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# Deliverable D5.2 | ENTRN DEL 5.2.01/2023

Maturity model with engagement competences and engagement  
incompetences | Date 30 -nov-2023

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# Document Summary

<b>Deliverable Title:</b> Maturity model with engagement competences and engagement incompetences
<b>Deliverable number:</b> D5.2
<b>Type:</b> Report
<b>Version:</b> 1.0
<b>ID code:</b> ENTRN DEL 5.2.01/2023
<b>Deliverable Lead:</b> UCLL
<b>Related Work package:</b> WP5
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<b>Communication level:</b> Public
<b>Grant Agreement Number:</b> 101071317
<b>Project name:</b> E <sup>3</sup> UDRES <sup>2</sup> Ent-r-e-novators: Cooperating for excellence and impact in research and innovation
<b>Acronym:</b> E <sup>3</sup> UDRES <sup>2</sup> Ent-r-e-novators
<b>Start date of Project:</b> 01-10-2022
<b>Project coordinator:</b> Luís Coelho (IPS)
<b>Duration:</b> 36 months
<b>Deliverable Date:</b> 30-11-2023
<b>Reviewed by:</b> Rudnák Ildikó (MATE)   Date of review: 25-11-2023
<b>Approved by:</b> Luís Coelho (IPS)   Approval date: 29-11-2023

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## Terms, definitions and abbreviated terms

### List of project participants

Participant organisation name	Country
Polytechnic Institute of Setúbal (IPS)	PT
St. Pölten University of Applied Sciences (STPUAS)	AT
Hungarian University of Agriculture and Life Sciences (MATE)	HU
Politehnica University of Timisoara (UPT)	RO
University Colleges Leuven Limburg (UCLL)	BE
Vidzeme University of Applied Sciences (ViA)	LV

### Abbreviated terms

CS – Citizen Science

E<sup>3</sup>UDRES<sup>2</sup> – Engaged European Entrepreneurial University as Driver for European Smart and Sustainable Regions

## Executive summary

The rise of citizen engagement in scientific research has driven transformation of the research field, democratizing the scientific process and addressing real-life challenges. Citizen science, as a leading example, harnesses diverse voices, perspectives, and skills to advance scientific knowledge and foster collaboration between science and society. In order to guide researchers to adapt and collaborate effectively with citizens and stakeholders, this report introduces a maturity model for self-learning engagement competencies.

### Maturity Model

The maturity model, a dynamic document evolving throughout the Ent-r-e-novator project, departs from the EURAXESS Researcher Profile Descriptors. These descriptors categorize researchers into First Stage Researcher (R1), Recognized Researcher (R2), Established Researcher (R3), and Leading Researcher (R4). Our model outlines four levels of expertise in citizen science engagement competencies: First Stage CS Competences (CS1), Recognized Citizen Science Researcher (CS2), Established Citizen Science Researcher (CS3), and Leading Citizen Science Researcher (CS4). Rooted in the results of the Delphi Study from Task 5.1, the model identifies these four levels of expertise across eight categories of engagement competencies.

### Key Competency Categories and Progression:

#### 1. Project Design and Planning:

- Progresses from basic understanding (CS1) to strategic leadership in international projects (CS4).
- Emphasizes adaptive planning, inclusive choices, and innovative project designs.

#### 2. Communication:

- Advances from basic communication with citizen scientists (CS1) to developing communication strategies for diverse groups (CS3).
- Highlights the use of digital storytelling and collaboration with public relations.

#### 3. Understanding Context:

- Evolves from assessing barriers (CS2) to providing solutions for complex cases (CS4).
- Focuses on critical evaluation and overcoming engagement challenges.

#### 4. Networking and Outreach:

- Develops from connecting citizens with researchers (CS1) to building coalitions (CS4).
- Involves defining stakeholder roles, utilizing networks, and organizing consensus discussions.

## 5. Transdisciplinary Teamwork:

- Progresses from using advisory boards with supervision (CS1) to leading and supervising project planning (CS3).
- Encourages mentorship, team performance, and professional development.

## 6. Training, Consultation, and Education:

- Advances from participating in training activities (CS2) to creating learning collaboratives (CS4).
- Includes dynamic training, ongoing consultation, and leadership development.

