



Communication  
in Citizen Science

A practical guide to communication and  
engagement in citizen science



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Layout: De Deeluitgeverij, Victoria Lynn van Heesch

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# Preface

Citizen science is a vast field. It covers the spectrum of research approaches and offers different methods for engaging volunteers with research in a variety of ways. Common to every citizen science project is a need to communicate with the public effectively. This to recruit and retain citizen scientists, but equally to inform, train and thank them, in the proper manner, when the project ends.

It was this need which prompted Scivil, the Flemish Knowledge Centre for Citizen Science, to set up the working group on communication and participation. The working group decided to document its communication expertise in this guide for anyone who plans to initiate a citizen science project.

In June 2019 the working group surveyed the initiators of citizen science projects in Flanders. We asked them what their projects already had in the way of communication expertise, and in which areas they were still short of knowledge.

The results taught us that most projects do well when it comes to recruiting citizen scientists ('ordinary' people with no prior knowledge of the subject, who volunteer for citizen science projects). But the chal-

lenge, it seems, is to retain them over a longer period of time. Nor is it always a straightforward matter to engage the right, or more diverse, target audiences. In this guide we provide the building blocks to write up a communication plan for your project, and we include exercises on how to identify a target audience and reach out to schools.

We also offer a set of tactics and tools, to secure the initial and continued participation of your citizen scientists. Finally, with our practical tips, you can begin the job of defining your communication plan and choosing the right tactics for effective communication in citizen science.

This guide is for anyone who finds themselves communicating and engaging with citizen scientists. The content of the guide is based on studies of citizen participation and the real-life experience of science communicators. Use it as a source of inspiration, and draw on any of the ideas that suit your needs. And, above all, remember your enthusiasm is infectious!

If you have any questions about this guide please contact [info@scivil.be](mailto:info@scivil.be).

# Citizen Science in Flanders

Citizen science is burgeoning in Flanders today. With support from the Flemish government and other actors, academics are launching citizen science projects to which 'ordinary' people, who don't have a background in science, can contribute. Citizens also initiate projects themselves, usually to address or resolve problems in their own neighbourhoods.

In December 2017 the Government of Flanders ran a call for projects. The Department of Economy, Science and Innovation aims to promote citizen science among universities, colleges and other research institutions. With fifty projects entered and thirteen in receipt of funding, the call was an unqualified success. In May 2019 another call for projects followed. In support of these projects the Flemish Knowledge Centre for Citizen Science came into being in early 2019. It was given the name Scivil.

In 2015 came the launch of a digital platform for citizen science, Iedereen Wetenschapper (Everyone's a Scientist), an initiative by EOS Science and the Flemish Young Academy. In 2016 the Young Academy followed with a position statement on citizen science (1). Since then, a lot has changed. Flanders had its first sweeping encounter with citizen science in May 2018, when twenty thousand citizen scientists measured air quality for the Curieuzeneuzen (Nosy People) project. There are also quite a number of European initiatives in Flanders, which receive funding from the European Union, such as hackAIR, FloodCitiSense and www.hoemeetiklucht.eu. Smaller scale initiatives, set up by local groups, such as the successful Leuvenair, also exist, as do research projects undertaken by members of the public without any input from professional scientists.

### **What is citizen science?**

Citizen science is defined as scientific work undertaken wholly or partially by members of the public, often in collaboration with or under the direction of professional scientists (2, 3, 4). Citizens may act as contributors or collaborators in the project and offer up new knowledge and understanding.

Citizen science can be employed in the exact sciences, applied sciences and human sciences.

For more information on citizen science see the ten principles developed by the European Citizen Science Association (ECSA).

### **Citizen science versus science communication**

Citizen science is different to science communication. Citizen science is a 'new' form of science, in which members of the public actively participate in the research work. Through it, citizens are no longer the target of science communication, but actively engaged in the scientific process.

### **95% of citizen science is communication**

Communication is a vital aspect of citizen science. It is a necessary part of the process of recruiting, engaging and keeping participants motivated. And a necessary means of announcing research results (dissemination) and teaching participants more about the project focus and scientific process (education).

You cannot overestimate the amount of time you will spend communicating with your target audience. It is a continuous process of maintaining openness at every stage of the scientific process: from setting your research question to publishing the results.

It takes practice to stay open and accessible through your communication. Ideally, your citizen science project will have a community manager, a science communicator and a science trainer. The community manager focuses on direct and immediate contact with your citizen scientists and offers a point of contact for any questions. The science trainer directs your citizen scientists and trains them to collect data, write manuals, deliver support on the ground, and so on. The science communicator makes sure that your messages, research results included, are communicated in a way that is accessible for the target audience.

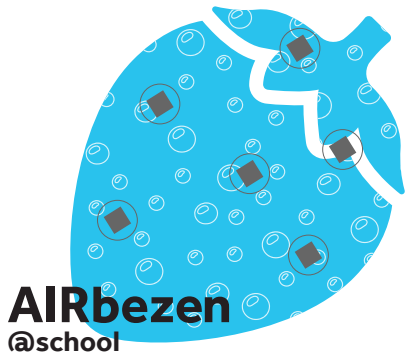
This practical guide equips you with a few tricks of the trade. In addition, Scivil arranges regular training courses and workshops. Keep an eye on our website and newsletter.

### **Stay tuned!**

Scivil & the Working Group on Communication and Participation



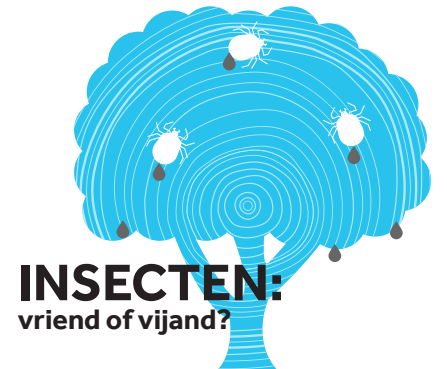
The first government-funded citizen science projects in Flanders.



**AIRbezen**  
@school



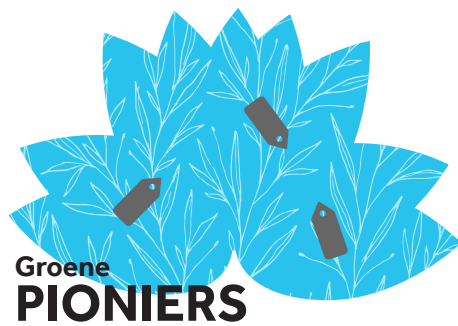
**FietsSTEM**  
voor scholen



**INSECTEN:**  
vriend of vijand?



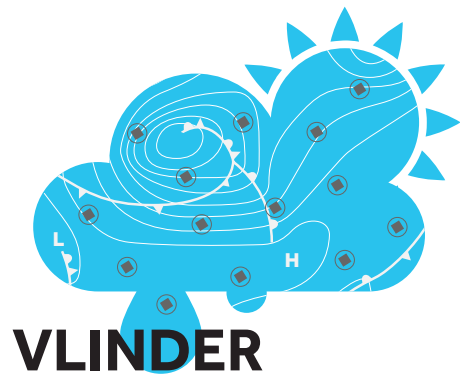
**HASSELair**



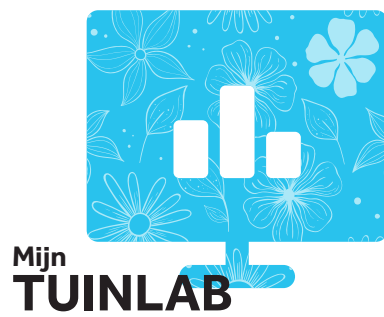
Groene  
**PIONIERS**



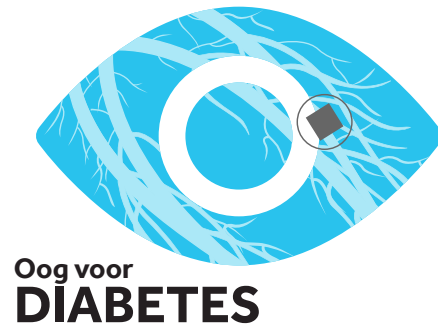
**SPIN-CITY**



**VLINDER**



Mijn  
**TUINLAB**



Oog voor  
**DIABETES**



**Vespa-Watch**



Knappe  
**K(N)OPPEN**



**MamaMito**



**¿Burgerpraat!**

# The building blocks of your communication plan

Every good citizen science project comes with a rock solid communication plan that you prepare before the research phase. These five building blocks form the basis for this.





# 1

## Determine your project objective

Before you even think about recruiting citizen scientists you will need to clarify your project aim(s). What is it that you hope to achieve through citizen science? Which target groups will benefit from your project?

Only when you have defined your project's ambitions can you think about the target audiences you intend to engage, the level of engagement you hope to achieve and how you intend to recruit them.

Although they can differ vastly, most citizen science

projects have several aims in common. We identify three desirable results: contributing to science, raising public awareness of a scientific issue, involving members of the public in setting the research agenda and finding solutions to social issues.

The essential aim of any citizen science project is to contribute to scientific research by finding the answer to a research question. If it does not, it is science communication or science education. That said, most citizen science projects claim more than scientific progress in their results.

### What citizen science does

#### Contribution to science

The hard work that volunteers put into citizen science allows scientists to gather and analyse vast quantities of data in a short space of time. The accumulated time, the number of observation records and the geographic spread of the data far exceed the capacity of the individual research scientist (5). Here, citizen science works more like a research approach by which empirical data can be gathered. The contribution made by citizen scientists then becomes a driver for scientific progress.

#### Education

You can also employ citizen science from the perspective of informal learning. You want your participants to learn something new. By contributing to your research project their understanding of the concept behind the scientific process and research subject improves. This can open a path to loftier goals, such as awareness of social problems and engagement. Citizen scientists are better equipped to make informed decisions and have a greater appreciation of certain (policy) decisions and more confidence in the results of scientific studies (6).

