Citizen Science Policy & Assessment

TIME4CS

SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

AU, 27 November 2023

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Centre for Science Studies, AU

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

AIM

Embedding citizen science at AU

- Establishing AU citizen science network
- Running citizen science activities and events
- Offering workshops on citizen science

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H2020 EU-funded:

3 years: 1 January 2021 - 31 December 2023

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AIM
of this workshop

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

- Description of existing strategies and reward systems for citizen science
- Facilitation of strategic processes within RPOs, particularly relevant for citizen science
- Adoption of assessment criteria for evaluation of researchers and research projects, specifically targeting citizen science objectives

Frits Ahlefeldt, Hiking.org

TIME4CS Citizen Science Policy & Assessment

Time	Activities
14:00-14:05	• **Welcome and introduction**
14:05-14:15	• Citizen science strategies and policies
14:15-14:30	• Assessment criteria for citizen science
14:30-15:00	• *Interactive session:* *Assessing Citizen Science Impact: Collaborative Criteria Design*
15:00-15:10	• Methodological approaches to developing an evaluation framework for citizen science
15:10-15:20	• Citizen science and Responsible Research and Innovation (RRI)
15:20-15:50	• *Interactive session*: *Defining relevant Responsible Research and Innovation (RRI) indicators for citizen science projects*
15:50-16:00	• Wrap up and evaluation

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Citizen science – the term emerges

Amateur contributions to science

Audubon Society (1989) &
Rick Bonney (1996)

- Citizens collecting and analysing rain samples
- Birdwatchers submitting sightings
- *Participants are instruments*

Biodiversity monitoring

Democratisation of science

Alan Irwin (1995)

- Democratic, participatory science
- Science to address needs and concerns of citizens
- Citizens could develop process of producing reliable knowledge themselves
- *Participants can influence and transform science*

Activist science

Participatory action research

Community-based natural resource management

Public and Patient Involvement (PPI)

CS now

TIME4CS CS example

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | U.S. DEPARTMENT OF COMMERCE

NOAA FISHERIES

Search NOAA Fisheries

Find A Species | Fishing & Seafood | Protecting Marine Life | Environment | Regions | Resources & Services | About Us

SCIENCE & DATA

Artificial Intelligence: Right Whale Photo Identification

We apply deep learning algorithms to photographs of North Atlantic right whales to automate the process of matching individuals to the photo identification catalog.

New England/Mid-Atlantic

Table of Contents

- Right Whale Photo Identification
- Publications and Reports
- Awards
- More information

Right Whale Photo Identification

Managing the recovery of endangered species relies on estimating population abundance and monitoring trends over time. It is impossible to simply count wild animals, a common method for estimating abundance is mark-recapture using photo identification. Monitoring wild populations through photo identification allows us to detect changes in abundance that inform effective conservation.

Researchers take photographs from aircraft and vessels and match individuals to the North Atlantic Right Whale Catalog. The long-term nature of this data set allows for a nuanced understanding of demographics, social structure, reproductive rates, individual movement patterns, genetics, health, and causes of death. However, photo identification is time-consuming. Recent advances in machine learning, and deep learning in particular, have paved the way to automate image processing using neural networks modeled on the human brain. Harnessing this new technology could revolutionize the speed at which these images can be matched to known individuals.

Artificial Intelligence (AI) is the concept of computers performing tasks that normally require hum intelligence. The term "machine learning" was coined in 1959 by Arthur Samuel and is a branch intelligence based on the idea that systems can learn from data, identify patterns, and make dec with minimal human intervention. Machine learning is a way to achieve AI. Neural networks are a

New England Aquarium

Protecting the blue planet

North Atlantic Right Whale Catalog

NARWC THE NORTH ATLANTIC RIGHT WHALE CONSORTIUM

About | Find A Whale | Submit Photos | Sponsor A Whale

The Catalog database contains all known photographed sightings of right whales since 1935. Research groups, whale watch vessels, and individual mariners from all along the eastern seaboard contributed these sightings. Photographed sightings are matched to whales in the Catalog whenever possible so that individual animals can be monitored over time.

Every sighting counts! Each sighting is like a piece in a large and complex jigsaw puzzle that reveals each whale's life. A sighting could show a long migration. Or that a whale has a calf that year. Or that a whale is resident in an area for longer than we knew.

That's why the Catalog relies on contributions of right whale photographs from as many people and groups as possible. While it is illegal to approach a right whale (by boat or aircraft) within 500 yards without a permit in US waters and 100 meters in Canadian waters, private citizens occasionally photograph right whales if the whales approach their boat or swim near land.

If you have photographs and/or video of a North Atlantic right whale, please contribute them to the Catalog.

Submit Photos

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Key steps in the process of automated right whale photo id. Credit: NOAA Fisheries

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Citizen science strategies and policies

Significance of adopting explicit strategies and policies for citizen science at the institutional level

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TIME4CS Citizen science strategies and policies

Varied approaches to integrating citizen science

Policies (very few examples for citizen science)

- Set of principles or guidelines established by organisations (or government) to influence and determine decisions and actions
- Usually stable and do not change frequently

Strategies

- Plan of action to achieve specific goals, usually more focused than policies
- Usually adapted or adjusted on a regular basis, e.g. every 5 years or when circumstances change

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TIME4CS NOAA Citizen science strategy (2021) (link)

Building on US Crowdsourcing and Citizen Science Act 2017

§3724. Crowdsourcing and citizen science

(a) Short title

This section may be cited as the "Crowdsourcing and Citizen Science Act".

(b) Sense of Congress

It is the sense of Congress that-

(1) the authority granted to Federal agencies under the America COMPETES Reauthorization Act of 2010 (Public Law 111–358; 124 Stat. 398[illegible] use of incentive prizes and challenges has yielded numerous be

(2) crowdsourcing and citizen science projects have a number unique benefits, including accelerating scientific research, increa effectiveness to maximize the return on taxpayer dollars, addres needs, providing hands-on learning in STEM, and connecting me public directly to Federal science agency missions and to each o

(3) granting Federal science agencies the direct, explicit autho crowdsourcing and citizen science will encourage its appropriate Federal science agency missions and stimulate and facilitate bro participation in the innovation process, yielding numerous benefi Government and citizens who participate in such projects.

(c) Definitions

In this section:

(1) Citizen science

The term "citizen science" means a form of open collaboration individuals or organizations participate voluntarily in the scientific various ways, including-

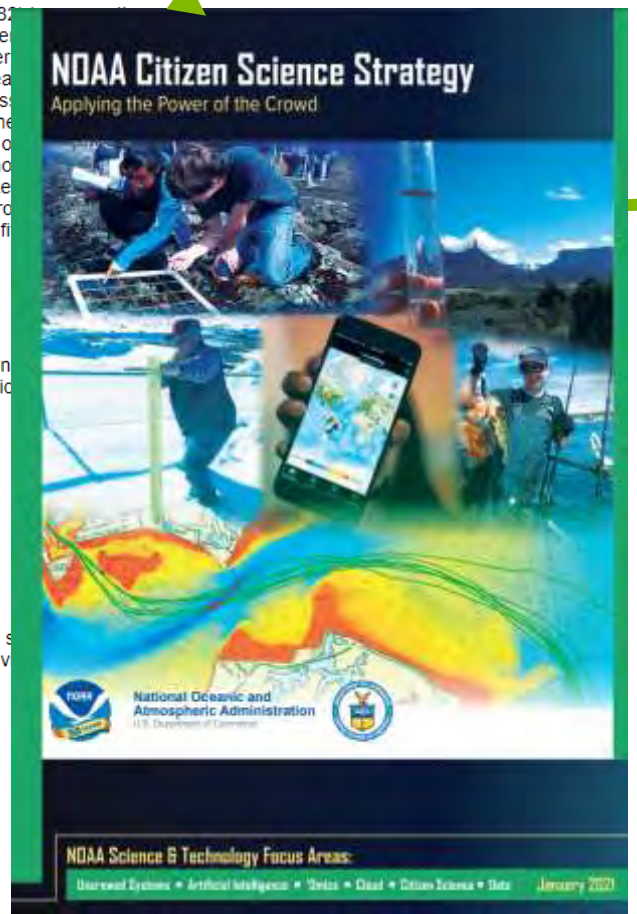
(A) enabling the formulation of research questions;
(B) creating and refining project design;
(C) conducting scientific experiments;
(D) collecting and analyzing data;
(E) interpreting the results of data;
(F) developing technologies and applications;
(G) making discoveries; and
(H) solving problems.

