Evaluating a Citizen Science Project from the Participant's Perspective: Delft Meet Regen

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Preface

This is a report of a research project on evaluating the outcomes from the participants's perspective of Delft Meet Regen, a citizen science project performed during the summer of 2021. The research project was part of an internship at PULSAQUA and part of the Master in Biology & Science Communication and Society performed by Jordy Janssen.

With this report I aim to set out the motivation, relevance and initial background research for this project. I begin with a small introduction on Citizen Science, after which I elaborate on the aim of this study. In the second section, I provide some background information on the specifics of evaluating Citizen Science projects necessary for understanding the approach. In the subsequent sections, I elaborate on the methods used to obtain the presented results and finally, I discuss these comprehensively providing some limitations and suggestions for the future.

I would like to thank all of the interviewees for participating to my research project. Furthermore, I owe Sandra de Vries, Sanne Romp and Marit Bogert for their extensive supervision and guidance. The design and other elements of this research was further helped by the contributions of Jesse Kamstra, Julie Schoorl, Anne-Land Zandstra and Margaret Gold.

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Abstract

Citizen science is a growing method of opening up scientific research by engaging the public in the scientific process. To evaluate projects of this type, evaluation frameworks are a useful method of organizing possible outcomes of a project, whether general outcomes or personal outcomes relevant to the participants themselves. Because these are usually created top-down by researchers themselves, it could be that the outcomes assessed in evaluation studies are biased towards the goals of researchers instead of participants. We created a method to evaluate the Citizen Science project Delft Meet Regen, in which participants measured rain during the summer of 2021, which combines an exploratory method of surfacing the outcomes relevant to the participants with a combination of frameworks and outcomes found in literature, to see if these align. We found that frameworks used for quantitative studies are comprehensive, but may still lack the complexity and detail of the participants' experience in specific projects. We suggest that qualitative methods of investaging outcomes remain necessary to obtain a realistic picture of the outcomes of citizen science projects.

Introduction

Citizen Science

Why Citizen Science?

Knowledge creation through (a premature form of) science can be seen as the driver of the advancement of humanity (Bartling & Friesike, 2014). After a period of organization of scientists in closed societies, from the 17th century, calls for the opening of science led to the publishing of produced knowledge through journal articles. Nonetheless, near the end of the 20th century, the scientific community developed the idea that the average citizen, or 'the public', had an insufficient level of understanding of scientific concepts and methods in order to make decisions based on scientific knowledge (Brossard et al., 2005).

The deficit model has become a notorious model within science communication in which the cause of this insufficient level is thought to be a lack of knowledge on the part of citizens (Simis et al., 2016). However, this model assumes a simplistic view of the public, in which everyone objectively interprets scientific information as facts. The simple presentation of facts will not automatically lead to increased public understanding of science (PUS). This has led scientists to believe that other strategies of enticing the public to reap the benefits of knowledge creation through science are more suitable (Simis et al., 2016).

These strategies include Open Science, a movement within science which has gained momentum in the first decades of the 21st century, facilitated by the ability of faster communication through the Internet (Smart et al., 2019). Open science has evolved into a diverse set of approaches to 'open up' science in multiple steps of the process (Figure 1), questioning the way in which scientific knowledge is created, structured, accessed, shared and evaluated (Fecher & Friesike, 2014). A definition was distilled of Open Science as "transparent and accessible knowledge that is shared and developed through collaborative networks" (Vicente-Saez & Martinez-Fuentes, 2018).

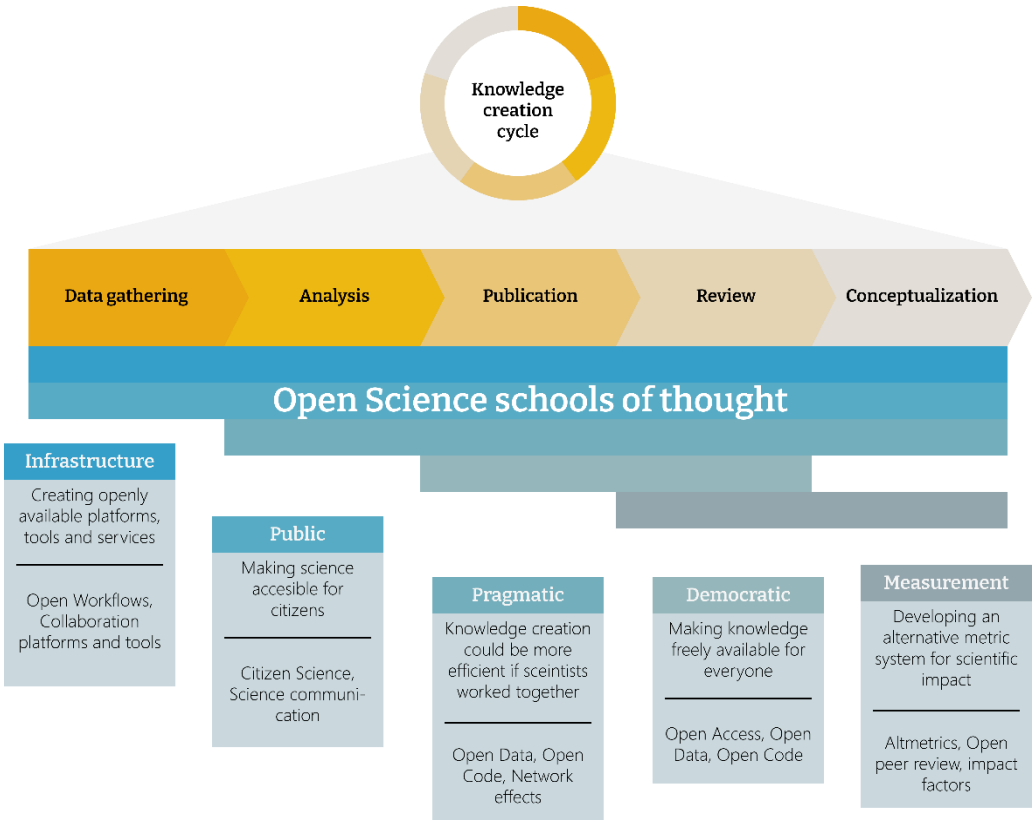

Figure 1: The knowledge creation cycle (adapted from Badr & Asmar, (2020)) and the Open Science five schools of thought by Fecher & Friesike, (2014). Citizen science is part of the public school of thought, aiming to make science more accessible to citizens.

Citizen Science for the engagement and public understanding of science of participants

This aim for a higher accessibility of science can be done by more efficient sharing, which is generally referred to as Open Science, but the development of knowledge through collaborative networks can be achieved through Citizen Science (CS). Citizen Science has been defined numerous times depending on the context, but the essence can be described as public participation in the scientific process, involving the collection, submission or analysis of data (Bonney et al., 2016). This participation to scientific research is thought to help make science more publically accessible (Fecher & Friesike, 2014).

Generally, two advantages of incorporating CS practices as a research method are assumed. From the rather practical scientific perspective, this kind of research is able to collect a large variety, quantity and resolution of data, e.g. for online projects such as Galaxy Zoo (Nielsen, 2020) giving researchers access to data collectors worldwide and around the clock (Shirk & Bonney, 2018). The most relevant advantages of CS for Open Science are usually outlined as changes within participating citizens. These involve, e.g., the increase of participants' knowledge of both the scientific process and the field studied during a project, as well as changes in citizens' attitude towards science and behavior concerning the environment or society (Brossard et al., 2005; Jordan et al., 2012). CS is seen as a way to create 'environmental citizen scientists' by exposing them to issues or connecting them with nature through the activities performed during their participation (Jørgensen & Jørgensen, 2021). These advantages touch on wide-ranging topics and are promising, but the still young field of Citizen Science is trying to evaluate whether they are being delivered upon.

Several models for the level of engagement in CS exist, e.g. by classifying projects from top-down to bottom-up (Reed et al., 2018) or by the amount of participation (Haklay et al., 2013). Shirk et al. (2012) describe citizen science project designs based on the 'degree' and 'quality' of participation. They define the degree of participation as the measurable extent to which participants are involved in the research process, and the quality of participation as to what extent the goals and activities of a project align with the needs and interests of participants. Their five models of degree of participation are based on an earlier typology constructed by Bonney et al. (2009) (Table 1). The characteristics of a CS project can influence the generated outcomes, which makes it crucial to keep this into account when designing and evaluating such a project (Peter et al., 2019, 2021).

Table 1: Models for citizen science projects. Adapted from Shirk et al. (2012). X = public included in aspect; (X) = public sometimes involved in aspect

Aspects of scientific research/monitoring process:	Contractual Projects:	Contributory Projects:	Collaborative Projects:	Co-Created Projects:	Collegial Projects:
Choose or define question(s) for study	X			X	X
Gather information and resources	(X)			X	X
Develop explanations (hypotheses)				X	X
Design data collection methodologies			(X)	X	X
Collect samples and/or record data		X	X	X	X
Analyze samples			X	X	X
Analyze data		(X)	X	X	X
Interpret data and draw conclusions	(X)		(X)	X	X
Disseminate conclusions/ translate results into action	(X)	(X)	(X)	X	
Discuss results and ask new questions	X			X	X

The Participant's Perspective

While evaluating such participatory projects, the goals of CS are an important factor to consider. To guide good practices in CS, ten principles of citizen science have been formulated by the European Association for Citizen Science. Their third principle states that both the professional scientists ánd the citizen scientist have to benefit from taking part (Robinson et al., 2018). It is therefore necessary to include participants' intended outcomes into design and evaluation of CS projects. This will encourage the engagement of participants, also aligning with scientific objectives, and steers away from more traditional science (Kieslinger et al., 2018).

However, outcomes influencing participants are often underreported in evaluation studies, or conclusions regarding citizen science in general are hard to draw (Land-Zandstra et al., 2021). In their review focusing on outcomes that improve PUS, Bonney et al., (2016) state a number of desired learning outcomes for participants, which are formulated by researchers with the goal of improving PUS in mind. They admit that there is a lack of understanding of how participation to a CS project influences a participant's role in science from their perspective, and other research methods have to be employed which assess participant experiences over different kinds of projects. A review studying the transformative potential of CS projects discussed that their case studies mirrored scientist perceptions and not practitioners', let alone participants (Bela et al., 2016).

This top-down perspective of desired outcomes can, although unwillingly, use the framing of genuine bottom-up democratization of science to achieve another, ultimate goal of public acceptance of science and its technological developments (Powell & Colin, 2009). Phillips et al., (2018) found that next to data collection and increasing content knowledge, influencing behavior change in participants is the most desired learning outcome of CS projects. More uncommon is the view of participants simply as a volunteer workforce, but as long as this goal is communicated clearly it does not have to degenerate the quality of participation (Fecher & Friesike, 2014).

Certain participant learning outcomes or effects on ecological quality might seem obviously beneficial for the participants on first sight, but motivations of joining a CS project and the evaluation of outcomes actually valued by participants are understudied (Land-Zandstra et al., 2021). We believe that it can be interesting and necessary to evaluate a citizen science project from the perspective of the participant. With this in mind, we aimed to evaluate the CS project 'Delft Meet Regen'.

Context and aim of the research

Delft Meet Regen (Delft Measures Rain, DMR) is a citizen science project initiated and executed by WaterLab, a platform of multiple organizations focused on demonstrating, performing, and sharing water research by organizing and facilitating Citizen Science projects in the region. During the summer of 2021, DMR collaborated with 105 citizens of Delft in order to measure rain using a provided rain gauge. These measurements have contributed to the research of the Technical University Delft (TU Delft), in which the effects of urban development on rain within the city are explored. The participants' measurements provided a higher resolution of rain measurement locations, giving a more detailed view on rain distribution.

