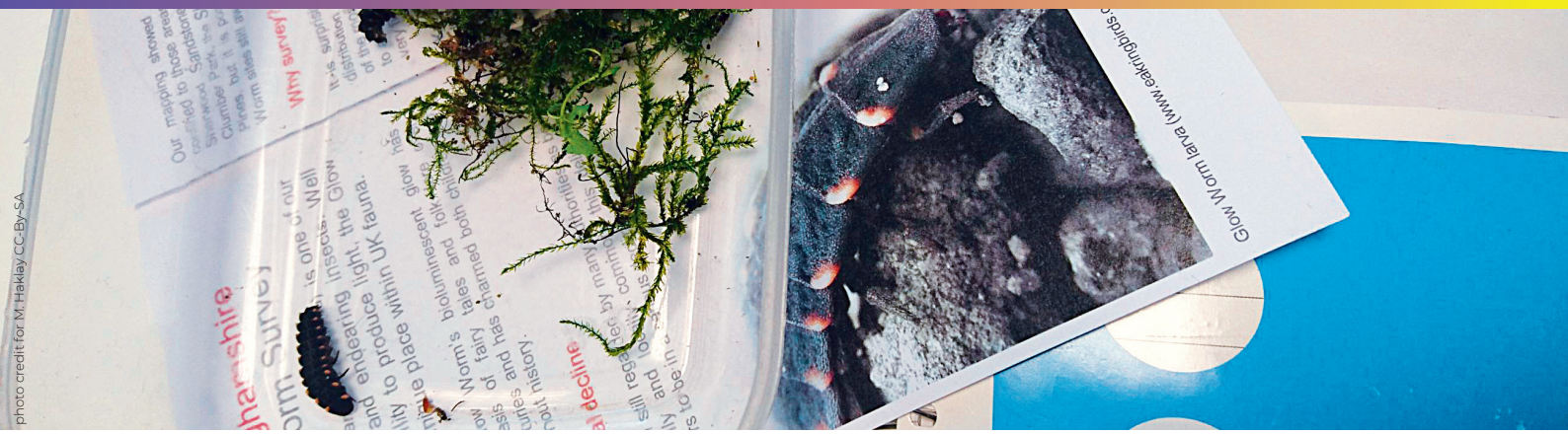

Making Citizen Science Work – Innovation Management for Citizen Science

Executive Summary

Established innovation management practices can be applied to the field of citizen science, to strengthen and increase the development of innovative applications for participatory science. However, the citizen science landscape is more complex than the social innovation landscape. Instruments and approaches that are appropriate for innovation management need to be developed and adapted for the unique characteristics of citizen science. This process is still at a very early stage, and therefore requires special attention.

This policy brief draws on a preliminary study that identified the main operational archetypes of citizen science and DIY science projects, which we call "operational models" or "modes of operation". The nature of the DITOs project and the WeObserve project have brought us into contact with a wide variety of different types, scales and aims of citizen science projects, as well as differing funding models, and ways in which citizen science projects are initiated. The clustering of specific operational models of citizen science are an indication that we can find commonality, and that this landscape of citizen science can be understood from a social innovation perspective, and therefore supported by innovation management techniques.

Citizen Science and Social Innovation

Citizen science approaches can be seen to comfortably fit within the definition of social innovation – a new configuration of social practices in which members learn, invent and lay out new rules for collaboration, and in this process acquire cognitive, rational and organizational skills[1]. However, the landscape of citizen science, while similar to the social innovation landscape, is more complex, with islands of activities and multiple discontinuities. The clustering of specific operational models of citizen science are an indication that we can find commonality, and that this landscape can be understood from a social innovation point of view, and therefore supported by innovation management techniques.

The area of social innovation was largely overlooked until the mid-2000s, when identifying the mechanisms to support the development of social enterprises, not-for-profit, and charities, as well as support for social entrepreneurs, began to receive attention[2]. Governmental bodies started to pay more attention to social investment only a decade ago[3], while recommendations on how universities and other research institutions could manage social innovation have only appeared in the past five years[4].

Social innovation presents a more complex case for innovation management since such projects are typically trying to achieve social, environmental, and health benefits, whilst also committing themselves to high standards in their business interactions (such as ensuring that all their source material is produced ethically). This is a tall order for a nascent business that is emerging from R&D efforts. Social innovation management therefore requires different expertise from general innovation management.

