Cos4Cloud

1. CITIZEN OBSERVATORIES

Essential tech for citizen science

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Citizen observatories

Society's active participation in co-producing **scientific knowledge** requires the use of open and interoperable technological **platforms**. Citizen observatories have become the tech infrastructure that facilitates the gathering, processing and sharing of data and information that citizens and the scientific community build collaboratively, making **citizen science** a reality of the 21st century.

Knowledge

Citizens can collaborate in generating knowledge about their environment thanks to citizen science projects. For example, they can upload biodiversity photos, audios or videos to an app. Citizen observatories contain a huge amount of **open data about species and environmental parameters** that can be used in research projects or to monitor biodiversity, among other things.

Platforms

Mobile apps, web-apps or do-it-yourself equipment.

Interoperability

The ability of two or more systems or components to exchange information and "communicate" with each other. In Cos4Cloud, interoperability has been essential to integrating some services and resources into the European Open Science Cloud (EOSC) ecosystem and finding a 'common vocabulary' between citizen observatories, making it possible to reuse, share or integrate the data. Developed by CREAF, Secure Dimensions and Bineo Consulting.

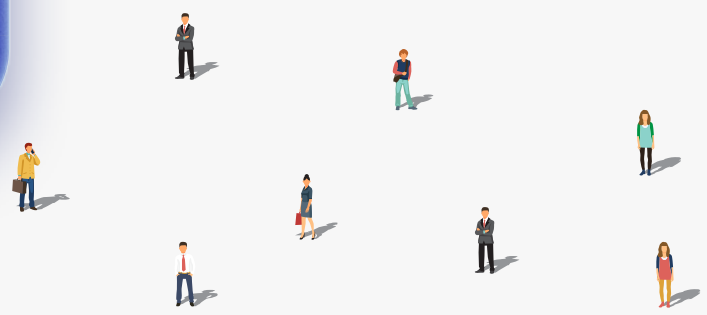

illustration credit: iconicbestiary (Freepik)

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2. COS4CLOUD

An answer to the technological challenges of citizen science

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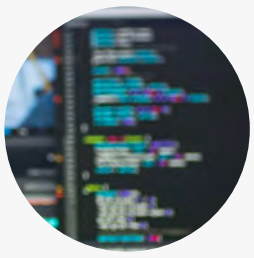
COS4CLOUD

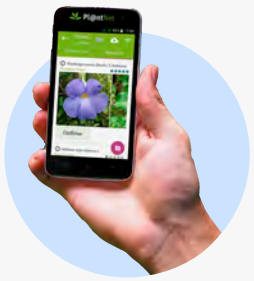
The main challenges citizen observatories face are:



Data

Failures in the gathering, identification and validation of data.

Photo Credit:Pexels



Technology

Limited resources for the technological development of platforms.

Photo Credit:Pl@ntNet, Inria

Standards

Lack of standards to facilitate information exchange between platforms.

Photo Credit:Karen Soacha

Interoperability

Low interoperability at local, regional and global levels, which prevents escalating the data to overcome geographic, thematic or even linguistic barriers to conduct research.

Photo Credit:Pexels

Sustainability

Long-term sustainability issues, with difficulty to obtain resources to develop basic functionalities with cutting edge technology.

Photo Credit:Freepik

Cos4cloud has tackled these challenges through the co-design of 13 technological services that have been tested by their final users, both current and potential: members of the citizen science community including citizen scientists, developers, data analysts and observatory coordinators, among others.

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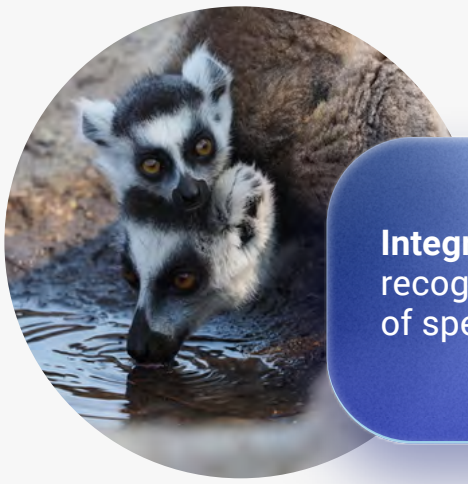
13 INNOVATIVE SERVICES

