MICS: Measuring the impact of citizen science

The practice of citizen science can have a far-reaching impact in various fields such as science, economy, environment, governance, and society. However, whilst the potential impact of citizen science is well documented, limitations exist when attempting to measure it in a quantifiable way. To assess a citizen-science project's impact, and to make comparisons with other projects, traditional science, or the status quo, we present **MICS: Measuring the Impact of Citizen Science**, an impact-assessment framework accessed through an online platform. MICS takes existing impact-assessment approaches and builds on them, providing an intuitive, quantitative method of measuring the impact of a project, highlighting both strengths to exploit and potential unexplored impacts yet to be realised.

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MICS
Measuring Impact of Citizen Science

Science:
Impact on the scientific process (method) as well as research more broadly; on the scientific system (institutions; science policy; incentive structures), scientific paradigms and resulting technological artefacts (e.g. sensors, apps, platforms) and standards.

For example: Does the project provide participants with easy and explicit access to pertinent research findings or literature used to inform the project before research begins?

Economy:
Impact on the production and exchange of goods and services among economic agents; on entrepreneurial activity; economic benefits derived from data, e.g. for the public interest or for the use of private sector actors.

For example: Does the project offer any aid or incentives for participation?

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

For example: Does the project have any direct impact on organisational policy?

Society:
Impact on society and individuals as well as collective (societal) values, understanding, actions and well-being (including relationships).

For example: Does the project contribute to personal change in behaviour?

Environment:
Impact on the bio-chemical-physical environment, e.g. on the quality of specific natural resources or ecosystems.

For example: Which environmental issues - as represented by the UN sustainable development goals (SDGs) - are related to the project?

UK Case Studies

Citizen-science activities are widespread across the UK and are an accepted method of engagement, stakeholder collaboration, data collection and monitoring. The established and long-running UK case studies allowed the MICS team to investigate the short and long-term impacts of citizen science on society, the environment, science and technology, governance and the economy.

The UK case studies included citizen-science activities coordinated by the Outfall Safari, Riverfly and Water with Integrated Local Delivery (WILD) projects. Each of these projects tackles issues related to poor river water quality or pollution, through citizen science monitoring.

To explore how citizen science contributes to achieving the aims of these projects the MICS team have held several events during 2020-21. The results of these workshops helped develop and test the MICS impact metrics and online platform.

Current Impact Assessment

The MICS project team undertook a systematic review of impact assessment approaches and empirical insights from other projects in the field of citizen science. We analysed 80 peer-reviewed publications and ten other citizen-science projects to understand how the impact of these projects is typically assessed. As might be expected, the methods were highly varied.

Although nearly all projects used a mix of quantitative and qualitative approaches, most projects only measured impact in one or two categories, with only two out of the reviewed publications referring to comprehensive impact categories. Impact on society was the most assessed, whereas the impact on the economy, perhaps unsurprisingly, was rarely investigated.

The "depth" of these analyses also varied, with the majority of projects only considering impact at the thematic level (for example, the theme of biodiversity within science), and very few considering impact at a more specific level (measures such as if the project explicitly informs any governmental policy process, or if the project explicitly fosters new collaborations amongst societal actors and groups).

The MICS Platform

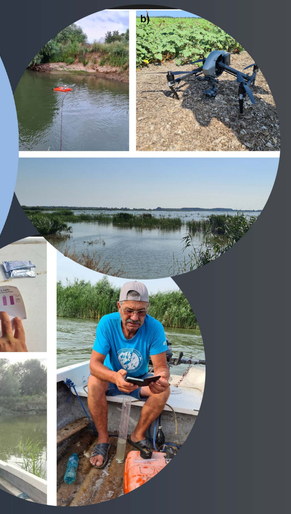
MICS is a platform which can be used to assess the impact of any citizen-science project, whether it is at the planning stage or years after it's completion.

Providing a clear framework for measuring impact helps to make citizen science more efficient and effective, reduce costs, and spread the use of citizen science more widely. All of this strengthens the role played by citizen science in research and policy.

Carasuhat Wetland Case Study

Carasuhat Wetland, part of the Danube Delta, has been subject to human intervention in the form of drainage for agriculture. The drainage project was abandoned in 1989 and the area became a local pasture. WWF Romania, the local Mahmudia Council and the Danube Delta Biosphere Reservation Administration initiated the Ecological restoration of the land from the Carasuhat polder, part of Danube Delta.

After the wetland restoration in 2016, no monitoring of water quality or biodiversity has taken place and there is no dedicated management plan for the wetland. MICS helped a network of volunteers to establish a baseline for a monitoring project by sampling and observing the evolution of the implemented Nature-Based Solutions.



Venice Lagoon Watershed Case Study

Among the multiple interventions being developed within the Venice Lagoon watershed, the MICS project focused on the restoration of two important wetlands: the "Oasi di Noale" and the "Oasi Lycaena" in the Marzenego river basin. Through co-design workshops, local interested parties and actors decided that the most important aspects to monitor through citizen science were water quality (chemical, optical and microbiological) and riparian vegetation.

The main benefit for the community was that citizen science increased the involvement of citizens who have become more aware of the territory in which they live. Secondary schools developed or improved monitoring methods. Politicians developed processes and projects that started from the needs of citizens. Efficient collaborations across citizen-science project improved transparency and trust in public institutions.

Early warning monitoring detected potential problems reducing financial resources required for mitigation.

The Operationalisation of Impact Indicators

Six principles have been devised to guide the development of the MICS comprehensive citizen-science impact assessment framework that synthesise and expand existing approaches in assessing citizen-science impacts.

The framework includes three different levels of abstraction: i) overarching impact categories (Environment, Society, Science and Technology, Economy, and Governance); ii) the intervention logic (a representation of how inputs and planned activities are expected to lead to desired impacts); and iii) the identified conceptual and practical approaches within each domain (e.g. themes and indicators).

The practical application of the framework has been tested in four case studies: each case was guided to devise its impact logic, to prioritise impacts to measure, and to select relevant indicators for measuring these priorities, including with citizen scientists. The next step was to integrate the framework into the MICS online platform and make it available to the wider citizen-science community.

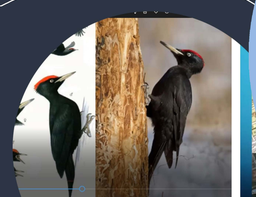
- Purpose of citizen-science impact assessment
- Non-linear impact journeys rather than impact silos
- IA data collection methods & information sources
- Relative vs absolute impact
- Comparison of IA results across citizen-science projects
- Cumulative enhancement of the framework over time

Creek Rakos Case Study

The case study at Creek Rakos aimed to faciliate the ecological restoration of the, heavily modified, watercourse on the outskirts of Budapest (Hungary). The local citizen-science project was set up via a co-design process with the interested parties and actors, and citizen-science activities on water quality measurements aligned with the Water Framework Directive. Mapping of specific species and the area naturalness measurements also started with enthusiastic citizen scientist help.

The creek restoration needed supporters from influential interested parties and actors and from the wider public; therefore, the citizen-science activities were complemented by strong awareness-raising activities on creek restoration.

The aim was to have a considerable impact among the major interested parties and actors and trigger real action towards the restoration of the Creek Rakos in District 17 of Budapest.



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824711.

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