The DMR project is likely categorized between the 'contributory' (participants are asked by scientists to collect and contribute data and/or samples) and 'collaborative' (participants assist scientists in developing a study and collecting and analyzing data for shared research goals) models. The participants received a rain gauge and instruction manual which provided information about the installation of the device and

methods for collecting and contributing measurements through an online form. They received updates about the project in bi-weekly newsletters and unplanned e-mails containing (background) information, tips and troubleshooting. A forum was created in order to provide participants with a platform for questions or remarks. Both the practitioners and other participants could react to posts on the forum, giving support for participants in trouble. After the project, a webinar was organized in which the results of the research were shared with participants. An infographic containing the most important results was developed and distributed. Finally, a small number of participants of the 2020 edition of DMR are contributing to the creation of a research paper describing the project as a case-study of what tools and organizational elements are necessary to successfully develop a CS project.

Prior to and after the DMR project, a survey was performed to analyze experiences of the participants and gain an initial understanding of outcomes of the project on participants' knowledge and awareness of water and rain in Delft. In this survey, it was asked if the participants felt like they gained knowledge about rain, flooding or drought in Delft or in general.

The participants of DMR likely entered with a certain set of motivations to join DMR and have experienced or observed certain changes and outcomes during and after the project. Participants can experience memorable interactions during CS projects in which they interact with scientists and academic institutions (Phillips et al., 2009), or they value certain outcomes such as the improvement of ecological conditions and their contribution to the research behind DMR. This research aimed to evaluate outcomes from the perspective of the participants of the 'Delft Meet Regen project. We sought to answer the following questions:

What are the outcomes of the citizen science project Delft Meet Regen experienced by its participants from their perspective?

1. What outcomes have participants of DMR experienced during and after the project?
2. How do the experienced outcomes of the participants of DMR align to known outcomes of citizen science projects?

This research thus measured the outcomes of DMR as perceived by the participants in order to find out what changes they actually noticed. We aimed to discover the experienced outcomes that the participants are able to produce in hindsight without relying on outcomes established in CS literature. Furthermore, we wanted to investigate how participants place their reported outcomes in a framework of outcomes as described in literature. This provided us with an overview of outcomes from the perspective of the participants, and the extent to which the known outcomes of citizen science projects were experienced by participants of DMR.

Because possible outcomes (and especially impacts) are numerous and complex, they are difficult to grasp and would likely only partially be perceived by participants (and scientists). In the next section, we will discuss the frameworks for outcomes of CS from literature that were used for the design of a viable research method which uses a common framework while preserving the participants' perspective.

Theoretical Framework

Evaluation of Citizen Science

To investigate whether the advantages of Citizen Science are real or if a specific project has met its desired results, it is necessary to do evaluations of outputs, outcomes and impacts (Figure 3). These terms, based on *a logic model of evaluation* (Örtengren, 2004) are useful for distinguishing between different kinds of results during the evaluation of projects (Schaefer et al., 2021). Similarly to Shirk et al. (2012), we define 'outputs' as the direct results of the activities during a CS project such as data or lived experiences. Outcomes are short-term effects that result from the CS project, often on participants, while impacts can be seen as more long-term and sustained changes or outcomes on a higher level.

Figure 2: The five domains of outcomes and impacts of Wehn et al. (2021), adapted with a zooming out from individual to global levels.

The outputs can be defined as part of the process of a project, and are important to evaluate the design and management of a project (Schaefer et al., 2021). Outcomes and impacts are often grouped together as the benefits and results contributing to the intended and unintended goals of Citizen Science (projects). This framework, originally developed by Kieslinger et al., (2018), further divided indicators in the three dimensions of scientific aspects, participants, and socio-ecological or economic.

These dimensions return in different forms, and after a thorough review of 'impact studies' by Wehn et al. (2021), they divided types of impacts resulting from CS projects over five domains: Society, economy, environment, science & technology, and governance. They stress that the five domains and the outcomes therein are not disconnected but can actually overlap. Although these frameworks are simplifications of the real world, i.e. the separated categorizations and linear flow of causal relations do not exactly represent events as they take place, they can be useful for determining measurable indicators (Wehn et al., 2021). We will elaborate on the relevant definitions of these frameworks before moving on to the research.

Outcome & Impact Indicators

Indicators for outcomes and impacts of CS are all different in terms of scale. It is possible to 'zoom out' from the level of a participant to the level of the universe, and indicators further differ in the time needed for change, and the level of complexity, developing from outputs to outcomes to impacts. This makes it even harder to create universal frameworks for evaluation and organization of indicators. However, for this research it is necessary to develop 'an' organization of possible indicators, which we will elaborate on next.

Indicators under the society domain concern both individual and societal changes in values, attitudes, knowledge, behavior and relationships. Phillips et al. (2018) have developed an elaborate framework for

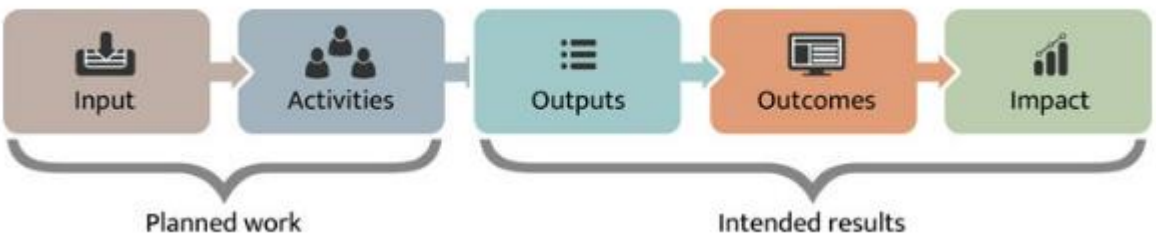

Figure 3: The logic model of evaluation. Adapted from Schaefer et al., (2021)

individual learning outcomes (ILOs) or CS participant-centered outcomes largely encompassing this domain. These outcomes include e.g. skills of science inquiry, knowledge of content or science, motivation, interest, self-efficacy and behavior. The domain further includes changes in societal relationships such as a participants' role in the community, or well-being of participants or the community.

Another set of indicators for outcomes of citizen science projects concern the environment and biodiversity, which have been discussed prominently in literature since many citizen science projects arose in this area of research (Peter et al., 2019). This domain is described by Wehn et al. (2021) as "impacts on the bio-chemical-physical environment, e.g., on the quality or quantity of specific natural resources or ecosystems." This domain includes, for example, improved ecosystems by increased conservation or environmental action.

Effects of citizen science on the production of knowledge or science and technology processes itself are grouped under the Science & Technology domain. These include, e.g., the way publications are made or new kinds of research questions being made. An outcome such as a better relationship between academia and non-scientific community encompasses this domain, but also touches on the society domain.

Another domain of outcomes is governance, which covers changes due to CS practice in processes and institutions that facilitate decisions, such as (public) policy, governance of data, and relationships or trust. Finally, the economy domain contains outcomes related to e.g. economic value such as the value of generated data, CS-related entrepreneurial activity or created jobs.

The Research

We conducted mixed-method interviews with the participants of DMR, aiming to answer both research questions with the interviewees themselves. Although it was completely outside the scope of this research to investigate the outcomes of DMR on all levels and within all domains, these topics were possibly of value to participants, or any outcomes experienced by the participants could indicate a starting point towards these larger-level outcomes or even impacts. Therefore, we include all of these indicators which might arise during the gathering of participant data, even though they might not affect the participants directly. We have used the framework from (Wehn et al., 2021) and that of (Phillips et al., 2018), to be able to map any outcomes that emerged from this study onto existent literature.

Ideally, the frameworks used in this study would mirror the outcomes that are provided by the participants of DMR. That would indicate that they are constructed and usable for the evaluation of CS projects with the participants' perspective in mind. Any outcomes of value to the participants of DMR that do not fit these frameworks might be interesting to pursue in further research, in order to propose adjustments to the frameworks or the definitions therein.

Furthermore, this study adds to the body of research on participant outcomes that uses bottom-up approaches. This is important to preserve the participants' perspective in evaluative studies aimed at changing future Citizen Science projects. We found that this approach does surface some outcomes that misalign with the frameworks as they are now. This has been proposed earlier in literature such as that of Peter, Diekötter, and Kremer (2019), who have reviewed studies that describe outcomes not directly applicable to the ILO framework of (Phillips et al., 2018).

Methods

Preparation

To answer the research question "What are the outcomes of the citizen science project Delft Meet Regen experienced by its participants from their perspective?" a number of approaches were considered. This study is backed and executed by PULSAQUA and the Science Center Delft from the TU Delft, two of the WaterLab associates. Aside from the goal to evaluate the outcomes of DMR from the participant's perspective, they intended to evaluate the outcomes of DMR comprehensively in order to communicate findings to stakeholders. These two goals drove the design of the research question and research method.

Data collection method

To be able to evaluate outcomes from the participant's perspective without projecting the existing view of the field on the participant, the research method was designed to be largely qualitative. Quantitative research such as surveys or closed interviews require the creation of pre-determined questions, which would have to contain the hypothesized outcomes (Mohajan, 2018). Qualitative methods are useful for exploratory research, such as obtaining the perspective of participants. To understand answers of participants about outcomes which are less commonly defined and require more time to explain, such as an increased sense of place (Haywood, 2014), a qualitative study is also more appropriate (Jensen & Laurie, 2016; Mohajan, 2018). For this reason it was decided to collect the data through qualitative interviews.

Participants

All participants of the DMR project were reached out to by mail. A few participants (n=2) replied via mail but the majority was recruited by calling a randomized list of the remaining participants. An amount of 10 to 20 interviewees were deemed realistic and recruitment stopped at an initial group of 16 participants (Table 2), who were provided with an information folder (Appendix IV). The first interview was held with a participant (Abby) who was a professional in CS and water management at the TU Delft, which was used as a test interview.

In total, 16 interviews were performed. The interviews took place at peoples home (n=12) or at the TU Delft (library) (n=3) or Leiden (n=1). The interview duration ranged from 25 to 75 minutes. This discrepancy in variance with the planned average of 45 minutes was mainly due to the difference in conciseness of interviewees, who differed greatly in being able to shortly state two outcomes and then stop, or philosophize lengthily about possible outcomes that they had experienced.

Table 2: Interviewees and their pseudonyms

Interview	Pseudonym	
1	*A*	*Abby*
2	B	Bob
3	C	Chris
4	D	Demi
5	E	Elisa
6	F	Fatima
7	G	George
8	H	Hayat
9	I	Irene
10	J	John
11	K	Klaus
12	L	Léon
13	M	Max
14	N	Naomi
15	O	Olga
16	P	Peter

Ethical issues and data management

A Data Management and Research Plan was created to anticipate the storage and management of data produced by the research, as well as specify the details of the research for ethical approval. These included the creation and signing of an Informed Consent Form (ICF) to inform participants of risks and purpose of the research. The collected data was numbered and when it was necessary to refer to a participant this was done by use of a pseudonym (Table 2). This plan was approved by the TU Delft Human Research Ethics Commission at the 23rd of March 2022.

Research design

Data was collected in the form of semi-structured interviews with an increasingly 'closed' approach, which resemble convergent interviews (Williams & Lewis, 2018). All interviews were conducted by the main researcher. The interviews were structured to contain three main parts: (1) Opening question and responses; (2) specifying and structuring questions and responses; and (3) framework mapping. These were sandwiched by the introduction with rapport building and the conclusion (Dick, 2017) (Figure 4). An interview guide was created to structure questions or reminders according to the convergent interview schedule (Appendix III).

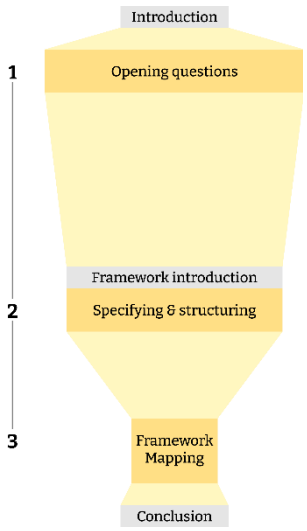

Figure 4: Outline of interview design. Adapted from Dick (2017)

At the start of each meeting, the ICF was read and signed by the participant and the researcher introduced the intent of the study as well as a global overview of the interview. The participants were then asked to introduce themselves shortly to the extent of their own comfort. This to obtain some context for coding purposes, while the provided information was not collected purposely.