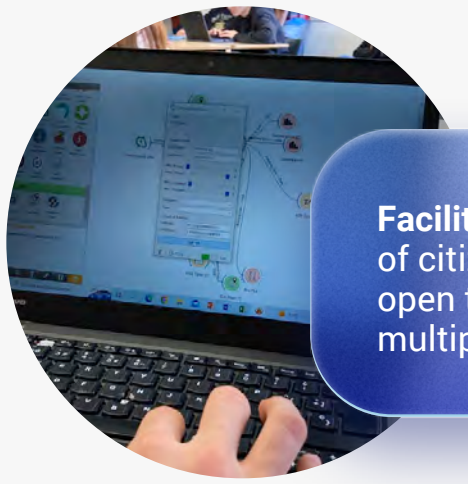
The Cos4Cloud services fulfil different needs

Each service is unique and responds to specific scientific and technological challenges.



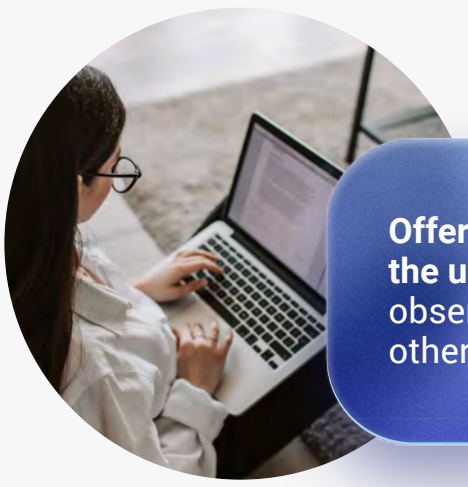
Integrating AI to facilitate recognition and location of species.

Photo Credit:Jaume Piera, Natusfera



Facilitating data analysis of citizen science based on open tools that integrate multiple observatories.

Photo Credit:Miguel Hernández

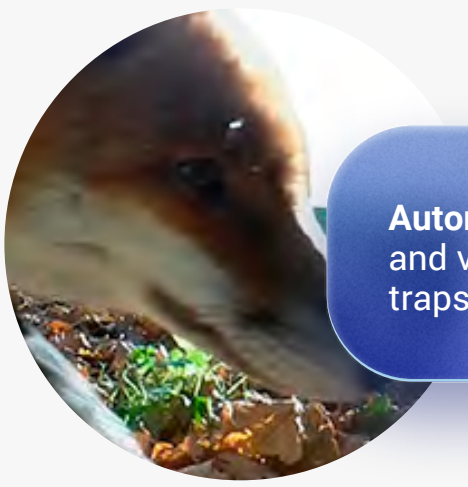


Offering information about the use of citizen's observations in articles or other scientific work.

Photo Credit: Pexels

Creating integrative apps that use data from various sensors that measure environmental factors.

Photo Credit: Pexels



Automatic filtering of photos and videos from camera traps.

Standardising citizen science data, among others.

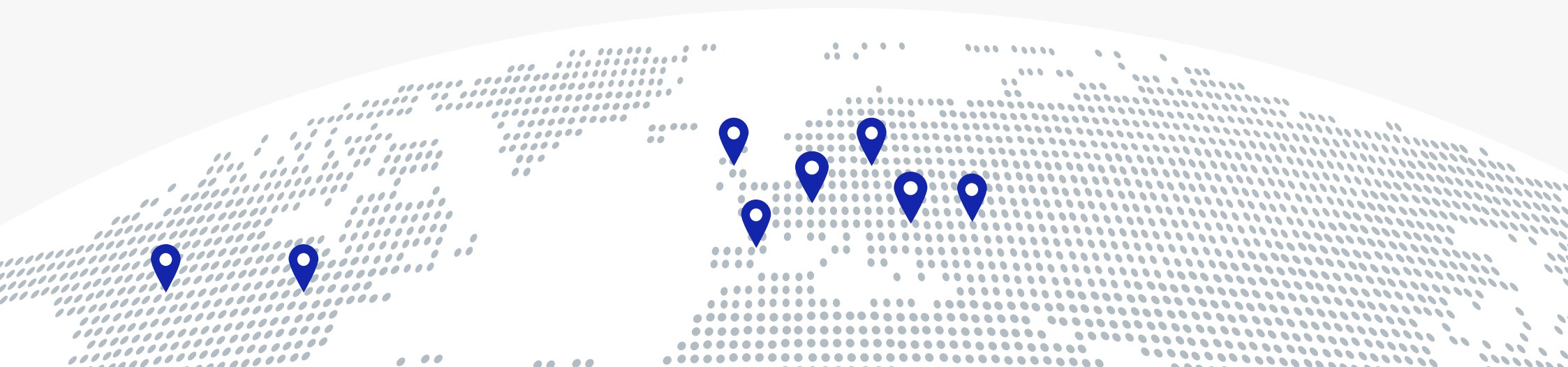
and much more!

