Citizen Science: A Practical Check

Implementation of best-practice criteria in citizen sciences

Abstract

Citizen Science (CS) has attracted more and more attention in recent years. The fields of application are very broad, which makes a uniform definition difficult. There are various international attempts to standardise and institutionalise CS. Based on the "Ten Principles of Citizen Science" of the European Association of Citizen Science (ECSA), which aims to encourage organisers to increase citizens' participation; we reviewed 75 projects based on a catalogue of criteria. The question whether such a unified standard is reflected in practice was investigated.

Of eight best practice ECSA-Principles examined, CS-projects on average met three. None of the CS-projects fulfilled all the principles examined. We found high fulfilment rates for the ECSA-Principles "Generation of new knowledge" (100%), "Feedback to participants" (61%) and "Democratisation of science" (89%). Much lower rates were recorded for the ECSA-Principles "Reliable results" (20%), "Participation at different stages" (12%), "Publicly available data" (15%), "Acknowledgement to participants" (7%) and "Scientific evaluation" (20%). On average, the CS-projects fulfilled only three of the ECSA-Principles. The low level of fulfilment of the ECSA-Principles confirms that CS is perceived and implemented in a very diverse way and does not always aim for a high degree of participation.

Keywords: Citizen Science, standards, best practice, ECSA, participation

Introduction

The number of Citizen Science (CS) projects is growing exponentially (Kullenberg & Kasperowski 2016). The annual number of published scientific articles dealing with CS or using data generated by CS-projects is also increasing (Follett & Strezov 2015). Nevertheless, a large number of CS-projects do not contribute to publications (Theobald et al. 2015; Kullenberg & Kasperowski 2016; Chandler et al. 2017). CS-projects are located in various disciplines, ranging from biological, social and natural sciences to engineering (Hecker et al. 2018). They are based on different definitions of the CS term (Eitzel et al. 2017). CS is a generic term used to summarize different forms of public participation in science, where participation can take place in different phases of the scientific process with different intensity (Chandler et al. 2017). In addition to numerous definitional approaches that have developed from the original definitions of Irwin (1995) and Bonney (1996) (in Hecker et al. 2018 p. 3), there are various international attempts to standardise and institutionalise CS (Eitzel et al. 2017).

In the European context this is being promoted by the European Association of Citizen Science (ECSA) (Robinson et al. 2018), in the German context by the Federal Environment Agency (Umweltbundesamt – UBA) (Rückert-John et al. 2017) and "Bürger schaffen Wissen" (Hecker et al. 2016).

Over a period of two years, ECSA developed the "Ten Principles of Citizen Science" (ECSA 2015), which are on the one hand, intended to provide practical support and on the other hand to challenge the participants in CS-projects to more citizen participation through high standards (Robinson et al. 2018 pp. 30-33).

Although the ECSA-Principles have been applied in various contexts, there is still no systematic review of their dissemination (Robinson et al. 2018 p. 30). As a contribution to this, this study addresses the question of whether current CS-projects, mainly within the German-speaking CS-community, comply with the ECSA-Principles.

In order to answer this question, we examined 75 CS-projects with regard to their compliance with these principles using a catalogue of criteria.

Methodology

For the compilation of our catalogue of indicators for the analysis of existing and past CS-projects, the checklist for the planning of CS-projects published by the platform "Bürger schaffen Wissen" (Wissenschaft im Dialog gGmbH 2020) was used. We classified each project according to guidelines of Rückert-John et al. (2017) and derived six indicators (Table 1) from their extensive catalogue for checking CS-projects for compliance with the ECSA-Principles.

A total of 75 CS-projects were examined (Table 1 supplement). We randomly selected 67 out of 111 projects from the database created as part of the "GEWISS" project (Wissenschaft im Dialog gGmbH 2020). Eight CS-projects were furthermore selected to which reference was made from the already selected ones. If insufficient information was available, another project out of the 75 original CS-projects was selected instead. The evaluation of the individual CS-projects was based on the ten principles of ECSA, which are intended to reflect the characteristics of high-quality CS (Robinson et al. 2018). Eight of the ten ECSA-Principles were examined and assessed as fulfilled or unfulfilled using indicators as shown in Table 1. ECSA-Principles, which were partly very broadly defined, were simplified in order to operationalise them.

Table 1 *Indicators for CS-project evaluation based on the ECSA-principles (ECSA 2015)*

ECSA-principle	**Indicator**
1: Generation of new knowledge	*Question:* Is the motivation to generate knowledge apparent? *Indicator*: Motivation to create new knowledge was expressed publically on CS-project websites and published texts.
2: Reliable results	*Question:* Were there any scientific publications? *Indicator:* At least on scientific peer-reviewed publications derived from CS-projec results.
3: Benefits for all participants	Not assessed.
4: Participation in different phases	*Question:* How was the CS-projec classified in terms of citizen involvement? *Indicator:* CS-projec has been classified as the categories "co-design" or "educational project with increased research component".
5: Feedback to participants	*Question:* Was any feedback given to participating citizens? *Indicator:* Participants receive feedback on their participation in the project via any communication channel (website, reports, peer-reviewed publication).
6: Democratisation of science	*Question:* Can citizens participate without prior knowledge? *Indicator:* No previous knowledge of the participating citizens was assumed.
7: Data publicly accessible	*Question:* Is data publicly accessible? *Indicator:* Data publication as Open-Access.
8: Acknowledgements of participants	*Question:* Were any acknowledgements formulated? *Indicator:* Acknowledgements in publications or on the project website.
9: Scientific evaluation	*Question:* Were there any scientific publications? *Indicator:* Result are published in peer-reviewed scientific journals
10: Compliance with legal/ ethical standards	Not assessed.

