBlitz, a new feature for the Conference that year.



Direct link to the presentation: https://www.youtube.com/watch?v=izcoifrsx_U

iSpot Autumn BioBlitz: a participation and engagement tool

Delegates were encouraged to participate in the BioBlitz ahead of the conference using [iSpot](#) to observe, record and identify Autumn wildlife and the wider iSpot community was invited to join in participate too: <https://www.ispotnature.org/communities/uk-and-ireland/view/article/814558/join-our-special-nbn-conference-ispotnature-autumn-bioblitz-nbnconf20>.

The [iSpot projects tool](#) was used to collate and display observations made over a set timeline (24/10/2020 - 16/11 2020) before the date of the conference as the [Autumn BioBlitz iSpot project](#). There was increased engagement on the iSpot website, with close to 700 engagements in the BioBlitz Project itself and higher viewings of associated articles and news.

All the research results, including the number of total observations, species groups and other data, are gathered in **D5.3 'Service performance challenges report'** (19).

Engagement, evaluation and feedback

The conference theme was “The NBN at 20 – Changing Times” theme marked the 20th Anniversary of the [NBN Trust](#). It was originally due to be hosted by the OU as a 2-day face-to-face event, covid-19 pandemic restrictions meant the conference had to be transformed into a 1-day online event run by the NBN and a Cos4Cloud / iSpot / OU Team using Microsoft Teams.

The conference was deemed a great success with over 200 delegates, its highest attendance yet and the synergies established provided possibilities for wide-scale engagement with Cos4Cloud. Participants came from a cross-section of UK organisations, including wildlife NGOs, academia, local environmental records centres, recording schemes, country agencies, students and individuals, all with an interest in sharing and using biodiversity data and wildlife recording.

Feedback from the evaluation survey was hugely positive, with 90% very/extremely satisfied overall. 79% viewed the integration of the BioBlitz using iSpot “as a positive addition” in particular:

“All excellent. Well suited to the online nature of the conference.”

“As the first completely remote conference that I have attended, I thought it went very well, it was convenient as well as “low carbon”.”

“...I would love to see an ongoing online element to the event, even if this is coupled with an ‘in person’ conference. The conference's reach can only be increased by providing access to more people.”

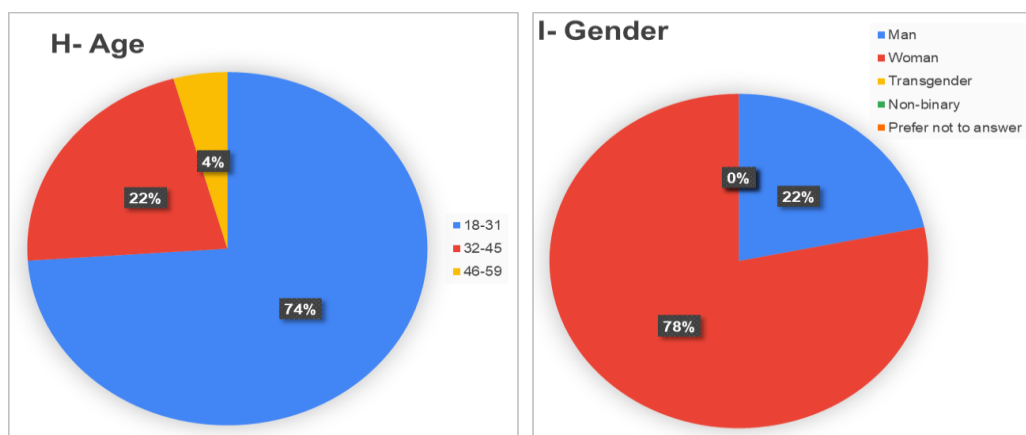
7.2. Datathons

The results and scientific evaluation of the Datathons are collected in ‘**D5.3 Service performance challenges report**’ (19) and will not be re-iterated here. In the following sections, we focus on the engagement strategy and its evaluation during the Datathons organised by Cos4Cloud.

7.2.1. Bio-Datathon ‘Trees for life, trees for learning’

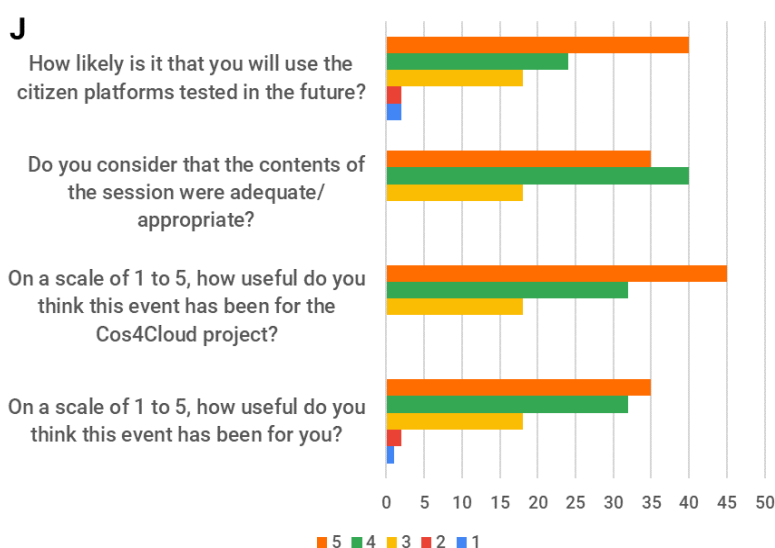
From December 2022 to January 2023, NKUA and CSIC organised the Bio-Datathon called ‘[Trees for life, trees for learning](#)’. This activity aimed to evaluate some tools and services developed within the Cos4Cloud project and create new ways for students to visualise data using MECODA. To do so, Greek postgraduate students in education and educational technology participated in two training workshops, one about MINKA and another about MECODA.

During this Bio-Datathon no engagement efforts were made to recruit participants since they were current students of NKUA. Anyway, students were asked to fill out a feedback questionnaire to understand this target audience better and to be able to use this information in future engagement strategies aimed at teachers and educators.



Graphic H-I: Responses of the participants in the Cos4Cloud dissemination activities regarding demographics.

Analysing the characteristics of the participants (Graphic H and I), the vast majority of the participants were women (78%) and between 18 and 31 years old (74%). Their assessment of Bio-Datathon was very positive (Graphic J), apart from the fact that the vast majority were willing to use both MINKA and MECODA in the future. So we positively evaluate the success of the engagement in this event in terms of energy investment and eagerness in a defined project.