Citizen science, as a recent newcomer to the field of social innovation, is arguably in even more challenging a position because it is the epitome of the Quadruple Helix[5] or "Mode 3" innovation. In these models, we expect to see the co-production of innovation between universities and research institutions, governments, civil society, and business and industry. Unlike social enterprises with a commercial business model, citizen science projects do not have the same imperative to establish a customer base and revenue stream at the heart of their funding model. We therefore speak of operational models rather than business models when referring to citizen science.

Definition: Operational Model

We use the term 'Operational Model' to describe the organisational structure within which citizen science projects happen, the form of funding used to finance project costs, the geographical scale and participation volume that define the scope of the project, and the temporal scales that define its length of operation.

Citizen Science and Innovation Management

Innovation management is a well-established practice within technological and scientific research as well as regular business practice in large and small companies. It has led to the creation of a host of mechanisms to overcome the "Death Valley" between the end of the research phase, and the attraction of investment[6] .

Innovation management inside a firm tends to be concentrated on product development and process innovation. However, the expectations on citizen science projects are much higher and have multiple aims, such as promoting scientific education, producing high-quality scientific outputs, reaching out to groups that are underrepresented in science, creating meaningful and enjoyable engagement, performing the research in an ethical way that includes a duty of care towards participants, and contributing to environmental sustainability and economic development.

An additional challenge is the lack of clear routes for scaling up involvement from local projects to a sustainable national programme, for example in the environmental monitoring of air quality or biodiversity. We are still at a very early stage in the development of innovation management for citizen science and the understanding of the appropriate mechanisms that are required to streamline it.

The mode of operation of citizen science, especially when it relates to popular topics, seems to be easier in areas where economic activities (either commercially or in the not-for-profit sector) are well established. One of the most established areas in citizen science - bird and wildlife watching - has been identified as having a significant economic value, estimated at around $32 billion in the USA. However, economic activity does not necessarily translate to direct support of citizen science, for example in the case of biotechnology and DIY Biology.

Definition: Popular Topics

In particular areas of citizen science, there are topics that are more likely to attract attention because of an already established community of amateurs, volunteers, or interested publics and economic activity. For example, bird watching is a popular activity and has significant economic activity associated with it. Astronomy, weather observations, and research about dinosaurs are also popular topics for which the public is willing to spend money by buying a telescope, weather monitoring station, or paying for an exhibition related to such topics. Stories about such areas of research have a broad reach for which it is easy to get coverage in the general media.

Methods

To understand the innovation landscape of citizen science, we focused on two critical elements - the organisational structure within which citizen science projects happen, and the form of funding that is used to finance these projects. We first undertook desk research to accumulate general information on citizen science and DIY science projects, and then contacted those responsible for the projects to check for completeness and accuracy. The activities carried out thus formed an iterative cycle of gathering information, checking understanding with project coordinators, asking for further recommendations of projects and adding to the project summaries. We completed this process once insights began to repeat themselves, and ended with a total of 35 different types of citizen science and DIY science projects.

Outcomes

We identified five broad "archetypes" of operational models in citizen science, whilst seeking to retain acknowledgement of the unique nature of the formation and aims of each project considered.

The projects analysed were qualitatively mapped onto an axis of geographical scale (y axis) and length of time (temporality) of a project (x axis) as shown in Figure 1. When the funding scale was mapped onto the projects, a form of clustering can be observed. There is a cluster of those projects with little to no funding, or ad hoc funding, in the bottom left, operating at a local level and on more of a one-off basis. However, it is also possible to observe a relatively diverse spread of projects with little to no funding, or ad hoc funding, operating both at a larger geographical scale (National or indeed Global) and on a longer terms basis.

Figure 1 indicates the organisational structure of

the project leader or initiator. This is interesting as it demonstrates that the long term projects that operate on a global scale tend to be run by NGOs. It is also possible to observe a band of projects operating at a national to global scale, but for a moderate amount of time, that are run by universities.