Part 1: Opening question and discussion of outcomes

The researcher then asked the opening question, which was: 'Could you tell me in what ways participating to DMR has meant something according to you, as in what outcomes or results of the project did you experience?'. This approach aimed to ensure that initial answers provided by the interviewees containing outcomes of their participation are fully generated by their own experiences. The researcher alternated listening with asking non-content clarifying or probing questions to elaborate on the participants' answers (Dick, 2017). In this section of the first 10-40 minutes, the researcher noted down outcomes mentioned by the participant that can potentially be singled out.

When no other outcomes were mentioned by participants, the researcher mentioned the key aspects of the project such as the physical measurement of rain, the provided newsletters, forum and webinar to induce memories or associations. Every now and then, the participants had to be guided to the purpose of this study, away from technical feedback or topics irrelevant to the study. When no more or different outcomes were generated by asking questions to the participant, the researcher moved on to the next part.

Part 2: Framework introduction and elaborating on outcomes

A physical two-sided piece of cardboard was developed containing the discussed frameworks as visible in Figure 5. This cardboard was used to give a general introduction of frameworks that describe outcomes of citizen science projects and specifically these two by explaining the concepts that they portray. When the interviewee was familiar with the frameworks, they were asked if it made them think of other outcomes or experiences that they had. These were then discussed, and if these were actual outcomes experienced by the interviewee, they were written down as well. If the researcher had any uncertainties about the outcomes provided by the interviewee, or needed more information or specification, follow-up questions were asked. After the conclusion of this section, the researcher had a list of distinct outcomes that were used for part 3.

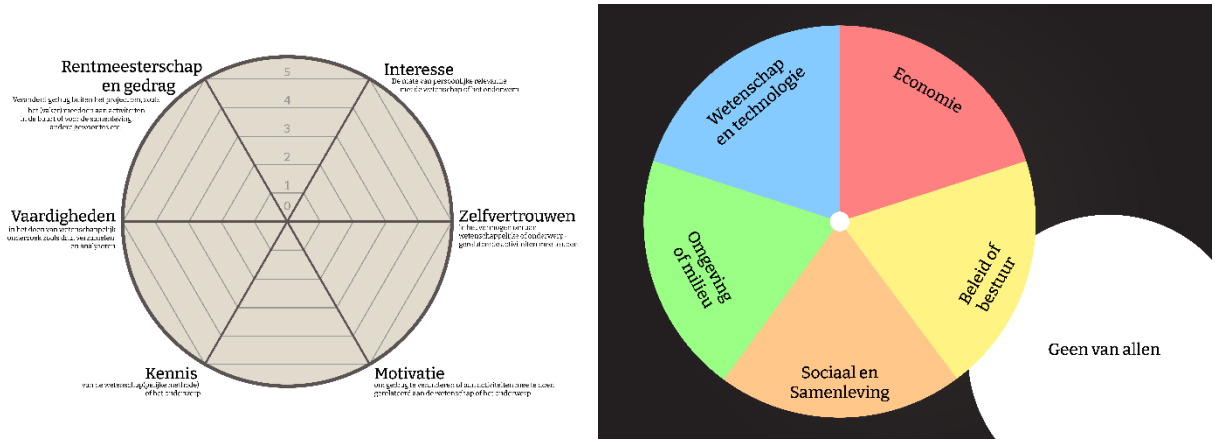

Figure 5: The two frameworks discussed in this study as designed on a cardboard for explanation of the framework and mapping of outcomes. (Left) ILO framework by Phillips et al. (2019). (Right) Impact domain framework by Wehn et al. (2021)

Part 3: Framework mapping and scoring

Subsequently, the researcher explained that the goal of this part was to map all of the discussed outcomes together with the interviewees within the frameworks on the board. This compelled the interviewees to make decisions regarding the outcomes that they experienced, and generated a map of distinct outcomes as experienced by the participants. For each of the discussed outcomes the interviewee was asked in what category or categories the interviewee would place it.

For the ILO framework, the interviewee assigned to a maximum of 5 points for the extent to which an outcome fitted a category (Phillips et al., 2018). The framework of Wehn et al. (2021) was used to classify any domains in which an outcome had impact according to the interviewee. A 'none' zone was added outside of the framework to give the participant the option of not picking a domain. For each listed outcome, the scores per ILO category and which domains were noted. This part provided the interviewees with the possibility of clarifying why they thought certain outcomes would fit a category, thereby again preserving some of the participants' perspective in the method.

Analysis and coding

The interviews and analysis would result in three types of data. Each interview resulted in a set of outcomes with the interviewees' scores and categorizations and a recording. Aside from the noted outcomes, the recordings were analyzed by the use of coding using ATLAS.ti. This would result in another set of outcomes generated from the interviews' content. Finally, the resulting outcomes were aligned with the frameworks by the researcher to obtain any outcomes not included in the frameworks from the researchers' perspective.

To have a starting point for coding, a primary codebook was constructed using the definitions of outcomes of the ILO and Impact domain frameworks as codes (Appendix I). This was done beforehand, during the interview period and preparation for the analysis. This primary codebook provided some initial categories to be able to place codes in, and as background information for the researcher to be able to start coding round 1.

Coding round 1

A first round of coding was performed on all interviews, to obtain a set of codes containing primary information about the content of the interviews. These were mainly descriptive and less analytical, but were already based on a small level of background knowledge of the existing codebook used for deductive coding. This round of coding was performed on unpolished transcriptions and audio recordings for clarification, to obtain a preliminary image of the data early in the research. This inductive start of the analysis ensured that the codes made are true to the data (Skjott Linneberg & Korsgaard, 2019).

Coding round 2

After this first round of coding, the resulting codes (n=~140) were again scanned for their meaning and placed in categories based on the codes in the primary codebook. A non-applicable (N/A) category was added for each of the codes that required more thought or were not easily to categorize. By doing this, any codes representing outcomes that were directly applicable to any categories within the framework were isolated, after which further investigation of any new or ambiguous codes was possible. The codes in the N/A category were compressed when possible to form the final codebook (Appendix II) (n =~ 27). This compression was done by looking for codes that overlapped, were not relevant to the research question, or by creating a separate category for remarks that are useful to the project organizers but not for this research. Comments on the mergers or decisions of this process were saved and kept to preserve any necessary justifications.

The coding rounds resulted in a final codebook of the outcomes obtained from the interviews (Table 3). The number of interviews in which a code was mentioned by the participants, or occurrence, was counted as a variable and added. The frameworks of the codes that were already categorized were also added in another table (Table 4) to be able to see which codes (and therefore outcomes) could be used to give insight into their alignment with the frameworks.

Inter-coding agreement

In line with (Jensen and Laurie 2016), 10% of quotations (21 out of 208) were randomly selected using the Random function in Excel and prepared in a document for second coding by another researcher. An intercoder agreement of 57% was calculated. The coding agreement increased to 66,7% when the codes were ‘simplified’ by compression of the codebook into the main codes without subcodes.

Results

The outcomes

In Table 3, the final codebook resulting from the coding process described before is shown, containing their occurrence or the number of interviews that they were mentioned in. In the following section, I will discuss each outcome and support it with direct quotes from the interviews, in order to get a representation of the outcomes that participants have experienced. With this, the first research question is largely answered.

Table 3: The final codebook constructed after two rounds of coding. For further explanation of the code titles, see Appendix II. Green shade represents the occurrence of each code, the amount of interviews the code was present in. Darkest shade = fourteen interviews, white = one of the interviews.

Code	Code name	Occurrence (n/15 interviews)
1	Contributing data …	14
1.1	to science or knowledge in general	13
1.2	for the climate	4
1.3	to return the favor	1
1.4	out of altruïsm	5
2	Project as embodiment of already existing stewardship	8
2.1	Increased by participation	6
2.2	Not increased by participation	2
3	Social aspects such as...	9
3.1	Interactions about the project	7
3.2	Education	3
4	Awareness…	11
4.1	of rainfall or the weather in general	11
5	Knowledge of..	13
	Science	**12**
5.01	Measuring rain	5
5.2	Science	3
5.3	Citizen Science	2
5.4	Watermanagement	5
	Subject/content knowledge	**12**
5.5	The value of water	2
5.6	How to contribute	2
5.7	The larger picture and rain variability	7
5.8	Indifferent	5
5.9	Incompetent	4
6	Motivation to…	6
6.1	Participate again or more deeply	4
6.2	Change behavior	4
7	Confidence to…	2
7.1	Write a paper	1
7.2	Work with the technology	1
8	Interest…	4
8.1	Reading more about the subject	4
9	Framework remarks	4
9.1	Holistic	4
10	Behavior	3
10.1	Learned a habit	3
	Other codes	
11.1	Connection	2
11.2	Cooperation involved instutions	1
11.3	Suggestion for further research	1
11.4	Experience is fun to do	6

Contributing data

One of the more prominent outcomes mentioned by the participants of DMR was that they had contributed data. This feeling of contributing was mentioned by 14 out of the 15 participants during the interviews. As long as the collection of data is not too much effort, their common view seems to be 'why not?' and to be able to contribute just a small part to be part of a bigger whole was a returning topic:

> *Well, the fact that you think, oh well, I am just one of the 100.000 inhabitants of Delft so I won't have that much influence. But by doing one's tiny bit, apparently, together we do have influence. (John)*

> *Well, it's just… A nice feeling to participate to something that is larger than me. That you are contributing to something, that is something that this has yielded. (Elisa)*

The reasons why this contribution seemed valuable for the participants differed, varying from contributing for science, the climate or out of altruism. Science was the foremost driver behind this feeling of having contributed, with 13 out of 15 participants mentioning it:

> *It is fun to contribute to science. And yeah, this is something that is not hard. It is a contribution that doesn't cost me anything, except for a bit of time and effort. So I might as well do it, right? (Max)*

> *Every research project that contributes to better insight is valuable. So if I can contribute a small part to that, then I will do that with content. (. . .) It gives me a good feeling. A little bit, but yeah, it gives me a good feeling to be able to contribute to that. (Irene)*

Five out of the 15 participants talked about contributing to do something for other people.

> *Actually you are doing it for the people who are asking for it, I mean, I don't have that much to gain from it. Apart from that I liked doing it. (Demi)*

The topic of the citizen science project was discussed as a reason for contributing in four interviews, where the participants did mention science but rather as a pathway towards helping the climate:

> *Well, I think it's important to participate to such a thing. Because somebody has to do it. I am not sure what they are eventually able to do with it [the data], but it would be nice if somebody in science can do something more with it to get some extra insight into the climate and those kinds of things. Yes, especially for the climate I think. And that society will become a bit more aware of the mechanics of the weather and stuff. (Hayat)*

And one person was a scientist himself, who also liked to return the favor to other scientists, which could be altruistic but can be regarded as a bit more transactional:

> *You know, I use data that other people gather. So yeah, you know, for me it's similar to Google, or the data of Google Maps and locations, where you share your data and you go somewhere and you know whether it's open and it's closed. That depends on somebody else actually having done something. (Klaus)*

Awareness

An outcome brought up by 11 out of 15 participants which regarded some personal change was an increased awareness of rain or the weather. This could also be defined as mindfulness, cognizance or perception of rainfall.