Graphic J: Responses of the participants in the Cos4Cloud dissemination activities.

7.2.2. Bio-Datathon: 'A unique validation event of biodiversity data!'

From the 7th of December until the 15th of January, Cos4Cloud organised an [online Bio-DATathon](#) to validate as many species observations as possible using Cos4Bio. The aim was to teach participants how to use the Cos4Bio portal and evaluate it. To do so, the project created a guideline for the activity explaining what Cos4Bio is and how to validate species through this portal.

To engage participants, the project designed a strategy including the following actions: design a banner, [promote the activity on social media](#) and website, send an [event newsletter](#); share the activity with ECSA's community and contact specific people and groups interested in biodiversity, such as: Catalan Institute of Ornithology (ICO) or experts that had been involved in identifying marine species during the BioMARató.

At the moment of presenting this document, the data from this Bio-Datathon has not yet been analysed, so there is no data available to evaluate the engagement strategy properly.

7.2.3. Datathon with the 'Escola Gravi' school's students

On the 16th of January and the 20th of January 2023, Cos4Cloud organised a datathon with high school students from the Escola Gravi in Catalonia. The aim was that (1) they learn to analyse odour data coming from the OdourCollect app using MECODA, (2), and then they evaluate the tool.

The datathon was divided into two sessions; in one, the Cos4Cloud team taught them how to use MECODA, and in the second session, they used the tool to analyse odour data using different case studies and stories.

No efforts were made in terms of recruitment since the project took advantage of this school being a stakeholder with a close relationship with SfC. The activity results and their feedback on using MECODA and OdourCollect app are collected in '**D5.3 Service performance challenges report**' (19). The students also answer a question about their willingness to recommend the activity so that we can calculate the NPS. In this case, we have a negative NPR of 13%, meaning that more intensive efforts should be made to engage this community in the future.

8. Citizen and stakeholder engagement in COs

For monitoring and evaluating citizen and stakeholder engagement in citizen observatories (COS), Cos4Cloud explored the impact on citizens and communities engaged in activities and learning through citizen science in formal and informal contexts. During the project, two approaches were explored, one involved the analysis of a CO user community and learning using the CO iSpotnature as a case study and the other using the CO MINKA. Additionally, two surveys for the Cos4Cloud COs were designed and distributed between different COs. The results of these surveys and recommendations for other COs can be found in **D6.2 'Guidelines on best practice for COs as part of the outreach methodology** (16).

8.1. iSpotnature case study

This case study is based on an evaluation study that considers learning in COs by highlighting iSpot (www.ispotnature.org) activity. This research evaluates the science learning potential of citizen science observatories, defining 'learning journeys through the user experiences of iSpot's online community. iSpot is a citizen science platform (citizen observatory) for biodiversity developed and operated by The Open University (OU). It is aimed at helping anyone share wildlife observations, identify, explore and learn about nature. The OU extends engagement, teaching and learning about the natural world beyond the parameters of the laboratory or lecture hall using approaches that include citizen science i.e. iSpot.

iSpot is one of the nine established citizen observatories (COs) and Do it Yourself (DIY) initiatives focused on the environment or biodiversity involved in the Cos4Cloud project. iSpot has supported the development of the Cos4Cloud technological services by integrating and testing some of these services as well as providing a wide range of expertise which has contributed to the delivery of Cos4Cloud.

iSpotnature.org: a citizen observatory supporting an online learning community for nature lovers

The scale and range of online citizen science projects, platforms and initiatives, i.e. citizen observatories, focused on biodiversity have evolved particularly over the past 10 - 20 years. Alongside interest and increasing public participation in science is growing recognition of its role in contributing to learning. ***How can CO user experiences be explored from the context of learning and demonstrated as learner/learning journeys?***

As part of this Cos4Cloud research, a review was conducted exploring citizen science participant learning journeys by analysing iSpot user experiences and approaches, within the context of a range of learning approaches, as an exemplar for other citizen observatories. The evaluation was developed using insight from an earlier five-step thematic approach: explore, identify, contribute, personalise and recognise (i.e. learning) (21).

The concept of a learning/learner journey applies to different educational settings. It can be defined simply as a way to describe one's own experience, referring "to how people move between different types (or periods) of learning" (22). User journeys can evolve reflecting spaces that stage the experience; besides interaction time which also influences the activity; how participants engage and the role of the environment facilitating the experience (23).

iSpot: Building a community - outreach and engagement

iSpot was launched by the OU in 2009 and uses the challenge of identifying nature to engage people as citizen scientists, encouraging learning about biodiversity while building species identification skills. iSpot is based in the UK but is global: anyone can browse the platform and take a look at the latest spots. Users are encouraged to learn while sharing their interests with a friendly community by registering, uploading photos and adding observations, joining in discussions, supporting others and getting help identifying what they have seen. iSpot aims to (24):

- Lower barriers to ID – build ID skills
- Make nature accessible/open to all
- A new generation of naturalists
- Contribute to biological data recording

The website incorporates a range of features and tools that support and facilitate learning, these include: global, national species dictionaries, integrated tools (i.e. quizzes and projects), links to resources and courses directly contributing to informal & formal learning.

iSpot supports a global online community of over 80,000 registered users and reaches a wider audience of millions through outreach and engagement activities, including media, radio & TV (OU/BBC co-productions), social media, events & activities with schools, community groups etc. connections and collaborations with Schemes & Societies, etc. as well as informal and formal learning activities.

Summary: iSpot community learning experiences

Table 4 below summarises results from the research conducted that demonstrates learning on iSpot within the context of established learning approaches applied to examples of iSpot user activity.

Table 4. Results from Cos4Cloud research demonstrating learning on iSpot.