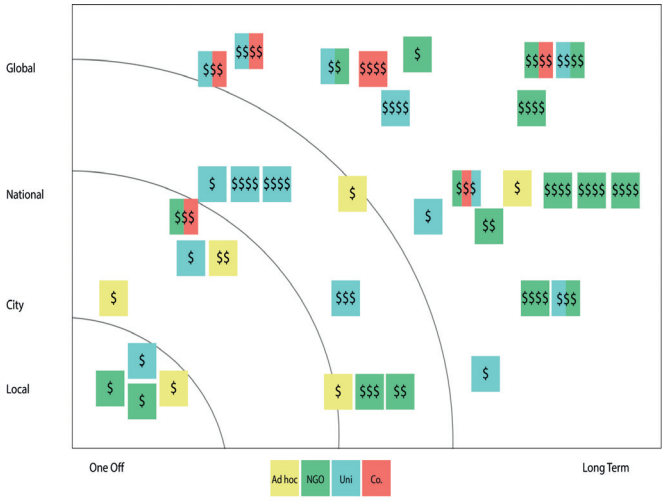

Figure 1: Mapping of projects by organisational structure and funding

Motivated individual: these projects are the result of a committed researcher with a strong interest in a topic. These projects would not have come about without the impetus and motivation of that individual (or small group of individuals). These are commonly small-scale projects, often with little to no funding, apart from funding that the leaders of the project secure through their entrepreneurial activities inside their organisation, or the environment within which they operate.

Example: ***UK Glow Worm Survey:***
www.glowworms.org.uk/

Small Crowdsourcing (SCS): these types of projects are task specific, or one-off, though in some instances the intention is that the communities generated around such projects will be ongoing. These projects tend to be funded through a crowdsourcing model, or small amounts of funding from different resources. They are of a limited scale in time and place, but many of them hold the potential for replication and expansion.

Example: ***Crowdfunding air quality monitoring:***
https://www.crowdfunder.co.uk/community-air-pollution-monitoring

Outreach (Outreach): these projects are primarily concerned with engaging participants on as broad a scale as possible. Outreach might mean that the organisers of the activity are doing it in order to encourage people to learn and engage with an issue, as well as being involved in a scientific project and creating information that can be used for research and monitoring. Other outreach projects are aimed at reaching out to audiences that usually do not engage with science. The extent of funding of such projects might vary considerably, but the scale of operation tends to be larger than other citizen science projects.

Example: ***Big Bumblebee discovery:***
www.britishscienceassociation.org/the-big-bumblebee-discovery

Research and Innovation (R&I): these projects take their name from the classification in the Horizon 2020 framework. These projects are aimed at creating new scientific or technical knowledge. A key characteristic of this type of project is that it is run by a university or consortium of organisations including a university. These are potentially large scale, well-funded projects, which are time limited - from a few months to five years. While they operate within the traditional framework of innovation management, in the case of citizen science, they require different support and development beyond the end of the funding.

Example: ***LandSense:***
landsense.eu/

Long Term NGO (LT NGO): These projects tend to be quite well established, having been in existence for over five years, and in some cases, many decades. A key characteristic is that they are run by an NGO whose predominant mission is very well aligned with the project. Since these projects are more long term, they may have experimented with different funding sources, before arriving at their current funding source.

Example: ***Riverfly Partnership:***
www.riverflies.org/

Recommendations and Implications

Citizen science can learn and adopt approaches from the field of social innovation, but it needs to take into account the unique characteristics of these projects, such as the need to release the data under open science principles.

1. Innovation in the area of citizen science and DIY science requires attention and support, as the field is still emergent and needs research, experimentation, and funding.
2. Infrastructure for innovation management in citizen science needs to be provided. Parts of this infrastructure are starting to emerge[7] (e.g. the analysis of Intellectual Property Rights) but there is a long way to go. This will require dedicated attention from funders.
3. In the current landscape, NGOs seem to be the most capable of running long term projects, with membership fees being the most sustainable funding model. This should be taken into account when developing citizen science projects that are expected to last over a long time period.
4. Universities and research institutions should team up with NGOs who have a mission that is closely aligned with the research area of the citizen science project, so as to become a potential legacy partner for the R&I project.
5. There is a specifically challenging situation for Motivated Individual and SCS projects, where there is currently plenty of innovation and evidence of entrepreneurship (sometimes inside an organisation). These efforts should be supported and enhanced; social innovation mechanisms might be effective here.
6. Specific attention should be given to those projects which have successfully transitioned from one archetype model to another. This will allow for a better understanding of the enabling factors and how best to support such transitions to longer term and more stabilized models and funding sources.

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How to cite

DITOS Consortium and WeObserve Consortium (2019) Making Citizen Science work: Innovation Management for Citizen Science. DITOS Policy Brief 6.

Colophon

This policy brief was facilitated by the lead authors, UCL and ECSA, through open interaction and discussion with the DITOs community. While this was carried out as part of the H2020 'Doing It Together Science' (DITOs) Coordination and Support Action project, the views expressed in it do not reflect the consensus opinion of DITOs and WeObserve partners.

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weobserve.eu

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 709443 and 776740 respectively.