(2) Crowdsourcing

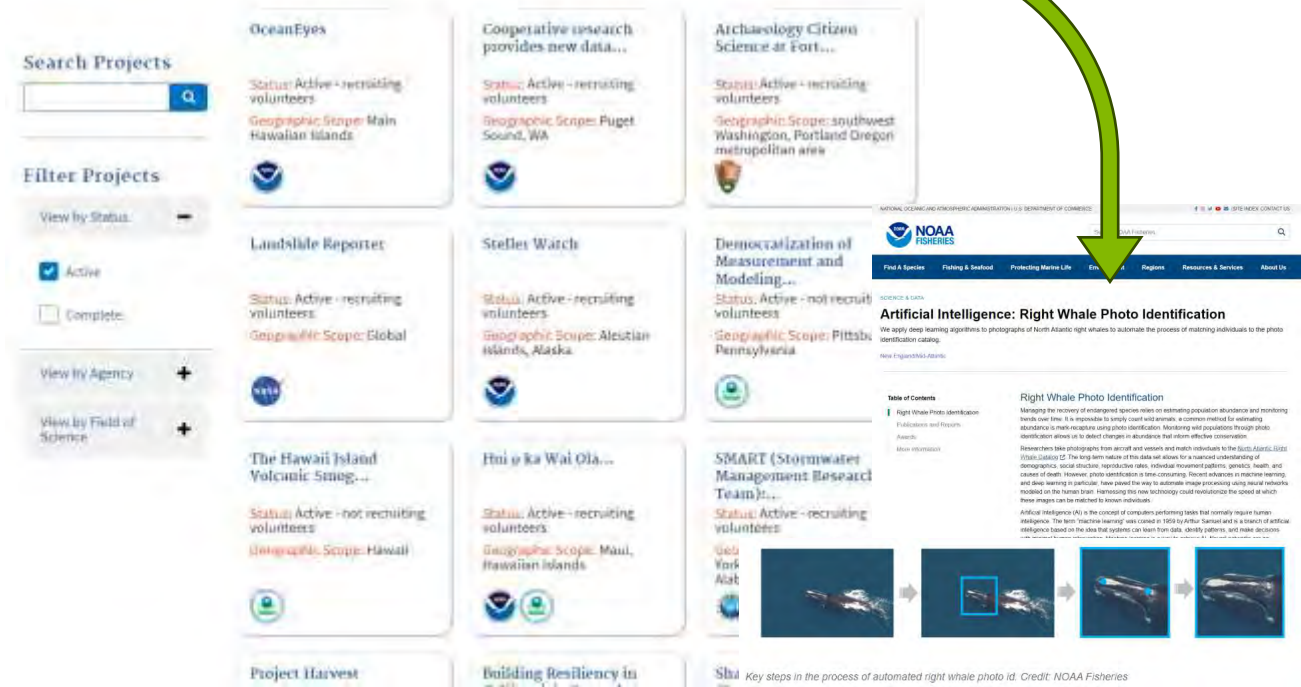
The term "crowdsourcing" means a method to obtain needed s content by soliciting voluntary contributions from a group of indiv organizations, especially from an online community.

Act led to project platform

and NOAA CS Strategy



40 active NOAA projects



In 2019:
→ 1.2 million volunteer hours
→ 0.55 million volunteers
→ 16 million observations for NOAA projects

TIME4CS NOAA Citizen science strategy

Includes goals and objectives

Goal 1: Coordinate and Support Citizen Science Efforts across NOAA

Goal 2: Expand integration of citizen science into agency mission activities as resources permit

Goal 3: Promote Citizen Science Data Quality and Accessibility at NOAA

Goal 4: Strengthen and Expand Partnerships to Advance Citizen Science

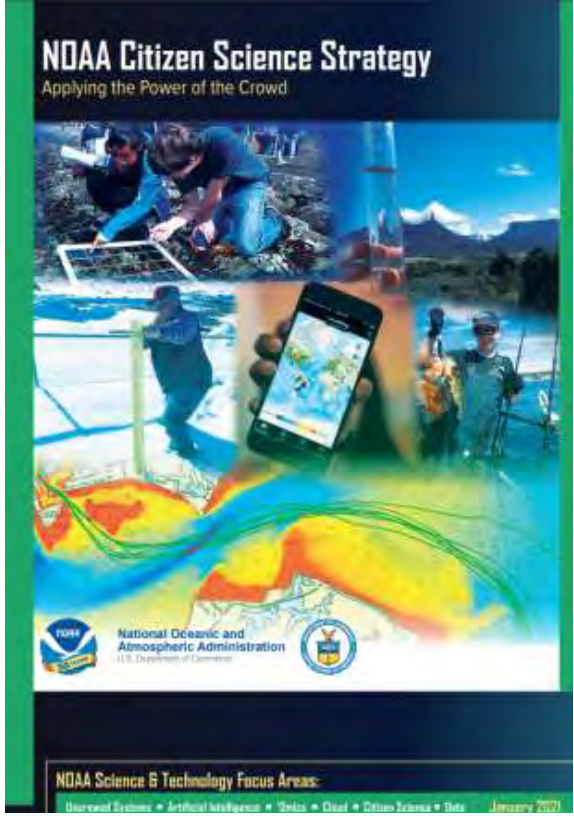
Goal 5: Increase Workforce Proficiency for Appropriately Using Citizen Science

Goal 1: Coordinate and Support Citizen Science Efforts across NOAA

NOAA values public participation and ingenuity to help meet its mission. It is critical that project managers apply best practices to build trusting relationships with project participants, assess project impacts, and produce high quality data. Toward this end, NOAA maintains a community of practice, with subject matter experts to provide the foundation for contemporary information exchange. NOAA will stay on the frontline of innovation by building and supporting an internal community empowered to effectively engage the public.

Objectives:

a. Strengthen and expand an agency community of practice
b. Increase awareness, and capacity to use, citizen science as a viable and increasingly capable tool to engage the public in helping NOAA meet its mission
c. Develop flexible and diverse metrics and processes to track projects and impacts
d. Ensure project managers take into consideration the particular needs, skills and motivation of project participants
e. Establish a formal program and designate a Program Manager, pending available resources, to support existing and new projects and facilitate opportunities for collaboration
f. Recognize citizen science in NOAA budget submissions



Vision Statement

NOAA supports opportunities for the public to engage with the agency's mission and address societal needs through science, technology, and innovation.

TIME4CS NOAA Citizen science *action plan 2023-27*

Includes goals, objectives *and actions*

Connecting top-down (Act & Strategy) with bottom-up (existing individual projects)

Goal 1: Coordinate and Support Citizen Science Efforts across NOAA

Objective A. Strengthen and expand an agency community of practice

Action 1.A.1. Host webinars for NOAA staff focused on model projects, project challenges, and best practices by NOAA staff and/or outside experts. (FY24, New Action)

Action 1.A.2. Develop an internal NOAA portal for resources and information on citizen science and connect insights into what other offices and agencies are doing; Include examples, templates, and best practices on topics including liability, environmental compliance, data ownership, and attribution. (Aspirational)

Objective B. Increase awareness, and capacity to use citizen science as a viable and increasingly capable tool to engage the public in helping NOAA meet its mission

Action 1.B.1. NOAA leadership sends a message to the agency about citizen science and its importance in advancing the nation's goals in order to help support and promote its use internally. (FY24, New Action)

Action 1.B.2. Increase awareness of NOAA's citizen science efforts through social media campaigns, web stories, and other communication strategies (e.g., Citizen Science Month countdown events). (FY23, Ongoing)

Action 1.B.3. Create a NOAA citizen science report that highlights the value of citizen science to NOAA and identifies exemplary projects from across the agency. Should the report prove useful, identify the most efficient means for producing it in future years. (Aspirational)

Action 1.B.4. Develop and maintain a NOAA-wide information collection request for citizen science projects. (FY24, Ongoing)

Action 1.B.5. Provide all agency staff with information on how to participate in NOAA citizen science opportunities. (Aspirational)

Objective C. Develop flexible and diverse metrics and processes to track projects and impacts

Action 1.C.1. Develop an inventory of existing projects using existing resources, including the NOAA Research and Development Database, and determine a process for updating and maintaining this inventory. (FY26, New Action)

Action 1.C.2. Develop a formal set of metrics to track NOAA citizen science efforts. These metrics may include the number of projects, types of partnerships, the number of citizen science volunteers, and volunteer hours, etc. (Aspirational)

Action 1.C.3. Quantify the economic value of citizen science to NOAA. (Aspirational)

Objective D. Ensure project managers take into consideration the particular needs, skills, and motivation of project participants

Action 1.D.1. Share information about the NOAA Citizen Science Community of Practice to encourage NOAA project managers interested in citizen science to join, learn about, and contribute to best practices. (FY24, Ongoing)

A. Ongoing, meaning they are already being undertaken;
B. New Action, meaning they can be accomplished without additional funds; or
C. Aspirational, meaning they will require additional new funds or additional staff time to accomplish. Note: we do not include fiscal years in aspirational items.

