POLICY PAPER:

NONPROFITS, CITIZEN SCIENCE AND SOCIAL SCIENCE

MANAGING NGO'S

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EXECUTIVE SUMMARY

In today's era of interconnectivity, globalization and a sharing economy, science is increasingly participatory and voluntary, a trend known as Citizen Science (CS), that nonprofit organizations should make use of for their own benefit and that of society. Three purposes of CS have been identified: data collection, education and policy making. These three purposes can be enforced by three models of cooperation, namely the *contributory model*, in which volunteers only contribute to data collection, the *collaborative model* in which volunteers also engage in data analysis and interpretation, and the *co-created model* in which volunteers are involved in very stage of the research process. The implementation of such projects for nonprofits holds great potential. However, given the lack of clarity surrounding the implementation and execution of CS within the field of nonprofits, many organizations do not consider engaging in CS. In order to tackle this, a thorough analysis of issues is conducted to determine potential risks for NPOs engaging in CS projects. Following, policy recommendations to avoid and suppress these potential issues are provided. The policies have been clearly outlined according to potential purposes of citizen science and different types of projects that NPOs may want to use to employ citizen science. These recommendations hope to enhance public understanding and engagement

in CS, ease processes of such projects and stimulate interdisciplinary relationships between society, the organization, and academics.

1.O CITIZEN SCIENCE

1.1 HISTORICAL CONTEXT

The notion of engaging volunteering citizens in conducting science is traceable to the year 1900, when the National Audubon Society's yearly Christmas Bird Count took place (Kullenberg & Kasperowski, 2015). In fact, several scholars agree that Citizen Science has been prominent for the majority of documented history, as most people interested in science could not have a career in science until the late 19th century, and therefore individuals with an interest for conducting scientific research before this period were, technically, citizen scientists (Miller-Rushing, Primack & Bonney, 2012). Despite this, today citizen science still does not have one clear-cut definition and lacks any definitive policies or guidelines. The Royal Dutch Academy for Science remarks that many researchers as organizations show interest in citizen science, but the lack of clarity holds them back (Lalieu, 2016). The information contributed by citizen scientist is of great value for scientific inquiry, and it is perceived that these voluntarily research projects pose an opportunity for nonprofits to gather insight data as to engage their community members.

This report addresses this uncertainty regarding citizen science, hereby focusing on the application by nonprofits. The report documents a working definition, the relevance of volunteer citizens, outlines the type of projects currently known and the associated issues and presents a practical policy advice on how to best implement these projects.

1.2 WHAT IS CITIZEN SCIENCE?

Having only been conceptualized around the 1990s, the term Citizen Science has been used in many different ways. As such, explaining the confusion that exists among professionals (Lalieu, 2016). Some authors have used the term CS in situations where citizens use scientific techniques to study a phenomenon without any institutional help (Finke, 2015). Other studies refer to CS as 'volunteers monitoring activities'. In such cases the term CS is used in conjunction with the terms; 'community-based monitoring', 'volunteer monitoring' and 'participatory science' as well (Kullenberg & Kasperowski, 2016). What we notice is that the definition of CS is highly dependent on the research context and purpose.

The most common conceptualization of CS is a collaboration between professional scientists and citizens in research projects, in which citizens ('amateurs') implement research tasks which are traditionally executed by scientists (Bonney, Ballard, Jordan, McCallie, Philips, Shirk, & Wilderman, 2009). This is the working definition accepted in this report. Not every collaboration between citizen and a scientist or organization can be described as citizen science however. To be titled a citizen science, or a citizen science project, one has to adhere to a couple criteria. First, the citizens should take an active role as research *subjects* rather than participating as a research *object* in a study, which is often

the case in, for instance, social science (Wiggins & Crowston, 2011; Kullenberg & Kasperowski, 2016). As such, the volunteer scientists should be actively involved in one or more stages of inquiry (see Figure 1), such as research design, data collection, data analysis or interpretation, or publication. The most common design of CS projects, involves following an established protocol on data gathering, or completing structured tasks that depend on human competencies such as data recognition and data classification (Wiggins & Crowston, 2011). As a second criteria, citizens are not actual scientists. The volunteers may receive training or a financial compensation for their cooperation, but they do differ from professional scientists who received specialized education (Resnik, Elliot, & Miller, 2015). The collaboration characterizing citizen science often results in mutual learning outcomes: citizen scientists can learn about the scientific research process and the research topic at hand. In turn, scientists, or organizations can learn from the valuable local knowledge of citizen scientists and build upon this (Resnik, Elliot, & Miller, 2015).

	Stages of Inquiry
1	Define a question/issue
2	Gather information
3	Develop hypotheses
4	Design data collection methods
5	Collect samples/data
6	Analyse samples
7	Analyse data
8	Interpret data
9	Disseminate conclusions
10	Discuss results/ask new questions

Figure 1. Outline of Stages of Inquiry (Phillips, Ferguson, Minarchek, Porticella, & Bonney, 2014)

Hence, citizen science projects are research projects, where citizen volunteers and scientists, in this case nonprofit organizations, work together to collect data, and hereby contribute to answering certain questions or exploring phenomena. Citizen scientists are not just volunteers who pick up trash: a volunteer scientists also observes this trash, delivers data and may be actively involved in designing the study. In addition, since it is proposed that involved citizens are not trained scientists, the projects should be carried out with a nonprofit and/or with a scientific organization. It is acknowledged that literature also sees individual actions and projects of citizens as citizen science, yet this policy focuses on collaboration between actors.

1.3 CITIZEN SCIENCE IN ACADEMIA

During the last decades, CS has become more popular amongst academics (Huygen, 2016; Lalieu, 2016). Traditionally, CS has been affiliated with participation and observations of the environment, such as in bird counting, and the classification and collection of data (Kullenberg & Kasperowski, 2016). Besides ecology, citizen science has also been increasingly used in areas as astronomy, geography and the social sciences, however, the latter not as extensively. Citizen science has made significant contributions to our current understanding of many disciplines including, ecology, important historical datasets and

museum collections (Kullenberg & Kasperowski, 2016). Professionally trained scientists generally view citizen science in a positive light, as unpaid CS volunteers do a significant amount of work for researchers or organizations with limited budgets (Cohn, 2008). Furthermore, CS volunteers contribute to the general societal awareness of issues, and help to communicate the importance of science, potentially making their peers more enthusiastic about science (NIOO, 2016).

The majority of the actual published scientific papers that use CS are within the disciplines of biology and ecology (Kullenberg & Kasperowski, 2016). Clearly, CS is not, yet, a standard in scientific research. However, a journal solely dedicated to CS does exist; Citizen Science Theory and Practice:
https://theoryandpractice.citizenscienceassociation.org.
This journal is open-access, peer-reviewed and co-created by scientists and citizens. The research conducted by CS volunteers, is 'checked' by trained scientists (Citizen Science: Theory and Practice, n.d.). Along with this journal, there is a rise in digital platforms facilitating citizen science projects, such as the Belgian and Dutch platform iedereenwetenschapper.nl ("Everyone is a scientist") launched by the Dutch Magazine EOS Wetenschap. This website shows the broad appliance of citizen science, with projects ranging from counting animals to writing down word associations. Furthermore, citizen science has unified amateurs and professionals alike on a larger scale, for example through the European Citizen Science Association (ECSA). However, these platforms are currently only enablers of CS and could still do a lot more to facilitate and collaborate for the best possible execution of CS.