Evaluation themes	Learning approaches	iSpotnature.org learning activity and user community experiences	Documentation, review and analysis
Explore	Social learning	A free online platform - anyone can browse iSpot: analytics data shows an average of 9 pages viewed per session with an average session duration of 8 – 10 minutes.	Participant learner engagement from purposive browsing. i.e. iSpot's 'browse observation' search page was the second-highest page viewed. (21) p87.
Identify	Participatory learning	Registered participants can post observations and photos, gather content, share comments and in doing so give and receive help with species identification.	iSpot is described as having a participatory learning approach where an active participant the learner engages in an activity, developing their interest and passion" (26).
Contribute	Experiential learning	iSpot integrates participant rewards and motivation through a bespoke reputation system.	Registered participants gain scores for each of the species groups represented. iSpot gives points/scores for activity, which is a key feature behind how the site works (27).
Personalise	Personalised learning	iSpot has tools and features that encourage and facilitate personalisation to meet the participants' interest and pace i.e. iSpot projects.	iSpot's design is described as one which gives participants control over the learning process (28) through technology with integrated tools and features (29). Over 3,000 projects were added in the first two years the feature was added (2014 – 2016) highlighting personalised interest based on selected sites, regions, habitats, species and/or time frames (21).

Recognition	Active learning	iSpot has integrated and bespoke learning assessment tools i.e. iSpot quizzes; and associated courses. iSpot Quiz data / structured courses project data	iSpot quizzes were added in 2013 as an assessment tool to support/provide evidence of learning. Within the first year of development quizzes were done by approximately 50 participants per week (28). iSpot is also integrated into OU formal and informal courses i.e. Citizen science and global biodiversity .
--------------------	-----------------	--	--

Conclusion and Impact:

Analysis of iSpot user experience, so far, suggests that citizen science learner journeys can occur individually as well as part of group experiences. This includes participation in the integration of iSpot services FASTCAT-Cloud and the PI@ntNet API in iSpot (<https://www.ispotnature.org/communities/uk-and-ireland/view/article/846963/ispot-and-ai-fastcat-cloud-and-the-plantnet-api>).

iSpot's citizen science learner/learning journeys can be described as being controlled by the participant; each is unique in its own way based on levels of expertise / pre-existing knowledge and the amount of time spent involved. They can be on single or multiple topics which stop, start, and continue based on the motivation and/or interest influencing engagement and experience.

Influenced by the results of this evaluation, conducted as part of Cos4Cloud, iSpot's engagement and learning model has been reviewed, revised and updated to emphasise better and demonstrate the iSpot user experience see:

<https://www.ispotnature.org/communities/global/view/article/834369/welcome-to-ispot-explore-record-collaborate-learn>.

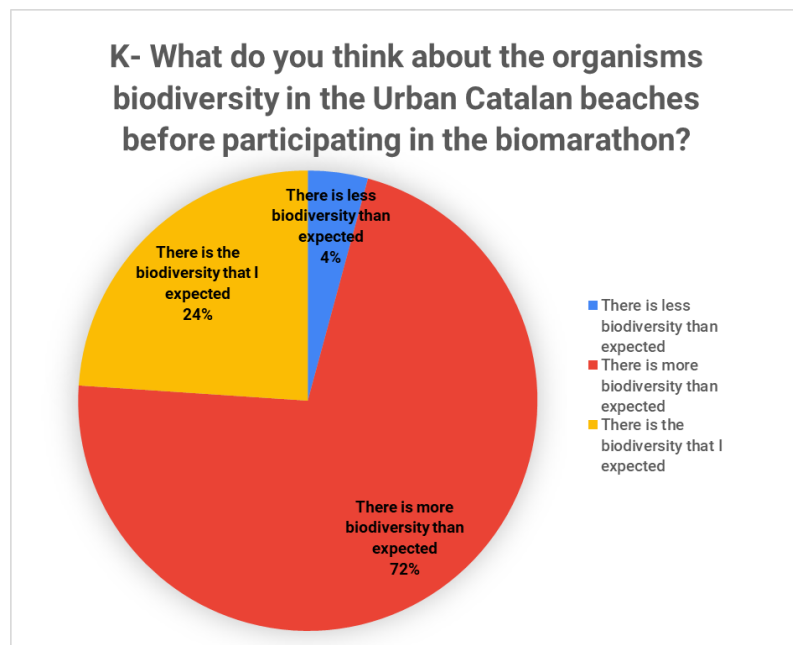
Summary results of this study have been shared as part of Cos4Cloud engagement activities (i.e. Ansine J., (2021) Exploring citizen science learning journeys through iSpotnature.org: an online community of nature lovers, CitSciVirtual Conference, Citizen Science Association). The case study is also being shared as a project output as part of **D6.3 'Citizen science toolbox and evidence hub' (i.e. The Cos4Cloud Toolbox and Evidence Hub)** (25). A research paper is also under development for publication.

8.2. MINKA case study

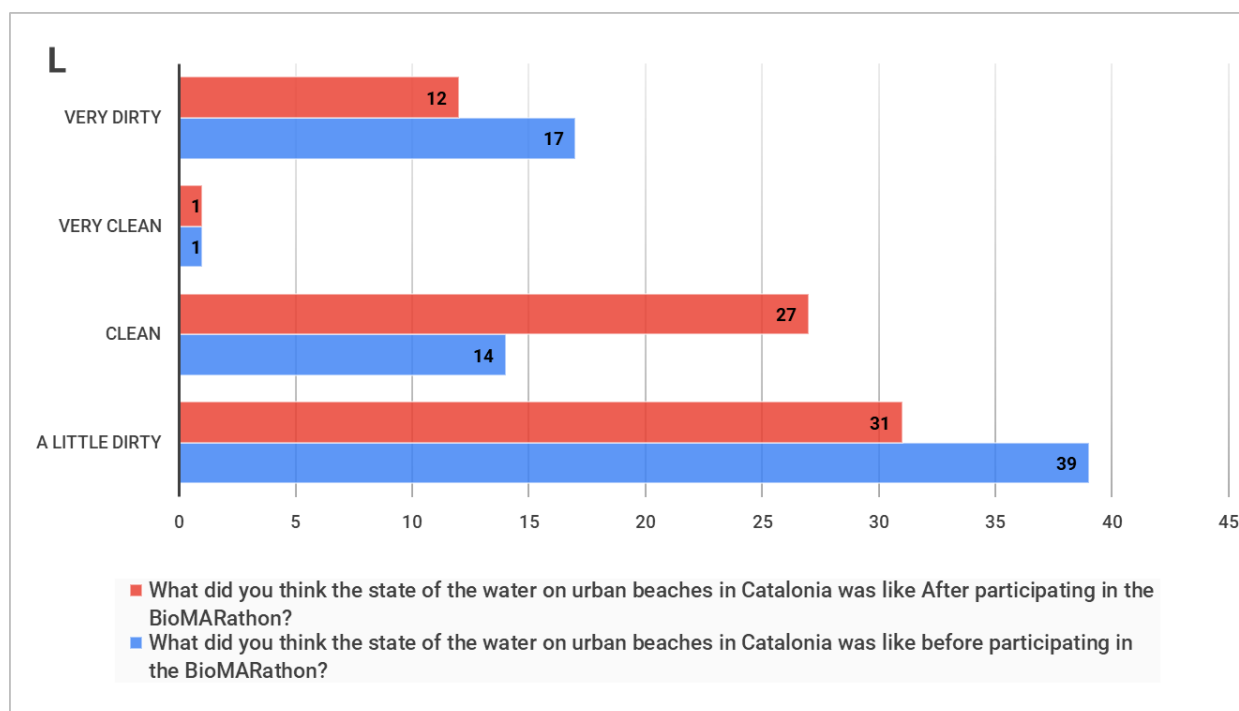
As mentioned in section 7, Cos4Cloud collected feedback from the participants of the BioMARathon. To better understand the learning process after participating in these events and using the CO MINKA, the online survey collected feedback on:

- The learning value of the activities
- Whether the activities affected the audience's perception towards the urban beaches.

Only 31 people responded to the survey. In any case, we can draw some interesting conclusions that can be used to continue analysing these aspects during future editions of the BioMARatón and the engagement focused on learning within MINKA. The perception of the richness of biodiversity in Catalan urban beaches increased significantly after participating in the BioMARathon since 72% of the attendees responded that there is more biodiversity than expected (Graph K). In contrast, their perception of water quality did not change as much after participating (Graph L).



Graphic K: Responses about the biodiversity perception after participating in the BioMARathon



Graphic L: Responses about the water quality after participating in the BioMARathon

Table 5: Learning after participating in the identification training sessions of the BioMARathon in a sample of 19 individuals. When the number of species an individual can identify increases after the identification training session, we consider that they improve their knowledge. Suppose the number of species is the same. In that case, it is considered to have been maintained, as well as if it is less since we consider that this knowledge is preserved after participating in the sessions and is due to human error due to the subjectivity associated with the question.

Participant	How many of your photographs were YOU able to identify ALONE?	How many of your photographs were you able to identify AFTER ATTENDING AN IDENTIFICATION SESSION?	Learning
1	Between 50% and 75%	More than 75%	Improvement
2	Between 25% and 49%	Between 50% and 75%	Improvement
3	Between 50% and 75%	More than 75%	Improvement
4	Less than 25%	Less than 25%	Same
5	Less than 25%	Between 25% and 49%	Improvement

6	Less than 25%	Less than 25%	Same
7	More than 75%	All (100%)	Improvement
8	More than 75%	Between 50% and 75%	Same
9	Between 50% and 75%	Between 50% and 75%	Same
10	More than 25%	Entre el 25% y el 50%	Improvement
11	Between 50% and 75%	More than 75%	Improvement
12	Between 25% and 49%	Between 50% and 75%	Improvement
13	Between 50% and 75%	More than 75%	Improvement
14	Less than 25%	Less than 25%	Same
15	Less than 25%	Between 25% and 49%	Improvement
16	Less than 25%	Less than 25%	Same
17	More than 75%	All (100%)	Improvement
18	More than 75%	Between 50% and 75%	Same
19	Between 50% and 75%	Between 25% and 49%	Same

Various training sessions on species identification were also organised for the BioMARathon participants. These improved the participants' knowledge of this subject (Table 5) since 58% of the participants improved their ability to identify species.

Also, Cos4cloud collected information on using MINKA after the MINKA training sessions organised for the different Cos4Cloud Datathons. All this information is collected in '**D5.3 Service performance challenges report**' (19) and will not be repeated here.

8.3. Surveys for COs

Cos4Cloud includes the participation of nine established citizen observatories (COs) and Do it Yourself (DIY) initiatives. To help gather insight and understand the role and context of COs in the project, two citizen observatories surveys were initiated inviting all citizen observatories in Cos4Cloud to participate. This includes four focused on biodiversity:

- Artportalen (<https://www.artportalen.se/>)
- iSpotnature (<https://www.ispotnature.org/>)
- Natusfera (<https://natusfera.gbif.es>) / Now MINKA (<https://minka-sdg.org>)
- Pl@ntNet (<https://plantnet.org/en/>)

And five focused on the environment:

- CanAirIO (<https://canair.io/>)
- FreshWater Watch (<https://www.freshwaterwatch.org/>)
- iSPEX (<https://ispex.org/>)
- Kduino (<http://kduino.weebly.com/>)
- OdourCollect (<https://odourcollect.eu/>)

Cos4Cloud CO Survey 1: understanding needs and differences (June 2020)

The focus of the first survey was to understand better the shared needs and differences amongst the nine citizen observatories (see **D6.2 'Guidelines on Best Practice for COs'** (16) as part of the Outreach Methodology Report). It collated information to inform key strategic planning for co-design, networking, engagement, outreach, communication and dissemination while gathering information on best practice and capacity building for other COs. Information collected includes:

- **Introductory / general information:** i.e. CO name, years in operation, objective, discipline, etc.
- **Data collection:** type of data, geographical focus, main locations of observations
- **Technical information:** programming language, protocols/standards; data management, storage and licences for data sharing
- **Engagement:** main user groups, types of use i.e. contributing to data, educational activities, research etc.; types and no. of users

- **Testimonials, success stories collection/documentation, activities, etc.**
- Use of **co-design**
- **Training and educational** tools and resources
- **Performance:** i.e. metrics for data collection
- **Use and impact**, as well as lessons learned
- **Governance**
- **Lessons learned** about: development of and use of user materials; technology; ensuring reliability; sustainability

Similarities and differences were noted by the COs, who collectively have over 40 years-experience (i.e. Artportalen over 20 years, iSpot 14 years, Naturfera 6 years and Pl@ntNet 12, years). Themes emerging provided a range of best practices from years of experience engaging with different user groups, including the impact of working collaboratively and contributing to the co-design of Cos4Cloud services and the impact on data and its use. The use of different tools and resources in educational, engagement and outreach activities, as well as how they engage and reach users, also provided a range of best practices. **D6.2 'Guidelines on Best Practice for COs'** (16) contains extensive information on this survey.