Objective E. Establish a formal program and designate a program manager, pending available resources, to support existing and new projects and facilitate opportunities for collaboration

Action 1.E.1. Develop terms of reference (TOR) for the NOAA Citizen Science Community of Practice (e.g., goals of community of practice, participation, connections to other communities). (Aspirational)

Objective F. Recognize citizen science in NOAA budget submissions

Action 1.F.1. Add citizen science categories into Notice of Federal Funding Opportunities and internal funding opportunities where appropriate to promote the use of citizen science. (Aspirational)

TIME4CS Citizen science strategy for Germany 2030 (White paper)

Built on initial government funding 2014-2016, and the CS Strategy for 2020 (Green paper)

219 people, 136 organisations involved over 18 months

14 public dialogue and workshop events & 420 respondents to online survey

15 action areas

Figure 1: The 15 action areas in the white paper

94 actions – 6 target audiences

Figure 2: Action recommendations in the white paper and their target groups

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TIME4CS Citizen science strategy for Germany 2030

Integration into policy

Policy integration is fundamental to the whole strategy, not only where 'Policy makers' are indicated specifically, for example:

- 2: Funding instruments
- 8: Integration into scientific processes

Mission statement: In 2030, Citizen Science in all its facets will be an expression of a modern scientific process that enables social participation in research through various formats. Citizen Science enriches scientific culture by helping to collectively identify and research social, ecological and economic challenges. The integration of Citizen Science in scientific processes is strengthened in a sustainable and structural way by explicitly incorporating research organisations' strategies and staff positions. Good scientific practice is achieved by making targeted expansions of interdisciplinary training and continued education programmes in Citizen Science an integral part of university teaching.

"The integration of Citizen Science in scientific processes is strengthened in a sustainable and structural way by explicitly incorporating research organisations' strategies and staff positions."

Funding instruments

2.3 Recommended actions for area funding instruments

2.5
Scientific institutions, organisations, administrations, educational institutions, associations and professional societies should support Citizen Science **coordinators and communicators** through third-party funding or permanent positions.

8.3 Recommended actions for area integration into scientific processes

Integration into scientific processes

8.1
Interaction with civil society must be within the scope of researchers. Research communities and universities should improve recognition of Citizen Science as a research method, e.g. by including Citizen Science experiences in the scientific evaluation system through a point system for Citizen Science engagement and by including Citizen Science as a criterion when performing a general evaluation of research projects. Citizen Science could be further strengthened by mutual exchange between Citizen Science projects in different research fields and the promotion of interdisciplinary Citizen Science projects.

8.4
Universities and scientific institutions should create advisory structures on Citizen Science that can be used by their own academic researchers and students. In support of institutional structures, we should promote developing a national network for the exchange of experience between Citizen Science advisory centres (→ action area 1, → course of action 1.10).

TIME4CS Citizen science strategy for Germany 2030

Recognition and assessment of researchers involved in CS

Mission statement: In 2030, targeted instruments of recognition in and for Citizen Science will be applied in Citizen Science practice and evaluated with regard to their effectiveness. The previous instruments of individual recognition such as network meetings, continued education and an established, respectful feedback culture have been extended to the professional and social spheres of those involved, e.g. by testing pension points for Citizen Science. New structures and measures have been established, such as support units for Citizen Science activities at universities, training institutions and government agencies. Additionally, a review for the effectiveness of recognition tools and the introduction of a Citizen Science seal have also been instituted. This makes recognition a quality feature of Citizen Science and thus possible on an institutional and political level. The scientific reputation system integrates Citizen Science activities as valuable contributions to research.

"The scientific reputation system integrates Citizen Science activities as valuable contributions to research."

Recognition in and for Citizen Science is essential for the success and maintenance of participation in Citizen Science projects. In order to establish and expand recognition, respectful collaboration must be developed and applied in a targeted manner at the individual, political and formal levels. Already established and effective instruments of recognition must be continuously enhanced, both for citizen scientists and for project coordinators in the academic system (e.g. continuous communication and feedback culture). . In addition, new instruments of recognition should be established, such as an expansion of the scientific reputation system to include a social impact indicator.

Recognition culture in and for Citizen Science

5.3 Recommended actions for area recognition culture within and for CS

5.4
Research institutions should establish a **social impact indicator** for research based on Citizen Science as a **reputation factor** similar to the publication indicator. The indicator should be based on existing proposals for social impact, e.g. that of the EU, which present and recognise collaborations between participants from the academic and non-academic worlds [65]. Thus, practical experience of project coordinators and participants should also be recognised for profile-building and criteria when deciding on chair positions.

5.6
University and non-university research institutions and authorities should **establish or expand formal and political structures, such as departments and strategies**, at institutional scientific and non-scientific levels for **services and advice regarding Citizen Science**. This can establish a recognition culture for Citizen Science.

5.7
Ministries, authorities, Citizen Science participants and research institutions should collaborate to create and test new recognition instruments. One could create a **"Citizen Science Day"**, for example, which might also involve **employers** within the professional environment and create **time quotas** for Citizen Science, or **introduce pension points for involvement in Citizen Science** or for researchers or policy makers involved in Citizen Science projects.

TIME4CS Citizen Science Strategies & Policies

Key take-aways

1. **Strategies and policies are needed:** without top-level buy-in and support, it is unlikely that citizen science can become embedded and recognized in an organization
2. **Strategies need to outline specific goals and objectives:** specific goals (and possibly subgoals) and objectives need to be agreed
3. **Strategies need action plans** (or roadmaps): without concrete action plans, including funding for the detailed actions, it can be difficult to reach set goals and objectives

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Assessment criteria for citizen science

Measuring and acknowledging impact for science, society, and participants

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TIME4CS Challenges in assessing citizen science

Assessments should be comprehensive and customized

Diverse objectives and project types

- Citizen science projects vary widely in goals and types, making it challenging to apply standardized assessment criteria.

Data quality and reliability

- Ensuring the accuracy and reliability of data collected by citizen scientists can be difficult, requiring rigorous validation processes.

Subjective impact

- Some impacts, such as community awareness or empowerment, are subjective and require more qualitative assessments.

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TIME4CS Assessing citizen science to evaluate its quality, impact, and effectiveness

Benefits to science, society, and participants

Scientific impact

- **Data quality:** Evaluation of the accuracy, consistency, and reliability of data.
- **Research contribution:** Scientific discoveries, publications, or advancements in the field.

Societal impact

- **Environmental or social benefits:** Impact on the environment, public policy, or community.
- **Awareness and education:** Raising public awareness and public understanding of science.

Impact for participants

- **Engagement:** The involvement, satisfaction, and personal growth experienced by participants.
- **Skill development and empowerment:** Whether participants acquire new skills, knowledge or roles through their involvement in the project.

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TIME4CS Citizen Science Impact Assessment Framework (CSIAF)

Six guiding principles for assessment of citizen science

1. **Acknowledging a variety of purposes of citizen science impact assessment**
   - Evaluating the process and feasibility of projects (formative assessment) as well as outcome and impact (summative assessment).
2. **Non-linear conceptualisation of impact journeys to overcome impact silos**
   - Impact journeys offer a dynamic framework for tracking and evaluating the evolving impacts of citizen science projects over time, capturing their multifaceted contributions to science and society.
3. **Comprehensive impact assessment methods and information sources**
   - Reliable impact assessment of citizen science projects involves a range of data collection methods and sources and ideally captures them not only from participants' but also other relevant stakeholders' and beneficiaries' point of view.