1.4 CITIZEN SCIENCE AND NONPROFITS

The potential of citizen science for data collection, raising awareness and public engagement is also very valuable for nonprofits. Nonprofits often have loyal members or contributors, that share a common interest through their membership. The fact that these members are part of the organization generally implies that members are dedicated to the cause and mission that the nonprofit stands for posing as a promising opportunity for CS. In addition, research has also shown that people with similar interests and goals are more willing to work together on more intensive projects like research based ones (Ben-Ner & Kramer, 2006). While donors may be dedicated, they often perceive that their donations and membership do not have their desired impact (Das, Kerkhof & Kuiper, 2008). Through citizen science, nonprofits have the potential to empower their members to take action and positively contribute to the organization's objectives.

Despite this, CS is currently not a widely used practice among nonprofits. However, the number of CS initiatives by nonprofits is growing. As described before in the area of academia, most initiatives are focusing on environmental and ecological issues and are therefore mostly conducted by organisations in these fields. In China, the environmental NGO Green Hunan aims to preserve the water quality in an area that consists of many rivers, as well as factories (Tyson, 2017). The organization uses its base of volunteers to test

the water quality along the river and monitor pollution levels, after which results are posted on social media in order to put pressure on the local government and industries. Interestingly, Green Hunan has been growing fast, largely due to funding from the Alibaba Foundation, which allowed the project to scale up to having a million volunteers monitoring the Yangtze river, the largest river in Asia (Tyson, 2017). More traditionally, in the Netherlands, one of the well-known citizen science projects by nonprofits is the Bird Counting Initiative by the Bird Protection (Vogelbescherming). This is a project where citizens count birds on a specific date and send the data to the Bird Protection.

1.5 CITIZEN SCIENCE RESEARCH PROJECTS

1.5.1 THE PURPOSE OF CS

As mentioned, citizen science is currently mainly used by academics. For academia CS is known to serve three main purposes: data collecting, educating, and policy making.

1.5.1.1 DATA COLLECTION PURPOSE

By engaging citizen volunteers instead of hired scientists, graduate students or field technicians, organizations save on labor costs. In addition, since there are less financial constraints, citizen scientists can collect data on larger geographic scales and on longer time scales. Monetary advantages and an corresponding increase in data could help to identify trends, anomalies and differences among geographic areas as time periods in data (Cohn, 2008).

1.5.1.2 EDUCATIONAL PURPOSE

Next to yielding important scientific results, CS can serve an educational purpose, also referred to as ‘Public Understanding of Science’ (PUS) (Bonney, Phillips, Ballard, & Enck, 2016). For volunteers, participating in CS increases understanding and awareness of research and its purposes, and promotes civil knowledge about research and research designs. Citizen scientists can for instance learn about very scientific concepts, as reliability, about broader issues in society, national as academic regulations and, hidden, structures in their communities. Besides these personal benefits for the civil scientists, CS also promotes civic interest in and engagement with science in general or a specific discipline or topic. Environmental focused research also illustrated that CS could, positively, impact pro-environmental behavior of volunteers, foster advocacy and knowledge sharing among peers (Bonney et al., 2009; Bonney et al., 2016).

1.5.1.3 POLICY MAKING PURPOSE

The third purpose is influencing public policy through CS, or community science. Community science aligns with citizen science, only here citizens are asked to engage in roundtables on political decision-making on specific matters as health risks or environmental concerns. With these type of research projects, citizens get the opportunity to influence research questions and to document otherwise hidden local or regional problems that can inform policy (Bonney et al., 2016).

These different purposes can be enforced or impaired by the three possible models of cooperation identified by Bonney and colleagues (2009). The *contributory model* in which volunteers only contribute to data collection is suitable to produce high quality scientific data.

The *collaborative model* also engages volunteers in data analysis and interpretation, and in *co-created models* volunteers are involved in every stage of the scientific process. In these models volunteers have a higher level of cooperation, making an educational outcome more likely. Community Science projects are mostly co-created (Bonney et al., 2016), therefore these types of projects can serve two purposes at once.

1.5.2 TYPES OF CS PROJECTS

1.5.2.1 CONTRIBUTORY PROJECTS AND NONPROFITS

For nonprofits this type of research is relatively easy to implement, since the citizen scientists are 'solely' responsible for collecting data. This design is similar to traditional volunteer programs in which the nonprofit hierarchically designs, implements and controls the programs (Macduff, Netting & O'Connor, 2009).

A well-known example in this category is the 'bird counting' initiative by the Dutch Bird protection. Every year, this nonprofit asks households to count the birds that reside or land in their garden for a weekend (Tuinvogeltelling, n.d.). The edition of 2018, knew approximately 65.000 participants who counted more than 1 million birds (Tuinvogeltelling, n.d.).

Contributory projects might be relatively simple, yet highly valuable, to design and implement. Besides, the objects studied are often non-human, which reduces ethical concerns, human errors (to an extent) and makes the data less vulnerable to questions of reliability and validity (Conrad & Hilchey, 2011). Nonprofits working on themes outside biology or environmental studies, can very well apply the contributory model of citizen science. If an organization wants to have more numerical data regarding a certain question

or phenomena it could ask citizens for help in the same way as ecologically oriented organizations do.

1.5.2.2 COLLABORATIVE PROJECTS AND NONPROFITS

Due to the social dimension of many nonprofits, the organizations might be even more interested in collaborative research projects. Collaborative projects are types of initiatives where citizens not only collect data, but also think along about the research and its directions (Bonney et al., 2009). For nonprofits these type of projects are ideal to get expert knowledge on a very specific topic, yet barely used to this day.

An example of a collaborative project is the work of the Dutch researcher Lea den Broeder. In her dissertation she illustrated how neighborhood researchers delivered very valuable information from their peers about health and well-being (RIVM, 2017). Collaborating with citizen scientist helps to embed research in context and provides richer data. Another example is the Dutch public nonprofit KWF Kankerbestrijding (cancer research) which recently started to engage (ex-) patients in formulating research and governance policies (KWF, n.d.). With this input, the foundation can enhance its operations and better understand symptoms and experiences of patients and how to cater to these.

Collaborative projects deem to be fit to generate insights into specific communities or topics. For nonprofits this type of information may be the key to tackling local poverty, to stimulate people to eat well or to understand why they are not being successful with their programmes. This type of research projects may be very valuable for social oriented nonprofits, yet it does not have to be exclusive to social nonprofits. Nonprofits focusing on the environment, or even geography, may use these collaborative projects too to enhance programs or increase their understanding.

1.5.2.3 CO-CREATED PROJECTS AND NONPROFITS

With the former two research designs, nonprofits control either the entire process of the study or the general research design. In this, co-created projects differ. As the name implies, co-created projects are designed by scientists (or nonprofits) and citizens together. The public participants are actively involved in most of the steps of the research (Bonney et al., 2009).

Bonney et al.,(2009), provide an example by describing a watershed management project in which citizens had a lot of responsibilities. In addition to these responsibilities, they became active lobbyists, designed follow-up plans and committed themselves to related projects (Bonney et al., 2009).

Both collaborative as co-created projects enable nonprofit organizations and citizens to connect. The projects stimulate the organization's community engagement, as provide volunteers, and perhaps nonprofit staff, with increased knowledge about general research, research design and conducting research. Yet, co-created projects may also be harder to

implement since it requires more involvement of both the nonprofit as the citizen and the citizens are granted more power to influence the research projects.

2.0 ISSUES

As previously mentioned, Citizen Science is often used within academia, but its use within nonprofits is still uncommon. This can be, in part, explained by the skepticism of its benefits for the nonprofit organization and the lack of policies provided to guide the process. This is particularly the case for social science research that rely on human observations like social or humanitarian projects, where CS is less used and for longer term research that requires more guidance. As such, the use of CS comes with various complexities and concerns, that have yet to be addressed. Some of the most prominent and recurring concerns are outlined in the following section with a particular focus, but not exclusively, on longer-term social projects. It is important to consider that due to the rarity of nonprofits involving CS in their projects many problems faced by citizen scientists or those implementing it within academia have been considered transferable to the more practical field. Furthermore, the managerial implications in regard to CS for nonprofits have also been evaluated.