Cos4Cloud CO Survey 2: Experiences from the COs in Cos4Cloud (December 2022)

The 2nd Citizen Observatory Survey sought to gather perspectives, suggestions and comments from the Citizen Observatory (CO) leaders about their own experiences associating their CO with Cos4Cloud. This experience can help other COs make the best use of the project's outputs. This includes how a CO can be enhanced and developed within a Cos4Cloud framework and demonstrations of best practice for citizen observatories from the nine COs involved.

The information collated included:

- **Involvement of CO in Cos4Cloud:** such as integrating and testing services in the CO, educational activities involving schools, as well as any kind of activity involving other COs, citizens scientists or other beneficiaries etc.
- **Benefits from this experience:** technical benefits such as the development of platform infrastructure, contributing to data, quantity/quality of observations etc.
- **Impact on the CO user community:** contributions to the use of the CO.

- **Contributions to the COs, outreach, publicity and or public engagement:** for example, reaching new or wider audiences; research etc.
- **Outcomes and highlights of COs involvement in Cos4Cloud:** best practices
- **How can these be beneficial to other COs**
- **Lessons learned:** technology (Cos4Cloud Services)
- **What works or doesn't work when creating or sustaining a CO**

Representatives either directly involved in the development of the CO or either running these COs, provided feedback. Their input is part of Cos4Cloud CO knowledge transfer (see **D8.4 'Evaluation of the KT materials deployed'** (30)). This knowledge base includes insight from networking and engagement with projects of interest, and the knowledge sharing within the Cos4Cloud consortium (i.e. actions, activities, discussions, workshops etc.), particularly between COs contributions in the co-design of the technological services.

An analysis framework summarising best practice experiences of Cos4Cloud COs

Best practices can be described as “solutions, policies, interventions, actions, or procedures that are deemed successful and may assist other entities grappling with similar challenges” (31). In the context of this report, we can view best practice as guidelines which are developed after years of trial and error or established as well as through research setting guidelines for others that can produce good outcomes if followed. (32)

Examples of Cos4Cloud CO best practice, contributed from the surveys, were reviewed using the ECSA Ten Principles (33) as a framework for analysis. Firstly, responses gathered from the first Cos4Cloud CO survey questionnaire were collated and analysed in the context of each of the Ten Principles. After identifying the core themes, we review the responses to the 2nd survey. The feedback from COs becomes even more relevant through this targeted methodology, which can be useful to other COs or associated stakeholders.

Table 6 below summarises the framework developed using the ECSA Ten Principles as a guide to analysing responses to the Cos4Cloud Citizen Observatories Surveys.

Table 6: ECSA's Ten Principles of Citizen Science: an analysis framework for collating the best practice experiences of Cos4Cloud COs. Summary challenges and examples source: Robinson, L.D., Cawthray, J.L., West, S.E., Bonn, A. and Ansine, J., 2018. Ten principles of citizen science. In Citizen science: Innovation in open science, society and policy (pp. 27-40). UCL Press

ECSA Principle	Principle in practice – summary challenges/examples	Categories / attributes: Cos4Cloud COs experience and best practice examples and information available from surveys
<p>1. Citizen science projects actively involve citizens in scientific endeavour that generates new knowledge or understanding.</p> <p><i>Citizens may act as contributors, collaborators, or project leaders and have a meaningful role in the project.</i></p>	<p>ideas and examples of initiatives that can engage participants in person as well through digital technologies</p>	<ul style="list-style-type: none"> • Purpose/role/objective • Type of data collected, purpose and contribution to research etc. • Disciplinary field/topic • Timeline of operation/activity • Number of users • Evidence/examples of involvement and participation of different user groups. Tools for engagement, outreach, education etc.
<p>2. Citizen science projects have a genuine science outcome.</p> <p><i>For example, answering a research question or informing conservation action, management decisions or environmental policy.</i></p>	<p>It is more than education or outreach i.e. increased evidence of support for learning and research e.g. publications.</p>	<ul style="list-style-type: none"> • Type of data collected and purpose • Scientific and research contributions/outputs i.e. scientific publications, conferences, etc.

<p>3. Both the professional scientists and the citizen scientists benefit from taking part.</p> <p><i>Benefits may include the publication of research outputs, learning opportunities, personal enjoyment, social benefits, and satisfaction through contributing to scientific evidence.</i></p>	<p>Citizen Science initiatives must benefit all involved to be sustainable. This can include scientific outcomes, social interaction, skills development, learning etc.</p>	<ul style="list-style-type: none"> • Main groups that use the CO • Resources available (i.e. guidelines, tutorials, promo/info videos, leaflets, training courses/ webinars, etc. • Embedded quizzes educational / learning/training activities and how they facilitate involvement and participation of different user groups • Engagement activities/strategies
<p>4. Citizen scientists may, if they wish, participate in multiple stages of the scientific process.</p> <p><i>This may include developing the research question, designing the method, gathering and analysing data, and communicating the results</i></p>	<p>The main method of engaging the public is contributory in which participants mainly contribute data. others should be encouraged.</p>	<ul style="list-style-type: none"> • How users contribute/use the CO • Metrics used for measuring performance, activities, or impact
<p>5. Citizen scientists receive feedback from the project.</p> <p><i>For example, how their data are being used and what the research, policy or societal outcomes are.</i></p>	<p>Different options can be used to provide feedback i.e. social media, websites, newsletters, events, blogs etc. Sharing feedback demonstrates and encourages participation</p>	<ul style="list-style-type: none"> • Different channels and tools used to give and receive participants' feedback i.e. user comments, collecting testimonials, stories etc from users. • Evidence/examples of different types of user participation in tools for engagement, outreach, guidelines etc for different target groups