> *Definitely, I did not know anything about it, (. . .) But now for example, it hasn't rained for a while and I would never expect it to not rain for three weeks around this time. But now that really strikes me, that that happens a lot. (. . .) And then I think oh but that [1m² of rain] actually is a lot, but this absolutely was not the world as I would look at it, and now I see (. . .) how much rain does or does not fall. That [outcome] alone is very interesting to me. You are more aware now. (Bob)*

One participant suggested that the regular aspect of measuring rain everyday could contribute to this:

> *Because you are tending the rain meter daily, you get a much more improved feeling of what is really happening. Regarding the climate. Normally you think 'oh now it's raining really hard' but afterwards you easily forget. But because you empty the meter every day, loyally, well… if you empty it every day that is a completely different habit. And I hope that that is a realization that other people who participated have as well. (Elisa)*

This effect also makes people think about the rainfall by placing it in the context of what is normal: *'And sometimes it hasn't rained for such a long time that I start wondering if that is normal. Now for example, it has been raining a lot for a long time that I start thinking about if that is normal or not. (Hayat)'* and seven out of the 11 participants said that the effect was still active during the time of the interview, 5-6 months after the project.

Knowledge

An outcome that is widely desired and described in the evaluation of citizen science projects that also emerged during the interviews was knowledge. During coding, it became clear that it was possible to divide the types of knowledge into two main themes: knowledge of the subject or content of the project, and knowledge of science or policy around the project. This can be further defined as knowledge of that what is studied, i.e. rain and weather variability, and the method with which it is studied or managed, e.g. citizen science or taking rain measurements. This division was mirrored from Phillips et al. (2018), although they included a third type of knowledge, that of the Nature of Science. This Nature of Science is defined as the understanding of certain key ways of thinking within science. No clear accounts of this type were talked about in the interviews of this study and it was therefore omitted.

Knowledge can mean knowing something of many different subjects, but altogether 13 out of 15 interviewees mentioned gaining some kind of knowledge. Seven out of fifteen talked about learning something about the research subject: *'What I understood from the webinar was that it [rainfall] can be very different locally. I thought that was an interesting conclusion from the research.' (Fatima).* An interesting result is that more people (5/15) mentioned learning about watermanagement and policy related institutions or people in the municipality, than for example science (3/15) or the value of water (2/15):

> *Well, I was at the information evening until the end and that was quite interesting. Someone was present who manages the sewage for the municipality, and then I thought, oh yeah, that is of course interesting information for those people as well. And you hope that something will happen with that. (Elisa)*

'A second thing was that I had never realized that so few measurements were being made in the Netherlands, and that around here only in Rotterdam there's a professional rain measurement device.' (Peter)

5 out of the 15 people also mentioned learning some technical or methodical knowledge of measuring rain yourself:

For example, I didn't know what measuring 1 millimeter of rain even meant. (. . .) So I looked it up, and apparently that is one liter on 1m², and I was thinking that that is quite a lot and something which I never paid attention to. (Bob)

Something I also noticed, is that when it drizzled I thought it had rained but I wasn't able to see anything in the meter, probably because of evaporation. However the soil did get wet, so you'd think that the plants had at least some profit. (. . .) So I noted that although it rained you aren't able to measure it – Uhm… [Acted like, what to do with that?] (Chris)

Some remarks were made during the interviews which were also interesting for the organization of citizen science projects, as the participants learned about citizen science as a possible solution for these kind of problems. They seemed to previously have been skeptical about analogue measuring of rain by hand.

What was interesting as well, was that the collected data was actually quite similar to the machine-collected data. So eventually, if we're with plenty of ants, then that will be sufficient. (Elisa)

And that gave me the idea that citizen science can indeed be a good method of observation. To disperse the collection of observation broadly. And otherwise that wouldn't have been known as I understood from the researchers. (Fatima)

Stewardship

A form of stewardship was mentioned by 8 out of 15 interviewees, who mentioned that participation to the project was rather a part of their already existing stewardship or environmental citizenship. 6 out 15 said their level of stewardship was increased by participation, for example by reinforcing the urgency of the topic in daily life:

Well to be honest it [participation to the project] did not really provide a new measure [for rain management]. The urgency was already present, that it is important to try not to further heat up the earth and be sparse with our rainwater. But it has been increased, yes. (John)

I already always did my best, so to speak. But it could have increased a bit by participation to such a project. (Irene)

While two others mentioned that it is the other way around:

I was already busy with awareness of our usage of water and those kind of thing. You could rather say that it is turned around, because of that I was interested in this project. (. . .) In my case, I already wanted to [get a rain barrel] and I was interested in contributing to what could be the result of better insight in rainfall. (. . .) My participation was more of an expansion, a part of, or extension of that. (Elisa)

Social

A social aspect surfaced which regarded sharing the experience of the project or its information with other people (8/15). Seven participants mentioned just talking to other people about it, including colleagues, neighbors (who saw the rain meter) or family, and three said they used the project for 'educational' purposes such as their children (2/15) or high school students (1/15).

> *Because such a device [automatic rain meter] rises many questions with other people, so I had increased contact with my neighbors. They all came asking what it was, why it was there and how long it would last. (. . .) Though that was more prominent in the beginning, when I first put that thing there. (Max)*

> *So I was doing it [emptying the rain meter] with my oldest daughter. To do it together and explain to her why and what were we doing. (. . .) Well, she was three years so very small, so for her it's more like a game. But she perfectly understands it, you know, that it's the rain that is in there. (Klaus)*

> *And personally, for me, because I was involved in this [project] and receive some e-mails every now and then, that is something that I can pass on to my students, to show how they can be a bit more involved as well. (. . .) Especially the participation of the project itself gives you some information to be able to pass on to students. (Olga)*

Other outcomes

Some outcomes were less prevalent in the interviews and were just mentioned by one or two people. However, they are worth mentioning. Although it might seem like a trivial outcome, 6 out of 15 people said that 'it was fun to do', which is important for the organization of citizen science projects nevertheless.

Only two people mentioned it gave them a feeling of connection or engagement with Delft or the world.

> *Measuring rain is not something done only in Delft, but also on other places in the world where they have different problems with rain. And yes, that is rather nice to see that they do these projects in more or less the same way. (. . .) So that gives me a bit of connection, although that doesn't mean a thing, but still. It does feel that way … that you are part of a larger whole. (Naomi)*

> *Well I think it is a bit of engagement. It gives me the feeling that I am a bit more engaged with what happens in Delft, a bit of connection with the city so to speak. (. . .) Because I am relatively new in town. Most people have already settled right, so something like this is a lot of fun to get a bit more connection. (Olga)*

One person noticed that because of this project, some people active in water management were reconnected as an outcome:

> *There were some people who knew each other, from the municipality and the district water boards, and they vaguely knew that they did something with the groundwater level and rain measurements. But they had never spoken to each other in detail about that before. So I liked to see that because of such a project, with just a plastic thing in your garden, this kind of knowledge surfaces! (Peter)*

Two types of outcomes related to motivation were present in the interviewees' answers. Some (6/15) mentioned that by participating they gained motivation to join this or another project again, or with more

enthusiasm. The motivation to change behavior due to the project was mentioned by 4 out of 15 participants as well.

> *I think that if I join again, that I would go to the forum because I would like to see that. But last year that didn't really happen and I held off the boat a bit. But it could just be that the first time takes some getting used to. (Demi)*

> *You dwell on it a bit more, regarding the weather and of course climate and rain. So you think 'oh I should really… ensure that I can make the rain flow away and those kind of thinks. So yeah, that is what it has achieved. (Hayat)*

This motivation to change behavior could result in a change of behavior, and four interviewees have said that they gained a new habit since the project:

> *Actually I did [change behavior], because I left it [rain meter] in the garden and still enjoy doing it, so I have gained a new habit. Every Sunday I measure, so that's in my head now, whether it rained or not. (Bob)*

Furthermore, four participants started reading or looking up information about rain (management) because of the project, which was coded as interest but relates to motivation as well: '*Because of this project I have been looking into what drought does with our country and the soil, just a little bit more in-depth. (John)*

And finally, one interesting topic is that of self-confidence or self-efficacy raised by two of the interviewees. Although they stood alone in their viewpoints, they did form unique cases. Elisa was also involved in the creation of a scientific paper about the project in 2020, which continued well into 2021:

> *I would have to think about what changed … well with writing that paper, that really changed. So without this project I would not have participated to that, or it wouldn't even have crossed my path. And only then I realized oh but I would actually like doing that. That has some skill to it, but not really because I'm just reading along, which I can do with other pieces. (. . .) But that really entails the confidence to join doing that. (Elisa)*

And although learning skills such as technical practicalities was not often mentioned as an outcome of this project, one participant did mention that she overcame her insecurity of joining the project:

> Well at first I was a bit insecure about working with this app and participating to such a project. As in [I was thinking] am I doing it right, is that meter placed correctly? Did I enter the right time? and all of those factors. (. . .) So it has lowered the threshold for participation, because we work a lot with apps and technology, but I have to say I have a somewhat healthy distrust for all of the privacy dangers and such. (John)

Alignment with frameworks and literature

In Table 4, the outcome groups are shown without their subcodes linked with the outcome (category) of the frameworks that resulted from the coding process, representing the researchers' perspective. A large number of codes were applicable to the Society domain of Wehn et al. (2021), including those that fit the ILO framework, and are therefore color-coded red. This represents the researchers' perspective on the alignment of generated outcomes with the frameworks.

After the collection of outcomes in part I and II of the interview, the participants were asked to fit the discussed outcomes in the provided frameworks in part III. These scores were kept, but after initial discussion about analysis of the data, it became clear that statistical analysis would be hard to pursue. The data of the Impact domain framework was too vague to be able to show in a clear manner, which largely boils down to the more indirect, larger-level nature of these impact categories which proved difficult for participants to connect with their reported outcomes. See the discussion for further notes on this.

The outcomes discussed and noted during the interviews differed in number from the outcomes derived from the previous conversation as described above. The scores of these outcomes were adjusted to either picking the category (1) or not (0), after which it was possible for each outcome to count the amount of times an interviewees picked a category for that outcome. Only the three most prominent or distinctive (meaning they were clearly stated and thus noted during the interview) outcomes have more than three mentions in the interviews, and these are shown in a collection of graphs below. Some of the outcomes were not applicable to any category according to the interviewee, resulting in a 0 for each framework category, representing the difficulty of the interviewee in picking a category which is further elaborated on in the discussion.

Table 4: The main codes (without subcodes) with their respective connection to an outcome from the discussed frameworks as analyzed by the researcher (Framework references between brackets. For simplification, all lightred colored codes are connected to the Society domain of Wehn et al. (2021). (*) This outcome is connected to, but does not perfectly fit the suggested outcome, as discussed further on in the report. Also shown is the occurrence or the number of interviews in which a code was mentioned by the participants.

Code	Code name	Occurrence (n/15 interviews)	Connection with outcome (Reference of framework or evaluation)
1	Contributing data …	14	
2	Project as embodiment of already existing stewardship	8	
3	Social aspects such as…	9	
4	Awareness…	11	*Interest or Knowledge (Phillips et al. 2018) **
5	Knowledge of..	13	Knowledge (Phillips et al. 2018)
6	Motivation to…	6	Motivation (Phillips et al. 2018)
7	Confidence to…	2	Self-efficacy (Phillips et al. 2018)
8	Interest…	4	Interest (Phillips et al. 2018)
10	Behavior	3	Behavior & Stewardship (Phillips et al. 2018)
11	Other codes		-
11.1	*Connection*	*2*	
11.2	*Cooperation involved instutions*	*1*	*Governance (When et al. 2021)*
11.3	*Suggestion for further research*	*1*	*Science & Technology (Wehn et al. 2021)*
11.4	*Experience is fun to do*	*6*	

Participant's perspective of aligning outcomes with frameworks

I include the following graphs as a representation of the outcomes that were most prominently discussed and scored during the interview, Contributing data, Awareness of rainfall and knowledge.