ISSUE 1: MOBILIZING CITIZENS AND MAKING EVIDENT THE VALUE OF CS

The first challenge relates to the issues of mobilizing and encouraging engagement in citizen science particularly within the social science realm (Heiss & Matthes, 2017). This is clearly a primary problem, as citizens are a precondition to the successful implementation of this scientific work. Whilst, citizen scientists are plentiful in projects concerning astronomy, ornithology and ecology there seems to be a lack of engagement in regards to citizen science directed at the social sciences (Heiss & Matthes, 2017). For nonprofits looking to involve CS within their social work, for example, may be hampered by this issue. Researchers claim that one reason for this issue is the general lack of interest in the social sciences, as well as failure to recognize the value of the social sciences due to the context-dependent results - as opposed to the natural sciences which often provides straightforward quantitative results that people perceive as useful and adding to existing knowledge (Heiss & Matthes, 2017). Some also claim that the preference for the natural sciences stems from the fact that these, as opposed to the social sciences, are taught at a very young age at schools across the world (Heiss & Matthes, 2017). By extension, volunteers of citizen science are often driven by their intrinsic motivations and genuine interest and enthusiasm for the project and since the natural sciences are more popular these research projects see more volunteers than that of the social sciences (Cohn, 2008).

ISSUE 2: QUALITY AND RELIABILITY OF DATA

Another problem outlined by many (Heiss & Matthes, 2017; Cohn, 2008; Resnik, Elliott & Miller, 2015) is the reliability of citizen science and particularly for the social sciences. Often volunteers have no experience within the field of scientific research, having little understanding on proper collection, reporting and management of data. Forged and false data are just examples of risks that are associated with using such volunteers (Resnik, Elliott, & Miller, 2015). Therefore, scientists question whether the data collected is reliable or valid and whether it meets scientific standards (Resnik, Elliott & Miller, 2015). Given the nature and scope of the projects and issues addressed by nonprofits the quality of the data is particularly important, as imprecise data may mean making assumptions on important global issues. Additionally, nonprofits face high scrutinization by the media and inaccurate data could result in harming the organization's reputation.

ISSUE 3: SUBJECTIVITY OF MEASUREMENTS

Closely related to the issue of reliability of data, is the aspect of subjectivity when collecting data. The risk of being biased is omnipresent across research, however, when a researcher is inexperienced, as is often the case in citizen science, this risk is further enlarged (Whitelaw, Vaughan, Craig & Atkinson, 2003). The field of social science is particularly vulnerable to subjective measurements due to the dependency on human observation (Resnik, Elliott & Miller, 2015). Often, untrained observers are not completely certain of what they perceive, and therefore the generated data often represents a range rather than specific numbers (Cohn, 2008). It is also possible that volunteers let their enthusiasm for the research topic cloud their dedication to scientific standards (Cohn, 2008). Again, this could have serious repercussions for nonprofits using CS. To illustrate, the US Congress called to disregard data gathered through CS in 1994 for the National Biological Survey following their belief that the volunteers' 'environmentalist agenda' resulted in biased and subjective outcomes (Root & Alpert, 1994 as cited in Conrad & Hilchey, 2011). Additionally, nonprofits should consider the potential that volunteers have an alternative political or corporate agendas which may influence their particular data outcomes (Resnik, Elliott & Miller, 2015).

ISSUE 4: EXPLOITATION OF VOLUNTEERS

Ethical considerations may also come to play when implementing CS for social projects (Heiss & Matthes, 2017; Resnik, Elliott & Miller, 2015). Volunteers dedicate their free time and are asked to give quality work without an expectation of any monetary compensation. Even so, nonprofits who might want to offer financial compensation are unlikely to have the resources to do so, let alone offer any compensation. Hence, there is the risk that volunteers perceive that the nonprofits are exploiting their efforts or taking advantage of their willingness to participate (Resnik, Elliott & Miller, 2015). A volunteer may believe they are being exploited when there is a lack of consent, perceived harm or inequality (Wertheimer,

1999 as cited in Resnik, Elliott & Miller, 2015). To be more specific, unsafe data collection methods or locations, unattainable deadlines or being uncredited for their work might lead to a volunteer feeling exploited (Wertheimer, 1999 as cited in Resnik, Elliott & Miller, 2015). There is also the potential that citizen scientists may be misled by the degree of their involvement throughout the project, either expecting more or less responsibility. Thus, it is especially important for nonprofits to consider the way their volunteers may feel exploited.

ISSUE 5: PROPERTY RIGHTS AND RECOGNITION

As mentioned, discrediting of the research outcomes may also lead to feelings of exploitation. Thus, related to this matter is another widely contested ethical issue within this field of research, the issue of property rights of the gathered data. As previously mentioned, one of the purposes of citizen science is to spread scientific messages and increase awareness and enthusiasm about science. Thus, the sharing of data is key as it encourages debate and critical discussion which is especially beneficial for nonprofits to promote their cause. Yet, many volunteers feel their work is not properly accounted for during the distribution of (partly) their work (Resnik, Elliott & Miller, 2015). Due to the time devotion and fact that volunteers are actively collecting data for a cause they may feel very passionately about, many argue that volunteers should be recognized as co-producers of the data (Riesch & Potter, 2014).

ISSUE 6: LACK OF SCIENTIFIC UNDERSTANDING AND COMPLICATED INSTRUMENTS

Within citizen science a prominent risk revolves around demanding volunteers to collect data that may be too complex or detailed for them to measure or fully understand (Heiss & Matthes, 2017). Furthermore, certain research projects may involve the usage of complicated instruments, that would require a deeper understanding of. This lack of scientific knowledge may also decrease the motivation of volunteer scientists to collect accurate and reliable data as well as the efficiency of data collection (Heiss & Matthes, 2017; Kudo et al., 2013). A common pitfall is that volunteers focus their efforts on the data collection and not on how they collect the data, hence simply recording figures through rough estimation or careless collection (Conrad & Hilchey, 2011).

ISSUE 7: PERCEIVED THREAT OF VOLULNTEERS BY PAID STAFF

Nonprofit management scholars have widely research the interchangeability of paid staff and volunteers in nonprofits. Although varying results have been found, in some cases paid staff can sufficiently take up tasks by volunteers and in other circumstances volunteers are found to more efficiently undertake the work of paid employees (Handy, Mook & Quarter,

2007; Brudney & Gazley, 2002). For example, some assert that paid professionals could not feasibly gather the amount of data that volunteers do (Conrad & Hilchey, 2011). For this reason, paid staff may feel threatened by the rise of (unpaid) volunteer science, and sometimes justly so, as they risk becoming redundant in the face of CS projects (Cohn, 2008). Putting paid staff in an even more negative light, some organizations claim that the citizen scientists often prove to be more dedicated to their work than many of the employed young professionals (Cohn, 2008). Particularly since, volunteers of nonprofits are increasingly highly educated professionals whom have experience in high managerial positions (Drücker, 1989). Hence, they are greatly dissatisfied with simply being considered helpers to the paid employees of the nonprofit, all in all causing executives to reevaluate the various roles held within the organization (Drücker, 1989).