ECSA-Principle 1 (generation of new knowledge) was regarded as fulfilled if the motivation to create new knowledge was discernible. In the context of this work, this included both the transfer of knowledge to interested parties and the answering of previously unresolved questions. The existence of scientific peer-reviewed publications was used as an indicator for ECSA-Principle 2 (scientific results) and ECSA-Principle 9 (scientific project evaluation). ECSA-Principle 3 (all parties benefit) could not be investigated based on the data collected, since the benefits for the various individuals involved certainly differ greatly. In order to evaluate ECSA-Principle 4 (participation in different phases of the scientific process), the projects were classified into individual categories based on the typology of Rückert-John et al. (2017) as follows:

- "co-design": citizens design a project together with scientists
- "co-production": citizens take on individual tasks, e.g., data collection or image recognition
- "educational project with research component": educational project in which participants can participate in at least one phase of the research process
- "educational project with increased research component": educational project in which participants can participate in several phases of the research process

ECSA-Principle 4 was considered fulfilled if a project has been classified as the categories "co-design" or "educational project with increased research component". If the participants receive feedback on their participation in the project via any communication channel, ECSA-Principle 5 was also considered fulfilled. ECSA-Principle 6 (democratisation of science) was examined in terms of how easily accessible it is to participate in the project. This principle was considered fulfilled if no previous knowledge of the participating citizens was assumed. ECSA-Principle 7 deals with the public accessibility of the collected data and was considered fulfilled if the data were available for download without registration (open access). If the participants were thanked in publications or on the project website, ECSA-Principle 8 was also considered fulfilled. ECSA-Principle 10 (compliance with legal and ethical standards) was not dealt with in this paper due to the difficulty of collecting data.

Results

The data collected on the CS-projects show that the fulfilment of the individual indicators was not uniform (Figure 1). For example, the majority of the CS-projects did not publish, did not formulate public acknowledgements, but gave internal feedback. Furthermore, the majority of the CS-projects fell into the category "co-production" and were open to all interested parties. Most of the CS-projects did not provide data in an open-access format.

The analysis shows that individual principles were fulfilled much more frequently than others were. ECSA-Principle 1 (generation of new knowledge) was fulfilled by all CS-projects, while ECSA-Principle 5 (feedback to participants) and ECSA-Principle 6 (democratisation of science) were fulfilled by 61% (n = 46) and 89% (n = 67) of the CS-projects respectively. Only nine CS-projects (12%) fulfilled ECSA-Principle 4 (participation in different phases), ECSA-Principle 7 (data publicly accessible) was fulfilled by only eleven CS-projects (15%), 15 CS-

projects (20%) fulfilled ECSA-Principles 2 (Reliable results) and 9 (Scientific evaluation), while ECSA-Principle 8 was the least frequently fulfilled, with only five CS-projects (7%) giving acknowledgements.

Furthermore, it was analysed how many ECSA-Principles were fulfilled by each individual CS-project (see Figure 2). It was found that no single CS-project was able to fulfil all eight ECSA-Principles examined; only one project fulfilled seven ECSA-Principles. On average, three ECSA-Principles were fulfilled. Out of the 75 project examined 67 projects (84%) fulfilled only half or fewer ECSA-Principles.

Discussion

The GEWISS platform represents a comprehensive collection of CS-projects in German-speaking countries. At the end of 2019, we examined 67 (60%) out of 111 listed projects and further eight related projects (Table 1 supplement). Due to the large number and random selection of the projects, they can be regarded as representative for the German-speaking Cs-community.

In all projects examined, the motivation to create new knowledge was generally recognizable based on the project websites and published texts, thus fulfilling ECSA-Principle 1. This coincides with the requirements that projects must meet in order to be published on the GEWISS platform. Among the conditions formulated is the following: "Common goal of all Citizen Science projects is the creation of new knowledge" (Wissenschaft im Dialog gGmbH 2020, Pettibone et al. 2016). The motivation to create new knowledge can also be seen in the examined projects not listed on the platform, based on their publically accessible publications.

Whether knowledge is new and relevant is a question of perspective. The perspective of all those involved in a CS-project includes both the perspective of the scientists and the participating citizens. Therefore, the generation of new knowledge includes both the transfer of knowledge to interested parties and the generation of new knowledge relevant to science, society or administrations. These are two central goals of CS-projects (Turrini et al. 2018). It is often assumed that CS is well suited to imparting knowledge, but there is little empirical research to prove that knowledge transfer has taken place (Bela et al. 2016; Bonney et al. 2016; Peter et al. 2019). This study, too, does not examine the knowledge transfer that took place, but rather the recognizable motivation to bring it about. Newly generated relevant knowledge for science, society and administrations is better documented than knowledge transfer (Bonney et al. 2016). CS projects are in general seen as a successfully used tool for the generation of this knowledge (Bonney et al. 2016; Chandler et al. 2017; Turrini et al. 2018).