#### Engagement of citizens as stakeholders

You can also begin your citizen science from an ideological perspective. In that case, members of the public will help decide the study focus, as a pathway to more socially responsible research and insights that actually enhance general wellbeing. Scientists, policymakers and citizens from all walks of life coming together (in co-creation) to solve the social problems that stand at the very heart of people's lives (6). When your project has the express aim of opening science to the general public, you engage your citizen scientists to do more than gather data. You become a researcher 'as facilitator', and in this role you encourage people to ask questions. And you give them support when it comes to answering those questions, by choosing the right scientific approach. Projects like these are also set up by members of the public and go on to receive support at a later stage from professional research scientists. Projects initiated by members of the public are often a response to a (local) social question for which an answer is needed.



When it comes to clarifying your project aims, be realistic. What can you achieve with the resources you have? And what is the main aim of your project? Going for all three aims may be highly commendable, but, in reality, might be difficult to achieve. Placing too much emphasis on the educational side of your project could affect the quality of your dataset (7). But the reverse can also lead to problems. Being too particular about a strict method of data collection could prevent citizens from taking part or make them drop out after only a short while.

On page 15 of the '[Choosing and Using Citizen Science](#)' guide you will find a decision framework

which you can use to check whether a citizen science approach is suitable for your project idea. The guide is intended for use in environment monitoring projects, but the decision framework is equally useful for other subjects.

#### Aims of my project:

- Contribution to science
- Education
- Engagement of citizens as stakeholders

## 2

### Define the level of engagement

There are many ways to engage members of the public in a citizen science project. Citizen scientists can be of help in (7):

- setting the research question
- searching for information
- formulating a hypothesis
- choosing the data collection methods
- gathering, analysing and interpreting data
- writing and disseminating conclusions
- discussing the results

In the scientific literature we find lots of models in which citizen science projects are classified according to engagement with the research activities above. The two most popular classifications are by Rick Bonney (8) and Muki Haklay (9).

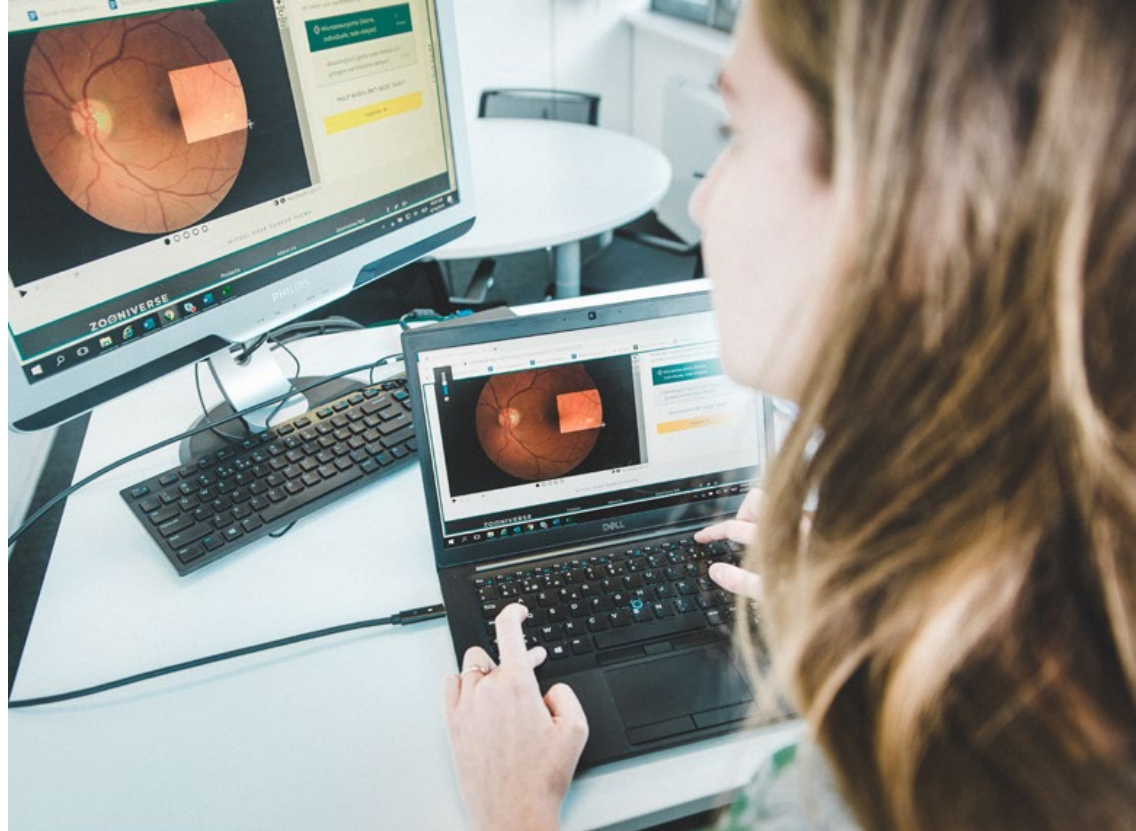
It is important to realise that these typologies are not normative rankings (10). Not every project need involve the general public, and the opposite is also true: not every study needs volunteers at every stage in the scientific process. The level at which you hope to involve the public has a lot to do with the aims you have in mind.

For example, a *contributory project* – in which citizens are primarily used to collect data – will generally deliver scientific results and knowledge for you (the project leader), and, depending on how

accessible your subject is, you will probably try to draw from a wide recruitment base.

**Co-creation**, on the other hand, is more suitable for a study with which you hope, with the public's help, to influence policy decisions, or when you have an educational approach in mind. In these projects the research activities are decided with the participants' help. They require a higher level of participant engagement, measured in terms of skills, effort and time, and will probably lead you to engage a more clearly defined target audience (10).

Some citizen science projects are run without professional scientists. In this case, the citizens do the work themselves: they set the research question, conduct the experiments and interpret the results. Enthusiasts at the DIY lab [ReaGent](#), for example, are working on a vegan alternative to leather, made from bacteria. They, and other DIY volunteers around the world, are trying to find a cheap alternative to insulin, which would allow pharmacists to produce and supply insulin themselves. This initiative took root in the United States, where the cost of the medicine is prohibitive for some people with diabetes. The research undertaken by these citizen scientists is entirely independent of professional science.



Type	Description	Example
<b>Crowdsourcing</b>	Members of the public offer their time and devices only.	The <u>World Community Grid</u> projects make use of the computers of thousands of volunteers. You create an account on the website and download a tool to your computer. The application monitors your computer for spare computing power and that power is used to conduct virtual experiments. Research has been done in areas such as childhood cancer. The citizen scientists play a passive role, but are notified about the research being done.
<b>Distributed intelligence</b>	Members of the public sift through gathered research material and provide simple interpretations or help categorise the material.	Citizen scientists in the <u>Oog voor Diabetes (Eye On Diabetes)</u> project examine the retinal images of diabetes patients online. They note any signs of diabetic retinopathy, a disorder which can lead to blindness. The catalogue of images can then be used to teach an algorithm to recognise the disorder, paving the way for screening by artificial intelligence.
<b>Participatory science</b>	Volunteers are engaged at the start of the project. They help define the problem, collect data and then help the scientists analyse the material. However, the researcher/expert has a high level of control over the analysis and interpretation.	The idea for <u>CurieuzeNeuzen 2016</u> , in which members of the public measure the air quality in Antwerp, arose in the <u>Ringland</u> community group. Scientists and the Flemish Environment Agency (VMM) then became involved in the research.
<b>Extreme citizen science</b>	Researchers and volunteers develop the various steps in the research process together. But here the role of the scientist is confined to that of facilitator. The volunteers run the citizen science project and do the work.	Using the so-called <u>flitsfiets (flashbike)</u> , a DIY bike, the action group <u>30Max</u> records speeding offences in the centre of Antwerp. The group aims to use the data to show that the speed limit is rarely observed and hopes to force the introduction of measures. The action group itself came up with the idea for the flashbike. Researchers from the <u>imec City of Things</u> helped find the technology and data to make it work.

Source: Models of citizen science projects according to Hakley et al. (9), along with examples from Flanders.





Type	Description	Example
<b>Contributory project</b>	A citizen science project run from the top down by research scientists, in which citizens are generally invited to gather data. The researchers decide the research focus.	In the citizen science project <u>Vespa-Watch</u> members of the public are asked to look out for Asian hornets (and their nests). This exotic wasp species is a threat to the native bee. When they spot the insect, citizens upload a photo and the GPS coordinates to the project website. Research scientists working at Ghent University use the data to map out the dispersal of the species. The citizen scientists merely supply the data.
<b>Collaborative project</b>	The research scientist decides the research focus. Citizen scientists can take part in different phases of the scientific process (e.g. analysis, interpretation and presentation of the data gathered).	In 2014 the project <u>AIRbezen</u> in Antwerp involved a large group of citizens who collected data (they submitted the leaves of a strawberry plant, which they had left out on the window ledge, for an analysis of the air quality). Research scientists at the University of Antwerp were to collaborate in the first phase of the project with volunteers from the Stadslab 2050 group. They and the volunteers brainstormed how the study would be done and what it should be called. This small group of volunteers also helped with the plant distribution and communication.
<b>Co-created project</b>	A co-created project begins with a question set by members of the public. All of the steps leading on from this are taken by the participants in consultation with the researchers.	In Antwerp a <u>citizens' observatory</u> was set up under the European Ground Truth 2.0 project. Scientists, policymakers and citizens regularly meet around the table to consider study areas and solutions for environment-related challenges like air pollution, drought, flooding, lack of greenery, and heat. In 2019 they began work on the subject of heat stress.

Source: Models of citizen science projects according to Bonney et al. (8), along with examples from Flanders.

### My project is closest to:

- Crowd sourcing
- Distributed intelligence
- Participatory science
- Extreme citizen science
- Contributory project
- Collaborative project
- Co-created project



# 3

## Specify your target audience

To set up a good basis for communication it is important that you understand your target audience(s). Do you want to engage with the general public or with active citizen scientists? Or passive sympathisers, opinion givers or niche experts? The better you understand your target audience the more personal, and the more effective, you can make your communication.

When defining your target audience, you should consider the following: size, age, gender, level of education, prior knowledge of the research subject, initial interest and engagement with the subject and your organisation.