Cos4Cloud

Cos4Cloud is a **Horizon2020** project led by **ICM-CSIC**. **Fifteen organisations** from 8 different countries are part of the project. It comprises a network of **9 citizen observatories and Do it Yourself (DIY) initiatives** focused on cataloguing and monitoring biodiversity and the environment.

Cos4Cloud is pioneering in the introduction of citizen science in the EOSC

Almost all the services, tools and materials that Cos4Cloud has developed are available in the European Open Science Cloud (EOSC). EOSC will be the reference archive for the European scientific community. For the first time, Cos4Cloud integrates into its cloud services oriented towards citizen observatories. The goal is to improve availability, quality and efficiency in the use of such information. Thus, data from citizen science can gain strength and trustworthiness in academic and political fields.



Cos4Cloud

3. THE PROCESS

Co-design and agile methodologies

3. THE PROCESS

Co-design

The process has been conducted with different communities of citizen science, academia and tech development to adapt each service to the needs of its final users.

Co-design

The co-design comprises methodologies originated in the design field that allows working collaboratively to create something new. The main contribution of these methodologies is the high degree of innovation that can be achieved when using them, in opposition to more traditional methods. Thanks to their multisensory techniques, they facilitate complex conversations in a seemingly easy way. They make it possible to generate a common language between different interested entities revolving around a need, challenge or issue. The co-design activities in Cos4Cloud have been coordinated by ICM-CSIC, in collaboration with Science for Change, CREAF and the European Citizen Science Association (ECSA), and Science for Change has led the co-design methodologies.

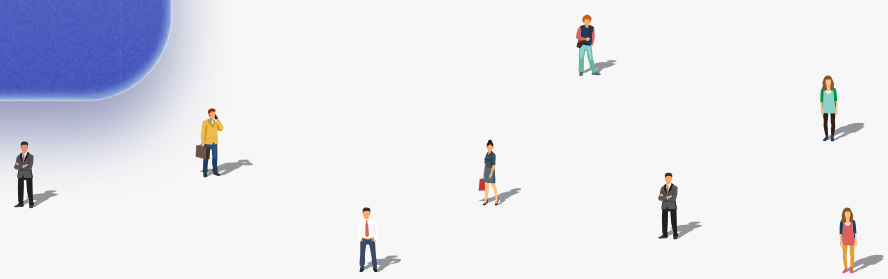
Community

The Cos4Cloud community includes citizen scientists, app developers, citizen observatory managers, citizen science projects, naturalists, professors and camera trap users, among others.

Cos4Cloud has carried out activities to explain to them the goals of each service, organised demonstrations and created spaces for the community to share opinions, needs and expectations about the services: is it easy to use? Should we add more functionalities? Etc. A very valuable source of feedback for the development team.

Agile Methodologies

Integrating agile methodologies has allowed for the revision and constant improvement of the Cos4Cloud services thanks to the collaboration with the final users in all stages of development: before, during and after. 52º North has led Agile Methodology.



3. THE PROCESS

First stage of the co-design process

The first activities focused on getting to know the end-users needs and expectations for each service and took place in an early stage of development. Developers used feedback from these users to improve and adapt the services.

Credit: Blanca Guasch.

EXAMPLE

Cos4Bio

Cos4Bio is an online portal that integrates biodiversity data from different citizen observatories in the same place so that experts[1] who validate the species names save time, as they don't have to access and validate on various platforms. Moreover, users can download the biodiversity data gathered in Cos4Bio in a standardised form to make their studies or reports. For example, you can download all observations on squirrels from various observatories. Service developed by Bineo Consulting and available in the EOSC.