Other indicators could also be used to review ECSA-Principle 1, since the term "knowledge" has many different connotations. If the term "knowledge" is defined more narrowly by leaving out the knowledge gain of the citizens involved and focusing on scientific knowledge gain, one must check whether a concrete question has been formulated and whether the answer to it has been evaluated according to scientific criteria. In this study, only 35% of the projects examined had formulated a concrete question.

An assessment according to scientific criteria can be examined by a scientific publication derived from CS-project results. The study shows that only 20% of the CS-projects publish their results in peer-reviewed scientific journals. Our finding still exceeds the results of Theobald et al. (2015), which determined a publication rate of 12% in CS-projects. The low publication rate of the CS-projects is partly due to the fact that most of the projects examined in this study (at least 73%) are still ongoing and therefore the research process has not yet led to publication. In particular, projects that were not initiated by scientific institutions may not give priority to scientific publication. In total 40% of the projects examined made results available online. Thus, although communication of the results seems desirable, the scientific audience is not always the target group. Of the projects examined, only very few of the privately or cooperatively funded CS-projects published scientific results (Figure 3). Nevertheless, publication in scientific journals is one generally accepted way of assessing the quality of scientific work in a case-by-case manner, and therefore, despite all the difficulties, it is a suitable indicator for ECSA-Principles 2 and ECSA-Principle 9.

Our result that participation in different phases of the scientific process is only possible in a minority of CS-projects (12%) is consistent with other studies. For example, when Rückert-John et al. (2017: 72) examined the database of "Bürger schaffen Wissen" in 2017, citizens were active in all phases in ten of the 54 projects (19%) back then. Other studies also conclude that the activities of citizen scientists are limited to assistant services, e.g., data collection (Dickel 2017; Wagner 2018). This limitation is partly for historical reasons; since for many scientists the term only meant the participation of lay people in data collection (Cooper & Lewenstein 2016). In some cases, however, the participants may not wish to be more deeply involved than in one stage of the work, since a longer-term participation may take additional time and effort. On this basis, it is questionable whether this criterion is actually relevant to practice and whether CS-projects that only allow participation of citizen scientists in one phase do not satisfy the needs of certain citizens.

In 61% of the CS-projects examined, participants received feedback on their project involvement. This included all forms of feedback, so both direct feedback, e.g. in personal e-mails or automatically via apps, and feedback that the participants had to seek out themselves, e.g. in the form of a blog post. Besides these examples, many CS-projects also operate online forums or send out newsletters. Feedback enables participants to understand the impact of their work on the project and, where appropriate, the wider scientific, social and/or political context. It contributes to a sense of appreciation of the participants, as well as to their education about science, the handling of scientific data, and of course the content of the research projects. Feedback also helps to maintain the long-term interest of participants (Rotman et al. 2014). However, the type and frequency of feedback might need to be examined more closely here in order to be able to examine the effects in a more differentiated way, though this could not be ascertained from the information published by the CS-projects themselves.

ECSA-Principle 6 asks for the involvement of a broad public and the democratisation of science (ECSA 2015). It was considered fulfilled if the participation of interested citizens could take place without any prior knowledge. In total, ECSA-Principle 6 was fulfilled by 67 projects, corresponding to 89% of all CS-projects examined. ECSA-Principle 6 reveals different expectations of a social opening of science. Accordingly, the operationalisation of

this principle is difficult. If the democratisation of science is used as a frame of reference to measure the dissemination of CS, the interpretation of ECSA-Principle 6 in this study fails to take into account that the democratisation of science goes beyond the mere (unconditional) participation of interested citizens. Irwin (1995 pp. 177-180) introduced the concept of democratisation to CS, the semantic core attributed to a political system (Vilmar 1973; Donath 2001). In this context, the democratisation of science implies a symmetrisation of the asymmetrical difference between the roles of academics and the public, i.e. between professional and non-professional researchers (Dickel & Franzen 2015). Thus, Irwin sees the real value of CS in an inclusion of laypersons in scientific decision-making processes, which enables citizens to participate in the discourse on modern science and its social consequences. In this way, external value judgments are to be incorporated directly into the internal justification process of science and ultimately lead to a social influence that shapes scientific agendas and norms (Irwin 1995; Ramirez-Andreotta et al. 2015; Cooper & Lewenstein 2016; Stehr & Adolf 2018 p. 403; Wenninger & Dickel 2019).