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Wehn, U., Gharesifard, M., Ceccaroni, L. *et al.* Impact assessment of citizen science: state of the art and guiding principles for a consolidated approach. *Sustain Sci* 16, 1683–1699 (2021). https://doi.org/10.1007/s11625-021-00959-2

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TIME4CS Citizen Science Impact Assessment Framework (CSIAF)

Six guiding principles for assessment of citizen science

4. **Moving beyond absolute impact**
   - Enter and measure progress against project-specific objectives and to take context into account, including geographical context, socio-economic setting, available resources such as time, financial, staff, etc.
5. **Fostering comparison of impact assessment results across citizen science projects**
   - Enable comparability of results that are based on different methods and information sources using consistent overarching categories and definitions.
6. **Cumulative enhancement of the framework over time**
   - Assessments should be based on collective, evolving intelligence, incorporating input from researchers, practitioners, and structured reflection (peer review).

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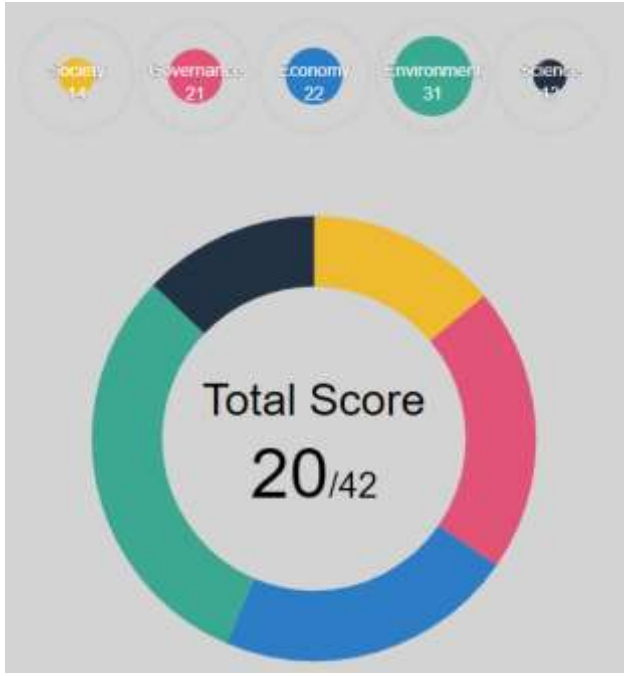

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Home

Log in Register

Home
About
Impact guidance
Project catalogue
Log in
Register

+ Create project

MICS: Measuring the impact of citizen science

MICS allows you to: (see the how-to guide for more details)

Assess the impact of a citizen-science project, through metrics and indicators across different domains.

Look at different projects in the same discipline and **compare** their impact.

Evaluate the impact of a project from conception to realisation and beyond, seeing how impact **changes over time**.

Produce an impact summary to **share** with communities, stakeholders, funders and policy makers.

Science Environment Economy Governance Society

Project catalogue - Take a look at other projects and their impact

Sort projects by:

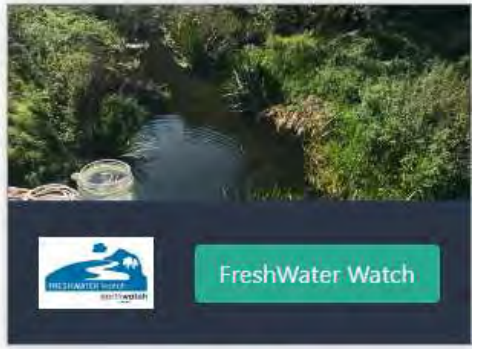
All projects

Arts (1)
Biology (4)
Climate (3)
History (1)
Language (0)
Literature (0)
Medicine (3)
Nature (5)

Featured projects


Dark Sky Meter

D-NOSES


FreshWater Watch

iMars


Marzenego (MICS)

Roadkill

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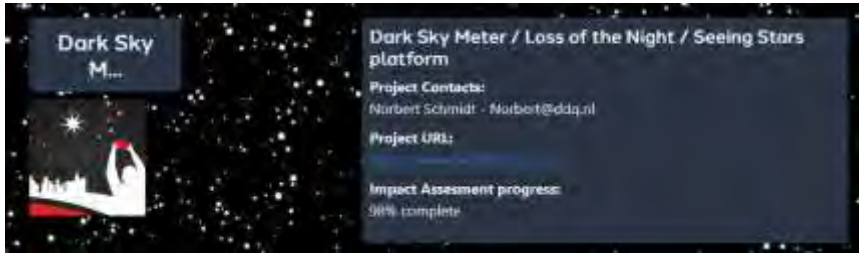
Impact Assesment Tools

View impact report



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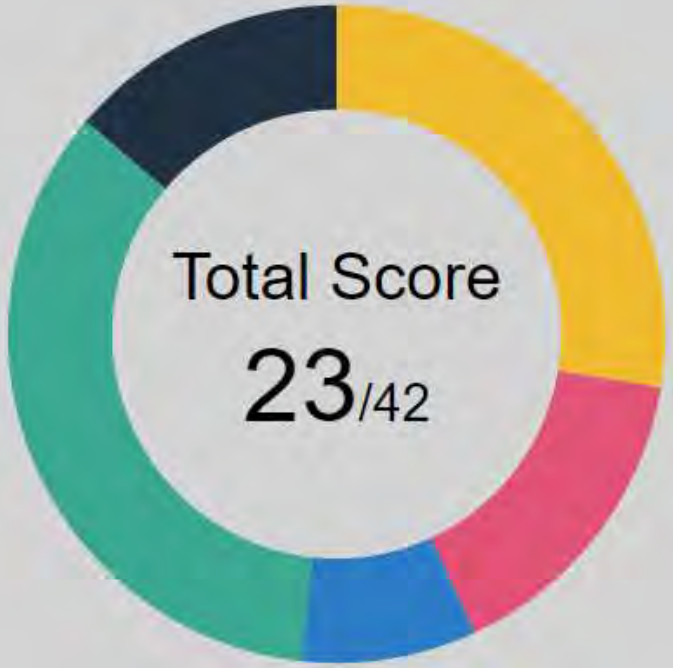
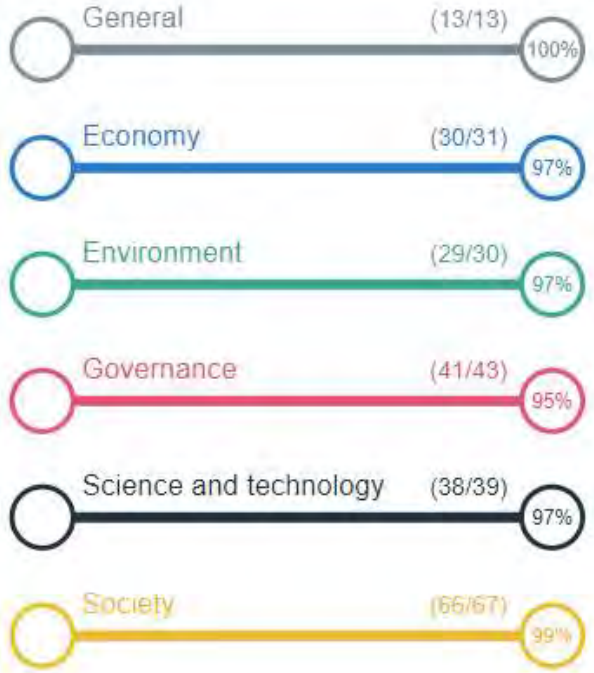
Current Project Impact

The following scores were calculated using a statistically-driven machine-learning approach, a type of AI that learns to perform a task by analysing patterns in data. This is an experimental approach to citizen-science impact assessment, and the exact reasoning behind the scores is not explainable. The scores represent a best guess of the impact the project is having in each domain. Scores are recalculated and updated when "View impact report" is clicked.



Domain Progress

Proportion of questions answered in each domain.