ISSUE 8: VOLUNTEERS EXPECTATION OF OR STRIVING FOR MORE INFLUENCE

Given the characteristics of (CS) volunteers described above, those especially knowledgeable may begin the project expecting to have or end the project striving for more influence within the project or organization as a whole (Resnik, Elliott & Miller, 2015). Particularly after having dedicated a lot of their time to a project and being fully immersed in the collection of data, volunteers may feel they are highly knowledgeable about the issue at hand, perhaps more so than those involved in the project from their desk. Thus, may want to be granted greater influence and power over the research or cause (Resnik, Elliott & Miller, 2015).

ISSUE 9: THREAT TO UNIFORMITY OF BRAND

Despite tension between volunteers and permanent paid employees, both groups can have similar influences on the nonprofit's brand. To external parties, volunteer scientists will be perceived as members of the organization, therefore being brand ambassadors (Balan, 2014). Through this association, volunteers pose as a threat to the uniformity of the brand image. This may be difficult to manage especially during the larger scale data collection projects, where focus is often placed on the quantity of collected data and hence number of employed volunteers. There is great potential that a citizen scientist, on the job, may deviate from the values and core principles of the organization (Balan, 2014). There are many practical examples that show the effect of volunteers not sufficiently embodying the organization. One example, outside of the realm of CS, is that of unpaid volunteers at refugee camps in Calais, France who were accused of sexual exploitation (Bulman, 2016). This had serious consequences to the credibility of the many charities being represented by the accused volunteers at the refugee camp (Bulman, 2016). Furthermore, also causing anger and further tensions between volunteers expecting to represent the brand appropriately and employees feeling the direct consequences. Whilst, the example may not

seem directly applicable it can be compared to using citizen scientists as brand ambassadors especially for more delicate social projects. On a smaller scale, having many volunteers reaching out to the public for research for example, may mean having inconsistent communication resulting in an incohesive brand (Chapleo, 2015; Kylander & Stone, 2011).

ISSUE 10: LACK OF CONSISTENT SUPERVISORY OR LEGISLATIVE ENTITIY AND PROTOCOL

Of those organizations involved in citizen science there is a definitive consensus that the research suffers from the lack of clarity in terms of research strategy and best practices (Conrad & Hilchey, 2011; Resnik, Elliott & Miller, 2015; Heiss & Matthes, 2017; Philips, Ballard & Enck, 2016). A common reason for nonprofits not to adopt Citizen Science is not knowing how to approach the projects (Philips, Ballard & Enck, 2016). Often nonprofit employees do not have an understanding of scientific research processes to create their own research design (Philips, Ballard & Enck, 2016). Additionally, setting up a tailored research design for each specific CS-based research project is time consuming and requires the allocation of knowledge, labor force and other resources. Furthermore, the absence of a consistent protocol poses as a threat to reliability of the data, making data collection difficult to replicate in other circumstances and may cause mistrust of the validity of the research by external organizations, like the government or other scientists (Conrad & Hilchey, 2011). Whilst, there does exist an academic journal that addresses CS from a scientific point of view and the European Citizen Science Association that tackles CS from a practical perspective these are both still underdeveloped and do not provide the clarity nonprofits currently require.

3.0 POLICY OUTLINE

Whilst the issues nonprofits could face when implementing CS are clearly extensive, this should not cause apprehension among those thinking of engaging in such projects. These issues are avoidable or potentially suppressed when simple policies are adhered to. This section suggests basic guidelines for nonprofits employing CS projects. These policies have great potential to ensure a smooth citizen science project from acquiring citizen scientists, to guiding the process and closing the project. However, by no means can these policies consider all the potential contexts in which CS research can take place. Hence, nonprofits must carefully evaluate how to best implement the suggested strategy for their given societal issue, given their organization objectives and resources, and considering their research purposes and project types. As such, the following has been organized, for ease of understanding, according to project purpose (i.e. data collection, education or policy making) and project type (i.e. contributory, collaborative or co-creation). A

comprehensive summary of the suggested policies has been articulated in a table in Appendix 1.

3.1 GENERAL OVERARCHING POLICIES

Some policies are seen as generally applicable to essentially every citizen science research project. For this reason some overarching guidelines have been provided:

- Allocate an interdisciplinary project team. Before starting a project, it is advised that the nonprofit assesses whether it has the needed skills and expertise in-house, or whether external parties such as universities should be consulted. When there is no in-house expertise, nor possibilities to collaborate or join projects of other organizations, scholars advise to create an interdisciplinary team consisting of researchers, ICT-specialists, communication experts and potentially educational experts (Bosch, Fijen, Laat, Nieuwpoort, Reinders, Scheen, et al., 2014).
- Establish standardized research protocols. In order to assure data quality, methods of data collection must be standardized and well designed (Silvertown, 2009). Hence, it is advisable that the organization establishes research protocols/volunteer protocols that guide the CS projects and ease execution of future projects. These protocols should state the time, place, date and directions to the location of the project. They should be sent to the CS volunteers beforehand, in order for them to prepare themselves if necessary. Not only does a clear framework helps the nonprofit, it also reduces uncertainty for volunteers. Furthermore, as stated, this could be done with in-house expertise as nonprofits may have researchers and university educated employees, or with external parties.
- Design data-forms as simple and clear as possible. This is important in order to stimulate participants to submit all their gathered data (Bosch et al., 2014).
- Verify volunteer consent. Consent is a difficult concept to discuss, since informing participants of the research may harm academic validity. However, for nonprofits this may be less of a concern. Nevertheless, volunteers should state that they are willing to cooperate, and that they understand the project. Moreover, the nonprofit should make sure that the groups that are worked with, for instance interviewees can receive anonymity if desired. An example of a consent form is found in Appendix 2.
- Provide volunteers with a formal document which states that the volunteers do not own data, since they chose to work with the nonprofit. This may reduce the threat of facing legal liabilities.
- Assign citizen science volunteers very specific tasks. Cohn (2008) gives the example of an ecological study. In the study, citizen scientists were asked to "identify, document, and count 5 or 10 easily recognizable plants that serve as indicator species, rather than asking the volunteers to recognize all species in a given area" (Cohn, 2008, p. 194). It is important to design these specific tasks into

different levels of intensity and difficulty in order to serve the wishes of as many participants as possible (Bosch et al., 2014).

- Validate gathered data from citizen scientists (Silvertown, 2009). To ensure the reliability of the gathered information, quality measure checks should generally be implemented, for example an expert may guide the citizen scientists (Heiss & Mathes, 2017). Nonprofits can assign their researchers or a few dedicated volunteers the task to check all collected data, or to test (some) results for reliability. Sometimes it is possible to statistically even out outlying data (Bosch et al., 2014).
- Communicate to the volunteers throughout the whole citizen science process stating values, purposes and more. This is crucial in order to obtain, retain and motivate participants. To recruit participants it is important to very clearly state the purpose of the project (Bosch et al., 2014). In addition, communicating the value of the help of the citizens for organization and society, and the benefits they may derive from the project are good methods to recruit volunteers. However, make sure to communicate clearly what exactly is expected from a participant (Bosch et al., 2014). These days, the internet is the first channel to be considered to address citizens. Online communication through the website, via email and via social network sites, reaches many people against, relatively, low costs. In order to help nonprofits make this clear, it may be beneficial to follow a similar structure as provided in appendix 3.
- Develop and strengthen partnerships with external bodies.
  In order to promote citizen science and strengthen its impact, it is advised for nonprofits to work with external and overarching organizations such as the European Citizen Science Association (ECSA) to ensure and develop a high quality, and consistent common approach and research protocol for citizen science, for the mutual benefit between nonprofits, volunteers and stakeholders involved. Considering how the ECSA is currently underdeveloped, strengthening partnerships with nonprofits and academia would enhance its legitimacy and provide improved conditions for citizen scientist on a wide scale.
- Use an umbrella platform. Similar to the online platform of iedereenwetenschapper.be previously mentioned, an umbrella platform should be established for nonprofits to post CS projects on a wider scale. Through this platform, citizen scientists may be recruited, and volunteers are able to filter projects to find a wide variety of projects across different disciplines.
- Sign code of conduct. As previously outlined, once a citizen offers themselves as a volunteer for the project they will be viewed as a member of the organization. This is particularly applicable for volunteers who are involved in projects that require interaction with other members of society or require being in the outdoors and less so for superficial data collection with no human interaction. Agreeing on a common code of for all projects that lays out the basic expectations, or do's and don'ts when representing the organization during the scientific process is considered of high importance for most projects.