## 7. Stakeholder and Citizen Incentives and Motivation:

- Develops from proposing incentives under supervision (CS2) to consulting on rewards systems (CS4).
- Focuses on creating motivation, providing feedback, and establishing supportive environments.

## 8. Ethical Considerations:

- Progresses from knowledge of ethical considerations (CS2) to supervising ethical aspects (CS4).
- Integrates ethical and legal aspects into citizen science practices.

## Resources for Self-Training:

For researchers wanting to self-train these eight key competencies related to citizen science, citizen engagement, and stakeholder engagement, this report provides a curated list of resources. General information concerning citizen science can be found through the following resources:

- Citizen Science Journal: Provides academic articles relating to both the theory and practice of citizen science.
- European Citizen Science Association (ECSA): Aims to coordinate and support the growth of citizen science.
- SCivil: The Flemish knowledge center on citizen science that gathers and spreads citizen science knowledge.
- EU-Citizen Science: Gives a broad introduction to what citizen science is.
- EU-Citizen Science Resources and EUSEA Good Reads: Offer a broad overview of different resources related to citizen science.
- Wissenschaftskommunikation: Provides a concise summary of what citizen science is, written in generally accessible language.

The maturity model that identifies 8 key competencies, provided with a list of resources organized by competence, encourages researchers for self-development to become an engaged researcher.

The more researchers understand what it takes to be an engaged researcher, the more they will be able to define their engagement incompetence and move to another aspect of the engagement model.

The resources that are added to help to develop the 8 key competencies aim to support researchers in their journey to enhance engagement competencies, fostering a collaborative and inclusive approach that strengthens the bond between researchers and the communities they engage with in scientific endeavours.



# 1 Maturity Model

## 1.1 Introduction

In recent years, citizen engagement has become more prevalent in different fields of scientific research. The convergence of different voices, perspectives and expertise that citizen and stakeholder engagement bring, not only leads to a democratizing of the scientific process, but is also considered essential in tackling complex scientific challenges. Citizen science has been the leading example of this burgeoning involvement of communities in research. Silvertown (2009) points out that public engagement brings with it many new resources such as free labour, different skills and computational power that can support decision making processes (see also Pocock et al., 2019; Van Vliet, & Moore, 2016). Wiggins and Crowston (2011) add that citizen science is valuable for collecting massive scale data. Under the right circumstances it can generate high quality data and novel insights (see also Van Vliet, & Moore, 2016). On the other side, citizens can gain skills in science literacy by participating in citizen science research (Bonney et al., 2009). Moreover, citizen science has shown itself to be a powerful tool for mobilizing collective action in the face of pressing global challenges such as climate change (Pocock et al., 2019; Silvertown, 2009). In summary, citizen science stands as a collaborative and inclusive approach that not only advances scientific knowledge but also strengthens the relationship between science and society.

This new approach to science requires researchers to harness skills for engaging and collaborating citizens and stakeholders in research projects. These skills are new to researchers more commonly engaged in traditional research. With the goal to provide practical guidance to researchers who want to strengthen their engagement competencies, this report gives an overview of a maturity model for self-learning engagement competencies. This maturity model is intended to be a *living document* which can be adjusted throughout the Ent-r-e-novator project, based on the feedback from citizen science experts and researchers using the maturity model.

The maturity model departs from the different experience levels described in the different EURAXESS Researcher Profile Descriptors. EURAXESS describes four different profiles, namely First Stage Researcher (R1), Recognized Researcher (R2), Established Researcher (R3) and Leading Researcher (R4)<sup>1</sup>.

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<sup>1</sup> <https://euraxess.ec.europa.eu/europe/career-development/training-researchers/research-profiles-descriptors>

## 1.2 Maturity model for citizen science engagement skills

Based on the four different Research Profiles identified by EURAXESS, four levels of expertise related to citizen science engagement competencies were identified, namely First Stage CS Competences (CS1), Recognized Citizen Science Researcher (CS2), Established Citizen Science Researcher (CS3) and Leading Citizen Science Researcher (CS4). Departing from the results of the Delphi Study carried out in Task 5.1 of the Ent-r-e-novator project, eight categories of engagement competencies were identified, namely project design and planning, communication, understanding context, networking and outreach, transdisciplinary teamwork, training, consultation and education, stakeholder and citizen incentives and motivation and ethical considerations. Departing from the perspective that the level of expertise for each engagement skills is fluid (e.g. junior researchers can sometimes have a more advanced level in one category of engagement skills than in another), the maturity model for engagement skills gives an overview of how the expertise level progresses for each category of engagement skills. Below you can find a description the categories of engagement competencies and the specific expectations for each level of expertise, followed by a visual representation of the maturity model for engagement skills.