TIME4CS The MICS evaluation framework

Society, economy, environment, S&T, and governance

Society, economy, and the environment

- Impact on society and individuals as well as collective (societal) values, understanding, policies, actions and well-being (including relationships)
- Impact on the production and exchange of goods and services among economic agents on entrepreneurial activity; and economic benefits derived from data
- Impact on the bio-chemical-physical environment

Science and technology (S&T)

- Impact on science, scientific institutions, and resulting technological artefacts

Governance

- Impact on the processes and institutions through which decisions are made, both informal and formal (e.g., public policy), and on relationships and partnerships, as well as the governance of data generated

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TIME4CS The MICS evaluation framework

Indicators for science and technology output

Data collection and management

- Data quality, data infrastructures and systems, enhanced data (data that has been augmented, verified, derived, aggregated, or in any way enhanced)

Collaboration in science and contributions to science

- Collaboration and synergies, scientific impact, scientific value of data, scientific contributions (1, 2, ...), community participation in research, etc.

Decision-making in science

- Management and policy, scientific outcomes (institutional change, new projects etc.)

Communication and outreach

- Communication material, activities, and events, evaluation and adaption

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TIME4CS The MICS evaluation framework

Indicators for economy, environment, and governance

Supply and demand side

- Company growth, international trade, innovation, competitiveness, economic potential and market opportunities, employment, value added for customers and organizations

Natural resources and biodiversity, environment & society

- Biodiversity and natural ressource indicators, enviromental impact on human health, resilience of ecosystems

Participation, equality and inclusion, and power dynamics

- Institutional commitment to public participation, gender equality, inclusion of minorities, power dynamics within citizen science initiative, empowerment of communities

Impact on politics

- Contributions to management plans and policy, incl. shifts and adaptations

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TIME4CS The MICS evaluation framework

Indicators for society and participants

Individual level

- Learning opportunities, participation in science, participation in decision-making, science, environmental and health literacy, attitudinal and behavioral change, etc.

Meso or institutional level

- Organizational outcomes, community-building, community engagement and feedback, citizen-led research initiatives

Societal level, incl. science & society relations

- Social inclusion, population health benefits, inclusive and constructive risk assessments, public engagement in science, civic action, identity and activism

Access to information; capacity-building & education

- Deliberation about science, environment, and health, awareness and responsibility

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

TIME4CS Assessment criteria for citizen science

Key take-aways

1. **Multidimensional evaluation:** Assessment of citizen science should encompass multiple dimensions, including scientific impact, societal impact, and the impact on participants. This multifaceted approach provides a comprehensive understanding of the project's effectiveness.
2. **Diverse assessment criteria:** Effective assessment involves the development of diverse and context-specific assessment criteria, considering the unique goals and objectives of each project.
3. **Continuous improvement:** Assessment is not just a one-time process but an ongoing effort. It should inform project improvements and adaptations over time, ensuring that citizen science initiatives remain effective and relevant.

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TIME4CS Citizen Science Policy & Assessment

Time	Activities
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15:00-15:10	• Methodological approaches to developing an evaluation framework for citizen science
15:10-15:20	• Citizen science and Responsible research and innovation (RRI)
15:20-15:50	• *Interactive session*: *Defining relevant Responsible Research and Innovation (RRI) indicators for citizen science projects*
15:50-16:00	• Wrap up and evaluation

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Assessing citizen science impact: Collaborative criteria design

Interactive session, 30 minutes

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TIME4CS Assessing citizen science impact: Collaborative criteria design

Interactive session – 30 min, incl. group presentations

For the upcoming activity, opt to collaborate on either your own citizen science project or the (hypothetical) citizen science project "Pollinator Paradise" as outlined in the handout.

- Each group must collaboratively brainstorm and design assessment criteria for the chosen citizen science project.
- The groups should consider the scientific impact, societal impact, and participant impact. If necessary, refer to the MICS domains and indicator clusters provided in the handout for guidance.
- Create a flip chart sheet outlining the assessment criteria. Explain criteria and the reasoning behind them in the presentation.

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TIME4CS Pollinator Paradise

A citizen science project that nurture nature's heroes

"Pollinator Paradise" is a citizen science project aimed at studying and conserving pollinators, such as bees, butterflies, and other insects, to support local ecosystems and agriculture. The project seeks to engage community members in monitoring and enhancing pollinator habitats. Participants are asked to observe, document, and contribute to the conservation of these vital creatures.

- **Project objectives: 1)** Monitor and document the diversity and abundance of pollinators in a specified area (e.g., a local park or garden). **2)** Identify and document plant species that attract and support pollinators. **3)** Implement habitat improvement actions based on collected data to support pollinator populations. **4)** Raise community awareness about the importance of pollinators in ecosystem health and food production.
- **Data Collection Methods:** Participants will be provided with observation kits, including identification guides, cameras, and data sheets. They will visit the designated area regularly to observe and photograph pollinators and the plants they interact with. Participants will note the date, time, weather conditions, and any specific behaviors observed. They will upload their observations and photos to a website or app, contributing to a shared database.
- **Participant Involvement:** The project is open to participants of all ages and backgrounds, including families, students, and nature enthusiasts. Participants are encouraged to engage in data collection during their leisure time. Training sessions and workshops will be offered to help participants identify pollinators and their behaviors.

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TIME4CS MICS: Domains and indicator clusters

Domain	Indicator Cluster
Science & Technology	Data collection and management
	Collaboration in science
	Contribution to science
	Decision making
	Communication and outreach

Domain	Indicator Cluster
Society	Individual level
	Meso-level
	Societal level
	Science & society
	Access to Information
	Capacity building & education

Domain	Indicator Cluster
Environment	Natural resources and biodiversity
	Environment & society

Domain	Indicator Cluster
Governance	Participation
	Power dynamics
	Impact on policy
	Equality and inclusion

Domain	Indicator Cluster
Economy	Supply side
	Demand side

MICS
Measuring Impact of Citizen Science

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Methodological approaches to developing an evaluation framework for citizen science

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

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TIME4CS Some *more* challenges to evaluating citizen science

New skills and more time required for extensive evaluation

- **Overview and skills:** when evaluation becomes more than ‘just’counting the number of scientific papers, most researchers need a better overview and different skills themselves or they need (new) collaborations with others with the required skills.
- **More time:** is needed throughout the project duration to allow for evaluation to take place. This is closely linked to the need for increased funding to pay for the extra time.
- **Continuous evaluation:** is needed to properly assess especially the outcomes and impacts of citizen science projects.

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TIME4CS Developing an evaluation framework for CS

Initial and ongoing evaluation in 3 dimensions

- Dimensions similar to MICS, but split in 'Process & feasibility' (initial) and 'Outcome & impact' (ongoing & later)
- Building on ECSA's 10 principles for citizen science
- Specific questions suggested for evaluation (adapt them!)