		<ul style="list-style-type: none"> Metrics used for measuring performance/activities/ impact (S1 / Qs 24 and 25)
<p>6. Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled for.</p> <p><i>However, unlike traditional research approaches, citizen science provides opportunity for greater public engagement and democratisation of science.</i></p>	<p>The validity & accuracy of citizen science data can be questioned; however, data can be of equal quality.</p>	<ul style="list-style-type: none"> Contributions to research papers/publications., conferences, etc. Use of the CO as a source of data or as a resource for scientific publications Assuring validity and accuracy – lessons to ensure this How data is managed
<p>7. Citizen science project data and meta-data are made publicly available and where possible; results are published in an open-access format.</p> <p><i>Data sharing may occur during or after the project unless there are security or privacy concerns that prevent this.</i></p>	<p>Projects and initiatives working towards open data.</p>	<ul style="list-style-type: none"> Data available as open access, how is it shared and managed Examples that demonstrate how CO seek to do this via lessons learnt etc. Licences used for sharing data
<p>8. Citizen scientists are acknowledged in project results and publications.</p>	<p>Recognition of citizen scientists' contributions via project, communication, user badges etc.</p>	<ul style="list-style-type: none"> How user contributions are acknowledged/recognised

9. Citizen science programmes are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact.	Evaluation is not always possible; therefore, despite outcomes, which can be valuable, they are sometimes not fully documented or reported.	<ul style="list-style-type: none"> • Impact of the data i.e. social, environmental, etc. • How is the CO used / what are the types of contributions made? i.e. to education, policy, public engagement, participation i.e. PES, PPSR, etc.
10. The leaders of citizen science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activities.	Considering ethical matters is an important part of CS activities which involve people volunteering their time.	<ul style="list-style-type: none"> • How privacy is managed and data shared • Terms and conditions around copyright, intellectual property, data sharing agreements, confidentiality, attribution, etc.

The results from both surveys contributed to **D6.2 ‘Guidelines on Best Practice for COs as part of the Outreach Methodology Report’** (16) as well as the development of best practice guidelines which are being made available as part of **D6.3 ‘The Cos4Cloud Toolbox and Evidence Hub’** (25). In this context, best practice was defined as a set of guidelines on how to carry out a task, that if followed can result in good outcomes. This focused on citizen observatories through the experiences of COs directly involved in the project, and included practical examples highlighting Cos4Cloud’s impact on the technological capabilities of citizen observatories from CO experiences. Both surveys also presented information on the engagement of participants, and public participation in scientific research while facilitating knowledge sharing, learning and building skills, etc. This is viewed as an important part of the growth of COs, playing a significant role in biodiversity recording and environmental monitoring (35).

9. Engagement with the EOSC community

EOSC (European Open Science Cloud) is a platform that provides a range of digital services, such as data storage, processing, and collaboration tools, to support European research and innovation. The platform aims to make it easier for researchers to access and use data and tools and to encourage collaboration and data sharing across borders.

Regarding engagement, EOSC provides various opportunities for researchers, citizens, and organisations to engage with the platform and each other. Specifically, Cos4Cloud has taken advantage of these opportunities to facilitate engagement through:

- **Citizen Science services:** EOSC offers a range of services that can be used to support citizen science projects, such as data storage, processing, and visualisation. This can make it easier for citizens to participate in projects and for researchers to engage with them.

Some of the Cos4Cloud services have already been uploaded to the EOSC Hub. The materials of the online training and educational scenarios for teachers, as well as case studies, policy briefings, and other materials, will also be uploaded to the EOSC hub during February 2023 or after the end of the project.

- **Outreach and dissemination:** EOSC platform offers a range of opportunities to share and disseminate research results, which can increase engagement among researchers and the general public.

Thanks to the efforts of the Cos4Cloud communication and engagement team, the EOSC blog has published news about Cos4Cloud and its services, as well as posts on its social media networks. Table 6 shows some quantitative indicators regarding these publications.

Table 6. Qualitative indicators regarding the Cos4Cloud publications in the EOSC.

Publication	Downloads	Views
EOSC in practice story – Pl@ntNet-API: https://zenodo.org/record/7049755#.Y8qvri8rzs1	199	66
EOSC in practice story – Cos4Bio https://zenodo.org/record/6516724#.Y8qv7y8rzs2	392	139
EOSC in practice story – MOBIS https://zenodo.org/record/6448793#.Y8qwlC8rzs0	261	131
Cos4Cloud news on the EOSC website https://eosc-portal.eu/news/plntnet-api-integrate-plants'-visual-identification-engine-your-citizen-science-app	N/A	N/A

https://eosc-portal.eu/connecting-researchers-developers-and-citizen-scientists-unique-mobile-app-environment https://eosc-portal.eu/news/access-vast-amount-biodiversity-data-coming-citizen-science-using-cos4bio		
EOSC Newsletter https://mailchi.mp/a1d19b442133/expanding-the-eosc-portal-together-14193796?e=1118afbf95	N/A	N/A
Delivering for EOSC – Key Exploitable Results of Horizon 2020 EOSC-related projects: https://zenodo.org/record/7404164#.Y85ebezML0p https://zenodo.org/record/7401539#.Y85eV-zML0p	164 231	124 195

Peeking at Table 6, you can easily see that the Cos4Cloud publications raised interest, accumulating 1247 downloads and 655 views.

References


1. Vincent, J. (2016). *Citizen science: A study of public participation in scientific research*. Routledge.
2. Brossard, D., Scheufele, D. A., Xenos, M. A., & Ladwig, P. (2018). Communicating science in social media: Understanding the role of interaction and engagement. *Public Understanding of Science*, 27(3), 344-356.
3. Kang, M., Kim, S., & Lee, J. (2017). Citizen science: A review of the literature. *International Journal of Environmental Research and Public Health*, 14(4), 391.
4. Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: A developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.
5. Kaczynski, D. (2018). *Citizen Science: A Study of People, Expertise, and Sustainable Development*. Routledge.
6. Bennett, A. (2016). *Citizen science: A study of people, expertise and sustainable development*. London, UK: Routledge.
7. Kullenberg, C., & Kasperowski, D. (2016). Citizen science as a tool for creating more sustainable societies. *Sustainability*, 8(7), 695. doi:10.3390/su8070695
8. Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2014). Citizen science: A developing tool for expanding science knowledge and scientific literacy. *BioScience*, 64(4), 459-464.
9. Kullenberg, C., & Kasperowski, D. (2016). Citizen science as a tool for creating engaged societies. *Current Opinion in Environmental Sustainability*, 22, 18-23.
10. Cos4Cloud consortium (2023) Woods, S., Ceccaroni, L. Deliverable 7.6 Cos4Cloud's set of documentation per stakeholder audience
11. Cos4Cloud consortium (2023) Ansine, J. Deliverable 6.3 The Cos4Cloud Toolbox and Evidence Hub'
12. Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). *Citizen Science: A Developing Tool for Expanding Science Knowledge and Scientific Literacy*. *BioScience*, 59(11), 977-984. doi:10.1525/bio.2009.59.11.9
13. Fink, D., & Kullenberg, C. (2016). *Citizen science: A study of people, expertise and sustainable development*. Routledge.