### Project design and planning:

- ✓ Have a basic understanding of citizen science engagement strategies, modes, levels (CS1).
- ✓ Carry out citizen engagement activities under supervision in the process of research project planning and implementing (CS1).
- ✓ Knowledge about collaborative tools for engagement (CS1).
- ✓ Have an understanding of citizen science, strategies, levels, modes (CS2).
- ✓ Contributes to citizen science projects planning and research designing (CS2).
- ✓ Purposely monitor the implementation of the citizen science project (CS2).
- ✓ Understands the necessity to adapt citizen engagement modes, tasks, communication as the project is on-going (CS2).
- ✓ Have an in-depth understanding of citizen science, strategies, levels, modes (CS3).
- ✓ Demonstrate the ability to choose appropriate engagement strategies and modes (CS3).
- ✓ Make inclusive project design choices and plan the research accordingly (CS3).
- ✓ Promote adaptability of research design (e.g. interventions, methods, innovation, ...) depending on context (CS3).
- ✓ Recruit and designate for leadership roles (e.g. researchers, project ambassadors, citizen scientists, ...) (CS3).
- ✓ Strategic lead of planning and implementation of international citizen science projects (CS4).
- ✓ Develops/adapts innovative modes of citizen engagement according to the context (CS4).
- ✓ Creates engaging research project designs (CS4).

### Communication:

- ✓ Communicates with citizen scientists (CS1).
- ✓ Use existing communication channels (CS1).
- ✓ Utilize mass media and social media (CS1).
- ✓ Adjust communication to target groups (C2).
- ✓ Use digital storytelling (C2).
- ✓ In cooperation with public relationship support, develops communication strategies how for communicating to diverse citizen groups (CS3).

### Understanding Context:

- ✓ Assess engagement barriers and facilitators (CS2).
- ✓ Critically evaluates the context of the citizen science research project (CS2).
- ✓ Contributes to solutions to overcome barriers for citizen engagement in a research project (CS3).
- ✓ Provides solutions for citizen engagement challenges in the complex cases (CS4).

### Networking and Outreach:

- ✓ Connect citizens with researchers (CS1).
- ✓ Organize regular stakeholder meetings (CS1).
- ✓ Organize fun and social activities (CS1).
- ✓ Define stakeholders and their roles, needs and motivation (CS2).
- ✓ Define the level of engagement for different target groups (CS2).
- ✓ Use organizations (in your network) as intermediaries (CS3).
- ✓ Use existing networks (CS3).
- ✓ Conduct local consensus discussions (CS3).
- ✓ Build a coalition (CS4).
- ✓ Create new innovation teams (e.g. connect the unconnected) (CS4).

### Transdisciplinary Teamwork:

- ✓ Use advisory boards and workgroups with the support of a supervisor (CS1).
- ✓ Use experts (e.g. an engagement advisor, data experts, communication, ...) (CS1).
- ✓ Demonstrates the ability to lead and supervise the process of planning and implementation of citizen science projects (CS2).
- ✓ Use advisory boards and workgroups (CS2).
- ✓ Mentors the performance of the team in citizen science research (CS3).
- ✓ Encourages the development of citizen science in research organization and among peers, scientific community (CS3).
- ✓ Acts as a professional development role model for other citizen scientists (CS4).

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### Training, consultation and education:

- ✓ Takes part in planning and implementing training activities for stakeholders (CS2).
- ✓ Develop and apply tools for quality monitoring (CS2).
- ✓ Conduct ongoing training and consultation with stakeholders and citizens (CS2).
- ✓ Distribute educational materials (CS2).
- ✓ Develop basic educational materials for stakeholders and citizens (CS2).
- ✓ Conduct educational meetings (CS2).
- ✓ Develop training materials (CS3).
- ✓ Train the trainer (CS3).
- ✓ Make training dynamic (CS3).
- ✓ Provide ongoing consultation for researchers (CS3).
- ✓ Provide ongoing consultation for a project team (CS4).
- ✓ Consults on engaging research project designs (CS4).
- ✓ Consults on training content creation for citizen science projects according to the needs of the audience (CS4).
- ✓ Create a learning collaborative (CS4).
- ✓ Train for leadership (e.g. researchers, project ambassadors, citizen scientists, ...) (CS4).