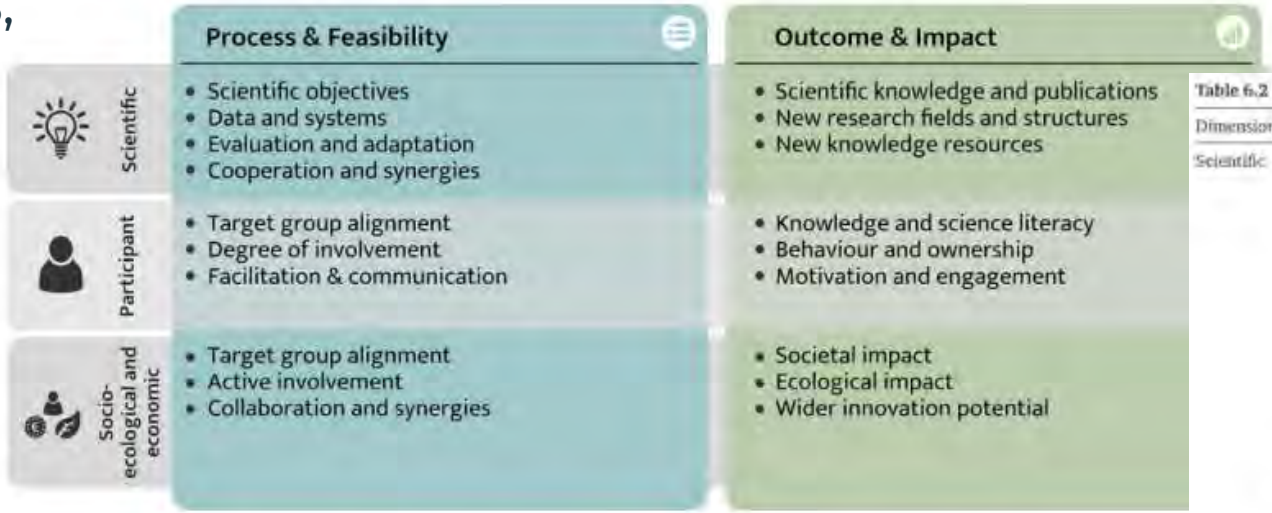

Table 6.2 Evaluation criteria and supporting questions

Dimension	Criteria	Supporting questions
Scientific	*Process and feasibility*	
	Scientific objectives (Principles 1, 2, 3)*	
	Scientific goals	• Are the scientific goals sufficiently clear and authentic?
		• Is the scientific objective appropriate to citizen science?
		• Does the project adhere to the principle of joint knowledge creation in citizen science?
		• Does the scientific objective have relevance for society and does it address a socially relevant problem?
	Data and systems (Principles 2, 3, 7, 10)	
	Data quality and standards	• Does the project have clear processes defined to validate and guarantee high data quality?
		• Does the data adhere to common standards?
	Ethics, data protection, Intellectual Property Rights (IPR)	• Does the project have a data management plan, IPR strategy and ethical guidelines?
		• Are data ownership and access rights clear and transparent?
		• Is the data handling process transparent?
		• Do citizens know what the data is used for, and where it is stored and shared?
	Openness, interfaces	• Does the project have open interfaces to connect to other systems and platforms?
		• Is the generated data shared publicly and if so, under which conditions?
		• Is the project data appropriately archived for future analysis?

- Need to identify who will conduct the evaluation (project members, funding agencies, or external experts)
- Evaluation is time- & ressource-intensive: plan for it by allocating time and funding!

Kieslinger et al. 2018. Evaluating Citizen Science

TIME4CS Tools for evaluation

Appropriate evaluation methods need to be chosen

- **Statistics:** usage statistics can be collected for apps, websites or project-related and engagement tools (*quantitative*). This will give insights on their users, but not on people who do not use those tools.
- **Embedded assessment:** quizzes or games embedded in CS activity (*quantitative*). Integrated, so participants all respond (and might not even know it).
- **Online:** online surveys are popular as they are less time-intensive than in-person methods and can reach further geographically (*quantitative* & qualitative). Only a self-selected group of people who are comfortable with digital media are likely to respond.
- **In-person:** focus groups or individual interviews are time-consuming (*qualitative* & quantitative). They offer greater flexibility when using qualitative approaches, as interviewers can adapt based on previous answers. Participatory observation, storytelling, photovoice and storyboards are also options, and more methods continue developing.

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TIME4CS The logic model applied to evaluation

5 distinct project aspects to consider

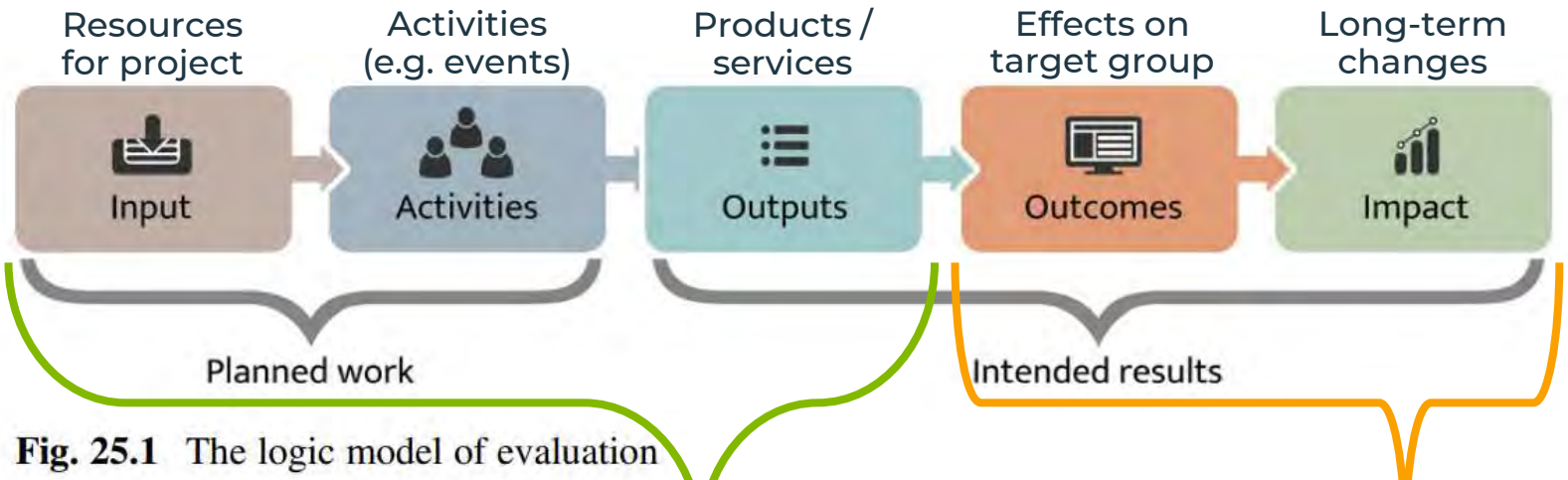

Fig. 25.1 The logic model of evaluation

Usually easy to measure with quantitative methods

Often difficult, requires effort, and usually qualitative methods. Requires inclusion of perceptions and experiences of intended beneficiaries

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Schaefer et al. 2021. Evaluation in Citizen Science: The art of tracing a moving target

TIME4CS Developing an evaluation framework for CS

Key take-aways

- **No 'one size fits all':** Evaluation of citizen science projects need to be adapted to the specific project based on project goals.
- **Evaluation methods:** many are available – again, the most appropriate methods for the specific project most be chosen.
- **Evaluation happens throughout the project period:** it is important that evaluation is continuous – though it may change focus during the project. The logic model can be used to consider evaluation throughout. Waiting until the end of the project to think about evaluation will not give an appropriate picture of especially outcomes and impact of the project.

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Citizen science and Responsible Research and Innovation (RRI)

Fostering inclusiveness, anticipation, sustainability, and responsiveness through citizen science

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TIME4CS Responsible Research and Innovation (RRI)

Fostering democratic, accountable, and responsive R&I

RRI is a framework and approach that seeks to ensure that research and innovation activities are conducted in a way that aligns with societal values and needs, and that they contribute to positive societal outcomes.

- **Ethical and inclusive approach:** RRI prioritizes ethical considerations throughout research and innovation processes, ensuring that they align with societal values and respect human rights. It also emphasizes inclusiveness and resposiveness by engaging diverse stakeholders, including the public, in decision-making.
- **Sustainability and anticipation:** RRI integrates sustainability principles into research and innovation, emphasizing environmental responsibility. It encourages foresight in addressing ethical, social, and environmental implications.
- **Transparency and openness:** RRI promotes transparency through open access to research results and data. It fosters a culture of openness and collaboration, enabling broader participation in research and innovation and facilitating informed decision-making.

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TIME4CS Adoption of Responsible Research and Innovation (RRI) in Citizen Observatories

Alignment with ethical, societal, and environmental values

Citizen Observatories are collaborative initiatives that engage members of the public, including volunteers and local communities, in monitoring and collecting data related to various aspects of the environment, society, or public services.

- **Community Participation and Data Collection:** Citizen observatories actively involve citizens in data collection and observation activities. Volunteers play a central role in contributing their time, knowledge, and efforts to gather information on specific issues.
- **Technology Integration and Scientific Research:** Technology plays a significant role in citizen observatories, enabling efficient data collection, storage, analysis, and sharing, often with an amibition goal of contributing to scientific research.
- **Community Empowerment and Policy Influence:** Beyound scientific impact, citizen observatories can raise public awareness, empower communities, and provide data that may be used to inform decisions, create evidence-based policies, and address environmental or societal challenges.