- Note of appreciation. Appreciation should be given to volunteers in all circumstances. As such, volunteers will feel recognized for their free labor and time. Depending on the intensity of the project, the extensiveness and personalization of the thank you note should differ.

3.2 POLICIES FOR PROJECTS WITH A DATA COLLECTION PURPOSE

3.2.1 CONTRIBUTORY PROJECTS

A contributory project design is the only design suited for the purpose of data collection. The data collected by participants can help nonprofits in various ways as extensively touched upon, however an organization should take precaution to ensure the quality and reliability of this data is as best as can be. In addition, special attention should be paid to participant recruitment and participant retention. Since the focus of the application of citizen science in this policy is on contribution of data by volunteers, the design of the study is very important. To assure sound research designs, and the other aspects mentioned above, nonprofits should carefully pay attention to the general overarching policies.

3.2.1 COLLABORATIVE PROJECTS AND CO-CREATED PROJECTS

As mentioned before, for data collection purposes contributory projects are most applicable. When collaborative or co-created project designs are preferred, the purpose of the study should be re-evaluated and added upon with another purpose as well.

3.3 POLICIES FOR PROJECTS WITH AN EDUCATIONAL PURPOSE

Besides the collection of data, CS can serve a public education purpose since citizens learn about research processes through the projects. Besides getting familiar with conducting research, citizens may also learn about the topics studied and the work of the nonprofit organization they volunteer for (Dickinson, Shirk, Bonter, Bonney, Crain et al., 2012). The educational outcomes of these type of projects are one of the main reasons that academic citizen science projects have received funding (Dickinson et al., 2012), which could also be the case for nonprofit projects. In educational projects, goal setting and evaluation are crucial, which has also been a requirement for academic grants for scientific CS projects.

General policies

- Decide upon the desired educational outcome of CS projects (Dickinson et al., 2012). Do you as an organization want to contribute to the personal development of citizens, to their understanding of science or to their knowledge about your nonprofit in the third sector? Setting these goals is important, since they guide the process of

educational projects. The goal of these projects is not solely generating insights, but aiding to the development of the citizens. The goals should be clearly formulated and communicated in advance with the citizen scientists.

- Provide additional materials. Citizens scientists can study this before the projects to increase their general knowledge on the chosen project goal. These materials can range from leaflets, books and journal papers to interactive quizzes, workshops or questionnaires (Dickinson et al., 2012).
- Evaluate educational projects. Evaluation is needed to measure the knowledge acquired by citizens. Depending on the goal of the project, this should be measured accordingly. Philips, Ferguson, Minarcheck, Porticella and Bonney, (2014, p. 10), provide the following framework for measuring personal development in CS projects. These elements could be measured through interviews and surveys for instance.
- Send the outcomes of the study to the volunteers, if necessary explain the implications of the outcomes.

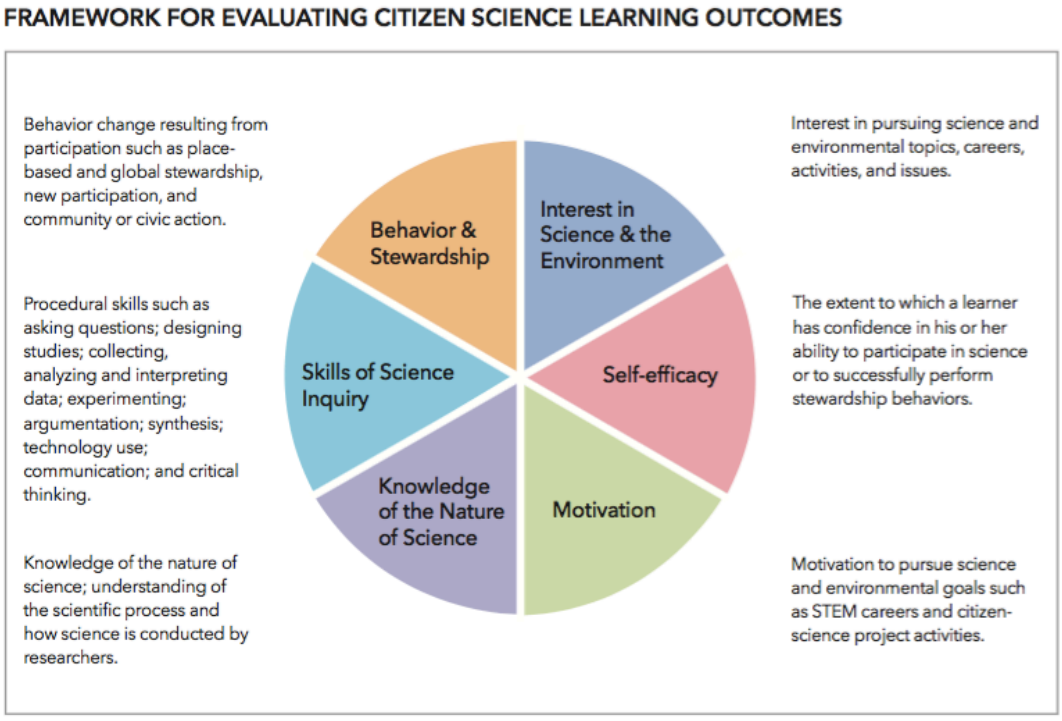

FIGURE 3: A guiding framework for evaluating individual learning outcomes from citizen-science projects.

The following sets out specific recommendations per type of project.

3.3.1 CONTRIBUTORY PROJECTS

- Provide additional sources of study-related information. Contributory projects mainly concern data collection in the forms of monitoring or testing. These types of projects have a clear framework and therefore require less pre-knowledge from volunteers. If your nonprofit organization wishes to make contributory projects more educational, it is advised to provide additional sources.

- Inform CS volunteers about the outcomes of the projects, and the value of the data collected. Along with evaluating the project with your volunteers, keep CS volunteers up to date about upcoming projects and opportunities to deepen their knowledge.

3.3.2 COLLABORATIVE PROJECTS AND CO-CREATED PROJECTS

- Conduct pre-evaluations. These projects often require volunteers to be trained or have a certain skill. To make sure that volunteers can live up to the expectations, some academics recommend to conduct pre-evaluations (Dickinson et al., 2012). With a simple questionnaire one can establish whether a volunteer has the required mindset or capacities to engage in the projects.
- Get a statement of good conduct, in Dutch a Verklaring Omtrent Goed Gedrag. This can be necessary since the volunteers works with other people in these type of projects, which are at times members of vulnerable groups in society.
- Provide training to volunteers. Volunteers should be equipped to deliver quality data, therefore the nonprofit should make sure volunteers are well prepared before commencing with the project. With the eye on participant retention, it is recommended to provide a form of engagement, as a workshop, to give people the chance to bond with each other and the organization (if new to NPO or project) and establish a connection with them. These efforts directly support the quality of the CS project. Literature indicates that CS participants who learn about the project are more motivated and consequently deliver higher quality data (Bosch et al., 2014).
- Require volunteers to regularly check-in for longer and more intensive collaborative projects (Dickinson et al., 2012). Whilst the nonprofit should remain its professional attitude, regular check-ins through digital platforms or on the site are recommended to stay up to date about the work of volunteers and their experiences. These check-ins also allow you to steer the direction of the project, or intervene if necessary.
- Provide participants with continuous feedback. This is necessary to increase involvement and volunteer retention. If possible, participants should be provided with personal feedback, consisting of a note of appreciation and potential clarification of corrections when errors were made. In addition, interim results should be send towards all participants, preferably displayed in a story format that participants can easily relate to their own surroundings. This interim merge of results provides participants with an opportunity to already disseminate results for themselves (Bosch et al., 2014). Lastly, an end report with impacts of the research and final results should be distributed among all participants (Silvertown, 2009).