It is best to split your audiences into primary, secondary and intermediary target audiences. Your primary target audience would be that group of people who feel the most engaged with your project, and who are the most affected by the research aim. This target audience will contribute the most when it comes to collecting data or giving feedback on your project. Think, for example, of a group of asthma patients, in a citizen science project set up to measure the air quality and disseminate the results. A secondary target audience would be a group who are aware of, but not directly involved in your project. This might change in a later phase of the project, when a secondary target audience becomes the primary target audience. Think, for example, of associations or government authorities with an interest in your research focus. An intermediary target audience is a group of people or a person that you can bring in to communicate about your project. Think of your organisation's internal communication department, the local or regional press or external partners. If your primary target audience is made up of youngsters, for example, a way to engage them might be by enlisting the help of teachers, parents or youth clubs. When defining your target audience and working out your communication strategy you should consider the following guidelines:

- Create separate communication plans if you want to engage different target audiences. Your message should address each of your target audiences personally.
- What tone will you adopt for your target audience(s)? Should your communication come across as formal or informal?
- How will you approach your target audience(s)? Will you go for a generic, specific or individual approach? (see chapter 2: tactics and tools).

## What target audience(s) do I hope to engage?

	Description	formal/ informal
Primary target audience		
Secondary target audience		
Intermediary target audience		

Will you take a proactive, active or passive approach to your target audience(s)? It is not necessary to communicate with all your target audiences at the same time or with the same intensity.

A special approach is needed for schools and so-called hard-to-reach groups, which we cover in more depth below.

### How to persuade schools to take part in research?

If education is one of your aims and there are children or youngsters in your target audience, you will soon need to set your sights on a school or classroom collaboration.

Citizen science has the potential to bring science home to this young target audience and to awaken interest in the subject and the underlying scientific process. It gets them actively acquainted with research and gets them thinking about socially relevant themes, such as health and conservation. The educational benefits seem endless. Yet schools, and schoolteachers, are hardly straining at the leash to get involved in citizen science. The school environment is saturated with annual requests to participate in studies (11), and given the busy curricula, time is a rare commodity.

If you want your project to stand a chance, it is best to keep the costs of participation as low as possible. Present your project early, to give teachers time to fit your project into their annual plan. Provide a visible space in which your schools and teachers can communicate their participation and results to the outside world. And go looking for ways to engage parents in your research too (12, 13, 14).

## How to engage teachers

- **Link your teaching material and assignments to the curriculum**  
Citizen science usually takes the form of an in-house activity, in which the teaching material and assignments are incorporated in the existing lessons. It is therefore vital that the material you provide for the teachers – and the activities you anticipate from the pupils – tie in well with the set lesson objectives or curriculum aims and final attainment levels. Look ahead and make things as easy as possible for the teacher by spelling out the links between the separate research assignments and subject-specific and cross-curricular learning aims. Or, go a step further and link every component of your lesson package to a learning aim. Actual attainment targets for the Flemish school system can be found at [www.onderwijsdoelen.be](http://www.onderwijsdoelen.be), in school curricula and on school administration department websites. Need an even stronger match between your project and the school curriculum? Think about inviting input from teachers at your project design stage.
- **Make the lesson package modular**  
Build in plenty of flexibility when designing your lesson packages. Draw a clear line between tasks that are strictly necessary and other supplementary learning content and activities. By doing this you allow teachers the room to adapt the offering to suit their own pace, their own preferences and the classroom context. Not all teachers like a ready-made package or are willing to accept the offering as is. Some prefer to adapt the content to make it more suited to the existing curriculum.

With an adaptable package you will reach the teachers who appreciate ready-made lessons and those who like to prepare their lessons themselves.

- **Offer teachers adequate and adapted support**  
Teachers require an adequate level of support at every stage of your research project and when doing the activities that go with the lesson. Keep the time they spend on preparation to a minimum and make sure they don't waste extra time looking for additional learning material. Have a thought here for the teacher's knowledge of the subject. Not all teachers will be familiar with the learning content you offer. Some teachers will have to take on new knowledge and get used to doing research activities. Don't allow them to doubt their own knowledge, and provide plenty of background information. Guidelines on the purpose of the lesson and the components of the lesson package are certainly a

welcome addition. Although it is important that a teacher be able to run through the lessons without help, a citizen science project with a more complex set of tasks can also come with additional aids, such as teacher training or how-to videos. Think up a procedure by which teachers can get in touch with you if they are experiencing difficulties or have specific questions they need to ask.

- **Promote your project through existing channels of communication**  
To attract attention to your project you might consider using the existing channels of communication for teachers. For example, add your project on [KlasCement](http://KlasCement), an online platform which offers free inspiration and learning material for teachers in the Netherlands and Belgium. Or promote your project in teachers' magazines like [Klasse](http://Klasse) or online newsletters like [schooldirect](http://schooldirect) and [lerarendirect](http://lerarendirect). Below you will read how to engage schools with your project by hitching a ride on existing networks.





### What about inclusion?

As theory has it, citizen science is inherently participatory. As well as involving people in research and improving scientific literacy, citizen science has a lot to offer in the way of social inclusion. Although we don't have the exact figures to support this, it is widely accepted that citizen scientists are not generally representative of society. The average citizen scientist seems to be white, middle-aged, well-educated and male, with a keen interest in science and research (15).

It needn't come as a surprise that this particular profile is so well represented. These people have the right motivation. They also have the time, money and expertise to participate in scientific research (9).

If you want to be inclusive, you will need to make explicit choices in your project design phase, such as working with at-risk groups (16). In that case, the citizen science will need to have a purposeful design, which considers diversity and accounts for the needs and expectations of minority groups. You will need to think upfront about how you intend to offer equal opportunities to participate in your project.

Start by clarifying how important it is for your project to be inclusive. Always base this on the project aims and the target audience you have in mind. Phrases like 'science for the general public', 'improve knowledge among the population', and 'meet the needs and expectations of society' imply an inclusive study which is likely to engage a broad range of participants. But is it really one of your project's stated aims? And is it achievable? Or do you merely want access to your project to be as open as possible, not to turn its focus onto the engagement of under-represented groups? When the collection of known-quality data overrides educational aims and participatory science, it is enough to eliminate the potential obstacles to participation as best you can. In this case, it may suffice to recruit your volunteers through general calls and to focus your recruitment campaigns on target audiences who possess the knowledge, time and resources needed to participate (20).

If you decide to attract people who are traditionally less well represented in citizen science, it is important that you also search out the right partners (see tactics). Arrangements with local organisations and intermediaries can help eliminate some of the initial barriers to participation.



### AIRbezen@School (Strawberries at school)

In the AIRbezen@School project research scientists from the University of Antwerp give primary and secondary school pupils a strawberry plant to look after for a few weeks. The pupils collect a leaf sample at the end of the project, which they submit to the analysis lab to measure for particulates. Participating schools are given a box of promotional material (a poster explaining air quality and particulates, three posters saying 'AIRbezen@school measurement station', a set of stickers and a board of NO<sub>2</sub> diffusion tubes to suspend at the window) as well as a box containing everything they need to participate in the study. Recruitment and communication are primarily by email. There is also a website, a Twitter account and a Facebook page. The recruitment campaign is widening its base for the second year (2019-2020). An element of competition is being introduced. Classes will be able to earn medals. At the end of the school year, participating classes will be able to present their results at a symposium.

Through careful consultation you may be able to reassess your own perception of the target audience and, at the same time, identify the needs, wishes and requirements of these local organisations and their members, and so better alter your research to suit. By listening to representatives from the local community at an early stage, you can identify context-specific barriers to participation (17).



### Improving public health in Amsterdam

Through a citizen science project entitled Gezond Sloterveer (Healthy Sloterveer) the RIVM (National Institute for Public Health and the Environment) is closely involved in neighbourhood development. The RIVM wanted to learn which environment factors the residents of the Sloterveer neighbourhood in Amsterdam thought were vital to their health. The researchers wanted to do more than send out yet another traditional survey, because these surveys only get through to the people who read, write and speak Dutch, and already have an interest. Through their neighbourhood development work the researchers trained 'health ambassadors', who were just ordinary residents of the neighbourhood. They helped devise the questions and went around the neighbourhood interviewing residents. It gave rise to questions and answers which the researchers hadn't expected. And it turned out to be a good way of reaching more people from minority groups.

### Tips to engage minority groups

In your search for relevant intermediaries you can turn to any of the sociocultural institutions or welfare organisations. Consider the OCMW (CPAS), poverty organisations, youth organisations or community centres. Don't forget to speak to more local, informal organisations and individuals. They tend (more than the formal institutions) to have the confidence of the local community.

Use every consultation opportunity with these institutions and trusted people to identify the best communication channels to use. Is it okay to make an announcement on Facebook or by email, or would it be better to meet face-to-face? Think long and hard about the wording of your message. Academic language is out of the question. When thinking about getting people together to inform, persuade, educate or put them to work, consider arranging these meetings at a time and place when your target audience would normally attend.

Once citizen scientists sign up to your project you can use the snowball method to attract new participants. Encourage them to contact other people in their personal network. They will close the gap between you (the project initiator) and your target audience.

Your communication with participants does not cease after initial contact. Once you have access to a particular group you will maintain the connection during the lifetime of the project. To do this, introduce regular opportunities for contact in which you highlight once again the project aims and its benefits to the community. Be sure to remember to share the (interim) research results at the appropriate times.

Source: Tips for engaging minority groups (18).

### Will your project address minority groups?

No

Yes

If yes: With which organisations would you like to collaborate?



# 4

## Understand what motivates your citizen scientists

At the heart of citizen science lies collaboration, between you – as the project initiator – and the citizen scientists. You are not the only party to come to the project with expectations. Citizen scientists have their own aspirations and their own reasons for joining in. Not understanding your potential target audience, and not knowing how to stimulate it as a group, is one of the biggest pitfalls in citizen science.

Once you know more about why members of the public like to get involved in scientific research, and why they don't, you can adjust your aims accordingly and employ the right strategies and tools to recruit and retain them. Understanding the attitudes and motivations of participants allows you to refine the target audience and, what is more, helps you select the right set of tasks, the right message and the right media channels for your audience.