Cos4Cloud organised two co-design activities that counted on the participation of 39 users with different backgrounds, such as naturalists, researchers and citizen observatories coordinators. These activities aimed to introduce the service to the participants and gather their feedback.

All the participants' insights were considered by the developers and integrated into the development process of the services when possible. For instance, in the case of Cos4Bio, thanks to the feedback provided by the users, the portal includes a geographical search in its search filters.

[1] *Experts by learning or by experience.*

3. THE PROCESS

Second stage of the co-designing process: testing

When the services were practically developed, there were activities to test them in real scenarios. The co-design team documented the comments of users about the services to improve some of their functionalities during or after the project.

Credit: Pau Gúzman.

EXAMPLE

FASTCAT-Edge

FASTCAT-Edge is a smart DIY camera trap. Compared to other cameras in the market, its advantage is that it works with AI, allowing the camera only to capture images of animals and avoids empty photos and videos. It is also capable of detecting images of small and fast animals. This service has been developed by **DynAikon**.

Cos4Cloud organised a workshop to test **FASTCAT-Edge** with the **FELIS** group, a project coordinated by **the Catalan Institute of Natural History** that uses photo-trap cameras to monitor mammals in the Catalan regions, focusing on wildcats (Felis silvestris). The workshop was held in the natural park of Sant Llorenç del Munt i l'Obac (Barcelona, Catalonia). The main goal was for the participants to evaluate the **FASTCAT-Edge** prototype and give feedback. Many of their comments are being integrated into the service.

Cos4Cloud

4. THE RESULT

13 services for the citizen science community

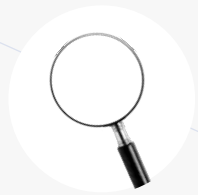
Cos4Cloud

THE RESULT

13 services for the citizen science community

Cos4Env

An online portal that integrates environmental data from multiple citizen observatories in one place.



DUNS

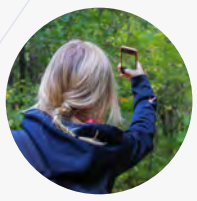
A system that helps citizen observatories track how their data have been used and inform their users. For example, if their observations have been used in a scientific article.

Credit: Freepik

Cos4Bio

An online portal that integrates biodiversity observations from multiple citizen observatories in one place.

Credit: Freepik



MOBIS

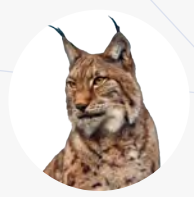
A service to create integrative citizen science apps to report environmental measurements and biodiversity observations.

Credit: Pixabay

Pl@ntNet-API

It allows the integration of Pl@ntNet's visual identification engine into an app.

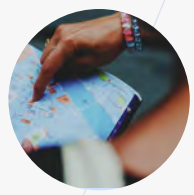
Credit: Freepik



AI-taxonomist

It facilitates the integration of automatic species identification tools into a citizen science platform.

Credit: Freepik



AI-GeoSpecies

It allows the integration of artificial intelligence into a citizen science app to predict which plant species users will find in a particular area.

Credit: Pexels

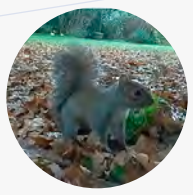
GBIF-DL

It provides groups of images that help developers train AI to recognise species.

Credit: Freepik

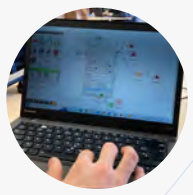
FASTCAT-Edge

A service to make a do-it-yourself smart camera that only takes videos and photos of animals and helps identify the species names



FASTCAT-Cloud

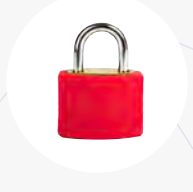
A website service to filter out videos and pictures from camera traps and only download those which have captured wildlife activity. It also helps identify the name of species.



MECODA

A repository to facilitate analysing and viewing all sorts of citizen science data.

Credit: Miguel Hernández



Authenix

An authentication system that facilitates compliance with the General Data Protection Regulation (GDPR) by citizen observatories.

Credit: Freepik

STAplus:

A proposal for a standard to make citizen science data more accessible, interoperable and reusable.