### Stakeholder and Citizen Incentives and Motivation:

- ✓ Propose incentives under supervision (CS2).
- ✓ Propose disincentives under supervision (CS2).
- ✓ Demonstrates ability to redefine citizens` tasks and other changes when participant motivation or other contextual factors have changed (CS3).
- ✓ Make sense / create motivation to participate in research project (CS3).
- ✓ Audit and provide feedback (CS3).
- ✓ Provide incentives (CS3).
- ✓ Develop disincentives (CS3).
- ✓ Establish an engaging and supportive environment for citizen participant groups (CS3).
- ✓ Consults on incentives or rewards system as an extrinsic motivation for citizens and stakeholders to participate in the citizen science projects (CS4).

### Ethical considerations:

- ✓ Knowledge about ethical and legal considerations for stakeholders and citizens involvement (CS2).
- ✓ Integrating ethical and legal aspects (CS3).
- ✓ Supervising ethical and legal aspects of citizen science (CS4).

## 1.3 Visual overview of the maturity model

The figure below shows a visual representation of the maturity model for engagement skills.

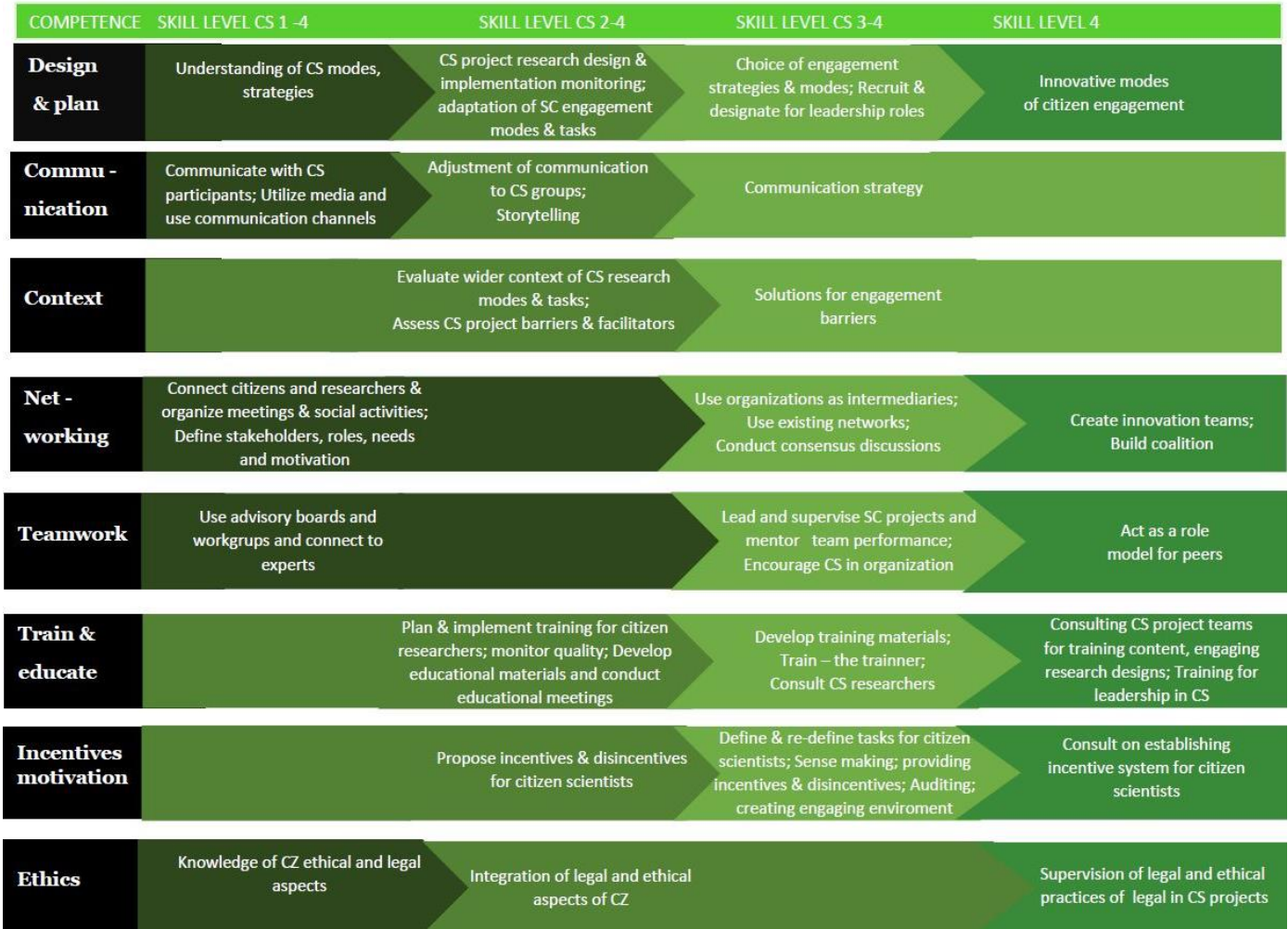


Figure 1 – Visual representation of the Maturity Model

## 1.4 Resources for the learning trajectory

For researchers wanting to self-train competencies related to citizen science, citizen engagement, and stakeholder engagement, this report provides some resources that they can use. General information concerning citizen science can be found through the following resources:

- The open access citizen science journal (<https://theoryandpractice.citizenscienceassociation.org/>) provides academic articles relating to both the theory and practice of citizen science.
- The European Citizen Science Association (ECSA, <https://www.ecsa.ngo/>) aims to coordinate and support the growth of citizen science.



- Similarly, SCivil (<https://www.scivil.be/en>), the Flemish knowledge centre on citizen science provides gathers and spreads citizen science knowledge and brings different actors together.
- <https://www.citizen-science.at/en/immerse/what-is-citizen-science> gives a broad introduction to what citizen science is.
- The websites <https://eu-citizen.science/resources> and <https://eusea.info/platform/resources/good-reads/> give a broad overview of different resources related to citizen science. On the <https://eu-citizen.science/resources> website, researchers can search more specific resources based on citizen science related themes.
- The German website <https://www.wissenschaftskommunikation.de/format/buergerwissenschaften/> gives a concise summary of what citizen science is, written in generally accessible language.

Apart from these broad resources, this report grouped resources together according to the engagement competencies identified in the maturity model. Below you can find resources for each category.