Contributing data

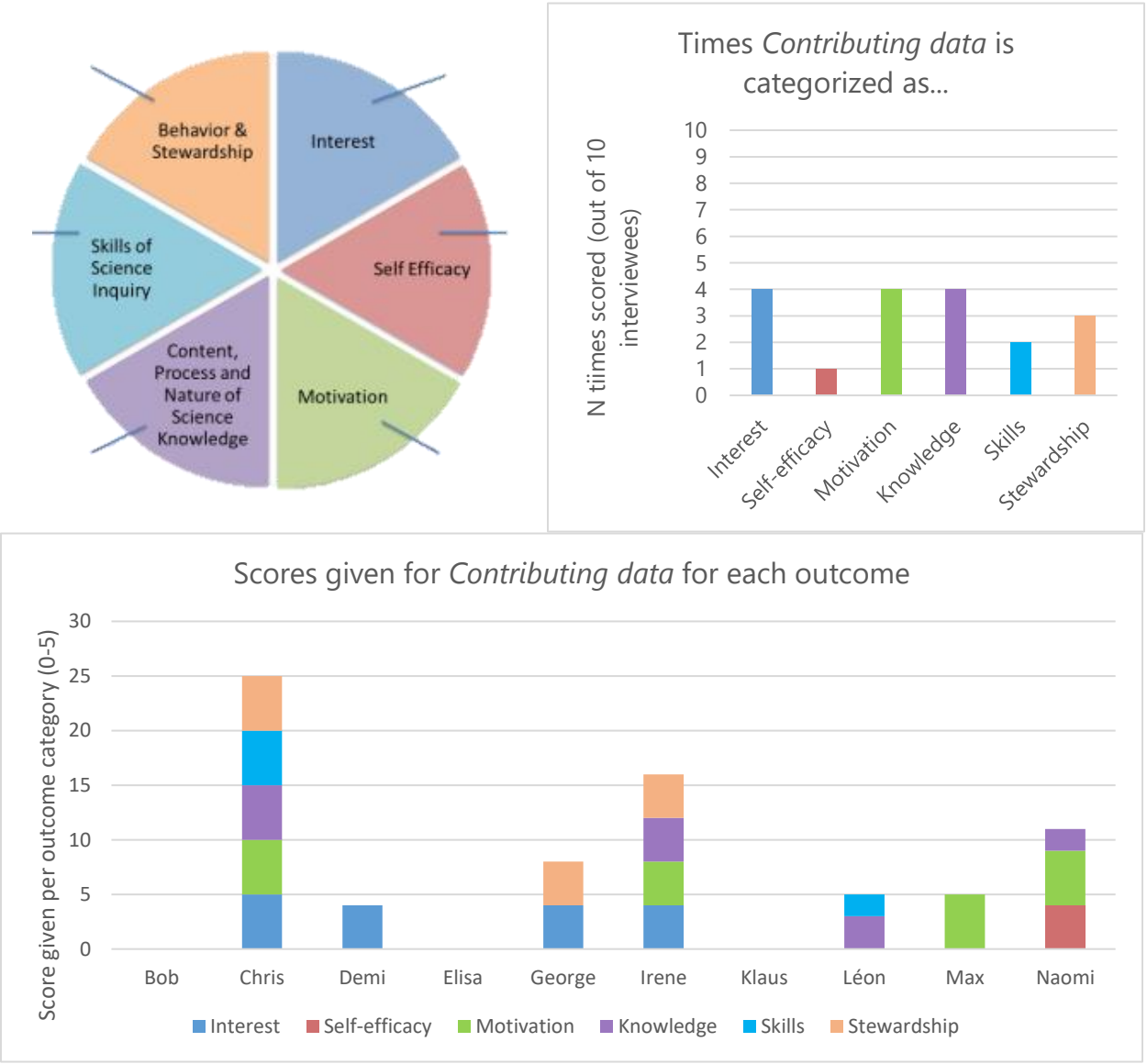

Figure 6: Data of the alignment of outcomes mentioned by the interviewees and the frameworks during the interview. (Top left) A visual of the ILO framework from Phillips et al. (2018). (Top right) The number of times that the interviewees picked a category of the ILO framework for the outcome 'Contributing data'. (Bottom) Distribution of scores for the outcome 'Contributing data' over the categories of the ILO framework, for each interviewee.

Awareness of rainfall

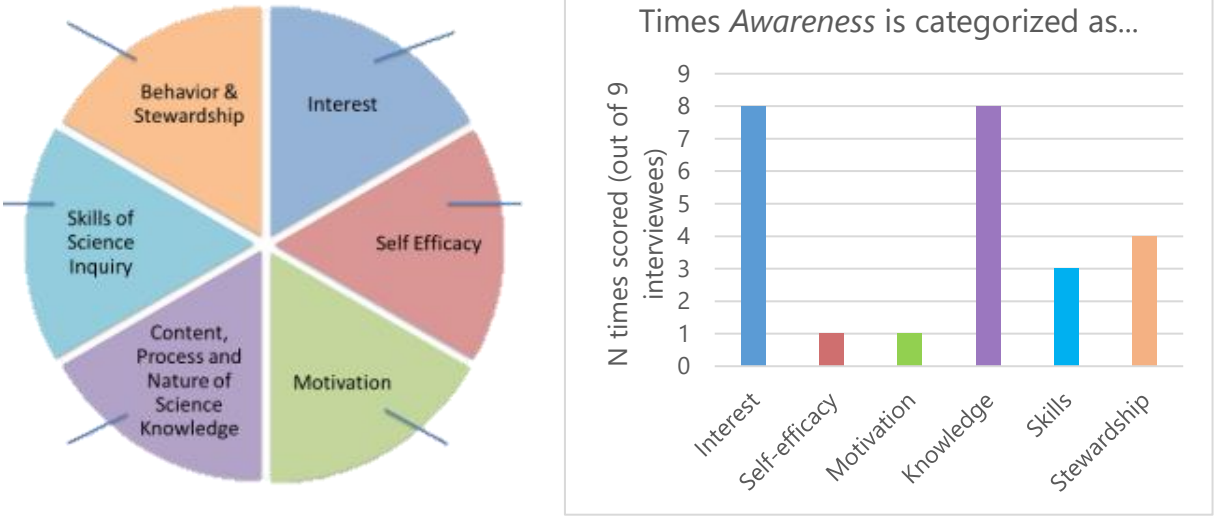

Figure 7: Data of the alignment of outcomes mentioned by the interviewees and the frameworks during the interview. (Top left) A visual of the ILO framework from Phillips et al. (2018). (Top right) The number of times that the interviewees picked a category of the ILO framework for the outcome 'Awareness of rainfall. (Bottom) Distribution of scores for the outcome 'Awareness of rainfall' over the categories of the ILO framework, for each interviewee.

Knowledge

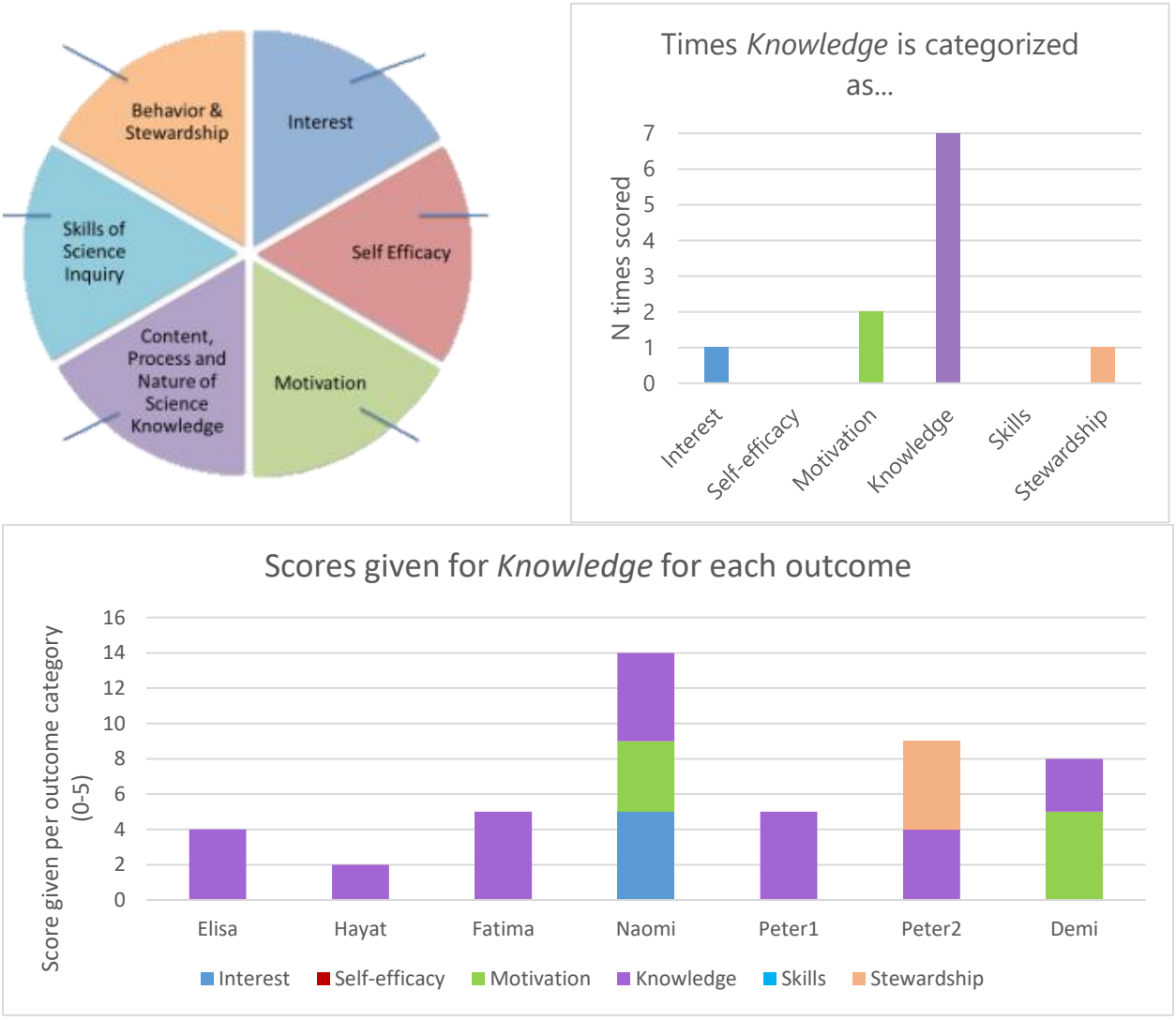

Figure 8: Data of the alignment of outcomes mentioned by the interviewees and the frameworks during the interview. (Top left) A visual of the ILO framework from Phillips et al. (2018). (Top right) The number of times that the interviewees picked a category of the ILO framework for the outcome 'Knowledge. (Bottom) Distribution of scores for the outcome 'Knowledge' over the categories of the ILO framework, for each interviewee. Peter mentioned two types of knowledge, that of rain variation (1) and that of watermanagement,(2) and is therefore present twice.

Discussion

In the following section, I will try to answer the original research questions with which we set out to evaluate the DMR project:

What are the outcomes of the citizen science project Delft Meet Regen experienced by its participants from their perspective?

1. What outcomes have participants of DMR experienced during and after the project?
2. How do the experienced outcomes of the participants of DMR align to known outcomes of citizen science projects?

Experienced outcomes from the participants' perspective

To answer the first question 1.1 'What outcomes have participants of DMR experienced during and after the project?', the summarization of coded outcomes and their occurrence in Table 3 gives some insight in the outcomes obtained through the method used in this study. The most prominent outcomes that participants have experienced are the feeling of contribution and the role of the project as an embodiment of their stewardship, as well as some gains in rain related awareness or knowledge and a (temporary) increase in social interaction.

In the survey performed before the project in 2021 (n=56), 47,7% of the respondents chose 'contributing to scientific research' as the reason for participation. However, that year the question was framed as a single select multiple-choice question, and the year before when the question was multi select this percentage was 86%. Our more qualitative study seems to adhere to those numbers with 13/15 (86,7% for comparison) interviewees saying that their feeling of contribution to specifically science was an experienced outcome.