In the specialist literature, it is stated very often that in CS the activities of laypersons are usually limited to preliminary work, such as the collection and evaluation of data, which in turn are orchestrated by professional scientists (Dickel 2017; Wagner 2018; Chen 2019; Franzen 2019). Consequently, most CS projects, with the exception of a few, do not do justice to Irwin's democratic aspirations (Wiggins & Crowston 2011; Riesch & Potter 2014; Follett & Strezov 2015). If ECSA-Principle 6 had been interpreted in this study applying Irwin's concept of democratisation, the result would certainly have been very different. Nevertheless, since ECSA (2015) did not explicitly refer to Irwin's concept of democratisation, even mere participation without prior knowledge can be interpreted as a democratisation of science. This can be justified by the fact that democracy is a malleable concept which gives rise to a multiplicity of meanings of "democratisation". Hence, democratisation can be understood simply as any contribution to a transition to a more democratic scientific regime. Therefore, the interpretation of ECSA-Principle 6 made here understands "democratisation" in this respect as an initial form of realisation of the democratic idea or as an approach to it. The specific democratising potential lies in the social opening of science in the form of an exceptionless inclusion of citizens from various educational backgrounds. This opens up the possibility of gradually incorporating the claim of democracy into scientific structures.

The publication of data in open access formats is only done in 15% of cases. Other literature also describes data from CS-projects as not very open. Reasons for this may be confusion due to the large number of licenses or the unwillingness of citizens to support commercial projects with their data (Groom et al. 2017). Project-specific reasons can also restrict the provision of data. For example, in a CS project to record Berlin's fauna, data on the occurrence of rare species is not published in order to protect the populations (Stiftung Naturschutz Berlin 2020). Our survey did not include whether projects plan to make their data public after the end of the project, which could distort the results. If the publication of data conflicts with the wishes and motivations of the citizens involved, compliance with ECSA-principle 7 could lead to problems in recruiting them and thus hinder the success of the project.

ECSA-Principle 8 was met by only 7% of the CS-projects. In the five CS-projects concerned, acknowledgements were given on the project website in four cases, and in one project citizens co-authored a publication. The low prevalence of co-authorship can be explained by the fact that in most journals each co-author has to meet certain criteria to be fully recognized, which is usually beyond participating in data collection or technical assistance (Gadermaier et al. 2018). Co-authors involvement is expected at higher levels, e.g. a substantial contribution to the text, writing or critical correction of the text, final approval of the publication and assumption of responsibility for the content of the publication (ICMJE 2018). Not all parties involved in most CS-projects can meet such high standards. In addition, many citizen scientists are less interested in authorship than in the research process itself (Gadermaier et al. 2018). This study did not examine whether participating citizens receive a personal acknowledgement when they submit data, for example. However, acknowledgement by scientists and other participants is of great importance to maintain the long-term motivation of the citizen scientists (Rotman et al. 2014). Thus, the lack of public acknowledgements on the websites and in publications can be detrimental to the project in the long run, if the number of participants decreases.

We did not assess ECSA-Principle 3. In order to examine it, a direct survey of the individual actors in the various projects may be required. It would also be conceivable and recommendable for the CS-projects themselves to interview participants as part of the project evaluation. A guideline for such an evaluation could be derived from the checklist of the platform "Bürger schaffen Wissen" (Pettibone et al. 2016) and its results should be published centrally for further analysis beyond the single CS-project.

ECSA-Principle 10 requires all CS-projects "to take into consideration legal and ethical issues surrounding copyright, intellectual property, data sharing agreements, confidentiality, attribution, and the environmental impact of any activities" (ECSA 2015). The fact that this principle was also not taken into account in our analysis is due to the broadness of the principle and the fact that CS-projects do not make this information publicly available. The authors assume that all actors involved comply with applicable laws, but details such as confidentiality and environmental impacts were not verifiable in the context of this study.

Conclusion

For CS-projects within the German-speaking CS-community, the evaluation showed a relatively low level of compliance with the best practice ECSA-Principles. ECSA sees its principles as a challenge to the organisers, which should lead to more citizen participation. It is therefore not always necessary to fulfil all principles. Depending on the demands of the participants in the project, different ECSA-Principles become important. This is already reflected in the different approaches to define CS, which indicate different priorities for the implementation of CS: Democratisation and reorientation of science and/or participation and further education of citizens.

For a successful CS-project implementation, however, all ECSA-Principles should be considered already in the planning phase in order to weigh up which of them are important for the project and how they can be achieved. A survey of participating citizens and

scientists could shed more light on which of the ECSA-principles these groups consider useful, or what they consider to be criteria for a successful CS-project.

Further research is needed to make the currently emerging field of CS efficient and satisfactory for all people involved as well as to improve relevance of the results derived from CS for our societies.

Supplemental Table 1: Appendix. Data collected from CS-projects

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Authors' contributions

Research into the topic of Citizen Science (CS) was a collaborative work, in which all authors agreed upon the definition of scope, research question and methodology. The data collection process was divided into smaller parts with every author researching a limited number of CS projects. S. Poldrack and M. Otto did the data analysis with R, whereas J. Pulka provided deeper insight into the theoretical and historical basis of CS through literature review. All authors worked in close exchange on the discussion section and provided in-depth knowledge through extensive literature review. All authors then wrote the paper collaboratively, with M. Otto, C. Achilles and D. Nissen overseeing internal cohesion and overall structure.

Competing interests

The authors have no competing interests to declare.

Figure captions

Figure 1 Distribution of relative fulfilment for the indicators: new knowledge, publication (scientific = peer-review, online e.g. website), credit (acknowledgement), feedback, (CS) category, perquisites (to participate) and (public) data (access) for the CS-projects examined (NA = no information available; educational project = educational project with research component, educational project+ = educational project with a main focus on research).