Resources and schedule permitting, you may decide – preferably in the design phase of your study – to survey your potential target audience as a way of logging their attitudes and motivations. Should this reveal nothing, you can always draw on already established general research.

Often this relies on self-determination theory (Ryan and Deci (18)) as a theoretical framework. It postulates two types of motivation: intrinsic and extrinsic. If you are intrinsically motivated to participate in citizen science, you take part because you enjoy it. Extrinsic motivation refers to behaviour which is driven by an external reward. Your participation in citizen science is motivated by money, recognition, status, or, also, deeper knowledge or a new skill set. The theory tells us that when people are intrinsically motivated, they remain engaged with a project for longer. Extrinsic motivation weakens over time. Yet both have their place, because people often have more than one reason for taking part in a citizen science project. Often, what drives a participant is a mix of altruistic considerations – a desire to help the advance of science or make the world a better place – with more self-serving stimuli (20).

### Why do people get involved in citizen science?

Using self-determination theory we can identify five different types of motivation in citizen science.

Collective motivations and intrinsic motivations have the biggest impact on participation.

<b>Collective motivation</b>	The citizen scientist sees the project aims as important.
<b>Norm-related motivation</b>	The participant hopes for positive responses from friends, family or work-mates.
<b>Motivation based on reward / extrinsic motivation</b>	Participation brings real benefits, such as building a reputation or making new friends.
<b>Collective identification</b>	The participant identifies with the group, its norms and its values.
<b>Hedonistic / intrinsic motivation</b>	Participation in the project gives pleasure.

Source: Classification of types of motivation for participation in citizen science, according to Nov, Arazy & Anderson (21)



### What specific motivations do you expect of your citizen scientists?

Collective motivations	
Norm-related motivations	
Motivation based on reward / extrinsic motivation	
Collective identification	
Hedonistic / intrinsic motivation	





### Reasons for monitoring air quality

As part of the development process for its engagement strategy the hackAIR project surveyed 370 potential citizen scientists. An online questionnaire gauged motivations for and barriers to air quality monitoring and measurement in the neighbourhood. The leading motivations were: general curiosity about the measurement results (56%), concern about the local air quality caused by the perception of living in an area with poor air quality (43%) and personal health problems (30%). These reasons were used as triggers during opportunities to communicate later in the project.



### "I'm proud of the contribution I made to science"

So who are these citizen scientists? Jeanine Goossens took part in Grote Schelpenteldag (Big Shell Count). Gitta Camfferman interviewed her about her experience.

#### Why did you take part?

"I think it's vital that we study the evolution of biodiversity on beaches. The beach, and the sea, offer me relaxation. I love being there. But today is special. You can go hunting for shells at any time, but today, as a member of the public, I got to be part of some important research. The more of us that take part, the better the results. That's why I'm here on this terribly cold Saturday in March."

"We need scientific research to safeguard our future here on Earth. By doing this I've been able to do my bit, and I'm very proud of it, even if I only played a tiny part."

#### What did you think of it?

"I thought it was really very interesting. The collection method they got us to use was pretty good and they communicated it to us well beforehand. And the experts from the Flanders Marine Institute (VLIZ), who helped us with the count, were really friendly and told us all a lot about the shells. I even managed to find a pretty rare one!"

"I think it's vital that our children and the generations to come grow up with science. It is our task to educate and train them. And I hope it works out well."

Source: Interview by Gitta Camfferman for Iedereen Wetenschapper.



# 5

## Engage and evaluate

You can evaluate the success and effectiveness of your project at various points: before, during or after the study. Your choice will depend on the purpose of the evaluation: what do you hope to achieve with it?

An evaluation before you start the project can help you identify the participants' expectations, and this will enable you to make early adjustments to the project design. Also, if you plan to measure the effect of participation afterwards, it is vital to look at aspects of knowledge, attitude, skills and behaviour at the beginning. What do people know about the project's subject, for example, and what do they think about it? With a baseline like this you can gather data before you start, which will allow you to measure change at the project's end. An evaluation in the live phase of the project can provide an impulse for change. An evaluation afterwards can shed light on the value generated and may also allow you to say more about how effective or successful your project was. Were its aims achieved? How did it work to the benefit of the participants or the project team?

By deciding your evaluation points early in the design process you sharpen your research focus. Not only are your project aims and the desired results decided sooner, but they are set with greater clarity (22, 10, 23).

### How to measure the success of your engagement strategy?

Your success as project organiser is a measure of the effectiveness of your engagement strategy and the satisfaction of your citizen scientists.

The easiest way to measure engagement is by gathering figures (e.g. number of records submitted, number of participants, etc.) on the actual behaviour of your citizen scientists. For participant numbers you can look at the number of contact opportunities and the number of participants per type of contact opportunity (e.g. workshops, meetings, lectures, etc.) and the number of visitors on websites and social media pages. It may also be relevant to look at these numbers at particular junctures in time. This will tell you how long citizen scientists are active, how often they participate and how many drop out.

If your project has a clear educational aim, you will be keen to discover whether change came about

### Tips for a strong evaluation framework

- A strong evaluation framework requires precise indicators to tell you whether the goals you set have been attained. The more clearly you define the project aims the more precise your indicators will be.
- Set your indicators at the start. This establishes consensus on what to measure in the project team, so you can adjust the design of your project in good time (24).
- Get several parties involved in the process of developing indicators. By engaging not only your project team but citizen scientists, partners and sponsors, you will have a better chance of evaluating the success of your project from a variety of standpoints.
- Not all indicators have to be quantitative or objectively quantifiable (consider the number of citizen scientists taking part, or the recruitment cost per participant). If you plan to evaluate the engagement of your citizen scientists and other stakeholders, quantitative indicators (which focus more on the type and quality of participation) are a welcome addition (24, 25).
- Develop different indicators for different evaluation purposes. Does your evaluation focus on a) the success of the citizen science project, b) the operational process, c) the immediate results or long-term impact, or d) a subject in which all these elements should be covered? The indicators needed to evaluate the project outcomes won't be the same as those needed to evaluate the activities and the process (26).
- Allow for adequate flexibility in your evaluation. Indicators are never carved in stone. When your project is up and running you will get a better feel for the context in which your research is taking place. Citizen science projects can throw up some surprising results. To be ready for both situations your evaluation should have flexibility built in. It should be possible to add or modify indicators as you go along (22).

as a result of taking part. Greater awareness, knowledge and understanding, heightened interest, changes in attitude or behaviour, and, finally, better skills (27, 6, 28). These changes may have occurred in relation to the subject (e.g. the participants know more about the effects of air quality on human health) or the scientific process (e.g. the participants have a better understanding of the importance of representative data).

The success of the actual engagement process can be measured against a set of normative criteria. For a vast evaluation framework see the study by Haywood and Besley (6). They look at things such as whether citizen scientists have sufficient access to information, equipment or time and whether they are sufficiently engaged in the design of tasks, analysis of data or communication of results. Other indicators in this scheme relate to things such as transparency, honesty, representativeness and inclusion.

Be sure to check whether your citizen scientists are satisfied in the end. Did the project satisfy their original motivation to take part? Did they have fun with their tasks? Were the tasks explained clearly enough? Did they get enough information? You might also ask if they were satisfied with the project communication. Was the information given on time, and was it relevant and clear? Did it come through the right channels of communication? Did they at every stage of the project feel that the opportunity was there to contact the project organisers if they needed to?

Not only do satisfied participants engage with a project longer, but they can be more easily encouraged to take part in new citizen science initiatives.



### When cities are in danger of flooding

In the FloodCitiSense project a 'pluviometer' and (web) application keep residents in Brussels, Rotterdam and Birmingham updated on the city's rainfall and flood risk. Citizens build their own pluviometer and set it up in the garden. Impact measurements are set up using an evaluation framework devised by Kieslinger et al. (26). The evaluation framework measures the project's impact at three levels: the contribution to science, the contribution made by the citizen scientists and the project's socio-ecological dimension. Special indicators have been devised for each dimension in the project context. For example, the evaluation framework is used to monitor the number of scientific publications produced, the number of contributions made by individual citizen scientists and any increments in their knowledge and skills. The socio-ecological dimension is evaluated by looking at the innovative nature of the technology and the influence exerted on the city's water and flood management policy.

### When will you evaluate your project and what indicators will you check?

#### When?

Evaluation in planning phase

Evaluation in live phase

Evaluation afterwards

Quantitative indicators

Qualitative indicators





# Tactics and tools

Recruiting citizen scientists and permanently engaging them can be done in many different ways. We offer six.



Before deciding on specific tactics and tools, you will need to think long and hard about your strategy. Will you be taking a generic approach or a specific one? Or will it be a combination of the two?

When you take a generic approach, you publicise your project through an open call. You can do this via social media, the press, by handing out flyers, etc. You target a huge number of potential citizen scientists, and you do not target specific profiles or specific audience(s).

When you take a specific approach, you send out personal invitations or contact people on member lists. Collaborations with existing networks and communities can work well for a specific approach. Your choice of strategy will affect the diversity of your project participants. Research shows that the generic approach does not always deliver a diverse target audience in terms of gender, age or education level (29). A generic approach is more likely to reach the 'archetypical' citizen science profile (30): the white, well-educated man who knows a bit about computers and has a lot of spare time.

### Initial or continued participation?

Once you know your target audience you can check out specific tactics and tools to help you engage it. By tactics and tools we mean the instruments or channels of communication you will use to recruit and retain your target audience. It is vital here to be aware of the motivations for initial and continued participation.

Citizen scientists don't necessarily stay to the end of a long-running project. The drop-out rate is highest at the time of initial participation or shortly afterwards (31). How come? At the time of initial participation, it is usually the use of jargon or a non-user-friendly application. Beyond initial participation it is lack of recognition from the scientist or lack of openness about the scientific pro-

cess and the research results. So make sure you communicate with your citizen scientists regularly, and that you do so beyond the data collection phase. What happens next? When will the results come in? Is there anything else they should know about the research topic?

Below is a list of six tactics to recruit citizen scientists and keep them engaged. You can also turn to the more traditional tools of communication such as press releases, newsletters or mailing lists, flyers, events and trade shows, a project website or a blog. We offer a few practical tips on this subject in [chapter 3](#).