Furthermore, 20,3% of the respondents said they wanted to learn more about the content of the project which was countering issues with water, flooding or droughts in the backyard or environment. This more or less corresponds to the 2/15 (13,3%) of interviewees who talked about having learned this. The amount of respondents of the survey performed after the project in 2021 who said they gained knowledge about rainfall, issues with water and/or droughts was 49,9%. However in the subsequent explanation it seemed that 22,2% was talking more about the awareness of rainfall, which is an outcome also obtained in the interviews of this research project which is discussed further on. In this study, 7/15 (46,7%) interviewees said they had gained knowledge of content such as the water and drought related topics. Taken together, it seems like half of the participants to DMR think they have gained content knowledge.

A third question in the survey after DMR asked the participants whether they were now planning to take measurements against water or drought issues, which resulted in 18% of the respondents saying that after their participation they now want to make changes. Another 34% of respondent stated that they already did so beforehand, and 30% did not know for sure. Again, the results of this study seem to align with these figures, as 4/15 (26,7%) of the interviewees have mentioned thinking about changing something in their behavior, i.e. taking some measurements against water or drought issues. The 34% who said that they already did so beforehand in the survey, might be a part of the same interviewees who said that participating to DMR was part of their already existing stewardship, however the (privacy) logistics of these separate evaluations did not allow for any further investigation to take place. Overall, it seems that the survey aligns with our study but is a less explorative method of investigation.

Alignment within the existing literature and frameworks regarding Citizen Science outcomes

By doing semi-structured convergent interviews, we aimed to obtain the outcomes from the participant's perspective without relying on the existing literature on and frameworks of outcomes. In this section, I will aggregate the obtained outcomes and do the opposite, by trying to fit them into the explored field and frameworks of Citizen Science evaluation. In this process we aim to give the researchers perspective on answering question 'How do the experienced outcomes of the participants of DMR align to known outcomes of citizen science projects?'.

In Table 4, the outcomes obtained in this study are supplemented by the definitions of certain outcomes of the previously discussed frameworks which I have connected them to, which I will elaborate on after. The majority of outcomes mentioned by the interviewees could be aligned to Individual Learning Outcomes, or outcomes on the personal level of participants, and the Impact domain frameworks. Participant outcomes are different from general outcomes such as scientific (knowledge) or socio-ecological and economic outcomes (Kieslinger et al., 2018), of which only one has been mentioned by an interviewee – the observation of increased contact between people active in water management.

Similar to the review of participant outcomes of CS projects by Peter, Diekötter, and Kremer (2019), we have found some participant outcomes that do not or not perfectly fit the framework developed by Phillips et al. (2018). They found that a sense of contribution or enjoyment and a sense of connection to nature or other participants were investigated by the reviewed projects but difficult to fit in. We will discuss the outcomes obtained in this study unaligned with the ILO framework (Table 5) and provide alternative frameworks and outcomes from literature that align with these to be able to formulate any considerations about the framework.

Table 5: The main codes (without subcodes) with their respective connection to an outcome from the discussed frameworks as analyzed by the researcher (Framework references between brackets. For simplification, all (light)red colored codes are connected to the Society domain of Wehn et al. (2021). (*) This outcome is connected to, but does not perfectly fit the suggested outcome, as discussed further on in the report. Also shown is the occurrence or the number of interviews in which a code was mentioned by the participants.

Code	Code name	Occurrence (n/15 interviews)	Connection with outcome (Reference of framework or evaluation)
1	Contributing data …	14	Sense of satisfaction and contributing (Haywood 2014)
2	Project as embodiment of already existing stewardship	8	*Self-expression (McAteer, Flannery, and Murtagh, 2021) **
3	Social aspects such as…	9	Society (Wehn et al. 2021)
4	Awareness…	11	Awareness and appreciation (Haywood et al. 2016) Appreciation of nature (Peter et al. 2019) Sense of connection to nature (Peter et al. 2019) *Interest or Knowledge (Phillips et al. 2018)**
5	Knowledge of..	13	Knowledge (Phillips et al. 2018)
6	Motivation to…	6	Motivation (Phillips et al. 2018)
7	Confidence to…	2	Self-efficacy (Phillips et al. 2018)
8	Interest…	4	Interest (Phillips et al. 2018)
10	Behavior	3	Behavior & Stewardship (Phillips et al. 2018)
11	Other codes		-
11.1	*Connection*	*2*	*Sense of Place (Haywood 2014)* *Sense of belonging (Peter et al. 2019)*
11.2	*Cooperation involved instutions*	*1*	*Governance (When et al. 2021)*
11.3	*Suggestion for further research*	*1*	*Science & Technology (Wehn et al. 2021)*
11.4	*Experience is fun to do*	*6*	*Enjoyment (Sickler et al. 2014)**

Raised awareness of rain

One important outcome stated by the participants after the opening question was their heightened awareness or perceptibility of rainfall (Table 5, code 4). This awareness is different than other definitions of awareness in the context of how someone's behavior has an effect on the world. It does have some alignment with increased knowledge of or interest in the subject of the project, rainfall, and seems to be most aligned with interest as defined by Phillips et al. (2018): 'the degree to which an individual assign personal relevance to a science or environmental topic or endeavor.' However, increased awareness of rainfall (quantities) is different than increased interest in the topic of rain. Only four participants mentioned having increased interest in rainfall in the context of reading and learning more about it (Table 5, code 8).

It can also be discerned from knowledge of science content which are facts or concepts as defined in that framework. For example, the remark how much one millimeter of rain in the meter actually represents in real life, or how rainfall varies within Delft. To put it this way, interest in rain is heightened, but because you have more knowledge about the quantities of rain you are more prone to be aware of it. This reasoning seems to reflect the results when asked to the participants if this outcome fits in the ILO framework (Figure 7), with interest and knowledge being the most picked of all categories.

This outcome is very similar to the *Greater Awareness and Appreciation* described by Haywood (2016). They also argue that a heightened awareness is not necessarily the same as increased understanding, and categorize this outcome differently than a heightened connection to nature. These outcomes, among others, have been placed under changes in attitude by (Chase et al., 2018), who found that half of their reviewed participants noticed a change in their attitude towards the resource being monitored. (Phillips et al., 2018) say that their outcome category of *Interest* is relatable to, but distinct from the umbrella term attitude, encompassing appreciation as well. Therefore, they specifically say that the outcome we found does not fit in their framework, as confirmed by (Peter et al., 2019).

Although one interviewee mentioned that it might be more useful to reach participants who are not already interested in rain, the fact that this outcome is so prominent could indicate that the majority of DMR participants did gain rainfall awareness from their participation to the project.

Knowledge

The outcome of having gained knowledge is one that was easily applicable to the ILO framework, but some notes are worth mentioning. Phillips et al. (2018) combine knowledge of the subject (content), the process of science and the nature of science (NOS) into the knowledge category. In this research, knowledge of NOS and science in the context of water management was separated from knowledge of the subject. Participants mentioned gaining science knowledge such as the method of measuring rain, science, water management policy and Citizen Science.

Furthermore, the interviewees mentioned knowledge of weather and rainfall (variability), the value of water and how to contribute to the environment. The different topics in the knowledge category were very fragmented. It remains important to consider that this research is a qualitative study towards the participant's perspective of outcomes, and the fact that interviewees do not mention gaining knowledge does not mean that they have not gained knowledge. Merely, that this was not a prominently experienced outcome of participation at the time of the interview. This could indicate that self-reported gains in knowledge depend on the pre-existing knowledge or interest of the participant, which we discuss later on.

The feeling of contributing

At first, contributing data seemed like an obvious outcome of participating to a project in which you collect data. However, since such a large amount of interviewees talked about it in the 'open' first section of the interview, from the participants' perspective this seems to be an important outcome. Some interviewees said that they hoped that something good happened with their data. Contributing gave some interviewees a good feeling or a feeling of usefulness, but for others it could be part of their environmental citizenship (Jørgensen & Jørgensen, 2021) for whom the reason of contributing was more for the climate or out of altruism than for science.

To have gained the feeling of having contributed is difficult to fit in original outcome frameworks. For example, the discussed ILO framework defines stewardship & behavior as measureable actions, which excludes feelings. This outcome is similar to the *sense of satisfaction and contribution* described by Haywood (2016). It might also relate to a sense of enjoyment, an outcome which some participants mentioned, since the contribution can add to the enjoyment as also described by (Sickler et al., 2014).

When the participants were asked where to place this outcome in the ILO framework, a variety of categories were picked and there appears to be no clear consensus (Figure 6), with three out of 10 not even picking any of the outcome categories. The participants seem to have the same issue with fitting this outcome in the framework as we do.

Project as part of stewardship

It was interesting to note that some interviewees were eager to stress that already before the project they were 'environmental citizens' to a certain degree. Differently put, that they already had stewardship, defined similarly to Phillips et al. (2018) as awareness of your behavior in the environment. Since their definition of the ILO category Behavior & stewardship requires measurable behavior, this observed outcome cannot be aligned with their framework. When asked if the project contributed to the level of this stewardship, some say it helps reinforcing it, while others think it is the other way around and the project is a part of stewardship.

This could mean that participation to the project was an embodiment of the participants' existing stewardship, further contributing to a feeling of satisfaction similar to the outcome discussed previously. However, this outcome diverges from that feeling because it does not only mean contributing through participation, but actively thinking (and doing) outside of the project as well. Since the majority of interviewees who mentioned this outcome said that their stewardship had improved because of the project, this can count as a separate outcome altogether.

It seems that the reasons for participating are a factor in which outcomes the participants experience, and these are thus important for the way this fulfillment (Feeling of contribution) or embodiment (Part of stewardship) feels. McAteer, Flannery, and Murtagh (2021) have linked participants' motivations to outcomes, and they characterize types of CS participants in *Conservationists*, *Hobbyists*, *Professionals* and *Activists*. They place the wish to contribute to scientific knowledge under an 'egotistical' drive of *Conservationists* and *Hobbyists*, similar to wanting to spend time with nature, or expanding personal knowledge and skills. They found that these types of participants view projects like these as a way of self-expression, which may overlap with the outcome that the interviewees see this project as a part of their already existing stewardship.

The *Conservationists* and *Activists* characterized in McAteer, Flannery, and Murtagh (2021) are different from *Hobbyists* and *Professionals* in that they see beyond purely technical science and value the ultimate knowledge produced by the project for e.g. environmental reasons. It could be that people who feel good by contributing data but did not mention having stewardship are more likely to fall in the second group than the first. The different focus points of participation mentioned by the interviewees on just gathering data for the sake of science, or wanting to improve rain and water management in Delft or in general could also reflect these characterizations.

It might be interesting to investigate if the nature of DMR as a mostly 'contributory' project (participants are asked by scientists to collect and contribute data and/or samples, Shirk et al. 2012) means that the participants are more likely to be *Hobbyists* or *Professionals*. The participants who are contributing more to the project than just the collection of data, which is the more 'collaborative' side of the project (participants assist scientists in developing a study and collecting and analyzing data for shared research goals), might be prone to have more activist or conservationist attitudes.

Social

A number of times, participants mentioned talking to other people about the project and what they were doing. Although in the Individual Learning Outcome framework by Phillips et al. (2018) a social aspect was only discussed as motivation for participation to a CS project, in the Society outcome domain described by Wehn et al. (2021) they include changes in relationships and community dynamics. Although many of the examples that the interviewees gave of social interaction were just during the project itself, the fact that it is stated as an outcome might indicate that from their perspective these moments of increased contact were valuable. Even on a small scale, their enthusiasm or learning outcomes of the project can be spread through such moments. The interviewees who explicitly stated that they wanted to use the project for educational purposes have even made spreading their enthusiasm a goal.

Considerations for CS frameworks and the participant's perspective on this

Impact domains

As expected, the impact domain framework is on a higher level, being more applicable to categorize impacts and outcomes outside of the participant's personal experience. While Wehn et al. (2021) clearly state that their framework is an Impact Assessment Framework for citizen science projects, the domains were regarded as very zoomed out categories by the interviewees, making it hard for them to pinpoint domains for each outcome.