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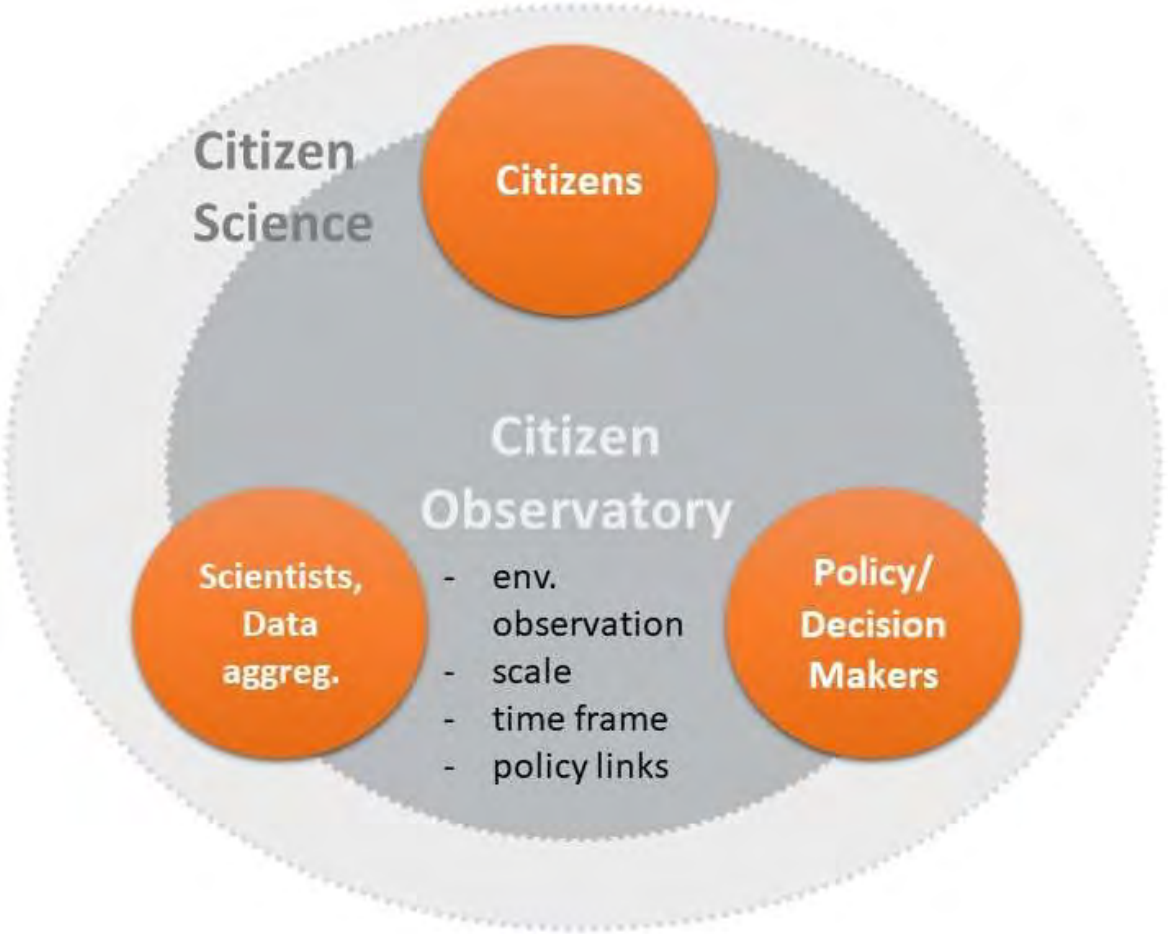
TIME4CS Citizen Observatories are a component of citizen science

LandSense
A Citizen Observatory and Innovation Marketplace for Land Use and Land Cover Monitoring



ALERC
Association of Local Environmental Records Centres

WeSenseIt
Citizen Water Observatories

COBWEB
Citizen Observatory Web

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TIME4CS Adoption of Responsible Research and Innovation (RRI) in Citizen Observatories

Open Access Review

Adoption of Responsible Research and Innovation in Citizen Observatories

by Michael O'Grady * and Eleni Mangina

School of Computer Science, University College Dublin, Dublin 4, Ireland

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Sustainability **2022**, *14*(12), 7379; **https://doi.org/10.3390/su14127379**

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Abstract

An ethos of Responsible Research and Innovation (RRI) has been promoted in the last decade, especially within European research. The broad objective is to ensure that research and innovation activities align with society's needs and expectations. In parallel, citizen observatories seek to mainstream citizen science as a valid paradigm for scientific investigation but additionally as a model for increasing societal participation in local democracy and policy definition. This paper explores how precepts of RRI have permeated research in citizen observatories. The methodology adopted is that of a scoping review. Results confirm a relatively simple adoption of RRI principles. However, the adoption is uneven and shallow, perhaps reflecting the ongoing evolution of both RRI and the citizen observatory model. It is recommended that the diverse actors charged with the definition, design, validation, and deployment of citizen observatories unambiguously integrate, promote, and report on how the RRI principles are reflected in their activities.

Keywords: citizen observatory; citizen science; responsible research and innovation

5.1. Open Access

A solid commitment to open access is manifested, encompassing publication, open-source software and hardware, open standards, and open data. Open access to scientific publications is reasonably well-advanced. Open data remain problematic as they encompass diverse issues such as security, GDPR, privacy, and the definition of meta-data. More importantly, they demand a complete understanding of licensing. It is fundamental that citizen scientists understand the need to explicitly define the conditions under which others may use the data. It must be observed that where data are collected as part of validation and testing, such data may not be suitable for long-term archiving.

P1: All COs should have a documented policy for open access management, including, if necessary, a training plan for citizen scientists.

5.2. Public Participation

COs offer several opportunities for public engagement. Such engagement has encompassed classic data collection, usability, and requirements definition. Thus, participation in CO broadly replicates that of citizen science. However, both RRI and the CO concept demand more meaningful engagement, including contributing to loca democracy through policy definition. Such engagement is lacking. Moreover, the vision of how such engagement anc participation might be achieved, and its overall objectives, are rarely developed.

P2: COs should define the role of the public and how pathways to local democratic input and policy derivatior are actively supported.

5.3. Science Education

Education within the context of a CO is informal and may be classified under lifelong learning. How it is provided is flexible; the GROW CO used MOOCs to good effect, but such a model is not always practical. In some cases, learning is trivial, for example, how to use an app, though in this case, some domain-specific training is almost invariably needed. When conceptualising a CO, a holistic interpretation should be considered when constructing a plan for participants that is cognisant of their role and training needs while specifying how the educational dimensions of the CO should be accomplished. Though RRI highlights science education, a broader education interpretation is more appropriate for a CO.

P3: COs should define the educational dimension of their mission and plan for its implementation.

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Keywords: citizen observatory; citizen science; responsible research and innovation

5.4. Gender

Equality and inclusion are intrinsic to COs, especially when considering their overall mission of increasing democracy and driving evidence-driven policymaking. To date, gender is treated in general terms, for example, ensuring that a population in a survey may be categorised as usual for subsequent statistical analysis. The deeper motivations for gender analysis are not meaningfully considered. A simple example might be the design of the WWW interface and ensuring that an inclusive approach is adopted from the design stage through to testing. Nevertheless, gender is much more profound; gender sensitivity must permeate all aspects of the CO, including its rationale. If this rationale is to gather data to support a particular policy intervention, then the proposed methodology needs a detailed analysis of how it facilitates or impedes gender mainstreaming.

P4: COs should define how gender mainstreaming will be accomplished.

5.5. Ethics

As people are central to the CO concept, ethics are intrinsic to its activities. Of all the RRI keys, ethics is the most weakly developed. As a starting point, all reports on CO activities should, where appropriate, confirm that ethical approval was given. Where obtaining ethical approval was challenging, some explanation should be given of the relevant issues and how they were addressed. Such information can be of great practical use to the CO community. Moreover, it should not be forgotten that as COs evolve, the ethical landscape changes. Thus, the CO is obligated to continuously monitor all activities and review the ethical implications as these arise. Indeed, any CO seeking to operate over an extended period should develop its own guidelines for ethics.

P5: COs should seek ethical approval and establish guidelines as appropriate.