Credit: Pixabay

THE RESULT

Educate to promote citizen science

Cos4Cloud has worked on integrating citizen science into the curricula of environmental subjects in Greek schools and creating networks of teachers to promote them. The Environmental Education Lab at the National and Kaprodisiakan University of Athens (NKUA) has led this activity.

In particular, NKUA has organised training events, an online course for school teachers and educational stakeholders and implemented case studies to incorporate citizen science into the teaching practice.

In the onsite activities NKUA has organised, participants have used some citizen observatories and services, such as:

Pl@ntNet-API

A citizen observatory to report images of plants and helps the user to identify the species. Coordinated by Inria.

MINKA

A citizen observatory to report biodiversity observations and environmental variables. Coordinated by ICM-CSIC.

Odour Collect

A citizen observatory to report odours. Coordinated by Science for Change.

Credit: Freepik

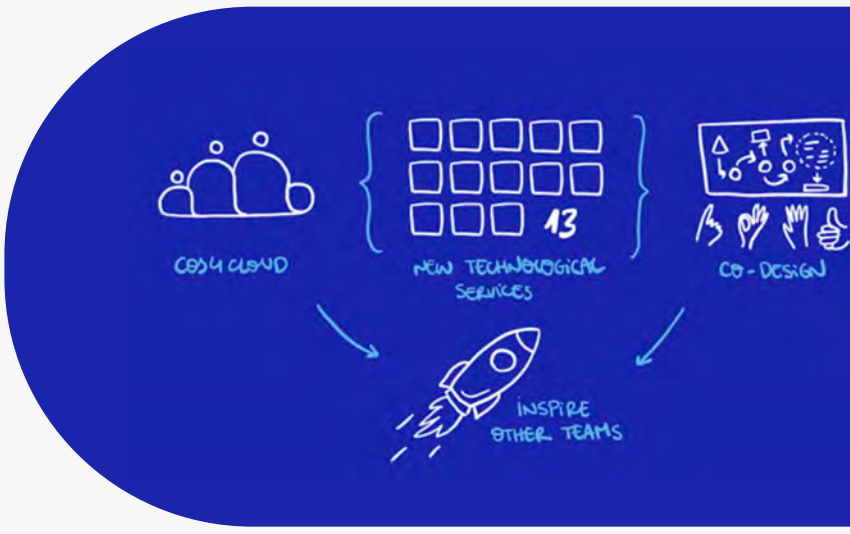
MECODA

A repository to analyse and view citizen science data. Service developed by ICM-CSIC.

THE RESULT

Co-design as a service:

As a result of the co-design experiences, Cos4Cloud has produced the **'Co-design as a service: Methodological guide'**, which aims that anyone interested in co-design can implement it in their own citizen science or software development projects by following this document. This guide has been led by Science for Change as a result of the co-design process implemented with ICM-CSIC, CREAF and ECSA.



THE RESULT

Evidence Hub & Toolbox

To support the sustainability of all knowledge and products that Cos4Cloud has produced, **The Open University** has created the Toolbox and Evidence Hub, an accessible collection of different resources to highlight and demonstrate the Cos4Cloud results, best practices and lessons learned. It includes: training and capacity building resources, best practice guidelines, educational resources, case studies and a space for reflection on the content provided.

THE RESULT

Guides and DIY sensor networks

Empowering communities to measure air quality was also part of the project. In the Cos4Cloud framework, **Trébola Organización Ecológica**, a Colombian foundation, worked with local and regional vulnerable communities to improve the guides to build particulate matter sensors and expand a permanent and mobile network of sensors that contribute with real-time air quality data.

THE RESULT

Two policy briefs

Cos4Cloud has produced two policy briefs. The first one is focused on describing how citizen science contributes to the Sustainable Development Goals (SDGs) and the potential of Cos4Cloud's technology to improve data quality and quantity. The second one is focused on the sustainability of the services developed in Cos4Cloud. Documents led by ECSA.

Credit: Pixabay

Policy brief 1: Citizen science to support progress of the SDGs and Cos4Cloud's contribution through its services and tools.

Policy brief 2: Sustainability of Cos4Cloud services for Citizen Observatories

To download the materials, documents related to the services and other products that Cos4Cloud has produced, access the community the project has created in Zenodo.


Cos4Cloud