3.4 POLICIES FOR PROJECTS WITH A POLICY MAKING PURPOSE

Typically, besides addressing scientific questions and contributing to academic literature, citizen science also aims to influence public policy (Bonney at al., 2016). Although the political power of nonprofits is limited, nonprofit organisations have achieved many accomplishments (Paul, 2000). Examples of these are the promotion of new environmental agreements and the improvement of women's and children's rights, as well increasing the societal position of the disabled, poor and indigenous peoples. This is largely due to increased globalization, and pressure from ordinary citizens on and within NGOs (Paul, 2000). Furthermore, scholars have been pleading for the increased involvement of citizens in the policy making process. This is where CS plays a significant role (Belyakov, 2011; Fischer, 1993).

3.4.1 CONTRIBUTORY PROJECTS

Firstly, the use of contributory projects for policy making purpose is discussed. Taking the most well-known example of contributory projects concerning citizen science use by nonprofits in the Netherlands, annual bird counting, data is used to influence nature policy on a national level. Sovon Vogelonderzoek Nederland, a Dutch nonprofit concerned with the presence and development of birds in the Netherlands, works together with the Netherlands Statistics Bureau (CBS), and uses the data collected by bird watchers to make regional and national analyses, that is in turn being used by the government to change and implement nature policy. For example, by creating lists of endangered species and setting up habitat maps of bird species that are especially vulnerable to dehydration or nitrogen levels (Sovon, n.d.). The following is a proposal on how to develop contributory projects for policy making purposes:

- Strengthen partnerships with academia and target governmental agencies. For policy making purposes it is especially vital to create strong ties with external members, in this sense potential influence on society and of policies is enhanced.
- Set clear applicable goals: data collected by CS volunteers and the issue they address should be in line with the concern of government, a common ground should be found between the two parties. If this is not the case, the nonprofit may attempt to influence the perspective of the government by means of traditional ways such as campaigning, which raises societal pressure on government (Paul, 2000).
- Assess appropriate external parties and research within your scale: for smaller organizations and local issues, provide data from the local contributory project to local government and partners to put pressure for policy creation or change. For issues of (inter)national relevance and reach, combine contributory project-generated data from different locations to influence national policy, or combine data from different countries to push for international change, for example on the EU level.
- State explicit value of research to volunteers and governments. CS has the potential to generate unique data that can guide policy making. The use of CS by nonprofits has the potential to generate unique datasets that would normally not have been

able to be collected by government or academics alone, and has to the potential to address pressing issues, therefore this data would be valuable to governments when creating policy concerning these issues. This may increase motivation of volunteers, but also reiterate the importance of CS.

3.4.2 COLLABORATIVE AND CO-CREATED PROJECTS

As collaborative and co-created projects involve volunteers in a wider process of the research, increasing their scientific knowledge, participants in most of the collaborative and co-created projects gain knowledge of community structure and environmental regulation (Bonney et al., 2009). Influencing public policy is especially prominent in co-created projects. Research has suggested that co-created projects have the biggest potential for a wide range of impact among the public (Bonney et al., 2009; Shirk et al., 2012, as cited in Bonney et al., 2016). The primary reason for this is that this type of projects involve participants in full process of the research, from developing research questions to designing research protocols, interpreting data and distributing results (Bonney et al., 2016). Many co-created projects serve the goals of public engagement in governance and decision-making on a scientific basis. Recently, evidence for the value of co-created projects in shaping policy and resource management has been growing (Bonney et al., 2016). In the United States, the West Oakland Environmental Indicators Project engaged people living in one of Oakland's poorest African American and Latino neighborhoods to gather data on air quality and data on health impacts on residents, using company-sponsored equipment. This project resulted in recommendations preventing truckers to leave their engine running while waiting for pick-ups (Gordon, 2013). Another example is an instance of bird counting in California, where members of the Golden Gate Audubon ended up presenting their findings to local agencies. As they decided that scientific research was the best way to address local conservation goals, members formed committees and implemented additional monitoring projects. (Wheeden, 2012). Based on this academic research and the practical examples, the following is proposed:

- Formation of local working groups. By partnering up with local residents and engaging the community in community-based collaborative and co-created projects, citizen scientists have the potential to make a positive contribution to the wellbeing of their community, by taking on the role of community leaders and conducting research that may have a direct impact on local community, therefore providing direct pressure on policy makers on a municipality level, for example.(Bonney et al., 2016).
- Require statement of good conduct.
- Engage in cross-sector partnerships. Following the example of the West Oakland Environmental Indicators Project (WOEIP), partnerships need to be established between the nonprofit and businesses, as well as academic actors. For example, by partnering with a technology company such as Intel, citizens engaged in the WOEIP

are able to use devices to collect data more efficiently and accurately, therefore being more valuable to policymakers (Gordon, 2013).

- Sign contract emphasizing the role of volunteers in the organization, particularly in relation to paid staff.
- Provide interim results throughout the process. As such, volunteers can see the impact that their research is having on the formulation of policies and what effect this may have on a wider scale.
- Giving credit. Volunteers should be recognized when progress is made, for example when policies have been affected by CS data, the impact of volunteers and the role they have played should be made clear, further emphasizing the importance of volunteers to the organization.
- Developing training programs. By utilizing this equipment, WOEIP is providing practical training to residents, which allows volunteers to not only actively participate in a cause that directly relates to them and that they feel passionate about, they also aim to educate citizens about the extent to which they have ownership over the data they collect (Gordon, 2013).
- Mutual evaluation during and after projects. This will help volunteers to recognize how their mistakes could have influenced the project, but also how the organization could have aided the process, therefore providing a mutual learning experience.
- Accentuate value of data, share reports to spread awareness. One of the most efficient ways for NGOs to bring policy change is through raising awareness and campaigning (Chapman & Fisher, 2000). WOEIP's research outcomes have gained the organization national attention, and have done so through expanding across spheres. For example, WOEIP has reached out to bring their methods into schools, and are aiming to empower parents to address air quality issues in the house (Gordon, 2013). This way, WOEIP strengthens its societal presence and influence, two important factors when aiming to influence policymakers (Chapman & Fisher, 2000). It is therefore recommended for nonprofits to conduct citizen science research across institutions such as education and family, as to enhance its societal influence and pressure on policymakers.