5.6. Governance

Governance is the sixth key of RRI and seeks to integrate the other five keys. It was not considered in detail for the reasons explained earlier. While governance was considered within a broader context, for example, Wehn et al. [58] considered water governance, the RRI dimension did not manifestly permeate the CO discourse. How to effectively operationalise governance within CO remains an open question.

P6: COs should apply a holistic approach to RRI by defining and implementing an appropriate governance model.

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TIME4CS Citizen science and Responsible Research and Innovation (RRI)

Overlaps and divergences between the two approaches

Citizen science and RRI share common ground in promoting public engagement and transparency, yet they diverge in their focus, with RRI encompassing the entire research and innovation process.

- **Shared values:** Both citizen science and RRI share common values such as public engagement, transparency, and ethical conduct. They both emphasize involving stakeholders beyond traditional experts and fostering collaboration.
- **Divergence in focus:** While citizen science primarily focuses on public participation in scientific research, RRI considers the entire research and innovation process, including anticipation, reflection, and responsiveness to societal needs and values.
- **Lessons for citizen science:** Citizen science can learn valuable lessons from RRI's comprehensive approach to include the importance of anticipatory governance, ethical reflection, and long-term societal impacts, which can help citizen science initiatives enhance their effectiveness, ethical considerations, and overall impact on society.

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TIME4CS Integrating Responsible Research and Innovation (RRI) into higher education institutions

Advancing RRI in institutions that do citizen science

Incorporating RRI into higher education institutions involves establishing institutional frameworks, fostering awareness and education among staff, and integrating RRI principles into curricula and research projects to cultivate a culture of responsible innovation and research throughout these organisations

- **Institutional framework:** Establish a normative framework embracing RRI principles within institutions to guide responsible research and innovation.
- **Education and awareness:** Provide comprehensive training and awareness programs for staff at all levels to promote a deep understanding of RRI principles and practices.
- **Curricular integration:** Encourage the integration of RRI principles into curricula and research projects to educate the next generation of responsible innovators and ensure responsible research and innovation becomes an integral part of higher education.

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TIME4CS Evaluation dimensions for Responsible Research and Innovation (RRI)

RRI Dimensions	Process evaluation	Outcome evaluation	Key actors
Public engagement, incl. inclusiveness	Engagement methods, stakeholder participation, diversity of participants...	Inclusivity, responsiveness to public input, trust-building, empowerment...	Science communicators, researchers, science organisations, museums...
Gender equality	Gender balance, gender awareness training...	Equal opportunities, women in leadership roles...	Higher education bodies, governments...
Research ethics	Ethical review processes, ethics training...	Adherence to ethical guidelines...	Researchers, managers, funders, collaborators...
Open science	Open access awareness, data sharing practices...	Data accessibility, OA publications, collaboration...	Higher education and research-perfoming orgs...
Sustainability (social, economic, and ecological)	Sustainability assessments, ressource management...	Social equity, economic viability, ecological preservation...	Supra-national bodies, producers, distributors, consumers, NGOs...
Science education and outreach	Education programs, outreach initiatives...	Science literacy, increased interest in STEM...	Schools (teachers and leaders), education sector...
Governance, incl. anticipation and responsiveness	Governance structures, stakeholder involvement in decision-making...	Effective governance and accountability, diversity of stakeholders engaged...	Governments, cities, funding bodies, civil society organisations, companies...

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Defining relevant RRI indicators for citizen science projects

Interactive session, 30 minutes

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

TIME4CS Defining relevant Responsible Research and Innovation (RRI) indicators for citizen science

Interactive session – 30 min

In group discussions, our goal is to collectively define pertinent RRI indicators for citizen science projects, fostering a deeper comprehension of responsible and inclusive research and innovation practices in this context.

- **Brainstorming (10 minutes):** In small groups, please consider the key RRI dimensions outlined in the handout. Each group should brainstorm and compile a list of specific indicators within these dimensions that hold relevance for citizen science projects (such as Pollinator Paradise from the previous interactive session).
- **Sharing and discussion (10 minutes):** Each group will present one or two indicators they have generated for a general discussion on their RRI significance and potential impact on citizen science projects.
- **Consolidation and conclusion (10 minutes):** In groups, discuss common themes and trends that emerged from the shared indicators. Select a few indicators that seemed particularly important or universally applicable to citizen science.

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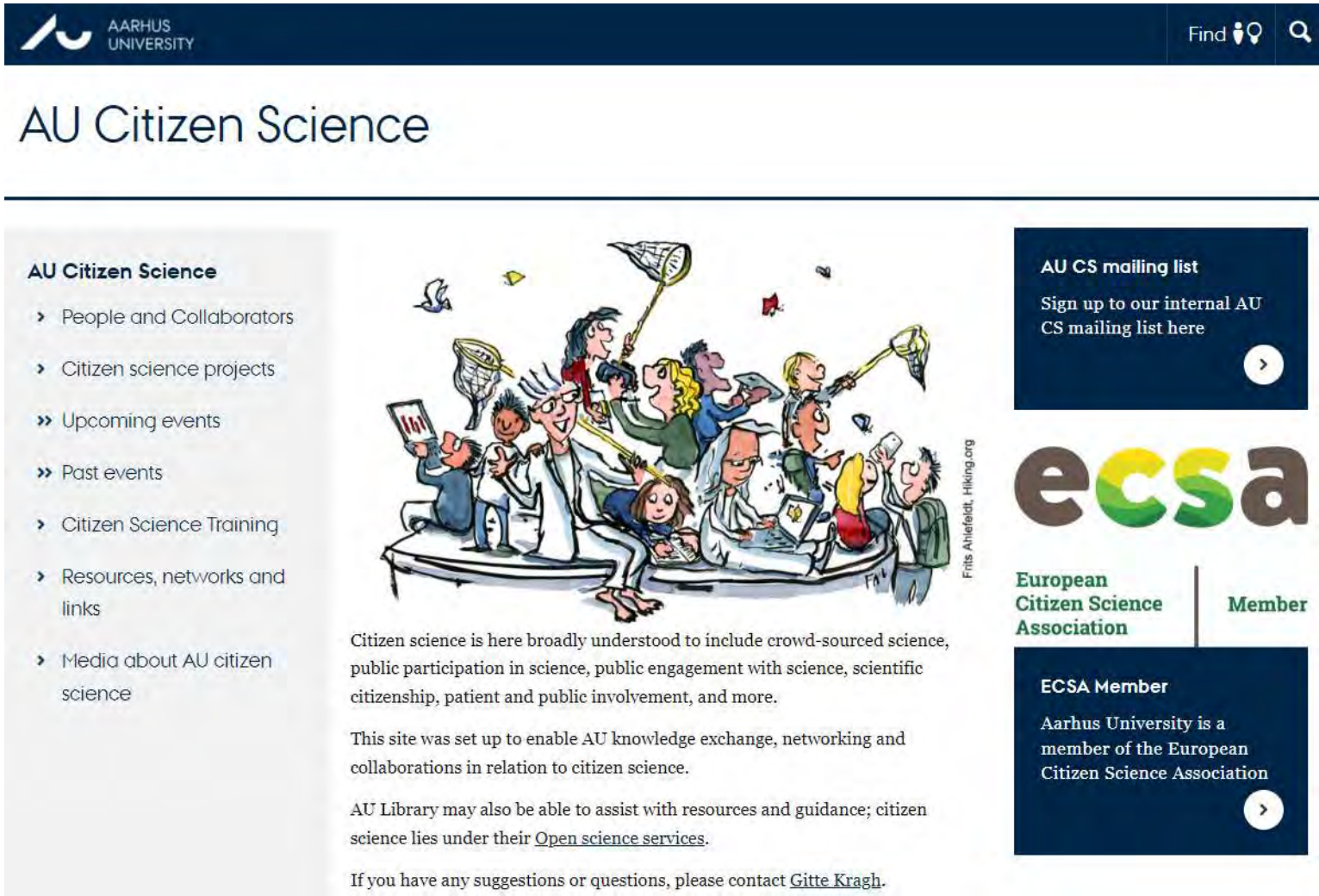
TIME4CS No more citizen science workshops (for now)

But slides and lots of other info are available on our website:

[AU Citizen Science website]

[Slides and workshop descriptions]



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#TIME4CS

Thank you for your attention !

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