However, in their proposal of this framework they do mention outcomes on a personal or individual level such as those assessed by Phillips et al. (2018), but in their definition these all fall under the Society domain because these outcomes have an effect on the participants. The outcomes that we consider not applicable to the ILO framework are for a large part applicable to their society domain, except for 11.2 (Governance) and 11.3 (Science & Technology) in Table 5. They also mention that earlier impact assessments have shown that the progress of impacts (including outcomes) often 'zigzags' through multiple domains and should not be framed as a linear pathway. This likely is the reason for the difficulty of the interviewees (and researchers) to pinpoint an outcome in one single impact domain without immediately thinking about possible pouring into other domains.

Interviewees' remarks on this more 'holistic' view of outcomes and impacts were coded to be able to preserve insights, but it mainly boils down to the notion that 'it's all interconnected', and thus hard to pick. This even continued after repeatedly stating that it was allowed to pick multiple categories. We suggest

that this framework is designed for researchers and evaluators in the field who have more experience with the plethora of outcome and impact indicators and definitions thereof, which could indicate that with its increasing rigidity and complexity the science of citizen science is becoming inversely public or democratic compared to its object of study.

Individual Learning Outcomes

Although almost all of the ILO categories constructed by Phillips et al. (2018) made an appearance in the interviews conducted with participants of DMR, some outcomes most relevant to the interviewees seem to be not included in the framework. It might be possible that because the framework is made for evaluation of citizen science projects by reviewing existing project goals and evaluated outcomes, these missing outcomes are really more valuable from the participant's rather than the scientists' perspective. Except for the awareness of rainfall, these under evaluated outcomes consist mostly of outcomes not related to the subject of the project such as personal increases in good feelings of contribution, embodiment of stewardship and having more social interaction or connection.

The goal of the framework seems to guide practitioners in evaluating whether their projects have 'achieved learning goals among their participants' and they have used intended learning outcomes from the Informal Science Education field as a starting point. Although it is a well-constructed starting point, it seems to articulate the more top-down perspective already cautioned for by Powell and Colin (2009). To genuinely evaluate a Citizen Science project while taking the third principle of the EACS seriously (Robinson et al., 2018), we recommend that outcomes only profitable for participants should be included in evaluation as well.

Whether it is necessary to include these types of outcomes in the framework proposed by Phillips et al. (2018) depends on the goal of the framework. As (McAteer et al., 2021) have shown by linking outcomes to motivations, it might be necessary to look at participants and learning goals more granularly, which they did by proposing four types of participants. For some projects and their *Activist* or *Conservationist* participants it might be sufficient that the stated environmental goals are met, while others would like to include as many people as possible in order to increase general awareness or understanding of science or the environment.

To be able to motivate people to join who are not already engaged with the project's topic, participant personal outcomes have to be evaluated and communicated. Factors other than those generally measured might even be necessary for participants to change their attitude or behavior, which are outcomes desired from the scientist's perspective rather than that of the participant (Peter et al., 2019). The participant's perspective seems to be understudied yet important for Citizen Science evaluation, and if the field wants to evaluate on a larger, more consistent, and reproducible scale as proposed by much literature, it should be included in the frameworks used for that purpose.

Limitations

Inter-coding agreement

Since inter-coder agreement seems low, especially when looking at the sub-codes, it is important to focus mainly on what the participants have said and use their quotes as guidance. Some definitions of sub-codes may be difficult to discern without looking at the substance of the quotations and context of the interview.

During coding, especially in the second round to finalize the codebook, I looked at the coded quotations, parts of the interview that were before or after, listened to the audio-fragments and compared similar

quotations within the same interview to ensure a difference or agreement between subcodes. The difficulty with transforming this research into a single sentence definition within the codebook is likely the reason for the disagreement. Also, the amount of subcodes could be an issue, since by compressing the codebook into the main codes without subcodes the coding agreement increased to 66,7%.

Still, this is an important limitation of the current report and further investigation should be done to be able to confirm the conclusions within it. A round of discussion with the second coders should be included to reach agreement (Jensen & Laurie, 2016). The codebook should be supplemented by quotes or other explanatory segments that communicate the intention of each code with more precision. And finally, a full third round of coding could smooth out any inconsistencies that may be present in the current data.

However, the fact that the larger level codes seem to be more agreed upon, and that the qualitative data shown in this report has been discussed extensively does allow for some leeway. The outcomes that have surfaced cannot be ignored, but the proportion of participants mentioning these outcomes might differ from the results of this study in its current state.

Obtaining the 'participant's perspective'

After the introduction of the frameworks in part II of the interview, some interviewees associatively thought of an outcome not previously discussed in the interview. The presence of the framework is therefore some kind of trigger for memories, but this does weaken the value of a reported outcome as purely springing from the participants' perspective. However, it cannot be expected that an interviewee is able to accurately sum up from memory all of the outcomes that they had experienced, so these outcomes were discussed regardless whenever they were mentioned, and treated as coming from the interviewee herself. Because in part I of the interview the participant had plenty of time and cues to think of their most valued outcomes, I believe the goal of surfacing any outcomes without bias from existing frameworks was still facilitated.

Interview style and self-reporting

The open nature of the interview was meant to enable the participants to surface the most-prevalent outcomes they had experienced and remembered. While this does make it genuinely unaffected by any predisposition of the CS evaluation field, it does render a bias towards certain outcomes that are more memorable months after the participation.

As discussed before, when the framework was introduced during the interview, sometimes a participant would add to their reported outcomes by association with something the researcher said or recognition of an exact outcome. Interviewees are not computers who can query all of their experienced outcomes on demand. Therefore, having a certain framework to guide the interviewees does help to cover an as complete as possible set of outcomes to pick from, which reduces the amount of 'availability bias' that comes when thinking of outcomes from the top of your mind.

This links to the problem of basing a method on self-reporting and focusing on perceived outcomes instead of measuring them objectively, which Peter et al., (2019) found is common among the evaluation studies that they evaluated. They suggested the use of embedded assessment, which means assessing participant outcomes by implementing different evaluation methods during the project itself (Becker-klein et al., 2016). Similarly, It remains important to consider that this research is a qualitative study to surface any outcomes from the participant's perspective, and the fact that interviewees do not mention e.g. gaining knowledge, does not mean that they have not gained knowledge. Merely, that this was not a prominently experienced outcome of participation at the time of the interview.

Another issue with this method can be inferred from the fact that the distinct outcomes noted during the interview differ from the outcomes gathered by coding the interview. This likely has to do with the researcher being new to doing interviews, making his mind focused on doing the interview well, thereby letting short remarks or deeper details slip by during the interview. Coding also requires more and prolonged thought, giving the researcher more time to process certain information. When this method of connecting interviewees' outcomes to a framework together with the researcher is to be used in the future, its important to consider some alterations. For example, the interview could be split in multiple sessions, with an 'open' session similar to this study, and using another more interactive or cooperative full-length session with the sole goal of aligning the collected outcomes within a framework.

Recommendations

An interesting aspect that we have purposely left out of this study due to time constraints, is linking participant outcomes to the degree and quality of participation as was already proposed by Shirk et al. (2012). The connection of project characteristics with participants' gains such as knowledge and skills was studied by (Peter et al., 2021) who found that these did increase with the amount or type of distributed information, received training, interaction and received feedback or recognition. They also suggest developing methods of assessment during, or at least before and after the project such as embedded assessment (Becker-klein et al., 2016). They say that including more participant outcomes than just knowledge and skills is also required, which we have tried to assess in this study. It would be interesting to investigate this relation with a comprehensive study to participant outcomes using these recommendations.

Future research could entail more efforts of combining the top-down nature of much evaluation studies with bottom-up approaches such as this one. Especially if participation to CS projects is to become more popular among all ranks of society, it is important to keep the participants' perspective in mind. As (Peter et al., 2019) found in their comprehensive literature review, it seemed that many citizen projects do not evaluate participant outcomes or do not publish the results. While the field of CS evaluation is still developing, it is important to keep incorporating recommendations into the development of frameworks and the like.

Conclusions

In conclusion, we have collected a wide variety of outcomes experienced by the participants of DMR, such as increases in a feeling of contribution, the awareness of rainfall and knowledge. Some outcomes obtained through this method were unexpectedly difficult to align to any framework, such as the outcome that the project is a type of embodiment or self-expression of participants' already existing stewardship. Not all outcomes obtained in this research were measured in the initial evaluation of the project done by use of a survey, acknowledging the importance of methods that try to obtain outcomes from the participants' perspective.

Furthermore, by using and analyzing two existing frameworks, we have found that they are a good way of structuring outcomes of Citizen Science projects. However, as the authors admit, they are still in development and in need of continuous improvement. We have given more body to the amount of bottom-up studies towards participant outcomes to be able to compare this type of results with the rather top-down created frameworks. Even though bottom-up studies often rely on self-reporting and more embedded assessment is recommended, we have made a start in the creation of multi-faceted methods that conserve the participants' perspective while using these types of frameworks.

It seems that motivations and outcomes are intertwined, and when evaluating a project with these frameworks it remains necessary to implement a holistic view by determining the kind of project, its participants and the goals that are constructed. Only then is it possible to make realistic expectations of individual learning outcomes from person to person and project to project.

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Appendices

Appendix I

		Theme 1: Deelname aan DMR heeft …
1	Outcome_ILO_Interest	… De mate van interesse of gevoel van persoonlijke relevantie met …
		… de wetenschap veranderd en …
1.1	Outcome_ILO_Interest_science_trigg	… dit is gestimuleerd door een bepaald evenement en heeft steun van anderen nodig
1.2	Outcome_ILO_Interest_science_main	… dit blijft aanhouden door persoonlijk betekenisvolle activiteiten en ervaringen
1.3	Outcome_ILO_Interest_science_emerg	… dit wordt gekarakteriseerd door positieve gevoelens en het zelfaangestuurde aangaan van activiteiten
1.4	Outcome_ILO_Interest_science_well	… dit leidt tot voortdurende deelname en toepassing van kennis
		… het onderwerp veranderd en …
1.5	Outcome_ILO_Interest_subject_trigg	… dit is gestimuleerd door een bepaald evenement en heeft steun van anderen nodig
1.6	Outcome_ILO_Interest_subject_main	… dit blijft aanhouden door persoonlijk betekenisvolle activiteiten en ervaringen
1.7	Outcome_ILO_Interest_subject_emerg	… dit wordt gekarakteriseerd door positieve gevoelens en het zelfaangestuurde aangaan van activiteiten
1.8	Outcome_ILO_Interest_subject_well	… dit leidt tot voortdurende deelname en toepassing van kennis
2	Outcome_ILO_Efficacy	Iemands vertrouwen in de eigen capaciteiten om specifieke stof tot zich te nemen of bepaalde activiteiten te doen veranderd…
2.1	Outcome_ILO_Efficacy_science	… tot het punt waarop de deelnemer vertrouwen heeft in de capaciteit om aan een wetenschappelijke activiteit mee te doen
2.2	Outcome_ILO_Efficacy_subject	… tot het punt waarop een deelnemer vertrouwen heeft in de capaciteit om aan een duurzame activeiten mee te doen
2.3	Outcome_ILO_Efficacy_humbled	… door een versterkt bewustzijn van hoe veel de deelnemer nog niet weet over een onderwerp
2.4	Outcome_ILO_Efficacy_citizen	… tot het punt waarop de deelnemer vertrouwen heeft dat zij genoeg vaardigheden, kennis en mogelijkheden heeft om positieve verandering in hun persoonlijke leven of de gemeenschap te brengen
3	Outcome_ILO_Motivation	blijvende motivatie gegeven om langer of vaker mee te doen …
3.1	Outcome_ILO_Motivation_science	… aan de wetenschap
3.2	Outcome_ILO_Motivation_subject	… aan het onderwerp
4	Outcome_ILO_Behaviour	meetbare acties als gevolg van de deelname teweeggebracht …
4.1	Outcome_ILO_Behaviour_global	… waaronder bewuste veranderingen in het gedrag om iemands ecologische voetafdruk te verkleinen en zo wereldwijde invloed te hebben
4.2	Outcome_ILO_Behaviour_place	… observeerbare acties om de gezondheid van een ecosysteem direct te behouden, verbeteren of hier onderwijs over te geven buiten het project zelf
4.3	Outcome_ILO_Behaviour_new	… waaronder het meedoen aan wetenschappelijke of duurzame activiteiten, organisaties of projecten
4.4	Outcome_ILO_Behaviour_civic	… deelname aan civiele, overheids- of culturele bezigheden om lokale, regionale of nationale problemen op te lossen
4.5	Outcome_ILO_Behaviour_trans	… handelingen die een grote investering of betrokkenheid nodig hebben
5	Outcome_ILO_Skills	observeerbare bezigheden vermeerdert die in het dagelijks leven toepasbaar zijn, zoals het vragen en beantwoorden van probleemstukken; data verzamelen; modellen ontwikkelen en gebruiken; plannen en uitvoeren van onderzoek; redeneren, analyseren en interpreteren van data; verklaringen construeeren;informatie communiceren; en bewijs gebruiken in argumentatie
6	Outcome_ILO_Knowledge	…. de hoeveelheid kennis …
6.1	Outcome_ILO_Knowledge_subject	en begrip van de inhoud van wetenschap en begrip van het onderwerp vermeerderd, zoals feiten of concepten
6.2	Outcome_ILO_Knowledge_science	en begrip van wetenschappelijke processen, begrip van de methodlogiën die gebruikt worden om onderzoek te doen (bijvoorbeeld het hypothetico-deductive model van de 'wetenschappelijke methode') vermeerderd
6.3	Outcome_ILO_Knowledge_nos	… van de aard van de wetenschap, begrip van epistemologische basis waarop wetenschappelijke kennis is gestoeld en hoe dit wordt gegenereerd, soms vanuit een post-positivistisch perspectief bekeken
		Theme 2: Outcomes of participation to DMR according to the participant have influence on…
7	Outcome_Domain_Science	…the way science operates
8	Outcome_Domain_Environment	
9	Outcome_Domain_Society	
10	Outcome_Domain_Economy	
11	Outcome_Domain_Governance	

