Integrating Citizen Science in the European Open Science Cloud 'Cos4Cloud': a minimum viable ecosystem (MVE) for tackling common challenges of citizen observatories

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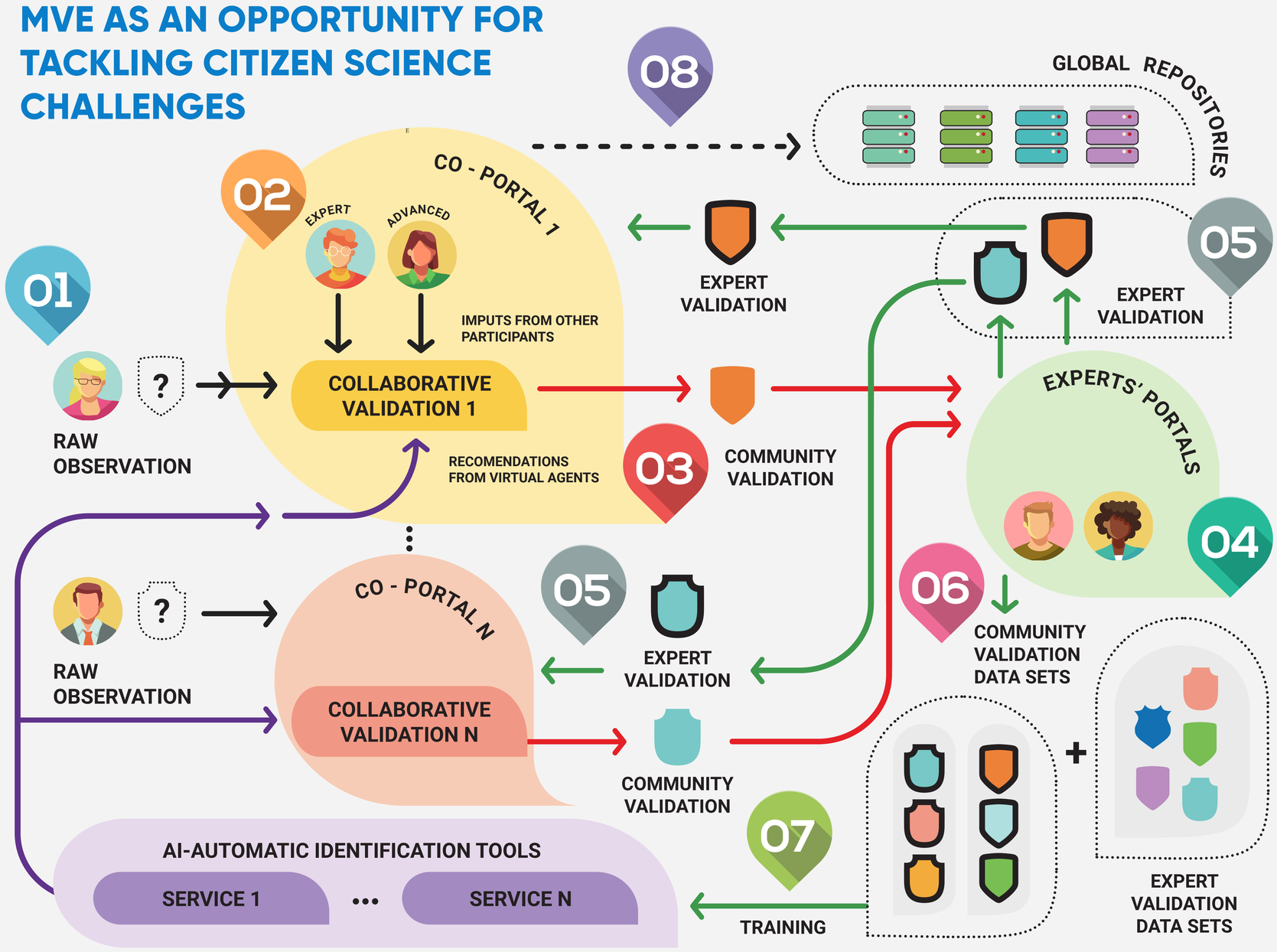
SYNTHESIS

Citizen science is one of the eight priorities of the European Open Science Agenda, together with the creation of the European Open Science Cloud (EOSC) (European Comission, 2019). Within this context, the European Union has promoted **Cos4Cloud (Co-designed Citizen Observatories Services for the European Open Science Cloud), a project to boost citizen science technologies and integrate them to the digital service ecosystem of EOSC, in order to ensure the viability in the long term of citizen science platforms -also known as citizen observatories- and help them reach a global scope.** The set of services that starts up EOSC's ecosystem is called **Minimum Viable Ecosystem (MVE)**. The MVE for citizen observatories (COs) proposed by Cos4Cloud consists on **co-designed and prototyped set of services focused on interoperability, innovative models of collaboration and architecture for federated infrastructures, so that all citizen observatories and their components are able to interact and establish synergies among them.**

MVE AS AN OPPORTUNITY FOR TACKLING CITIZEN SCIENCE CHALLENGES



The set of services that starts up EOSC's ecosystem is called **Minimum Viable Ecosystem (MVE). To consolidate this MVE are required a minimum technical, political, and human conditions.** Interoperable services and open data, a coordinated effort to put the right incentives in place for all those involved (researchers, software developers, and infrastructure managers, research managers, and users) are some of these conditions (European Commission, 2018). **The MVE for COs proposed by Cos4Cloud consist of co-designed and prototyped a set of services to face citizen observatories' challenges.**

The first requirement to build an MVE based on COs is to ensure that the interactions among the different components have a synergic benefit for all the participant actors. The main components of the MVE (COs and additional building blocks) can be seen in can be seen in **Figure 1**, which is an example of what is the MVE based on COs for Cos4Cloud project. **In the Figure we observe three main components of the MVE: CO-portals, experts' portals, and AI-based automatic-validation tools.** The interaction and feedbacks among them (coloured arrows) improve the associated services and data quality.

