MICS

Measuring Impact of Citizen Science

Science Brief

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Guiding Principles for Assessing the Impacts of Citizen Science

Introduction

Citizen science is experiencing exponential growth and popularity, presenting new ways for public participation in science as well as stakeholder engagement. With citizen science, it is possible to gather and analyse data across environmental, natural and health sciences, humanities and arts, and engage and empower additional people to join the debate about the future.

However, to demonstrate the *full potential* of citizen science, we must demonstrate its *impact and value*.

What do we mean by impact?

"Impact" is defined as "a marked effect or influence"; or - in other words - real, long-lasting changes. These changes might be to the physical world around us, or to people themselves; and we can think of them falling within five **categories**:

1. **Environment:** beaches less littered, air less polluted
2. **Society:** knowledge gained, attitudes and behaviour changed
3. **Science and technology:** data collected, methods and equipment improved
4. **Economy:** less money spent, sustainable tourism sector boosted
5. **Governance:** policies or laws changed, new forms of participation established

Why do we need to assess the impact of citizen science?

Capturing and reporting evidence of the impact and value of citizen science is lagging behind the uptake of citizen science. Existing impact assessment approaches are dispersed, often too case specific, and focus on limited categories or types of impact. As a result, actual changes resulting from citizen science interventions often either go unnoticed or they are assumed, speculated about, and incomparable.

KEY MESSAGES

Citizen science is experiencing exponential growth and popularity, presenting new ways for public participation in science as well as stakeholder engagement.

Capturing and reporting evidence of the impact and value of citizen science is lagging behind the uptake of citizen science.

There is a need for a comprehensive framework that allows for measuring and comparing impacts within and across Citizen Science initiatives.

Based on a comprehensive review of the literature and empirical evidence from past and ongoing projects, the MICS project has produced six recommendations which will frame the development of the MICS comprehensive Citizen Science impact assessment framework.

The MICS impact assessment approach will be integrated in the MICS online platform [https://mics.tools/]. In the course of 2021, it will be made available for the wider citizen science community to pilot and test.

How can we move forward?

This science brief presents six recommendations for developing the MICS comprehensive Citizen Science Impact Assessment framework that will help overcome the dispersion of approaches in assessing citizen science impacts. The H2020 MICS project (Measuring Impact of Citizen Science) develops approaches and tools to assess citizen science impacts which can help citizen science practitioners to plan and implement projects in ways that lead to more robust results. The recommendations are based on a systematic review of impact assessment approaches, and empirical insights from past and ongoing projects in the field of citizen science.

Recommendations for assessing the impact of citizen science

1

Accommodate a variety of purposes of citizen science impact assessment

Impact assessment of citizen science projects is diverse and undertaken for a range of reasons. This includes capturing the baseline situation, for example with respect to existing social and cultural norms, or commonly practiced methods of communication and information exchange among stakeholders. Impact assessment is also done to improve the ongoing implementation of citizen science projects or to inform future initiatives by assessing the effectiveness of adopted approaches. So-called *ex ante* assessments anticipate outcomes in detail and can play a role during grant application procedures to justify resources to funders. This means that the citizen science impact assessment framework needs to be able to satisfy a variety of needs, purposes and timing for conducting impact assessment across citizen science initiatives. In addition, the citizen science impact assessment framework needs to account for both, *process*-related indicators of impact e.g. number of citizens engaged in a citizen science initiative, and *results*-related ones, such as changes in the attitude or behavior of participants.

2

Conceptualise non-linear impact journeys rather than impact silos

Linear approaches of impact assessment conceptualise and study impacts of citizen science in 'impact silos' i.e. in isolation and without links to contextual factors and other types of impact. Such approaches often assume if 'A' happens, 'B' will follow. For example, it is often claimed that more environmental observations generated by citizen science initiatives (A) result in improvements in the state of the environment (B). In practice, the impact journeys of citizen science initiatives 'zigzag' across multiple categories of impact, and there are inter-dependencies among outcomes in terms of their sequence. For example, changes at societal level (e.g. cleaner modes of transport adopted) and institutional level (e.g. transport zoning plans in inner cities) often take place before improvements in the physical environment are achieved (e.g., better air quality). A comprehensive citizen science impact assessment framework therefore needs to allow for and distinguish between different impact categories, while providing flexibility for the end-users in the selection of relevant impact categories and planning for tracing impacts pathways in and across categories of impact.

MICS literature review

The MICS project team analysed 77 peer-reviewed publications as well as ten past and ongoing citizen-science projects to investigate how the impact of these projects is typically assessed. As might be expected, the methods were extremely 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 80 reviewed publications referring to all five of the impact categories considered in MICS. 'Society' was the most assessed category, whereas '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 the category of science), and very few considering impact at the indicator level (more specific 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).