Code	Code name	Occurrence (n interviews)	Definition
1	Contributing data ...	14	To have the feeling of having contributed...
1.1	to science or knowledge in general	13	To help science, for the generation of more knowledge or better insights to do good
1.2	for the climate	4	In order to help (scientists help) the climate by producing more or better knowledge
1.3	to return the favor	1	In order to return the favor to other scientists because you also use data from others
1.4	out of altruïsm	5	Out of altruism, to help other people out with their project
2	Project as embodiment of already existing stewardship	8	Stewardship & behavior as defined in the ILO framework, measurable actions or activities for the environment or community
2.1	Increased by participation	6	The project is an embodiment of already existing stewardship but has been increased by their participation
2.2	Not increased by participation	2	The project is an embodiment of already existing stewardship but has not been increased by their participation, because it is part of it
3	Social aspects such as...	9	Actively or passively gained social encounters
3.1	Interactions about the project	7	by sharing experiences or knowledge from the project with others in the surroundings
3.2	Education	3	By passing on knowledge to a new generation
4	Awareness...	11	
4.1	of rainfall or the weather in general	11	A higher perception or awareness of droughts, rainfall, changes in rainfall and the weather
5	Knowledge of..		**Participant** has more knowledge of...
	Science	**12**	
5.01	Measuring rain	5	The method or technicalities of measuring rain yourself (for this project)
5.2	Science	3	The process or nature of science
5.3	Citizen Science	4	Or insight in that Citizen Science data works and does not have to be innacurate
5.4	Watermanagement	5	Watermanagement or the (functioning of) water/climate related policy organs, institutions, foundations etc.
	Subject/content knowledge	**7**	
5.5	The value of water	2	The value and the importance of water (and watermanagement) for nature and people
5.6	How to contribute	2	How to contribute to the environment, climate or (management of) rain variability
5.7	The larger picture and rain variability	7	or information about rain variability, the larger picture of what the data is for, climate (change) or the weather
5.8	Indifferent	5	Participant doesn't really value what happens with the data, how the subject (5.7) works or what the outcomes of the project are
5.9	Incompetent	4	Participant did not really have time or hasn't been able to process the received information of the subject (5.7), by incompetence, not indifference.
6	Motivation to...	6	Motivation to... (gained by participation to the project, not motivation to participate to the project !)
6.1	Participate again or more deeply	4	To participate again to this or other projects, or participate more deeply and to more aspects of the project
6.2	Change behavior	4	Change behavor or think about making changes to lifestyle, home etc.
7	Confidence to...	2	
7.1	Write a paper	1	Being able to contribute to a paper, knowing it's a possibility
7.2	Work with the technology	1	Threshold has lowered because of technical reasons, or the project is more clear and approachable
8	Interest...	4	
8.1	Reading more about the subject	4	Has been reading more during or since participation about the subject of the project
9	Framework remarks	4	
9.1	Holistic	4	Sees the outcome categories more as things influencing eachother, are not able to easily categorize the outcomes in the framework
10	Behavior	3	
10.1	Learned a habit	3	Has gained a new habit due to the project
	Other codes		
11.1	Connection	2	Feeling of connectedness with the surroundings, or even globally with similar projects, being part of a larger whole
11.2	Cooperation involved instutions	1	Project has connected parties relevant to the subject of the project, sparking cooperation or sharing of knowledge
11.3	Suggestion for further research	1	Suggestion that this method of higher resolution could also be used for other topics
11.4	Experience is fun to do	6	The project has entertained, occupied, surprised. Not as a reason for joining (that's motivation) but as an outcome of the participation

Appendix III

Inleiding

- Bedanken
- Uitleg onderzoek: titel, doel
- Uitleg interview: structuur, alleen een gesprek, voldoende tijd
- Informed Consent

Interview

- Demografische vragen om in te komen: Wat is je beroep / dagelijkse bezigheid / stel je voor?

Openingsvragen: adhv bezigheden tijdens of na DMR ervaringen oprakelen

- **Kun je vertellen op welke manieren het meedoen aan DMR volgens jou iets heeft betekend?**
- **Of, welke uitkomsten/resultaten van het project heb jij ervaren?**
- Zijn er dingen aan jezelf of je omgeving veranderd?
- Waar heeft DMR volgens jou verder aan bijgedragen?
- **Samenvattende 'conclusie' omdat we nu gaan verdiepen en verbreden**

'Outcome' vragen: Duiden verdiepen van ervaringen door open vragen

- Denk je dat dit komt door DMR, heeft het meedoen aan DMR dit veranderd?
- Je zei dat je merkte dat [...] toen je [...] aan het doen was, zou je mij kunnen helpen verder te begrijpen hoe je daar achter kwam?
- Op welke manier heeft [outcome] invloed gehad op jou?
- Heb je nog andere voorbeelden van [...]?
- **Vernieuwde samenvattende conclusie en bruggetje naar het framework**

[Framework introductie]

Framework: Proberen de (nieuwe) gevolgen te pin-pointen en op het framework te plaatsen

- Nu we deze kaders hebben besproken, heb je hierdoor nog andere ervaringen te binnen schieten die je ook hebt gemerkt? Nee, dan:

  Ik zou met je willen kijken naar de ervaringen/gevolgen die we eerder hebben besproken en deze in de context van het raamwerk willen plaatsen.

- Welke van de besproken ervaringen of gevolgen zijn voor jou heel duidelijk te plaatsen op één van de domeinen in dit raamwerk?
- Dan hebben we [...] nog niet besproken, is die te beschrijven in de context van dit raamwerk?

  Dan wil ik nu de gevolgen concreet maken en op het raamwerk plakken door middel van Post-it's. Zullen we ze één voor één bespreken en plaatsen?

Framework mapping

Bedank + wat het waard is voor jou. Beschikbaar voor vragen via e-mail.

Appendix IV

INFORMATIEFOLDER

Evaluatie-onderzoek 'Delft Meet Regen 2021 vanuit het perspectief van de deelnemers'

Wie is de onderzoeker?
Ik ben Jordy Janssen, misschien heb je mij al gezien tijdens het webinar de afgelopen herfst. Ik ga voor het Delft Meet Regen-team een onderzoek uitvoeren naar de gevolgen van het meedoen aan een participatieproject zoals Delft Meet Regen. Dit onderzoek is mijn afstudeerproject als onderdeel van de opleiding Biologie & Wetenschapscommunicatie.

Tijdens mijn opleiding wetenschapscommunicatie kwam ik in aanraking met participatieprojecten (Citizen Science). Door na te denken over de positie van de wetenschap in de samenleving denk ik mijn nieuwsgierigheid in allerlei onderwerpen te kunnen combineren met mijn interesse in de wetenschap zelf. Zo is er nog een hoop te verbeteren aan de manier waarop wij wetenschappelijk verzamelde kennis gebruiken en communiceren. Dat is waar een project als Delft Meet Regen aan kan bijdragen, en de manier waarop dit gebeurt wil ik met jullie bespreken tijdens dit onderzoek.

Wat houdt het onderzoek in?
Dit onderzoek is een initiatief van het WaterLab, de organisatoren van Delft Meet Regen. Zij waren benieuwd naar wat de uitkomsten zijn voor deelnemers van dit project. Ik heb uitgezocht hoe we dit willen onderzoeken en wat de in de wetenschap bekende manieren zijn om dit te evalueren. Het viel ons op dat dit soort evaluaties vaak worden gedaan vanuit het perspectief van de wetenschap: Hoe veel beter wordt de wetenschap begrepen na het meedoen aan een project? Hoeveel kennis hebben de deelnemers over ons onderwerp gekregen? Ik ga daarom proberen uit te vinden wat Delft Meet Regen voor de deelnemers, jullie dus, betekend heeft. Dit wil ik doen door middel van interviews.

Hoe werken de interviews?
De interviews wil ik afnemen op een rustige plek waar wij een uur kunnen zitten. Dit zodat we niet gestoord worden en ik het gesprek op kan nemen voor verdere analyse. Deze opnames zijn uiteraard strikt voor verdere uitwerking en worden daarna verwijderd. De makkelijkste optie lijkt mij om bij jou thuis langs te komen, maar mocht je dit niet prettig vinden kunnen we ook ergens anders afspreken. Denk hierbij aan de bibliotheek van de TU Delft of een rustig cafétje. Nadat we even hebben kennisgemaakt kunnen we beginnen met het interview.

Ik heb de interviews ontworpen met een bepaalde structuur voor ogen, maar ik ben vooral benieuwd naar wat jij te zeggen hebt. Ik zal beginnen met een open vraag, waarmee jij je verhaal kan beginnen te vertellen. Vervolgens wil ik je laten zien hoe de gevolgen van Citizen Science of participatieprojecten worden beschreven in de wetenschap, en gaan we proberen jouw antwoorden in deze context te plaatsen.

Wat doen we met de resultaten?
De onderzoeksresultaten wil ik voor het begin van de zomer hebben uitgewerkt, waarna ik ze zal verwerken in een verslag of misschien zelfs een wetenschappelijke publicatie. Naast dat ik dit onderzoek moet presenteren voor mijn opleiding, willen we de resultaten ook graag met jullie delen. Ik zal een presentatie geven voor degenen die geïnteresseerd zijn. Uiteindelijk denken we een beter beeld te krijgen over wat participatie betekent voor deelnemers van Citizen Science projecten, en zo de organisatie van deze projecten meer af te kunnen stemmen op de wensen van zowel wetenschappers als deelnemers.

Mocht je nog vragen hebben, reageer dan op mijn e-mail: jordy.stage@pulsaqua.com

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