Key Takeaways on Citizen Science Success: A Literature Review

Corey Halbert for Caravan Studios, July 2018

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Definitions

Citizen Science: The practice of public participation and collaboration in scientific research.

Project Success: Not exclusive to creating scientific information. Can be a combination of education, stewardship, and community building. Dependent on the community and research entities goals.

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Introduction

Historically citizen science has been most commonly utilized to answer research questions that require a vast amount of data. Examples of this could be researching bird migration patterns across a large area. Research institutions would employ volunteer citizen scientists to collect data on what bird they saw, at what time, and where it was observed. This data is then analyzed by the research institution and informs the institutions research. This allows the institutions to receive greater amounts of data that would normally require tremendous resources to obtain.

Within the past 30 years citizen science is "no longer focusing on "scientists using citizens as data collectors" but "citizens as scientists"" (Lakshminarayanan 2007). Citizen science has been growing significantly since the 1990s. Over 500,000 new local groups were established in varying environmental and social contexts (mostly in USA and Canada) most likely due to the increase in public knowledge and concern about anthropogenic impacts on natural ecosystems.

This paper focuses on the success trends in the more recent, community driven, definition of citizen science. The information presented in this paper is the result of the interviews and analysis of over 150 citizen science research projects. This paper is intended to provide the most frequently reported issues and solutions of citizen science research.

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Governance Structures

The governance structure of citizen science can directly impact the projects success. The most common governance structures of citizen science projects are Consultative, Collaborative, and Transformative. Each governance structure has its own benefits and limitations. Choosing the most applicable governance structure can improve the programs chances of success.

Table 1. Governance Structures

Governance Structure	Consultative/Functional	Collaberative	Co-Created/Transformative
Summary	Government reaches out to a community to employ citizen scientists to provide data. The government then acts upon findings. (Top down)	Management of research is part of the goals of the government and the community.	Projects that engage the public in all aspects of the resaerch project including designing, analyizng and disseminating conclusions (Botom up).
Pros	Great short term success. Very good for specific quetsions that require vast resources to determine an answer for.	Good short term and long term success.	Involves the community in every stage of the program. The scientists advise and guide the community rather than set the communities agendas.
Cons	Reliant on government involvement, the communities has little flexibility in their data collection goals being met.	Less variability in stakeholders.	Lack of data success due to credibility and capacity issues. Less support in legislation and policy.
Examples	Galaxy Zoo. Images of deep space formations are classified and catagorized by citizen scientists online. The information is then used for further research outside of the Galaxy Zoo projects goals.	Dehoop Nature Preserve, South Africa. Researchers worked with local tracker J.J. to help create survey methodology and goals to monitor wildlife populations in the park.	Bucket Brigade. Norco, Louisiana residents nearby Shell petrolium refinery became concerned with the quality of the air they breathe. Data from their homemade sensors helped inform the decision by Shell to pay 5 million in community development and relocation in Norco.

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Common Issues and Solutions

1. Organizational
    a. Volunteer interest: Citizen volunteer dropout can be attributed to misalignment with the community goals. Communities that are not consistently engaged tend to see higher rates of volunteer dropout. The community is unsure of the project goals.
        i. Solutions: Conduct preliminary community interviews and identify skillsets that align with the research. Assign tasks that best fit a volunteer's interests and skillsets. Involve citizen scientists in many aspects of the research/project (design of the program, monthly check-ins and updates, etc.). Be as transparent as possible.
    b. Access to Resources/Funding: A significant limiting factor of citizen science research success is access to resources. Waiting on resources can halt the progress of the project and lead the community to dissolve.
        i. Solutions: Acquire funding before monitoring begins, have a consistent plan for funding the project. Keep good contact with the community during monitoring. Plan on the need to provide resources as the project develops.
2. Data Collection
    a. Data Credibility: It is uncommon that citizen science data is published due to the concern of its credibility.
        i. Solutions: Provide a standardized monitoring procedure, provide reputable quality assured sensors. Provide data collection trainings and field guides.
    b. Data Quality: Data can become fragmented in citizen science research, it may also introduce bias.
        i. Solutions: Increase sample size, perform power analysis before monitoring, increase stakeholder variability.

3. Data Use
    a. Disseminating the Data: Many groups found that their data is not used in the decision making process or published in peer reviewed journals. Difficulty getting their data to an appropriate journal. Journal articles using volunteer collected data are not common.
        i. Solutions: Dependent on the goals of the community. Work with the community to properly distribute data to an aligned journal. Provide alternatives to peer reviewed journal publications (community targeted monthly/yearly reports).

Best Practices/Key takeaways

The most effective programs will engage community members as active participants in every aspect of the scientific process.

Sustained communication with staff scientist/interns/participating groups was a critical element of the success of many projects.

Have a clear scientific, educational, and social goal for the project.

Have a consistent methodology.

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Example Framework

Align research and education with community priorities: Early meeting with community members to establish scientific questions that support community goals.

Plan for co management of the project: Invite community leaders onto oversight or advisory committees. Host regular meet ups and check-ins between community members and scientists. Can be achieved through partnerships with parallel groups.

Engage the community at every step: group engagement should be ongoing. Community members should be participants in scientific analysis.

Incorporate multiple kinds of knowledge: The most successful projects value traditional knowledge, historical accounts, and participant observations in addition to scientific data. Give equal attention scientific to cultural value.

Disseminate results widely: Most engaging programs disseminate research findings not only as publications to journals but also the local community.

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