Figure 2 Number of the relative fulfilment of ECSA-Principles in CS-projects (%).

Figure 3 Publication frequency and CS-project financing (NA = no information available).

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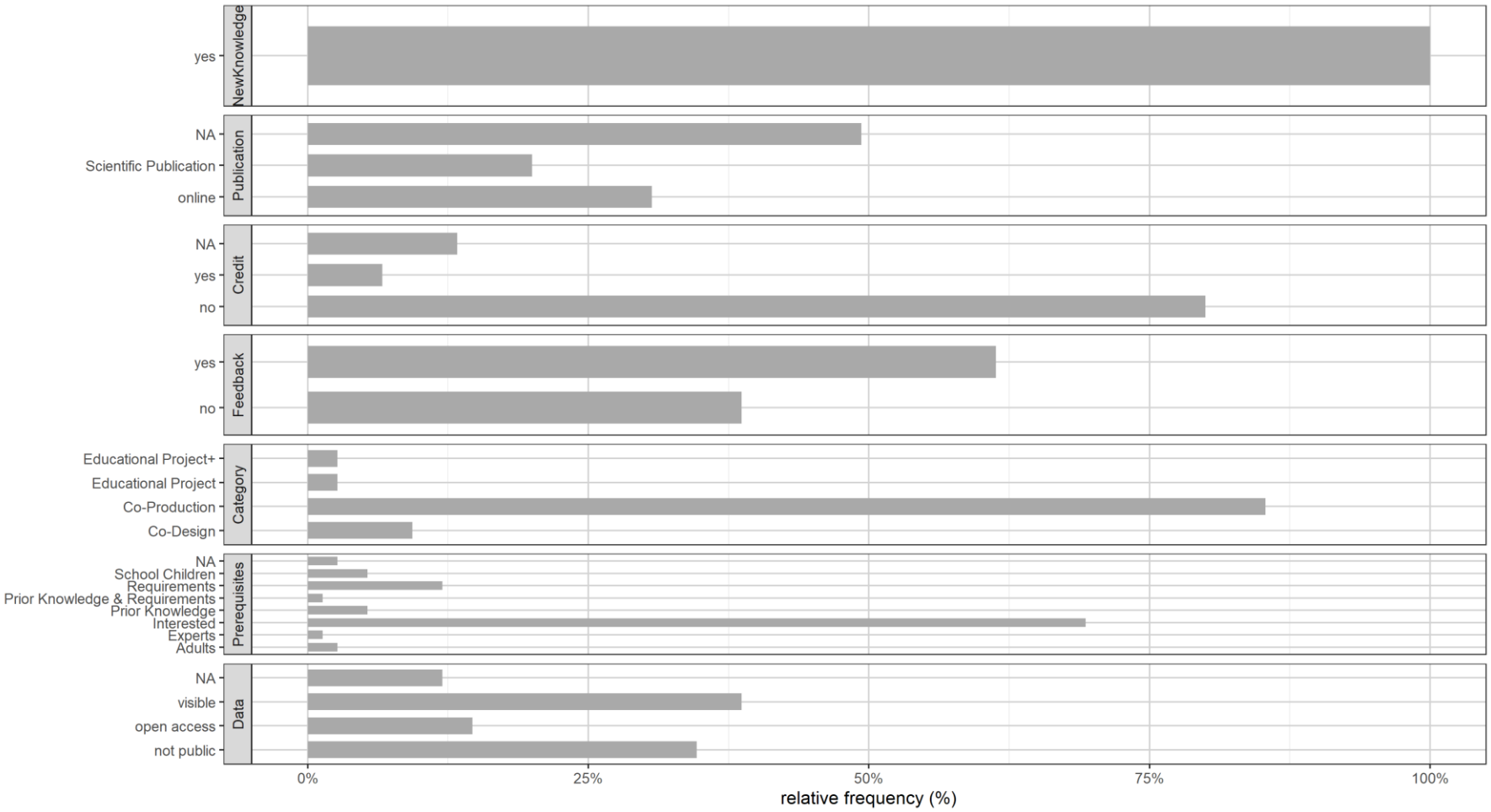

Figure 1 Distribution of relative fulfilment for the indicators: new knowledge, publication (scientific = peer-review, online e.g. website), credit (acknowledgement), feedback, (CS) category, perquisites (to participate) and (public) data (access) for the CS-projects examined (NA = no information available; educational project = educational project with research component, educational project+ = educational project with a main focus on research).