### Why do people take part in citizen science?

Initial participation	Personal interest in the topic
	Contributing to science
	The fun factor, taking pleasure
	Desire to learn and general inquisitiveness
Continued participation	Validation and appreciation for the contribution
	Deeper understanding of the topic
	Contact with the scientist and/or other like-minded people in the project
	Willingness to assume tasks or roles in the project

Source: Rotman et al. (31).





## TACTIC 1

# Hitch a ride on existing networks

Whether you set up citizen science on a small or large scale, the best way to effectively engage your target audience is often with help from existing networks and communities. Large societies and networks are usually on the lookout for a new angle or to inject new life into their annually recurring initiatives.





A partnership with an existing organisation or initiative linked to your research subject can mean that you come into contact with the right target audience sooner. It can put you in touch with citizens who have prior knowledge and a shared interest. Or it may offer a route to those hard-to-reach target audiences. Through partnerships you can reach citizens in greater numbers and increase the expertise in the topic, and you may even be able to

engage a niche target audience. In any case, we advise against building up an entirely new community of citizen scientists.

Once you have found your project partners it may be a good idea to discuss a visual identity and communication strategy with them. Always list the names of your partners on your website. In your communication with citizens, state who your project is 'in association with'. This will tell them that

### How to find and keep the right partner

- Look for meetings with a bearing on your research topic and try to introduce your project there. If you are studying air quality, for example, it might be interesting to attend debates on climate change and mobility, and workshops on preventive healthcare, or follow specific activities organised by city labs or local and neighbourhood committees. Other initiatives you can follow include Volunteer Week, Science Day, Biotech Day, Child Universities, History Day, Teachers' Day and Classroom Day. Introduce your project, try to swap details and try to stay in touch.

- Find member organisations or societies. Speak to the person in charge of communication about the possibility of raising your project's profile in a systematic way. For example, you might get coverage from a monthly newsletter to members.

- Look beyond national borders. Check out the 'community' section on the [ECSA website](#) (European Citizen Science Association). It lists European and international organisations all of which are active in citizen science. The site

<http://eu-citizen.science/> is currently under construction and gives an overview of citizen science tools and projects in Europe.

- Choose to partner existing networks and organisations whose objectives complement your own. Improving the knowledge of members, for example, or just offering a fun experience. The partnership must support information sharing and data collection. If you join forces on a similar citizen science

project, discuss the data collection protocol.

- Be sure to maintain good relations with your external partners and keep them informed of your project's progress. Give them a say in the project organisation and communication and every three to six months invite them for a face-to-face meeting between all the partners involved. This creates a sense of community, not just among the project participants, but among its leaders too.



they are part of a larger, like-minded community with an interest in the research topic.

You can also agree on rules about messages posted on social media and about joint events and activities.

### Inspiring examples

In the project Oog voor diabetes (Eye on Diabetes) the participants annotate abnormalities on retinal images. They are helping to build up a reference database of annotated images, which can be used to train an AI software to recognise diabetic retinopathy in future. To recruit citizen scientists the project partners Diabetes Liga (Diabetes League), an association for diabetes sufferers and their families and professional care providers. The league promotes the project on its website, social media and in its magazines. The members are naturally sympathetic towards the subject, which makes them an ideal target audience.

The Getuigenissen (Witnesses) project invites volunteers to delve into 18th and 19th century criminal law archives for historical witness statements. Citizen scientists visit an online platform to view and transcribe the historical texts. The project is partners with Histories, a society of genealogists and heritage and culture enthusiasts. Histories offers courses on these subjects and its members have often already transcribed historical documents in the past. The MamaMito project, in which citizen scientists go in search of their maternal ancestors, also partners Histories. Other associations and organisations which have partnered citizen science projects to date are Natuurpunt, Arabel, people's observatory, the Flanders Meteorology Society, beweging.net and The Flanders Cycling Council.

### Engaging schools and teachers

The Vlaanderen IN DE weer (Flanders in the weather) project monitors local weather in Flanders by means of weather stations at Flemish schools. The online learning platform is primarily of interest to first and second grade secondary school geography teachers. To engage this target audience the project partners the Flemish Association of Geography Teachers. There are many more teacher associations, such as the Association of Science Teachers and the Association of Biology, Environment and Health Education.



### Engaging youngsters and their parents

If you would rather engage youngsters in their spare time than in the classroom you might consider partnering local youth clubs or play areas. If your project is STEM-related you may be able to interest local STEM-academies in your offering. Technopolis is obviously an interesting partner. Beyond that, Youth, Culture and Science offers a wide range of leisure activities for children and youngsters. RVO-Society reaches out to young people in and out of the classroom in STEM-related matters and technology.

You can also engage the parents of children and young people through local parent-teacher associations and by partnering the Gezinsbond (Family Association) or Kind en Gezin (Child and Family).

### Don't forget your own organisation!

Are you embedded in a research institution? Be sure to look for what you need in your own organisation. Often you will have access to the science communication unit, the marketing and communication department, graduate associations, press officers and so on.



To reach out to young people you can partner your institute of higher education's teacher training college, children's university, marketing department or science communication unit.

University colleges, which lean towards socially oriented, applied research, are often well connected to local communities.

### Go local

Does your citizen science project target a predominantly local audience? Consider partnerships with local cultural centres, museums, libraries, sports clubs or music societies.

*Need help finding the right contacts and partners? Contact [Scivil](#) for advice.*

Generic or specific approach	Initial or continued participation	Outcome
<p>This tactic is suitable for a specific approach. Through partnerships you can engage specific target audiences or a niche audience.</p>	<p>This is a tactic which has its greatest effect during initial participation. By entering into partnerships with existing networks and communities you build or grow a community of people with a shared interest or concern.</p> <p>Good partnerships can also be good for the continued participation of citizen scientists, for example, through working on a shared visual identity and communication strategy. Here, a sense of community comes into play.</p>	<p>Engagement: building or growing your community</p>







## TACTIC 2

# Offer a fun experience

Participating in citizen science should be educational, but unless it is fun it will not be sustainable. How do you increase the fun factor of your citizen science project?



Most of the activities arranged for citizen scientists have an informative or educational focus. Think of workshops, where you (the project leader) describe the topic or explain the results. These appeal most to citizen scientists who are intrinsically motivated (interested or concerned about the topic). But the format offers little room for interactivity or experience.

We recommend that you also arrange activities that are more about the fun and the social experience. These activities satisfy social motivations such as getting to know people, having experiences, having a good time and having a sense of community.

Social events tend to motivate people in the long term. Their enthusiasm is at its highest when the topic connects to a specific location, such as a street, neighbourhood or city, and involves a group of people meeting to consider a shared concern. Be sure to get the balance right between your project's aims and scale, and the ratio of information to experience.

Examples of social activities include competitions or family games afternoons, meet & greets between citizens and scientists, group walks, a breakfast or appetiser and info opportunity, etc. These activities provide an opportunity to learn about the project interactively and to thank citizen scientists for their efforts.



### History excursions

For the Ja, ik wil (I Do) project citizen scientists logged onto their computers to transcribe and analyse historical marriage announcements in Amsterdam. It was all to do with a historical study of marriage relations. For an enhanced sense of community and to keep citizen scientists motivated and rewarded, the University of Utrecht's researchers arranged regular meet ups, at which they talked about the study's progress and gave the participants a chance to ask questions and interact with them. They also arranged excursions, such as a visit to the Trippenhuis, a historical building in Amsterdam, which is not normally open to the public.

See also the interview with project leader Tine De Moor.

Generic or specific approach	Initial or continued participation	Outcome
This tactic is suitable for a specific approach and mostly works for local or municipal citizen science projects.	This is a tactic which works best to support volunteers' continued participation and satisfies social motivations, such as getting to know new people, gaining a sense of community or having a good experience. The tactic can be employed at any point in the course of the project.	Experience: giving participating citizen scientists a positive and enjoyable experience.





### TACTIC 3

# Use social media

Facebook, Instagram and other social media can really bring your citizen science project to life. They offer opportunities for interaction between scientists and citizen scientists and between the citizens themselves.





You can build a virtual community around social media, through which scientists are able to interact with the citizen scientists on their project. Social media can also help engage citizen scientists more powerfully with the research, by giving them quick access to results or inviting their feedback.

### Which platform?

You can put social media to good use for a variety of objectives. You will want to use different platforms depending on your project aim and the target audience.

In Flanders, Facebook is still the leading choice (32). Three quarters of the Flemish population maintain an account and log on every month. Usage is growing fastest among the older age groups. Facebook's most interesting features are posting messages and sharing events, sharing photos and videos, paid advertising and setting up closed groups. Closed groups are a good way to let your citizen scientists keep their communication private and help each other out.

Instagram has grown rapidly in recent years and is very popular among 16- to 34-year-olds. This platform is particularly good for sharing high-grade visual content. By using #hashtags and Insta Stories you can interact with your target audience creatively and have them submit their own content. Although Facebook has more users, Instagram can be more effective at creating a sense of community.

There are relatively few Twitter users in Flanders and growth is still slow. This platform is more suitable for issuing short messages to engage a professional target audience, such as journalists, media professionals and domain experts. You can use Twitter to alert journalists to your project and 'feed' the media with relevant information or announce interim results.

### Vary the message type

Make sure you post a mix of message types on your social networking sites.

Start by posting 'project messages'. This type of message draws attention to your project and shares information about its aims, and about events, news items, results, and so on.

You can also post 'subject-specific messages'. These messages offer information about your research focus: scientific background information, current affairs, inspiring examples of similar projects, related events and conferences.



### City spiders

The SPIN-CITY project by the University of Ghent asks citizen scientists to photograph spiders and upload them along with additional details as part of a research study on the impact of heat stress on the city's animal population. SPIN-CITY has a [Facebook](#) page and an [Instagram](#) page. Striking are the extremely beautiful and appealing photos. The message content is also of considerable interest: you learn how to take the perfect spider picture, for example, and how to tell the difference between males and females. The lead researcher made a captivating video clip explaining the project's purpose.

Finally, it is best to post regular 'like' messages. Funny clips, photos, did-you-knows, GIFs, before-and-afters or 'behind the scenes' pictures.