#### 1.4.1 Project design and planning

Planning citizen science projects involves a systematic and thoughtful process to design initiatives that effectively engage and mobilize individuals in scientific endeavours. This planning encompasses defining the project's objectives, selecting a research question or problem, and determining the scope and scale of participant involvement. Project organizers must consider the target audience, ensuring that tasks are accessible and meaningful to participants with varying levels of expertise. Developing clear protocols for data collection, analysis, and communication is essential, as is establishing ethical guidelines to protect both participants and the integrity of the research. Choosing appropriate technology platforms, whether online interfaces, mobile applications, or other tools, is crucial for seamless participant engagement and data management. Effective planning also involves considering strategies for recruiting and retaining participants, as well as fostering a sense of community and collaboration within the citizen science network. By carefully mapping out these elements, planners can create citizen science projects that are not only scientifically rigorous but also inclusive, educational, and impactful. The German website <https://www.buergerschaftenwissen.de/citizen-science/projekt-entwickeln> gives guidance in how to plan and develop a citizen science project. The website <https://citsci.org/> provides a CS platform that supports the entire research process, from creating projects to managing participants; building custom data sheets; collecting data; sharing and analyzing data; and gathering feedback.

In order to create an appropriate project plan, citizen science projects leverage a diverse array of technical tools to empower individuals and communities in contributing to scientific research. Online platforms such as Zooniverse (<https://www.zooniverse.org/lab>) provide a user-friendly interface for participants to engage in tasks like image classification or data analysis. Mobile applications equipped with GPS functionalities enable crowd-sourced environmental monitoring, allowing citizens to collect and upload geotagged observations. Open-source data repositories and visualization tools facilitate the storage and exploration of collective findings. The website <https://pybossa.com/> provides a crowdsourcing framework to analyse or enrich data that can't be processed by machines alone. Additionally, social media platforms and forums foster collaboration and knowledge exchange among participants. The integration of machine learning algorithms further automates data processing, enabling participants with varying levels of technical expertise to actively contribute to scientific discovery. These tools not only democratize access to scientific research but also create a collaborative ecosystem that enhances the collective impact of citizen science initiatives.