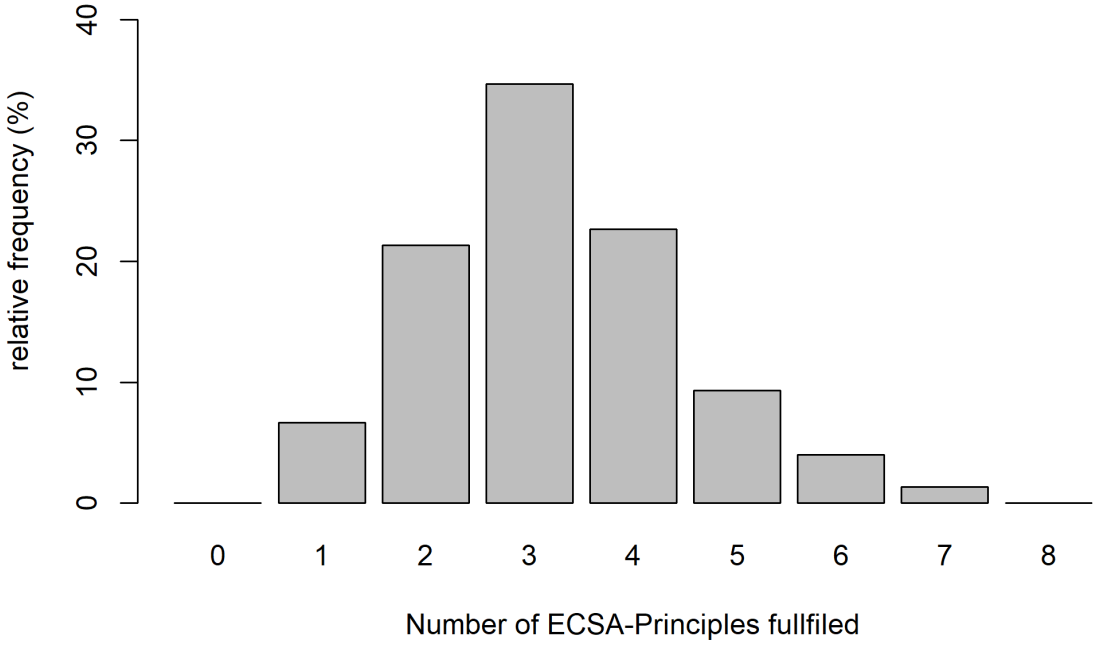

Figure 2 Number of the relative fulfilment of ECSA-Principles in CS-projects (%).

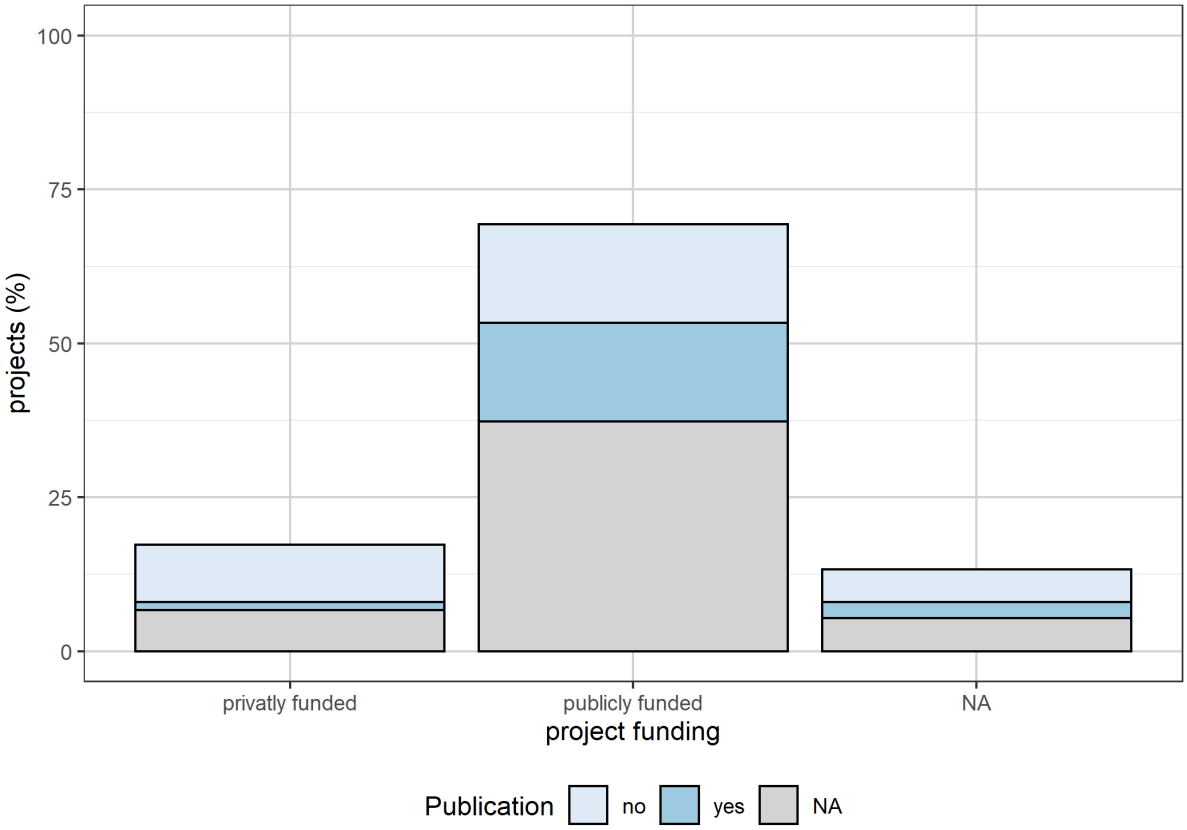

Figure 3 Publication frequency and CS-project financing (NA = no information available).