14. Cos4Cloud Consortium (2020). Justamante A., Liñán S. Ansine, J., Daskolia M., Grillia N., Gkatzos D., , Nolland K., Piera J., Ramón, A., Rodríguez-Arias M.A., Soacha K., Woods S., Woods T., Kakaroucha E. Deliverable 8.2 Communications plan
15. Cos4Cloud Consortium (2020) Woods, S., Ceccaroni, L., Liñán, S., Soacha, K., Piera, J., Woods, T., Justamante, A., Ansine, J., Joly, A. Cos4Cloud's strategic plan for the exploitation and dissemination of the results (PEDR) - Report (D7.3).
16. Cos4Cloud consortium (2023) Ansine, J. Deliverable 6.2 Guidelines on best practice for COs as part of the outreach methodology
17. Cos4Cloud consortium (2022). Hernández, M., Amo, A., Guasch, B, Soacha, K., Justamante, A.. Deliverable 5.1 Co-design services for Cos4Cloud report.
18. Cos4Cloud consortium (2023) Daskolia, M., Kakaroucha, E., Grillia, N., Gkatzos, D., Trigatzi, A., Pappa, M., Daskalaki, Z. (2020). Deliverable 6.5 - Design and Evaluation of School-based Citizen Science Activities
19. Cos4Cloud consortium (2023). Soacha, K., Liñan, S. D5.3 Service performance challenges report
20. Liñán, Sonia; Salvador, Xavier; Álvarez, Ana; Comaposada, Andrea; Sanchez, Laura; Aparicio, Nuria; Rodero, Ivan; Jaume Piera, jaume (2022). A new theoretical engagement framework for citizen science projects: using a multi-temporal approach to address long-term public engagement challenges. *Environ. Res. Lett.* 17 105006, DOI [10.1088/1748-9326/ac939d](https://doi.org/10.1088/1748-9326/ac939d)
21. Ansine, Janice; Dodd, Michael; Robinson, David and McAndrew, Patrick (2017). Exploring citizen science and inquiry learning through iSpotnature.org. In: Herodotou, Christothea; Scanlon, Eileen and Sharples, Mike eds. *Citizen Inquiry: Synthesising citizen science and inquiry learning*. Oxford: Routledge, pp. 83–103
22. Thomson, J., (2021) Taking students on a 'learner journey', The Open University in Scotland News <https://www.open.ac.uk/scotland/news/taking-students-learner-journey>
23. Benford, S., Giannachi, G., Koleva, B., & Rodden, T. (2009). From interaction to trajectories: designing coherent journeys through user experiences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 709-718). ACM
24. Ansine, Janice (2012). Reaching the public through iSpot: your place to share nature (Case Study 8.5). In: Bowater, Laura and Yeoman, Kay eds. *Science Communication: A Practical Guide for Scientists*. Oxford: Wiley Blackwell, pp. 257–259

25. Cos4Cloud consortium (2023). Ansine, J. Deliverable 6.3 Citizen science toolbox and evidence hub
26. Clow, D., Makriyannis E. (2011). iSpot Analysed: Participatory Learning and Reputation. Proceedings of the 1st international conference on learning analytics and knowledge (pp. 34-43). ACM.
27. Silvertown, J., Harvey, M., Greenwood, R., Dodd, M., Rosewell, J., Rebelo, T., Ansine, J., McConway, K. (2015). Crowdsourcing the identification of organisms: A case-study of iSpot. ZooKeys, (480), 125. doi: <https://doi.org/10.3897/zookeys.480.8803>
28. Scanlon, E., Woods, W., Clow, D. (2014). Informal participation in science in the UK: identification, location and mobility with iSpot. Educational Technology & Society 17: 58-71.
29. Woods, W., McLeod, K., Ansine, J. (2016). Supporting mobile learning and citizen science through iSpot. In H. Crompton & J. Traxler (eds) Mobile Learning and STEM – case studies in practice, Routledge, NY & Oxon.
30. Cos4Cloud consortium (2023). Liñán, S., Justamante, A., Fabó, C. Cos4Cloud's Evaluation of KT materials deployed - Report (D8.4).
31. Oliver Blake, Meredith Glaser, Luca Bertolini & Marco te Brömmelstroet (2021) How policies become best practices: a case study of best practice making in an EU knowledge sharing project, European Planning Studies, 29:7, 1251-1271, DOI: 10.1080/09654313.2020.1840523
32. Wright, G., Best practice
<https://www.techtarget.com/searchsoftwarequality/definition/best-practice#:~:text=A>
33. ECSA (European Citizen Science Association). 2015. Ten Principles of Citizen Science. Berlin. <http://doi.org/10.17605/OSF.IO/XPR2N>. Available at:
<https://zenodo.org/record/5127534#.Y7au9BWZOs9>
34. Robinson, L.D., Cawthray, J.L., West, S.E., Bonn, A. and Ansine, J., 2018. Ten principles of citizen science. In Citizen science: Innovation in open science, society and policy (pp. 27-40). UCL Press
35. We Observe, 2018

Annex I

Example of post-event survey sent to the participants of the Cos4Cloud events.



Tell us what you think about the webinar and help us improve

Thank you for having registered for the webinar 'Introducing Cos4Cloud: how will it benefit the citizen science community?!'

Knowing how do you feel about our event will help us to improve your experience at future events. That is why we encourage you to take part in a short survey after the event. Answering it will only take you a few minutes.

Your opinion is very important to us. Can you help us?

*** Required**

1. How likely is it that you would recommend the event to a friend or colleague? *

0 1 2 3 4 5 6 7 8 9 10

Not at all likely ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely likely

2. Why did you decide to attend the event?

Your answer

3. Which was your knowledge about citizen science observatories before the webinar? *

☐ Novice

☐ Beginner

☐ Intermediate

☐ Advanced

☐ Expert

4. What did you like about the event?

Your answer

5. Where can we improve for next time?

Your answer _____

6. Was the webinar too short, too long or about right? *

- ☐ Much too long
- ☐ Too long
- ☐ About right
- ☐ Too short
- ☐ Much too short

Only a few more questions, thank you!