3

Adopt comprehensive impact assessment data collection methods and information sources

A reliable approach for assessing the impacts of citizen science encompasses a range of data collection methods and sources of data that ideally also includes other relevant stakeholders and beneficiaries such as funders and government organizations that used the outputs of the projects. Widely used methods for collecting qualitative and quantitative data about the impacts of citizen science include interviews, surveys, and focus group discussions with participants, project partners and facilitators, as well as the review of project documention (reports, event journals, scientific publications, project websites, etc.) and participant observations. Impact assessment methods should not be prescriptive; instead, they should provide end-users with guidance on a wide range of possible and suitable methods for data collection and impact assessment approaches.

4

Move beyond absolute impact

Absolute and fixed measures of impact have inherent limitations. These limitations are becoming increasingly evident in impact assessment practices within and beyond the field of citizen science. For example, it is relatively easy to quantify the number of citizen scientists involved in a project, the number of training sessions held, and changes in patterns of communication. These are sometimes suggested as proxies of learning outcomes. Nevertheless, measuring actual learning outcomes of a citizen science project for individuals and within society is more complex and typically requires a qualitative research. Impact assessment approaches need to consider the changes relative to the context in which a citizen science project operates (e.g. geographic, socio-economic and institutional settings), as well as the goals, objectives and budget of citizen science initiatives.

For example, a citizen science project aiming to improve public participation needs to take into account the institutional set up (which may formally support public participation) as well as current practice (which may de facto exclude the public) at the start of the project. This allows measuring relative changes resulting from the project, e.g. the creation of distinct opportunities for public consultation and discussion using monitoring results, that did not exist before.

Moving beyond absolute impact entails considering unexpected impacts. These considerations can include an investigation of impacts for the local vs. the global environment such as harm caused downstream by an improvement in the local environment upstream; improvements in societal conditions in one area or country harming communities in other areas or countries; or trade-offs among positive economic impacts (e.g. more tourism) directly causing negative environmental degradation.

5

Foster comparison of impact assessment results across citizen science projects

Comparison of results across citizen science projects is particularly challenging because of the diversity of the subjects or themes covered by the initiatives, stakeholders involved and approaches for measuring impacts. For example, the results of a local citizen science initiative that aims to change public understanding of water pollution within a small city is not easily comparable with the results of an initiative that aims to change public understanding of air pollution at the global level, and with participation of thousands of volunteers. Similar to current efforts to build in interoperability across data systems and platforms of citizen science projects, cross-comparison of impacts and data impacts would be a beneficial development for citizen science.

Comparison of impact assessment results that are produced using different methods and information sources could be done by using consistent overarching categories and definitions. Impact assessment results from different projects could be captured via a single online tool (e.g. questionnaire). The validity and uncertainty levels of the impact assessment could be shown during the visualisation of individual and compared results (e.g. via a colour scheme) according to the range of underlying data sources. This can serve to generate both, project-specific as well as aggregated results which can be more easily compared.

6

Cumulative enhancement of the framework over time

The collective advancement of impact assessment theory and practice in the field of citizen science relies on reflection and cumulative additions, based on insights across projects and methods. In order to remain relevant over time and serve the citizen science community, the impact assessment needs to be built on collective and cumulatively evolving intelligence, based on additional inputs and definitions by researchers and practitioners as well as more structured reflection and quality control (peer review) to check whether appropriate items, definitions and methods are being used. A tiered level of impact indicators (similar to the SDG Tier 1-2 and 3 system of indicators) may be used to indicate the maturity level or peer review status of new impact indicators that are under review. A similar system may need to be set up and maintained for curation of the citizen science impact assessment framework. Communities of Practice such as the WeObserve CoPs, and other fora such as COST Action and ECSA Working Groups can offer the continuity and space for practitioners to reflect on, discuss and refine citizen science impact assessment frameworks.

Next steps

The development of the MICS citizen science impact assessment framework is well advanced and includes three different levels of abstraction: i) the 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 outcomes); and iii) the identified conceptual and practical approaches within each domain (e.g. themes and indicators). The impact assessment approach is being tested in four case studies in the MICS project. The next step is to integrate the framework in the MICS online platform and make it available for the wider citizen science community to pilot and test. The MICS online platform represents the gateway through which end-users, be they citizen science practitioners, reviewers, policy makers or other stakeholders, will be able to access the MICS toolbox, to better understand the impacts of their project. At the same time, and in line with Principle 6, the framework will be subject to constant reflection based on the new developments in impact assessment of citizen science projects, the results of the pilot tests in the MICS case studies and external peer reviews.

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THE MICS PROJECT [https://mics.tools/]

MICS is a three-year project funded by the European Union's Horizon 2020 research and innovation programme. MICS develops an integrated platform where these metrics and instruments are available for interested user e.g. citizen science practitioners or project funders. This platform is validated by pilot testing in four test and validation sites focusing on nature-based solutions in the UK, Italy, Hungary and Romania. These sites explore the applicability of MICS impact-assessment tools in regions with differing needs, contexts, and approaches to nature-based solutions, and with various levels of citizen-science application. MICS is coordinated by Earthwatch (Project Coordinator: Dr. Luigi Ceccaroni) and runs from 2019 to 2021.

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