4.0 CONCLUSION AND FUTURE OUTLOOK

In this paper, the wide applicability of citizen science was outlined and related to the potential for the use by nonprofit organizations. Furthermore, identified issues were explained, after which policies were formulated in relation to the different purposes of citizen science, and the types of projects that employ citizen science. In today's era of interconnectivity, globalization and a sharing economy, science is increasingly participatory and voluntary, a trend that nonprofit organizations should make use of for their own benefit and that of society. The proposed policies in this paper provide comprehensive guidance for nonprofits, attempting to account for the different purposes and project types that may

be of interest to nonprofits, however, it is not realistically feasible to assume that these policies can be blindly applied to every circumstance. For this reason, it is vital and strongly advised that nonprofits first and foremost evaluate their goals and capabilities for and when engaging in a CS project. In other words, it is unlikely for a CS project to be successful unless it is specifically tailored to the nonprofit organization. Several points of advice in this paper have the potential to be broadly applied across the field of citizen science and its applicability to nonprofits, as they would improve the practices and relevance of citizen science for nonprofits and overall. General points of policy include the creation of an umbrella platform for nonprofits to post projects and to recruit citizen science volunteers, as well as the advice for nonprofits to develop strong partnerships with organisations such as the European Citizen Science Association, which is currently lacking in influence. There is however great potential when nonprofits engage in partnerships and develop the legitimacy of the European Citizen Science Association, to ensure and develop a high quality, and consistent common approach and research protocols for citizen science, for the mutual benefit between volunteers and nonprofits.

REFERENCES

Balan, A. (2014). *Manage Your Volunteer Program*. Retrieved 15 March 2018, from https://npengage.com/nonprofit-management/why-and-how-manage-your-volunteer-program-professionally/

Belyakov, S. (2018). Increasing the influence of ngo's on policy-making through public consultations. *The National Endowment for Democracy.*

Ben-Ner, A., McCall, B., Stephane, M., & Wang, H. (2009). Identity and in-group/out-group differentiation in work and giving behaviors: Experimental evidence. *Journal Of Economic Behavior & Organization, 72(1*), 153-170. http://dx.doi.org/10.1016/j.jebo.2009.05.007

Bonney, R., Ballard, H., Jordan, R., McCallie, E., Philips, T., Shirk, J. & Wilderman, C.C. (2009). *Public participation in scientific research: defining the field and assessing its potential for informal science education.* [CAISE Research Report]. Retrieved 25 February 2018 from: http://www.informalscience.org/public-participation-scientific-research-defining-field-and-assessing-its-potential-informal-science

Bonney, R., Phillips, T., Ballard, H., & Enck, J. (2016). Can citizen science enhance public understanding of science?. *Public Understanding Of Science*, *25*(1), 2-16.

Bosch T, Fijen TPM, de Laat HHA, van Nieuwpoort D, Reinders M, Scheen M, Scheepens S & van Alebeek F (2014). Citizen science projecten effectief opzetten en uitvoeren voor ecologische studies in Nederland. ProPolis Rapport 1. ProPolis Ecologisch Adviesbureau, Wageningen & onderzoeksinsinstituut Praktijjkonderzoek Plant en Omgeving (PPO-AGV), Lelystad. 165 p.

Brudney, J., & Gazley, B. (2002). Testing the Conventional Wisdom Regarding Volunteer Programs: A Longitudinal Analysis of the Service Corps of Retired Executives and

the U.S. Small Business Administration. *Nonprofit And Voluntary Sector Quarterly*, *31*(4), 525-548.

Bulman, M. (2016). *Volunteers in Calais Jungle*. *The Independent*. Retrieved 15 March 2018, from http://www.independent.co.uk/news/world/europe/calais-jungle-volunteers-sex-refugees-allegations-facebook-care4calais-a7312066.html

Chapleo, C. (2015). Brand 'infrastructure' in nonprofit organizations: Challenges to successful brand building?. *Journal Of Marketing Communications*, *21*(3), 199-209.

Chapman, J., & Fisher, T. (2000). The effectiveness of NGO campaigning: Lessons from practice. *Development In Practice,* 10(2), 151-165. http://dx.doi.org/10.1080/09614520050010197

Citizen Science: Theory and Practice. Theoryandpractice.citizenscienceassociation.org. Retrieved 17 March 2018, from https://theoryandpractice.citizenscienceassociation.org/

Cohn, J. P. (2008). Citizen science: Can volunteers do real research?. *AIBS Bulletin*, *58*(3), 192-197.

Conrad, C., & Hilchey, K. (2011). A review of citizen science and community-based environmental monitoring: issues and opportunities. *Environmental Monitoring And Assessment*, *176*(1-4), 273-291.

Das, E., Kerkhof, P., & Kuiper, J. (2008). Improving the Effectiveness of Fundraising Messages: The Impact of Charity Goal Attainment, Message Framing, and Evidence on Persuasion. *Journal Of Applied Communication Research, 36(2*), 161-175. http://dx.doi.org/10.1080/00909880801922854

Dickinson, L.J., Shirk, J., Bonter, D., Bonney, R., Crain, L. R. Martin, J., Philips, T. & Purcel, K. (2012). The current state of citizen science. *Front Ecol Environ, 10*(6), 291 - 297.

Drücker, P. (1989). What Business Can Learn from Nonprofits. *Harvard Business Review*, 88-93.

Finke, P. (Ed.). 2015. Freie Bürger, freie Forschung: Die Wissenschaft verlässt den Elfenbeinturm. Munich: oekom.

Fischer, F. (1993). Citizen participation and the democratization of policy expertise: From theoretical inquiry to practical cases. *Policy Sciences,* 26(3), 165-187. http://dx.doi.org/10.1007/bf00999715

Gordon, M. (2013). *West Oakland Environmental Indicators Project: Citizen Engagement to Measure and Improve Air Quality. whitehouse.gov*. Retrieved 17 March 2018, from https://obamawhitehouse.archives.gov/blog/2013/06/26/west-oakland-environmental-indicators-project-citizen-engagement-measure-and-improve

Handy, F., Mook, L., & Quarter, J. (2007). The Interchangeability of Paid Staff and Volunteers in Nonprofit Organizations. *Nonprofit And Voluntary Sector Quarterly*, *37*(1), 76-92.

Heiss, R., & Matthes, J. (2017). Citizen Science in the Social Sciences: A Call for More Evidence. *GAIA - Ecological Perspectives For Science And Society*, *26*(1), 22-26.

Kudo, Y., Hayashi, S., Yoshimura, E., Tsunoda, M., Tsutsumi, A., Shibuya, A., & Aizawa, Y. (2013). Five Reasons for the Lack of Nursing Students' Motivation to Learn Public

Health. The Tohoku Journal Of Experimental Medicine, 231(3), 179-186. http://dx.doi.org/10.1620/tjem.231.179

Kullenberg, K. & Kasperowski, D. (2016). What is citizen science? - A scientometric meta-analysis. *PLoS ONE, 11*(1), 1-16.

KWF Kankerbestrijding. (n.d.). Denk mee over onderzoek. [Website page]. Retrieved 26 February 2018 from: https://www.kwf.nl/onderzoek/denk-mee-over-onderzoek/Pages/default.aspx

Kylander, N., & Stone, C. (2011). The Role of Brand in the Nonprofit Sector. *The Hauser Center For Nonprofit Organizations*.

