Citizen Science Impact Pathways for a Positive Contribution to Public Participation in Science: A Logic Model Approach for the EU project Doing It Together Science

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Introduction

Citizen science (CS) encompasses a wide range of activities (from dedicating an hour a year to count birds in your garden, to carrying out biological experiments in DIY Biology which take many hours every week), different levels of engagement, different types of projects, and different levels of technological use. These create implications in terms of how CS is applied and whether anticipated impacts are achieved, with insufficient evidence from real cases and their effect to the broader CS agenda. In this study we used the 'escalator concept' for first time, which helped us understand and encourage engagement in the European project, Doing It Together Science (DITOs), working with a detailed logic model and theory of change analysis to ensure that our assumptions for transformations in DITOs are identified, taken care of, and therefore impacts are achieved. We aim at providing practical evidence and a model that others can replicate for the successful implementation of their programme impacts.

Methods & Models

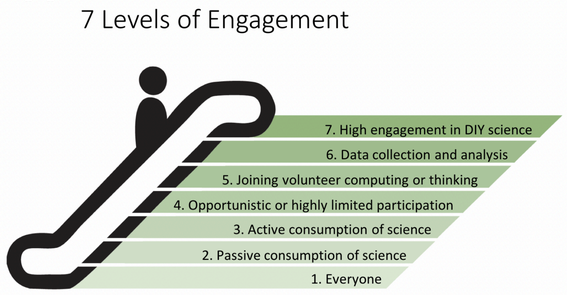
We use a theory approach to develop, present and discuss a macro-level logic model for DITOs, which was funded through the EU 'Science with and for Society' (SwafS) programme and included a wider range of activities that engage the public and policymakers in citizen and DIY science. We take an ex ante (and, when relevant, an ex post) approach to construct a 'broad and shallow pathway' logic model as a reflective tool for articulating and communicating our assumptions, evaluating (when applicable) and subsequently demonstrating the effectiveness of DITOs implementation and the role of conceptual and instrumental components in the change that we attempted to achieve.

Table 1: Logic Model Components

Programme process			Programme impacts		
Inputs	Activities	Outputs	Short-term impacts	Medium-term impacts	Long-term impacts
Resources and inputs into the programme	Programme activities (i.e. what's happening in the project)	Direct programme products from activities	Short-term impacts (usually within 1-3 years of project initiation)	Medium-term impacts (usually within 3-5 years of project initiation)	Long-term impacts (usually within 5-10 years of project initiation)

Using evidence from the UK, we conclude that as the level of engagement increases, the demands required of participants increase and the number of participants drops. Therefore, to enable a wider and deeper public engagement with science, we considered an escalator-like process, which creates awareness of the various levels and assists people in moving up or down the engagement level. We used the following 'Escalator model' to position DITOs CS practices along a continuum of public engagement.

Figure 1: DITOs escalator model



DITOs In Numbers

DITOs, a three-year H2020-funded coordination and support action (CSA), run from 2016 to 2019 focused on two themes: environmental sustainability and biodesign. The project delivered **829 public events** and engaged **515,254 face to face participants** and **3,296,773 online interactions**. It has generated best practice guidelines for participation in CS, networks and hubs for science and technology research and practice, open access deliverables, showcased a travelling exhibition across many European countries, generated sufficient evaluation materials including ethnographic reports, created dissemination and communication channels and tools which are now fully utilised by successive EU-funded projects. *Have these outputs been enough in terms of successfully achieving the project's anticipated impacts?* Key to the project's success, has been the development and use of the DITOs logic model, which was used to design DITOs in a way that ensures impacts are materialised even after the project's completion.

DITOs Logic Model and impact pathways

DITOs logic model consists of: Resources (Inputs), Activities, Outputs, short, medium and long-term impacts. An additional category has been added, that of Beneficiaries, to effectively monitor pathways for all major stakeholder categories, which are identified in DITOs outreach plan during the project planning stage. Figure 3, lists all items included in each category and provides details of the impact pathways from 'Activities' to 'LT impacts'. For example Output 1 (O1) which is 'Deliverables' in the form of reports generated from activities A10 and A11 (i.e. 'Write and submit deliverables to funders' and 'Manage the project').

