# **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.

	Programme pro	Programme impacts								
Inputs	Activities	Outputs	Short-term impacts	Medium-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)						

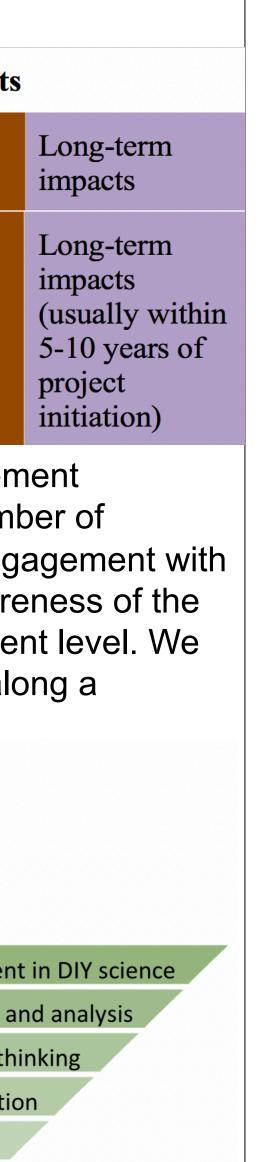
#### **Table 1:** Logic Model Components

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.

### 7 Levels of Engagement

7. High engagement in DIY science 6. Data collection and analysis *Figure 1:* DITOs 5. Joining volunteer computing or thinking escalator model 4. Opportunistic or highly limited participation 3. Active consumption of science 2. Passive consumption of science 1. Everyone

DITOs partners and participants.



### **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.

Resources	Activities	Beneficiaries	Outputs	ST impacts	MT impacts	LT impacts	
R1-Financial resources R2-People	A1-Develop outreach plan A2-Run events (public) A3-Run events (hard to reach) A4- Run events (science practitioners) A5-Run events	Public {A1, A2, A3, A6,A7, A10, A11}	O1-Deliverables (Reports) {A10,A11} O2-Events {A1, A2,A3} O3-Com & Dis channels, tools and materials {A6, A7, A11}	ST1-Public awareness of science and RRI {01,02,03} ST2-Increased participation in science & CS {01,02,03} ST3-Improved visibility of science and citizen science {01,02,03} ST4-Improve scientific literacy {01,02,03}	MT1-Engagement of citizens in shaping and conducting research {ST1, ST2,ST3} MT2-Social and gender inclusiveness in science {ST2,ST3} MT3- Enhanced scientific and civic literacy {ST4}	LT1-Wider and deeper public engagement in science {MT1, MT2, MT3, MT4, MT5, MT6, MT7}	Lessons • By loc we ide level a instrue anticip
R3-Material resources R4-Intangible assets	(policymakers) A6-Plan & design for communication and dissemination A7-Development of content and tools for communication and dissemination A8-Run evaluations A9-Plan and development of innovation hubs	Science practitioners {A1, A2,A3,A4, A5, A6, A7, A8, A9, A10, A11}	O4-Deliverables (Reports, Guidelines) {A10, A11} O5-Events {A1, A2,A3, A4, A5} O6-Com & Dis channels, tools and materials {A6, A7, A11} O7-DITOs Innovation hubs {A9] O8-Growth OF ECSA {All} O9-Project tools and mechanisms {A1, A7, A8, A10,A11}	ST5-Development of methods and tools for public eng. with science and CS {O6, O9} ST6-Increased knowledge, skills, & capacity {O4,O5,O6, 07, O8, O9} ST7-Sustainable Development of pan- European centre {07,08}	MT4-Capacity of local science actors {ST5, ST6, ST7} MT5-Strengthening of European cooperation and support in CS and science {ST7}	LT2-Maximise European innovation {MT1, MT2, MT3, MT4, MT5, MT6, MT7} LT3-Maximise societal input and external advice to R&I policies {MT1, MT2, MT3, MT4, MT5, MT6, MT7}	<ul> <li>The a benefit identifit identifies the provident of the provi</li></ul>
	A10-Write and submit deliverables to funders A11-Manage the project {R1, R2, R3, R4}	Policymakers {A1, A5, A6, A7, A9, A10, A11}	O10-Deliverables (Reports, Guidelines) {A10,A11} O11-Events {A5} O12-Com & Dis channels, tools and materials {A6, A7, A11}	ST8-Policy awareness of CS issues across Europe {O10, O11, O12} ST9-Policy Support in CS and DIY science across Europe {O10, O11, O12} ST10-Funding considers different levels of engagement {O10, O11, O12}	MT6-Engagement of policymakers in shaping and conducting research {ST8, ST9} MT7-Policymakers support CS {ST9, ST10}		achiev proble engag progra can re

*Figure 3:* DITOs (top-level) Logic Model

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## ns Learned

poking at a the DITOs top-level logic model, dentified the 'right' mechanisms at a strategic and subsequently created the tools and uments for achieving the change the project cipated;

approach helped us identify and target all eficiaries appropriately at all levels, and tify opportunities and challenges throughout project duration to support the design of vant actions to address them;

le it is possible to envisage a model that will identify what each action is aiming to eve, it is easier to miss top level impacts (a lematic aspect of most existing public agement programmes). This top-level ramme planning supported by a logic model resolve these issues.