Supplemental Table 1: Meta data collected from citizen science projects (continued)

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
African Plants - A Photo Guide	top-down	Co-Production	yes	no	5.50	publicly	Prior Knowledge	visible	no	no	none
Ampel-Pilot	top-down	Co-Production	no	no	NA	privately	Interested	open access	online	no	yes
Animal Tracker	top-down	Co-Production	yes	yes	5.50	publicly	Interested	not public	no	no	none
artigo - Laien beschreiben Kunst	top-down	Co-Production	no	no	8.00	NA	NA	NA	no	no	none
Bee Observer BOB	top-down	Co-Production	no	no	3.00	publicly	Prior Knowledge, Requirements	not public	no	NA	yes
BerlinAIR	top-down	Co-Design	yes	yes	NA	publicly	Interested	visible	online	no	yes
Biodiversitäts-Inventur im Main-Kinzig-Kreis	top-down	Co-Production	no	yes	NA	publicly	Interested	open access	online	no	none
Categories to Come	NA	Co-Production	NA	NA	NA	NA	Adults	not public	NA		yes
CitClops	top-down	Co-Production	NA	no	NA	publicly	Interested	visible	Scientific Publication, online	no	yes
Citizen Sensor - Umweltanalytik für Jedermann	top-down	Co-Production	no	yes	NA	publicly	Prior Knowledge	not public	NA		none

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
Climate CoLab	NA	Co-Design	NA	no	NA	publicly	Interested	open access	online		yes
CLUE Clusterkopfschmerzen erforschen	top-down	Co-Production	no	yes	3.00	publicly	Interested	NA	NA		yes
Die Apfelblütenaktion	top-down	Co-Production	yes	yes	NA	publicly	Interested	not public	online	no	yes
Die große Hirschkäfer-Pirsch	top-down	Co-Production	yes	no	12.50	publicly	Interested	not public	no	no	none
Erforsche Neophyten mit!	top-down	Educational Project	no	no	NA	publicly	School Children	open access	no	no	yes
Expedition Münsterland	bottom-up	Co-Production	no	no	9.50	publicly	Interested	NA	Scientific Publication	no	none
EyeOnWater	top-down	Co-Production	yes	no	5.00	publicly	Interested	open access	online	no	yes
Feldhasen in Berlin Lichtenberg	top-down	Co-Production	yes	no	NA	publicly	Interested	not public	no	no	none
Finde den Wiesenknopf	top-down	Co-Production	yes	no	7.50	publicly	Interested	visible	no	no	none
Fledermausforscher in Berlin	top-down	Educational Project+	yes	no	3.00	publicly	Adults	not public	no	no	yes
Flora Frankfurt online	top-down	Co-Production	NA	no	NA	publicly	Prior Knowledge	not public	no	no	none
Forschungsfall Nachtigall	top-down	Co-Production	no	yes	2.00	publicly	Interested	visible	no	no	none

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
Globe at Night/ "Verlust der Nacht" ist die deutsche Version davon	top-down	Co-Production	NA	no	NA	publicly	Interested	open access	no	no	none
GOV - Geschichtliches Ortsverzeichnis	top-down	Co-Production	yes	no	28.00	privately	Interested	visible	online	no	none
HackAir	top-down	Co-Production	yes	no	3.00	privately	Interested	visible	online	no	yes
Hush City	top-down	Co-Production	yes	no	3.00	publicly	Interested	visible	Scientific Publication	no	yes
Igel in Bayern zählen	NA	Co-Production	NA	NA	NA	NA	Interested	NA	NA		yes
Igel in Berlin	top-down	Co-Production	yes	yes	6.50	publicly	Interested	not public	NA		none
Insekten Sachsen	top-down	Co-Production	yes	no	9.00	publicly	Interested	visible	no	no	yes
ISeeChange	NA	Co-Production	NA	no	NA	NA	Interested	visible	online	no	yes
KLEKs	top-down	Co-Production	yes	no	20.00	privately	Interested	visible	no	no	none
Landinventur	top-down	Co-Production	yes	no	1.00	publicly	Interested	visible	online	no	yes
Medien-Doktor CITIZEN - Was ist guter Umweltjournalismus?	top-down	Co-Design	no	no	9.00	publicly	Interested	visible	NA	NA	yes
Meilensteine der motorischen Entwicklung im Kleinkindalter	top-down	Co-Production	no	yes	8.00	publicly	Requirements	not public	Scientific Publication	no	none
Mikroplastik auf der Spur: Mitforschen im Citizen Lab	NA	Co-Production	yes	no	1.50	publicly	Interested	not public	Scientific Publication		yes
	Mückenatlas	Co-Production	yes	yes	7.50	publicly	Interested	not public	Scientific	yes	yes