Our identified impact pathways correspond to specific beneficiaries and they include: ***a. Public engagement impacts; b. Impacts from engagement with science practitioners; c. Impacts from engagement with policy makers.*** To create effective pathways specific activities were designed, evaluated (and redesigned when necessary) iteratively throughout the project duration to ensure the development of outputs which contribute towards building a continuum from short to long-term impacts. In cases where gaps were identified (e.g. activity outputs which do not lead to the anticipated short-term impacts) and other missing or broken links in these linear relationships, activities and outputs had to be redesigned to better fit the DITOs framework and the change the project anticipated to bring.

The escalator model that DITOs has introduced was fundamental in setting up the DITOs mechanism and subsequently achieve: a. ***wider and deeper public participation in science and greater awareness of RRI; b. maximise European innovation; and c. maximise societal input and external advice to R&I policies.*** The model was effective in: a. enabling people to decide which level of contribution is suitable for them, while gently exposing them and encouraging them to move to the next level; b. promoting citizen and DIY science to encourage user-led innovation by drawing on expertise of grassroots groups which have a deeper understanding of local contexts; c. identifying potential participants and offering them a pathway for utilizing their efforts.

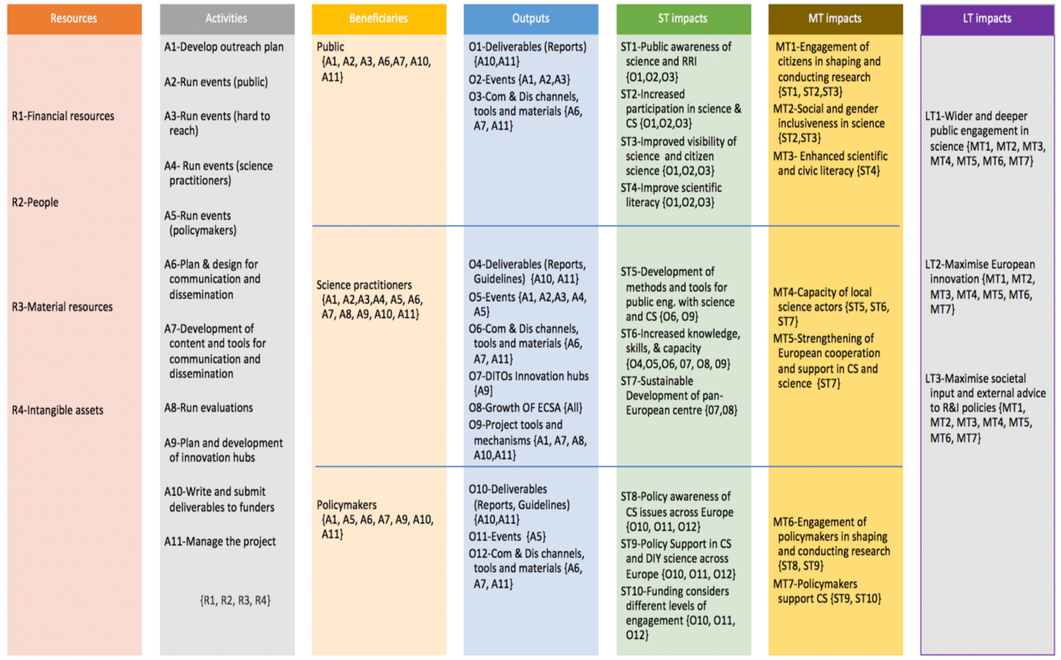


Figure 3: DITOs (top-level) Logic Model

Lessons Learned

- By looking at a the DITOs top-level logic model, we identified the 'right' mechanisms at a strategic level and subsequently created the tools and instruments for achieving the change the project anticipated;
- The approach helped us identify and target all beneficiaries appropriately at all levels, and identify opportunities and challenges throughout the project duration to support the design of relevant actions to address them;
- While it is possible to envisage a model that will try to identify what each action is aiming to achieve, it is easier to miss top level impacts (a problematic aspect of most existing public engagement programmes). This top-level programme planning supported by a logic model can resolve these issues.

The research that underline this project was supported by the European Union's H2020 research and innovation programme Doing It Together Science (under Grant Agreement No 709443) and the ERC Advanced Grant project European Citizen Science: Analysis and Visualisation (under Grant Agreement No 694767). Special thanks to all DITOs partners and participants.