Starting from the raw observation (1) that users provide **the CO-portals are able to generate a collaborative validation** from the inputs of other participants and the suggestions provided by the AI-based automatic-validation tools (2). The community-validated observations (3) could be integrated in **different experts' portals (4)** that can provide a higher level of validation (5). **The expert validations will provide feedback to the different COs for each of the integrated observations.** Furthermore, the expert validated observations could be grouped in different reference sets (6) that can be used as a complementary high-quality training sets (7) to **improve the classification capabilities of the AI-based automatic-validation tools** (which in turn will provide better recommendations in future collaborative validations in each CO). **This process will generate high-quality data in global repositories (8)** (Cos4Cloud Consortium, 2019).

CITIZEN OBSERVATORIES' CHALLENGES AND Cos4Cloud

The citizen science infrastructures in Europe take the name of **Citizen Observatories (COs), characterized by their focus on observing the environment** (rather than other phenomena), **the scale of their activities** (typically local), **and their timeline** (typically long term). Currently, there are dozens of citizen observatories in Europe. The growing evolution of these COs yields in a community of citizen science that is continuously expanding not only in Europe but also on a global scale (Gold, M., 2018).

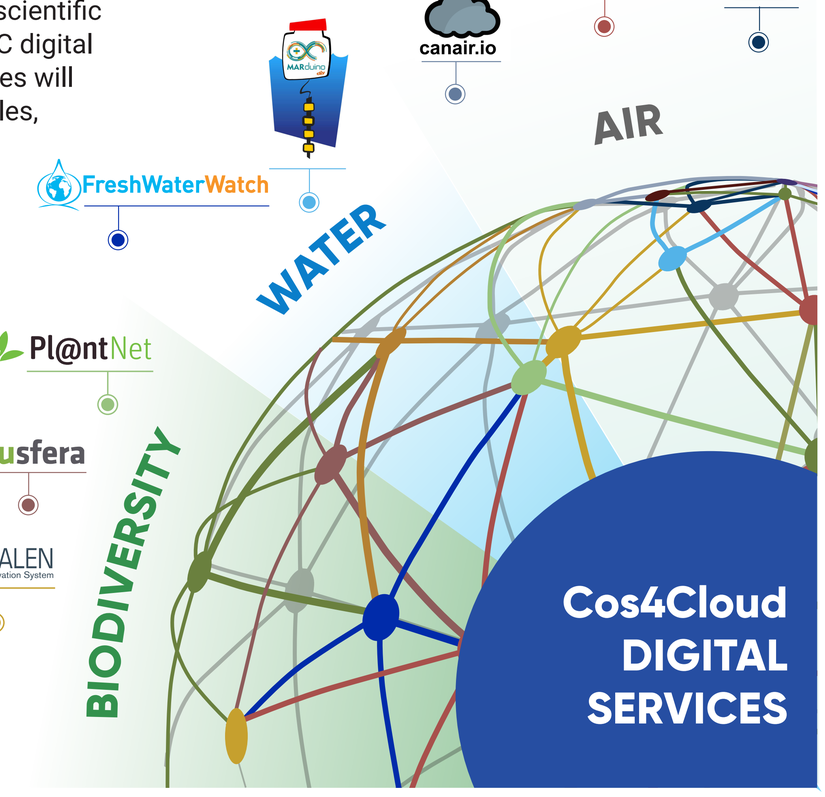
This in turn represents **large-scale challenges for citizen observatories** who must facilitate:

- **Efficient capture, identification and validation of data.**
- Interaction between participants based on a model that allows the **transfer of knowledge and, the stewardship and storage of large volumes of data in different formats** (photos, sounds, camera trap images...).
- **Interoperability at a local, regional, and global level** that allows scaling the impact of the data overcoming the geographic, thematic, or even linguistic barriers for doing research.
- **Long-term sustainability challenges** with difficulty in obtaining resources to develop functionalities based on cutting-edge technologies.

The services developed by Cos4Cloud will address these COs' challenges. During the project, co-design activities will also be carried out with key stakeholders to discuss and improve the proposed services according to citizen science needs. In addition, in order to assess the services, **9 citizen science platforms** focused on biodiversity and environmental monitoring participate in Cos4Cloud and **will test the technological services with their users** (Figure 2) (Cos4Cloud Consortium, 2019).

Citizen science and citizen observatories in EOSC

In order to reach a global scope, **there is a need to integrate Cos4Cloud's innovative citizen science services in EOSC** make them available to the entire scientific community in the EOSC digital ecosystem. The services will be presented as modules, so that existing citizen science observatory will be able to choose and install the technological services it needs to improve its functionalities.



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Cos4Cloud
Co-designing Citizen Observatories Services for the European Open Science Cloud

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