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
									Publication		
Natur im Wandel der Zeit	top-down	Educational Project	NA	no	NA	privately	School Children	not public	no	no	none
Naturblick	top-down	Co-Production	yes	NA	NA	publicly	Interested	not public	no	no	yes
naturgucker	top-down	Co-Production	yes	no	12.00	privately	Interested	not public	online	no	none
Patient Science	top-down	Co-Design	NA	yes	2,5	publicly	Requirements	not public	no	no	yes
Phänologische Beobachtungen	top-down	Co-Production	yes	no	4.00	publicly	School Children	visible	NA		yes
Picture Pile	top-down	Co-Production	no	no	NA	NA	Interested	not public	Scientific Publication	no	none
PlanktonID	top-down	Co-Production	no	yes	1.00	publicly	Interested	not public	NA	no	yes
Projekt Roadkill	top-down	Co-Production	yes	yes	5.50	publicly	Interested	visible	Scientific Publication	no	none
Reden Sie mit!	top-down	Co-Production	no	no	0.50	publicly	Requirements	visible	no	no	yes
Repara/kul/tur	top-down	Co-Production	no	yes	3.00	publicly	NA	NA	no	no	none
SAIN – Städtische Agrikultur	NA	Co-Design	no	yes	NA	NA	Interested	not public	online		yes
Sample das Saarland	top-down	Co-Production	no	no	NA	publicly	Interested	not public	no	no	yes
Schüler*innen und Bürger*innen forschen zusammen mit Wissenschaftler*innen zum Thema Stickstoffbelastung von Gewässern	NA	Co-Production	NA	NA	NA	NA	Interested	k. A.	online		yes

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
senseBox - Die Kiste mit Sinn	bottom-up	Co-Production	no	no	7.00	privately	Interested	open access	no	no	yes
SimRa	top-down	Co-Production	no	no	3.00	publicly	Requirements	open access	online	no	yes
Stall Catchers	top-down	Co-Production	no	yes	NA	publicly	Interested	k. A.	NA	no	yes
Stunde der Gartenvögel	top-down	Co-Production	yes	no	15.00	privately	Interested	visible	online	no	none
Stunde der Wintervögel	top-down	Co-Production	yes	no	15.00	privately	Interested	visible	online	no	none
Sugar Maple Regeneration	NA	Co-Production	NA	NA	NA	NA	Interested	k. A.	Scientific Publication, online		yes
Tagfalter-Monitoring Deutschland (TMD)	top-down	Co-Production	yes	yes	16.00	publicly	Interested	visible	Scientific Publication, online	yes	yes
Tatort Gewässer - dem CO2 auf der Spur	top-down	Co-Production	yes	NA	NA	NA	Interested	visible	NA		yes
Tauchen für den Naturschutz	top-down	Co-Production	yes	yes	11.00	privately	Requirements	NA	Scientific Publication, online	no	yes
Tierschnappschuss - Wildtierkameras um und in Konstanz	NA	Co-Production	NA	NA	NA	NA	Interested	visible	online		yes
Treechecker	top-down	Co-Production	yes	yes	NA	publicly	Interested	open access	online	no	none
Wildkatze-Totfundmonitoring	top-down	Co-Design	yes	no	NA	privately	Interested	visible	online	no	yes

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
Wildtierforscher Berlin	top-down	Co-Production	yes	no	1.50	publicly	Requirements	not public	NA		yes
Meilensteine der motorischen Entwicklung im Kleinkindalter	top-down	Co-Production	no	yes	9.00	publicly	Requirements	not public	Scientific Publication, online	no	yes
African Plants	top-down	Co-Production	no	no	NA	publicly	Prior Knowledge	open access	no	yes	none
GBOL - German Barcode of Life	top-down	Co-Production	no	yes	9.00	publicly	Experts	visible	Scientific Publication	no	none
Altes Leipzig	top-down	Co-Production	no	no	9.00	privately	Requirements	not public	no	no	none
Invasive Neophyten entdecken und melden!	top-down	Co-Production	yes	no	6.00	publicly	Interested	visible	online	no	none
C.S.I. Pollen Österreich	top-down	Co-Production	no	yes	2.00	publicly	Requirements	not public	Scientific Publication, online	yes	yes
Das Feuersalamander-Meldenetz	top-down	Co-Production	yes	no	3.00	publicly	Interested	not public	NA	no	none
Dem Plastikmüll auf der Spur	top-down	Educational Project+	no	yes	5.00	publicly	School Children	visible	online	no	yes
Onlinelabor für Digitale Kulturelle Bildung: Gemeinsam Soziale Medien erforschen	top-down	Co-Production	no	yes	NA	publicly	Interested	visible	k. A.	no	yes
Deutsche Kolonialgeschichte –	top-down	Co-Production	no	no	NA	publicly	Interested	visible	online	no	yes

Project Name	Kind of Project	Category	Moni-toring	Research Question	Project Time (years)	Funding	Prerequisites	Data	Publication	Credit	Feedback
Wer war was?											
Landauf. LandApp - Entdecke Dein BaWü!	top-down	Co-Production	no	yes	NA	publicly	Interested	open access	online	no	yes
Burg Wersau – Die Burg unter der Grasnarbe	top-down	Co-Production	no	no	NA	privately	Interested	visible	no	no	yes
WISSENSDINGE. Geschichten aus dem Naturkundemuseum Berlin	top-down	Co-Design	no	yes	2.00	publicly	Interested	visible	Scientific Publication, online	Authorship	yes