7. How did you first hear about the webinar? *

- ☐ Web
- ☐ Family and friends
- ☐ Work Colleague
- ☐ Twitter
- ☐ Instagram
- ☐ LinkedIn
- ☐ Facebook
- ☐ Email
- ☐ Other: _____

8. Age Range *

- ☐ 18-24 years old
- ☐ 25-34 years old
- ☐ 35-44 years old
- ☐ 45-54 years old
- ☐ 55-64 years old
- ☐ 65-74 years old
- ☐ 75 years or older
- ☐ Prefer not to answer

9. What is the highest level of education you have completed? *

☐ Preschool/Kindergarten

☐ Elementary/Primary School

☐ Middle/Junior High School

☐ High/Secondary School

☐ College Degree (Bachelor)

☐ Post-Graduate Degree (Master/PhD)

10. Would you like to subscribe to Cos4Cloud's newsletter? If yes, copy this link in your browser to subscribe: <http://bit.ly/NewsletterCos4Cloud>

10. Would you like to be part of the Cos4Cloud community? You can join the Co-design, Testing or Advisory Panels community. If yes, copy this link in your browser to register: <http://bit.ly/JoinCos4CloudCommunity>

Thanks a lot for your answers!

Annex II

The following tables contain examples of the solutions implemented in the BioMARathon and UrbamarBio to overcome engagement and recruitment challenges according to the Janus Engagement Model.

	CHALLENGE: Participant Motivation						
	Triggers		Rewards (Attribution and Acknowledgement)			Strategies to increment ability	Strategies to increment motivation
Actors	External	Internal	Short-term	Long-term	Action		
Academia - CO	<ul style="list-style-type: none"> -Notification of new observation -Notification of new identification -Notification of new validation -Curation of the data -Comments on your observation -Participation in BioBlitz 	-	Acknowledge contributors' activity (CO)	<ul style="list-style-type: none"> Creation of collaborative products: -Participatory guide with the observations and photographs made by the volunteers -Itinerant exhibition with photographs made by volunteers 	-	-	<ul style="list-style-type: none"> -Establish common goals: focus on local biodiversity -Establish common goals: focus on local biodiversity -Rewards: acknowledgements in the CO and collaborative products
Enablers	<ul style="list-style-type: none"> -Newsletters -Social Media -Organisation of guided activities -Events to present the collaborative products (exhibition, participatory guide) 	-	Acknowledge contributors' activity in social media	<ul style="list-style-type: none"> -Creation of collaborative products: -Participatory guide with the observations and photographs made by the volunteers -Itinerant exhibition with photographs made by volunteers 	-	-	<ul style="list-style-type: none"> -Establish common goals: focus on local communities - Rewards: acknowledgement on social media and collaborative products (exhibition, participatory guide)
Citizens	-	Own observation	Collaborative identification		<ul style="list-style-type: none"> -Login into the CO -Login into the CO -Participate into an organised activity and/or BioBlitz 	-	-

	CHALLENGE: Diving or snorkelling skills						
	Triggers		Rewards (Attribution and Acknowledgement)		Action	Strategies to increment ability	Strategies to increment motivation
Actors	External	Internal	Short-term	Long-term			
Academia - CO	-	-	-	-	-	-	-
Enablers	Organisation of activities with instructors that can help citizen scientist to feel secure and that can adapt the activity to different skill levels		-	-	-	-	-
Citizens	-	-	-	-	-	-	-
	CHALLENGE: Use of an online platform (CO)						
	Triggers		Rewards (Attribution and Acknowledgement)		Action	Strategies to increment ability	Strategies to increment motivation
Actors	External	Internal	Short-term	Long-term			
Academia - CO	-					- Creation of simple protocols to report data - Creation of videos and printed resources on the use of the CO - Organization of training webinars on the identification of marine species	-
Enablers						- Training on the use of the technological citizen observatory before each diving or snorkelling activity - Organization of collaborative identification sessions after each diving or snorkelling activity	
Citizens	-						
	CHALLENGE: Underwater equipment						
	Triggers		Rewards (Attribution and Acknowledgement)		Action	Strategies to increment ability	Strategies to increment motivation
Actors	External	Internal	Short-term	Long-term			
Academia - CO	-	-	-	-	-	-	-
Enablers	-	-	-	-	-	- Provide material: fins, diving goggles, scuba diving equipment, underwater cameras - Provide physical space to change clothes before and after the activities	-
Citizens	-	-	-	-	-	-	-

CHALLENGE: Bad weather can cause a lack of visibility underwater							
	Triggers		Rewards (Attribution and Acknowledgement)				
Actors	External	Internal	Short-term	Long-term	Action	Strategies to increment ability	Strategies to increment motivation
Academia - CO							- Schedule of multiples dates to report data
Enablers							-Continuous conversation with citizen scientists to re-schedule activities
Citizens							-
CHALLENGE: Underwater activities needs security and liability insurances that can be difficult to obtain							
	Triggers		Rewards (Attribution and Acknowledgement)				
Actors	External	Internal	Short-term	Long-term	Action	Strategies to increment ability	Strategies to increment motivation
Academia - CO	-	-	-	-	-	-	
Enablers	-	-	-	-	-	-	-Provide official permits for group underwater activities so citizens don't have to manage this issue
Citizens	-	-	-	-	-	-	-
CHALLENGE: It may be harder for volunteers to “take ownership” of a site without obvious demarcations or recognizable boundaries							
	Triggers		Rewards (Attribution and Acknowledgement)				
Actors	External	Internal	Short-term	Long-term	Action	Strategies to increment ability	Strategies to increment motivation
Academia - CO	-	-	-	-	-	-	-Organization of exhibitions and presentation of the collaborative products in local civic centres close to the beaches monitored and closely linked to the social fabric of the area
Enablers	-	-	-	-	-	-	-Activities in specifics beaches -Industry enabler contacts city-halls, local organisations, local schools to transmit stewardship values -Industry enabler design tailored communication activities focused on the target citizens -Organization of exhibitions and presentation of the collaborative products in local civic centres close to the beaches monitored and closely linked to the social fabric of the area
Citizens	-	-	-	-	-	-	-