If you are aiming to post three messages a week, for example, that would mean one of each message type.

Of course, that all requires content. Our advice is to plan ahead. This way you will already know what



content you need, and your messages will be more original and creative. You can also plan your messages around your activities and events. There are plenty of tools you can use to plan your messages upfront, for multiple social media platforms concurrently, so they appear automatically when you want them to.

#### **Think beyond the standard link or photo**

Try to post creative messages, rather than a photo with a piece of text and a link to an article. We read lots of messages every day, and what you obviously want is for people to notice yours. Do this by pricking the emotions of your target audience, keeping the content as relevant as you can and prompting action or interaction of some kind. Instagram Stories has all kinds of interactive possibilities, which you can try as a means of interacting with your target audience.

#### **Regularity is the rule!**

The regularity of your posts is more important than the daily or weekly number. Famous people

and brands post on average 1.5 messages a day on Facebook or Instagram. The more often you post, the more engagement you will create. The less often you post and the fewer responses you receive, the fewer people will see your post on their Facebook wall.

If you don't have the time, make sure you deliver on your promises, and plan to post fewer messages every week or month. The most important thing is to stick to a given regularity.

#### **Look at your statistics**

With a paid Instagram account or Facebook business page you will be able to look at your statistics, which tell you which messages and times are the most popular. This information can help you plan your messages and publish posts at the time you choose.

Generic or specific approach	Initial or continued participation	Outcome
<p>This is a tactic which can be employed in a generic or a specific approach. You can post messages for the general public and publicise, but you can also operate specifically by 'spying on the neighbours'. Follow similar projects or ambassadors for your topic, to make sure that they become aware of you too.</p>	<p>This tactic can be employed to support initial and continuous volunteer participation. Social media can be used to find new participants, and to keep your community motivated for the duration of the project.</p>	<p>Interaction: the main thing you do through social media is interact with your target audience. You can also use different message types to inform, engage and create awareness.</p>





## TACTIC 4

# Digital storytelling

Telling stories can create a sense of belonging between citizen scientists. Especially if you let them testify about their experience of taking part in your project.





People love stories and some seem to live for them. Digital storytelling (33) is a tactic which uses visuals, audio or text to tell a story about a subject through digital media.

You zoom in on a topic and recount the story, often from a personal perspective. The story is short and powerful (2 to 3 minutes' viewing time, or a single screen of text) and arouses curiosity and interest in the target audience.

### Personal, historical or educational

There are several kinds of stories that you might consider. In personal stories, you focus on the personal experience of one of your citizen scientists, such as the knowledge and skill set they have acquired, the challenges posed by the research work, the measurement and collection of data, and so on. To tell the story, you might ask citizen scientists to record a short video or audio clip, in which they talk about their experiences, or you might invite them for a short interview. Pick a person who is representative of your target audience. This will help other people empathise with the story or character. Why not tell a personal story from the viewpoint of the research scientist?

Historical or educational stories can also be told. Historical stories rely on historical elements to convey the more contextual information about your project, whereas educational stories inform and enlighten people about some aspect of the work. Educational stories are of particular benefit when reaching out to schools. They can be a fun way of engaging pupils (2). You can also draw attention to your project through social media, by throwing in historical facts and details, for example. 'Did you know that exactly x years ago to the day scientist X laid the basis for Y?'

Once you have your stories in place you can begin to share them through all kinds of communication channels, such as your website blog, a newsletter or social media. With permission from the participant or interviewee you can even share the story more widely, through the press or a selection of magazines.



### Dead baby in the toilet

From time to time the Getuigenissen project highlights a historical witness statement from one of the court cases transcribed by its volunteers. On one occasion we were given the story of 29-year-old domestic servant Marie, who stood trial for infanticide. One day the plumber found the body of a baby in the toilet pan. It was thought to have been Marie's, but her statements claimed otherwise. She began by saying that she didn't know that she was pregnant. Then she admitted killing the baby, but said she wasn't aware of what she was doing as the child-birth had made her psychotic. What was the truth? And what was she sentenced? The researchers behind this project give the story an element of suspense, put it into context and contrast it with the situation today. And at the end, of course, they call for more volunteers for their citizen science project.



## Elements of a good story

### Structure

The story follows a scenario, through which the project is introduced, followed by a specific activity to attract attention and interest, then closes on a climax.

### Character

Who is the story about? Stories are best told from a personal perspective so the reader, listener or viewer can truly empathise with the character's situation.

### Authenticity

The reader, viewer or listener must be able to identify with the character's story, so that a level of familiarity or connectedness is created. Hearing a voice, or choosing the right photos and captions play a role in this.

### Setting

Where is the story set? To create empathy for the character the story also includes details on the environment, time and season.

### Language

The language must be highly accessible. Use an airy and simple writing style.

### Message

The best stories are the simplest ones. Go for one clear story line.

Generic or specific approach	Initial or continued participation	Outcome
<p>This is a tactic which can be employed in a generic or specific approach. You can share the stories with the general public via the press or scientific magazines or share them specifically via your project's channels of communication (blog, website, social media).</p>	<p>This tactic can be employed to support continuous volunteer participation. When your story is about your participants they are recognised for their contribution and you satisfy the social motivations.</p>	<p>Illustration and knowledge sharing: Personal stories can create a sense of loyalty among citizen scientists.</p>





## TACTIC 5

# Gamification

Adding gaming elements to your citizen science project can benefit your research. Those who feel they can improve, take on a challenge or win a competition are more likely to stay motivated and keep participating for longer.





You can motivate citizen scientists by introducing *gamification* or game-design elements. Lots of projects make use of apps or digital platforms that allow for the incorporation of online game elements. But gamification also has its uses offline. By gamification we mean 'the introduction and use of game-design elements in a non-game environment' (36). Gamification is not a reference to gaming or educational games. The concept is specific to the integration or application of game-design elements in an application or activity with a view to making the task more enjoyable.

### Measurement campaigns

A measurement campaign motivates citizen scientists to gather as many data records as possible

in a given time. The organiser defines a task in very clear terms and sets the geographical area and time frame (from one day to several weeks) within which data records are to be submitted.

There are all kinds of ways to be creative about your measurement campaign.

Link your measurement campaign to a specific event, public holiday, occasion or season. An air quality measurement on New Year's Eve, (when lots of fireworks are set off), for example or a rainfall measurement during a summer thunderstorm. Get different communities of citizen scientists to compete against each other. For example: school X and school Y compete to annotate retinal images.

Set up a large-scale, small-scale or niche campaign. For a large-scale campaign it is best to work in collaboration with local organisations that can

### Game-design elements and motivation

We list several game-design elements below and link them to the specific motivations they support (36). Most of these game-design elements are integrated in online data collection applications used by citizen scientists.

Game-design element	Description	Motivation
Points, badges and trophies	Citizen scientists collect points by progressing in a specific task and completing it. The points can be exchanged for (virtual) badges or trophies.	Progression towards attainment of a goal
A ranking (involving levels)	Citizen scientists collect points and are ranked on a list or can go up in levels.	Status and recognition in a community
A mission, measurement campaign or race against the clock	Citizen scientists are challenged to embark on a mission or campaign under special conditions, such as a geographical location or time limit. On accomplishment of the mission a (virtual) prize may be awarded.	Challenge and competition
Group missions or campaigns	Missions or campaigns are run in groups and the tasks are divided among the participants.	Challenge, competition, new contacts and sense of a common cause



help you with your logistics and promotion. You could also appeal to the media to publicise your campaign. For a niche campaign, be specific about the citizen scientists you appeal to.

At the end of a measurement campaign the results are analysed and communicated to the citizen scientists. You might want to organise an event at which you discuss the results with the citizen scientists. Make sure you send each participant a copy and publish the results on your website and social media page.

### Rewards?

In the examples above, citizen scientists were rewarded with points, badges, trophies or prizes. In some cases, coupons or small sums of money are awarded. Rewards relating to the research topic can also be considered. Such as, for example, air-purifying plants in return for air quality measurements.

Your citizen scientists need not necessarily be rewarded in this way. Many of them are intrinsically motivated and need nothing in return for their research contribution. Handing out money and coupons could even be counterproductive. An equally valuable reward may be a citation for co-authorship when the results are published.

### Conditions for success

If you wish to incorporate game-design elements in your citizen science project, it is best to give the following aspects a little thought.

- Integrating game-design elements in your citizen science will have the greatest effect on that group of people who enjoy gaming in general. They will be driven to participate in your project based on extrinsic motivations, such as the element of competition or the collection of points or badges. But research shows that most citizen scientists are intrinsically motivated. With gamification you will manage to motivate only a small (extra) target audience, and most of those will be youngsters (37).
- Game-design elements can also be counterproductive. It can demotivate citizen scientists to find that their work is being evaluated, or



### Healthy competition

Through the website and app run by [Waarnemingen.be](http://Waarnemingen.be) animal and plant species observations can be submitted to the researchers at [Natuurpunt](http://Natuurpunt). The data is open to all – including other citizen scientists. This helps maintain the quality of the records and keeps the pranksters away. Participants can be named and shamed, in other words. It is also possible to see how many submissions a person has made – how many observations, how many different species. This can lead to healthy competition between the participants. The proportion of each species is displayed in a pie chart (if birds account for 60% of your observations you can try balancing things up by looking for other animal species).

[Natuurpunt](http://Natuurpunt) also arranges Bioblitzes on a regular basis. On these blitzes, everyone is invited to spot a set number of species over a two-day period.

that they are too slow to reach the targets set (38).

- Gamification only works when sufficient thought goes into the design of the game elements. If you can't spare the time or money, it is best forgotten.
- In citizen science, gamification is at its most effective when gathering data is the main thing the citizen scientists do.



Generic or specific approach	Initial or continued participation	Outcome
<p>This is a tactic which can be employed in a generic or specific approach. You can promote measurement campaigns among the general public via the press, or specifically via societies and associations.</p>	<p>Integrating game-design elements in your project works best in support of continued participation.</p> <p>Measurement campaigns can be introduced to the project at any time and can motivate new and existing participants to take part.</p>	<p>Experience and engagement: an extra fun-factor for the project.</p>







## TACTIC 6

# Find project ambassadors

An ambassador is a citizen scientist who has been involved since the very beginning. He or she usually knows a lot about your project's research topic and will often have taken part in other science-led projects. Ambassadors are also known as lead users. They have a strong intrinsic motivation to participate.