Lalieu, E. (2016). *Citizen science, de betrokkenheid van burgers in het wetenschappelijke proces*. [Report]. Retrieved 10 March 2018 from: https://www.knaw.nl/nl/actueel/publicaties/citizen-science-journalistiek-verslag

Miller-Rushing, A., Primack, R., & Bonney, R. (2012). The history of public participation in ecological research. *Frontiers In Ecology And The Environment*, 10(6), 285-290. http://dx.doi.org/10.1890/110278

NIOO. (2016). *Ook burgerwetenschap luistert nauw. Nioo.knaw.nl.* Retrieved 17 March 2018, from https://nioo.knaw.nl/nl/news/ook-burgerwetenschap-luistert-nauw

Paul, J. (2000). *NGOs and Global Policy-Making. Globalpolicy.org.* Retrieved 17 March 2018, from https://www.globalpolicy.org/empire/31611-ngos-and-global-policy-making.html

Philips, T., Ferguson, M., Minarchek, M., Porticella, N. & Bonney, R. (2014). User's guide for evaluating outcomes from citizen science. [Guide]. Retrieved from: http://sdchildrenandnature.org/wp/wp-content/uploads/2013/05/CornellLab_CitSci_UsrsGuide_Evaluation_58p_2014.pdf

Plastic Soup Foundation. (2017). Vrijwilligers gezocht voor afvalonderzoek langs de Maas en Waal. [Website page]. Retrieved 26 February 2018 from: https://www.plasticsoupfoundation.org/2017/12/vacature-vrijwilligers-gezocht-uniek-afvalonderzoek-maas-en-waal/

Resnik, D., Elliott, K., & Miller, A. (2015). A framework for addressing ethical issues in citizen science. *Environmental Science & Policy*, *54*, 475-481.

Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding Of Science*, *23*(1), 107-120.

RIVM. (2017). Burgerwetenschap in publieke gezondheid veelbelovend. [Website page]. Retrieved 26 February 2018 from: https://rivm.nl/Documenten_en_publicaties/Algemeen_Actueel/Nieuwsberichten/2017/Burgerwetenschap_in_Publieke_Gezondheid_veelbelovend

Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, *24*(9), 467-471.

Sovon (n.d.). Vogels tellen Sovon | Sovon.nl. Sovon.nl. Retrieved 17 March 2018, from https://www.sovon.nl/nl/content/over-sovon

Tuinvogeltelling. (n.d.). Hoe werkt het. [Website page]. Retrieved 26 February 2018 from: https://www.tuinvogeltelling.nl/hoe-werkt-de-tuinvogeltelling

Tyson, E. (2017). *Citizen Science Is Making it Harder for China's Biggest Polluters to Hide. New Security Beat.* Retrieved 17 March 2018, from https://www.newsecuritybeat.org/2017/06/citizen-science-making-harder-chinas-biggest-polluters-hide/

Wheeden N (2012) *Proceedings of the California Academy of Sciences Citizen Science Meetings.* Berkeley, CA: Golden Gate Audubon Society

Whitelaw, G., Vaughan, H., Craig, B., & Atkinson, D. (2003). Establishing the Canadian community monitoring network. *Environmental Monitoring And Assessment*, *88*(1-3), 409-418.

Wiggins, A., & Crowston, K. (2011, January). From conservation to crowdsourcing: A typology of citizen science. In *System Sciences (HICSS), 2011 44th Hawaii international conference on*(pp. 1-10).

Wilde Ganzen. (n.d.). Over Wilde Ganzen. [Website page]. Retrieved 23 February 2018 from: https://www.wildeganzen.nl/over-wilde-ganzen

APPENDIX

APPENDIX 1: SUMMARY OF POLICIES

Table 1: Summary of Policy and Applicability to CS Project and Purpose
**X indicates a recommendation for nonprofits to pay particular attention to*

Project Purpose	**Data collection**	**Education**		**Policy**	
Project Type	Contributory Project	Contributory Project	Collaborative & Co-created Projects	Contributory Project	Collaborative & Co-created Projects
Project Team					
Asses if and which knowledge/expertise of external parties are needed	**X**	**X**	**X**	**X**	**X**
Create an interdisciplinary project team consisting of for example: · Researchers · ICT-specialists · Communication experts · Educational experts	**X**	**X**	**X**	**X**	**X**
Work with academic and governmental external bodies like the European Citizen Science Association and the Journal of Citizen Science	**X**	**X**	**X**	**X**	**X**
Project Design					

Design standardized protocol • Guidelines for data collection (including information such as time, place, date and directions to the location of the project) • Guidelines for volunteer behavior • Simple and clear forms to submit data	**X**	**X**	**X**	**X**	**X**
Design specific tasks with different levels of intensity and difficulty	**X**	**X**	**X**	**X**	**X**
Setting clear applicable goals of the project		**X**	**X**	**X**	**X**
Recruit volunteers					
Use an umbrella platform	**X**	**X**	**X**	**X**	**X**
State clearly the · Project purpose · Expectations for volunteers · Value of volunteer help · Benefits of participating	**X**	**X**	**X**	**X**	**X**
Pre-evaluations			**X**		
Statement of good conduct			**X**		**X**
Prepare volunteers					
Provide study material		**X**	**X**		**X**

Organize gatherings when tasks are more demanding · Training days · Excursions · Workshops · Presentations			**X**		**X**
Make volunteers sign a code of conduct	**X**	**X**	**X**	**X**	**X**
Make volunteers sign a contract (that emphasizes differences between paid staff and volunteers)					**X**
Provide documentation expressing property rights over collected	**X**	**X**	**X**	**X**	**X**
Verify Volunteer Consent	**X**	**X**	**X**	**X**	**X**
Validate gathered data					
Assign researchers (internal or external) or a few dedicated volunteers to either · Check all data · Test some results for reliability	**X**	**X**	**X**	**X**	**X**
Provide feedback					
Note of appreciation	**X**	**X**	**X**	**X**	**X**
Individual feedback: clarification of correction when errors were made			**X**		
Interim results			**X**		**X**
Offer first viewing of end report · Final results · Impacts of the research		**X**	**X**	**X**	**X**
Recognize volunteer work					

Give credit when possible					**X**
Mutual evaluation after and during projects and check-ins if deemed necessary		**X**	**X**		**X**

APPENDIX 2: CONSENT FORM (Philips et al., 2014, p. 33)

APPENDIX C: PARTICIPANT CONSENT FORM TEMPLATE

You are invited to participate in a research study regarding [brief project description] and conducted through [*institution and partners*]. Please read this form carefully and ask any questions you may have before agreeing to be in the study. You will be given a copy of this form to keep for your records.

Purpose: The purpose of this study is [*describe the nature and purpose of the study in a few sentences*].

Procedures: If you agree to be in this study, you will be asked to [*explanation of what the participant is being asked to do*] regarding [*state the topic*]. This should take approximately [*approximate time commitment*].

Risks and Benefits: We do not anticipate any specific risks resulting from this study [*or acknowledge unpredictable risks if appropriate*]. The study will not have any direct benefits for you, [*or describe any benefits or incentives*] but your participation will help us learn more about [*describe any potential benefits for the researcher*].

Voluntary Nature of Participation: Your decision whether or not to participate will not affect your current or future relations with [*institution administering the study*]. If you decide to participate, you are free to withdraw at any time without affecting those relationships. You may decline to answer any questions that you do not feel comfortable answering.

Confidentiality: This research will not include any information that will make it possible to identify you. All data collected from [*describe data collection procedure, i.e., survey, interview, etc.*] will be kept in a locked file. Only the researcher will have access to this file. This consent form will be stored in a locked file separately from the data and will be destroyed at the end of the study.

Contacts and Questions: The researcher conducting this study is [*researcher name*]. If you have questions later, you may contact him/her at [*researcher contact information*].

If you have any questions or concerns regarding your rights as a subject in this study, you may contact the [*institution IRB name]* at [*contact information for Internal Review Board*].

Statement of Consent: I have been given information about this research study and its risks and benefits and have had the opportunity to ask questions and have them answered to my satisfaction. I consent to participate in this study.

Signature _____ **Date** _____

APPENDIX 3: EVALUATING CS PROJECT GOALS (Philips et al., 2014, p. 36)

APPENDIX E: DATA COLLECTION STRATEGY

INTENDED OUTCOME	EVALUATION QUESTIONS	INDICATORS	STUDY DESIGN	TIMELINE, PERSONNEL
1				
2				
3				
4				