#### 1.4.2 Communication

A MOOC course on doing citizen science as an open science, including how to disseminate results back to the community can be found at <https://moodle.eu-citizen.science/course/view.php?id=23>. More resources on how to communicate for public engagement can be found at <https://eu-citizen.science/resource/52> and <https://www.aaas.org/resources/communication-toolkit>.

Storytelling can be a useful tool when communicating with citizens and stakeholders. The website <https://stepchangeproject.eu/once-upon-a-time-the-power-of-storytelling-in-citizen-science/> gives an introduction to storytelling in citizen science. A MOOC on storytelling for citizen science can be found on <https://moodle.eu-citizen.science/course/view.php?id=21>.

Social media use can leverage citizen engagement. <https://moodle.eu-citizen.science/course/view.php?id=24> provides a MOOC on how to use social media to foster citizen engagement in citizen science projects.

Researchers wanting to learn more about how to publish CS results, can look into the MOOC <https://moodle.eu-citizen.science/course/view.php?id=37>.

#### 1.4.3 Understanding context

Pfadenhauer and colleagues (2017) provide a theoretical framework to understand the complexity and context of implementing an innovation or research intervention in the real world. Apart from taking into account factors related to the specific intervention or innovation and its setting, the

framework identifies seven broad contextual categories, namely geographical, epidemiological, socio-cultural, socio-economic, ethical, legal and political.

#### 1.4.4 Networking and outreach

Working with volunteers and volunteer organizations can require some specific competencies and knowledge. The German website <https://www.buergerschaftenwissen.de/citizen-science/fwa> provides guidance for researchers wanting to work with volunteering agencies.

#### 1.4.5 Transdisciplinary teamwork

Engaging in citizen science will require working with transdisciplinary teams. The website <https://www.citizenscience.gov/toolkit/howto/step3/#> provides a toolkit for how to build a community for your citizen science project and how to be sensitive to socio-cultural differences.

#### 1.4.6 Training, consultation and education

SciStart (<https://scistarter.org/>) provides training kits for citizens related to specific citizen science projects. It can function as an example for researchers developing their own training and education modules for a citizen science project.

#### 1.4.7 Stakeholder and citizen incentives and motivation

For a MOOC on volunteer engagement, management and care, researchers can turn to <https://moodle.eu-citizen.science/course/view.php?id=20>.

#### 1.4.8 Ethical considerations

For basic regulations and ethical guidelines in citizen science, the MOOC <https://moodle.eu-citizen.science/course/view.php?id=33> provides a good starting point. SCivil (<https://www.scivil.be/en/book/ethics-and-privacy>) provides a broad overview of ethical considerations to take into account. For more specific information on being inclusive when using digital tools, researchers can turn to <https://eu-citizen.science/resource/364>.

#### 1.4.9 Other resources

Apart from the categories of engagement competencies identified in our maturity model, other resources related to specific topics in citizen science are listed below:

##### Quality criteria

<https://www.ecsa.ngo/documents/>



This website provides the ten principles of a good citizen science project.

### Inspirations and best practice examples

Several websites exist listing best practices and showcases related to citizen science.

- <https://www.buergerschaffenwissen.de/projekte>  
This website gives a list of citizen science projects in Germany.
- <https://www.citizenscience-wettbewerb.de/blog/preistraegerInnen23>  
This website gives examples of award-winning German citizen science projects in 2023.
- <https://www.citizen-science.at/en/projects>  
This website gives a list of citizen science projects in Austria.
- <https://www.scivil.be/en/stories>  
This website gives an overview of citizen science success stories in Flanders.

### How to get funding for CS projects

- <https://zenodo.org/records/6794982>  
This website gives a policy brief on fostering funding for citizen science (with a focus on Social Sciences and Humanities).
- <https://www.time4cs.eu/webinar-2>  
This website provides a recorded webinar on different funding opportunities for citizen science projects.

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