Ambassadors can help with your project's logistics, administration or communication. An ambassador can (more readily) engage other, potential citizen scientists and can help you promote the work.

Take the following steps to set up a programme for ambassadors.

### Define the task and the profile

An ambassador can handle a wide variety of tasks. Talk to the other partners in the project to see where a little help might be of use, or where it might be a good idea to build trust with (new) citizen scientists. Consider administrative duties, helping with online or offline promotions (distributing flyers, forwarding newsletters or messages on social media, etc.), being the point of contact at events, helping out at workshops by assembling sensors, and so on.

It is vital for potential ambassadors to know what they can do (and when they can do it) and that they be able to choose a role that suits them.

### Find and train ambassadors

The only effective way to set up an ambassador programme is to put the time into finding and training the right people. Ambassadors may simply offer you their services, but you can also promote the programme by adding a registration module to your website. You can also feed the promotion through your project's other channels of communication, such as events, workshops, social media, and such-like.

With your ambassadors identified, you will need to provide the necessary training. This might be a one-off event, such as a tutorial on simple tasks. Or you might arrange regular sessions for your ambassadors on complex tasks. Through this, they will learn more about how your project works.

After a while you might bring in the *train-the-trainer* model, in which incoming ambassadors are trained by more experienced ambassadors.

### Give your ambassadors visibility

Your ambassadors are still volunteers. They deserve some kudos within the community by way of thanks. After a measurement campaign, thank your ambassadors publicly and do it officially, via the website or newsletter or by turning the spotlight on them. You can achieve visible recognition with a captioned T-shirt, or by adding a token or badge to their online profile.

Ambassadors are often satisfied with intrinsic rewards. A day spent with the team analysing the re-



### Ambassadors for the North Sea

In 2014 the Flanders Marine Institute (VLIZ) started a project by the name of SeaWatch-B. Since then, it has trained and engaged twenty volunteers. Each has a fixed area of beach to comb and takes ten standard measurements a season. Among other things they count the numbers of washed-up jellyfish, lugworm casts and shellfish species on the tide line. The collaboration provides the VLIZ with more than just research data. The SeaWatchers have also become ambassadors for the North Sea. They have a sense of involvement in what they do, learn something new every day and take good care of their own 'back yards'. If they have concerns, they write in or take some other form of action. As seashell experts they take the lead at the annual Grote Schelpenteldag, at which members of the general public identify shells along the coast. The VLIZ provides training at least twice a year, through which the SeaWatchers improve their knowledge. And the institute engages them regularly with other scientific activities aboard its marine research vessel.



sults or an excursion with professional scientists can be both interesting and special.

**Adjust where necessary**

Ambassadors can be brought in for a single activi-

ty or stay involved with the project during a longer period. Although adjustment and evaluation may be necessary, it could prove counterproductive. Find a balance between the support you provide and any performance evaluations you make.

Generic or specific approach	Initial or continued participation	Outcome
This is a tactic which can be employed in a generic or specific approach. You can appeal to the general public for ambassadors through your website, or specifically via email, a newsletter, or by approaching people in person at events.	This tactic can be employed to support continuous volunteer participation. Enthusiastic volunteers can be highly intrinsically motivated to play a role in your project.	Illustrative and engaging: project ambassadors can be role models for other participants and be of help in promotion and community building.





# Tips and tricks

These helpful tips will set you on the path to clear and successful communication.



■ **Communication is a matter for everyone**

The project team on a citizen science initiative usually has one person in charge of communication, and this is often the project leader or project coordinator. This keeps messages about the project's status, aims and results straightforward and consistent.

But communication is a matter for everyone, and so it concerns the project team as a whole. Every communication issued influences the image and perception of the project. But this is no reason for a communication blackout. Make clear arrangements up front and be sure that everyone in the team knows the latest developments and upcoming campaigns. This encourages team members to communicate the project via the medium of their choosing, which works well for the authenticity of your communication. Just be certain that the wrong message doesn't go out and that your communication isn't ambiguous.



■ **Keep to a uniform style, design and terminology**

Be consistent and always use the same project name (same spelling), logo and hashtags. Don't hesitate to ask your partners, project workers and the press to do the same. Refer to it on your website or at the bottom of your press releases, for example. Give plenty of thought to the launch of a project name. Does it capture the essence of the project? Does it arouse curiosity? Do the project partners like it?

**Be clear**

Don't blind your citizen scientists or the media with science. But at the same time, don't oversimplify. Science is not a *walk in the park*. It is the result of years of painstaking teamwork. That message can be conveyed, but it must be understandable.







### ■ Follow current affairs

Follow current affairs and try wherever possible to be topical. When your area of activity comes into the news, quote the news item and refer to your project. This allows your own citizen scientists and ambassadors to appreciate the relevance of their research work. Citizen science projects can even reinforce and refer to each other on social media, websites, and so on. Remember that your project and science in general is competing for attention with hundreds of news items every day.

### ■ Exploit the power of the media to the full

Decide in advance the two or three core messages you want to communicate and don't stray from them. Not even in an interview. Always try to return to them. If your project has a *baseline*, state it consistently.

Draw up a list of journalists before you start, give them regular briefings in person about the current status of your citizen science project and follow the items they publish. Inform them about the project at the very start and ask if they would like to see your website or talk to the scientists. Thank them for their interest in your project and, if possible, give them a little extra information from time to time. Don't leave your local newspapers or TV stations off the list, as they are often the path by which news travels to the national media. The national press can use images broadcast by the regional television stations.

Try to find an original angle for your press briefings. Provide visual material you have adapted yourself, or a clip that places you online (for example, a citizen scientist explaining what he has been doing). Find an appealing testimony, a scientist explaining her fascination for the subject, a twelve-year-old excited by the stars, a senior citizen with a lifetime of finding fossils, an animated teacher, etc.

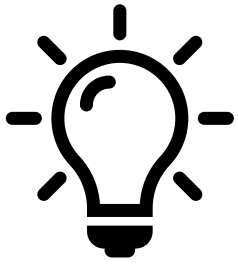
For some citizen science projects it may pay to identify a few local celebrities and to ask them if they would care to support or promote the project. They might be media celebrities, or just as easily teachers or nature tour guides. Offer them the chance to act as a patron for your project.

### ■ Don't forget cities and municipalities

Go and speak to your city or municipality officials to find out about activities before they happen or to reach out through them to societies and associations (if you aim to be inclusive, for example). They may tell you that your project coincides with a relevant city campaign or give you space to showcase your project in a temporary exhibition or pop-up shop. If the city uses a marketing agency it might be worth asking them if they would be prepared to help you with your campaign pro bono. But be aware of how time-consuming this would be and ask yourself if the results are worth the effort.







### ■ Go and blog (or vlog)

In blogs and vlogs, you can employ the storytelling tactic and set yourself up as the central character in a story. Blogs are best written from a personal viewpoint: they reveal the person behind the science and what she is up to. They can work to strengthen the engagement of (potential) citizen scientists, because they create a bond with the scientist and the research he is doing. Obviously, you don't have to stop at blogging, and you can also vlog (create a video message) or release a podcast (an audio recording).

If you aim to spread the message beyond your website, you can always enter your blog to Eos Wetenschap for publication. Contact the editors and show them your blog/vlog/etc. If they like it you can start posting articles, photos, videos and other content on the website. You will have a chance of inclusion in the *Eos* newsletter, which gets mailed to fifty thousand subscribers.

### ■ Use hashtags

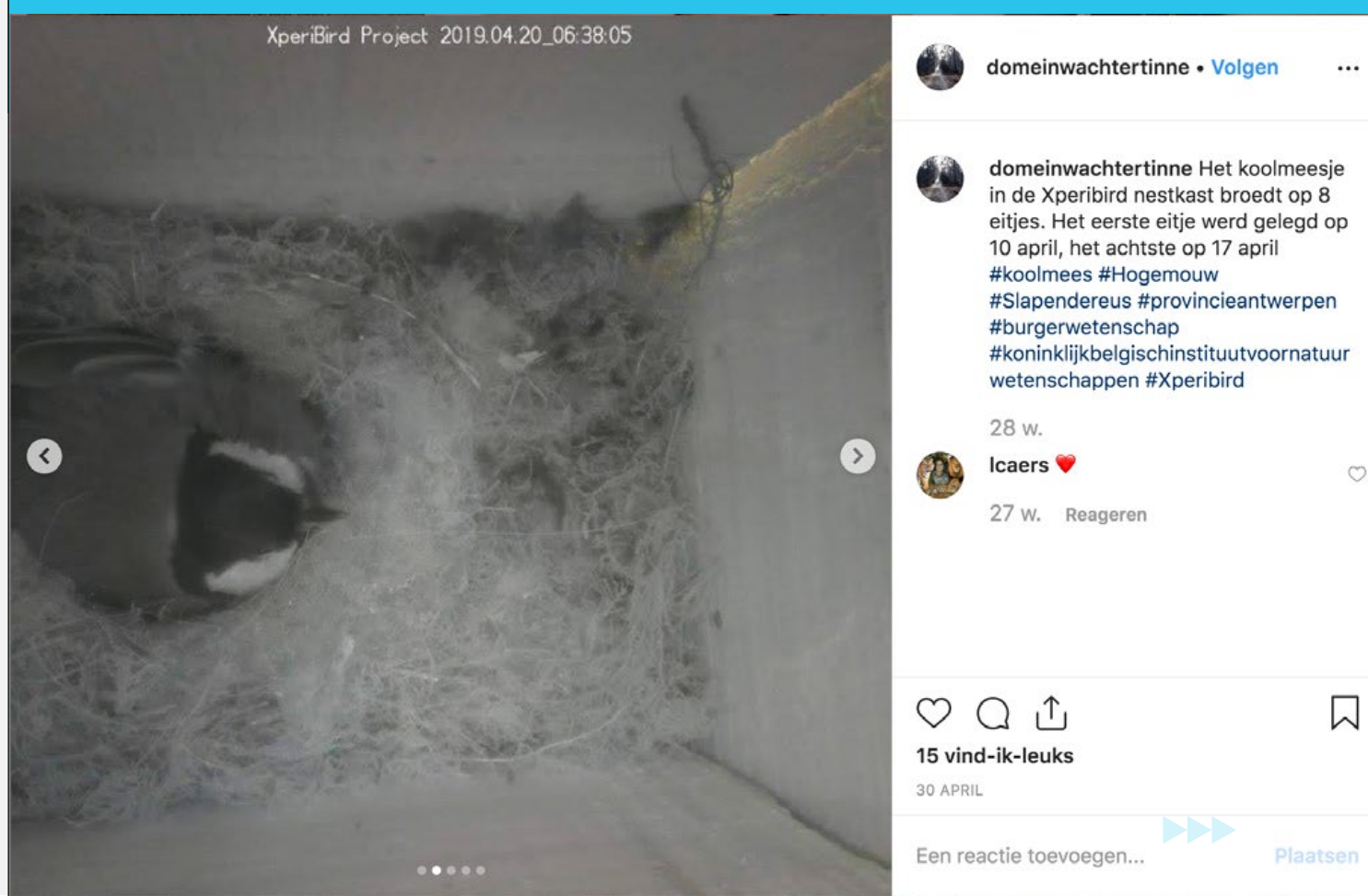
For messages posted on social media choose simple, clear, relevant and specific hashtags. Keep your *brand hashtag* (your project's hashtag) short, unique(!), simple and easy to type, so that your followers can use your *brand hashtag* easily and as intended. Before you launch a hashtag check the social media to see what kinds of photos, videos and messages are usually shared under that hashtag. Use about four to six hashtags on average and do not keep hashtags when they are irrelevant. Of course, it is okay to use a popular hashtag now and then, such as #throwback #tgif #picoftheday #regram

It may be a good idea to turn your social media accounts into a business account, because that will give you access to extra information and allow you to promote some of your messages. You will then be able to keep an eye on how your followers are trending, when they are online and which messages work well for your target audience.

### ■ Use tags

It's smart to tag institutions, societies and groups when you post on Facebook. Your partners of course, but consider your university, a nature society, a community group for clean air, and so on.

These users will get a notification about your message, and, with a little luck, like or share it, lending your post a broader reach.



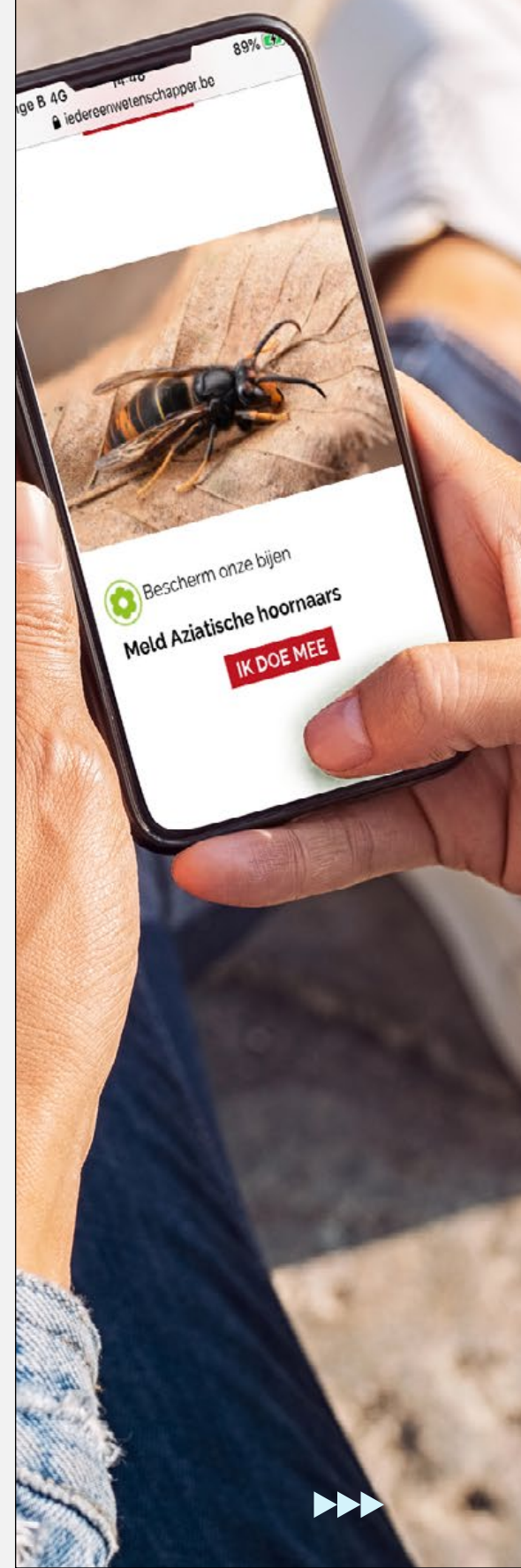


### ■ Get your project on a citizen science platform

There are lots of online platforms for citizen science projects. They will often have a newsletter to which many people with a general interest in science subscribe and who gladly participate in projects on a regular basis. The Dutch-speaking platform for citizen science is Iedereen Wetenschapper (Everyone's a Scientist). You can submit your project to the website [www.iedereenwetenschapper.be](http://www.iedereenwetenschapper.be). They will reply by email. If your project satisfies the conditions for a citizen science project, they will send out a standard questionnaire and the editor at Everyone's a Scientist will post your project to the platform. Your project is published on the platform freely, and it is mentioned in the monthly newsletter and on the Everyone's a Scientist social networking site.

[Zooniverse.org](http://Zooniverse.org) is an international platform, based on the annotation and transcription of datasets and counts more than a million interested citizen scientists worldwide. As well as calling for participants, Zooniverse runs the projects on its own servers. If you would like to run your project on Zooniverse, you will need to make that decision upfront and apply to the platform. [SciStarter](http://SciStarter) is an (English speaking) international platform which, like IedereenWetenschapper in Dutch, disseminates your project to a community of citizen scientists. SciStarter also allows citizen scientists to track and earn credit for their contributions to science projects.

Along with these general platforms there are online platforms for specific topics. [DoeDat \(Dolt\)](http://DoeDat (Dolt)), for example, is the online crowd sourcing platform for Meise Botanical Gardens, on which citizens can digitise their herbaria. [iNaturalist](http://iNaturalist) is an international app and online community through which people identify plants and animals. [MijnTuinlab \(MyGardenLab\)](http://MijnTuinlab (MyGardenLab)) is a Flemish platform which gathers citizen science projects that can be run in your own garden. [Vele Handen \(Many Hands\)](http://Vele Handen (Many Hands)) hosts citizen science projects which engage citizen scientists in the transcription of historical, often handwritten documents.



### ■ Keep communicating to the end

Do not think your work as a communicator is done when you find enough volunteers to take part in your citizen science project. You will need to keep 'feeding' your citizen scientists with information right through to the end of the project. Do this with a regular newsletter, messages on social media, lectures or workshops. People also expect to hear from you regularly after the project has ended, until you communicate the results. What are you researching now? Why are the results taking so long? What will be done with the results? Finally, do not forget to thank your citizen scientists for taking part or to let them know how important they were to the study.



# Six steps to a communication plan

You are now ready to prepare your communication plan. It contains all the steps you will want to take in your communication. As you run through the steps below, return to the answers you provided earlier in this guide.





A communication plan is a detailed description of the communication steps by which you plan to engage your project's target audiences. You list the steps in chronological order, link them to the relevant audiences, list the aims you hope to achieve and make sure you know your target audiences. You can also add an engagement strategy. This tells you more about what motivates or prevents citizen scientists from taking part in your project and suggests tactics and tools to secure their initial and continued participation. Your engagement strategy will also allow an evaluation of your citizen scientists' participation.

You write your communication plan in the planning phase of your citizen science project and adjust it while the project is live. An important point here is to set a budget, as it will help you set priorities. Do you plan to spread your resources evenly over the life the project, or will you introduce peaks in your communication?

Save the plan in an easy-access document, so that project partners and workers can see the latest changes. A communication plan is a tool for you and your team to use, not a sacred scroll.

Use the following diagram to create your own communication plan and engagement strategy.



# 1

## Define your project aim (see also page 9)



### Your aim(s)

- Contribution to science
- Education
- Engagement of citizens as stakeholders

**Effective description of your aim(s):**

# 2

## Define the level of engagement (see also page 10)



### The project is closest to a:

- Contributory project
- Collaborative project
- Co-created project
- Crowd sourcing project
- Distributed intelligence project
- Participatory science project
- Extreme citizen science project

**Explain why:**

# 3

## Identify your target audience (see also page 13)



**What target audience(s) have you identified? Be as accurate as you can in your description, by means of these characteristics:**

	Target audience I	Target audience II	Target audience III
Demography (age, gender, profession, socio-economic profile, etc.)			
Prior knowledge or skills			
Current behaviour			



**What is your primary target audience?**



**What is your secondary target audience?**



**Who are the intermediaries? (Consider organisations which are in contact with your primary target audience)**







Does your project need a diverse and inclusive target audience? (Consider your project aim)

- No
- Yes

If so, how will you engage a minority group or groups? (See tips in chapter 1)



What motivations might drive your target audience(s) to take part in your project?

	Target audience I	Target audience II	Target audience III
Motivation I			
Motivation II			
Motivation III			

# 4

## Define your strategy (see also page 17)



What approach will you take in your communication plan?

- Generic approach
- Specific approach
- Generic and specific approach

What is your total communication budget? Remember that some activities may be 'free' (e.g. giving a lecture).



# 5

## Tactics and tools (see also page 21)



**What tactics and tools will you apply to secure initial or continued participation?**

### Generic approach

initial participation  
social media  
gamification

### continued participation

social media  
storytelling  
gamification  
ambassadors

### Specific approach

initial participation  
hitching a ride on existing networks  
social media  
gamification

### continued participation

social events  
social media  
storytelling  
gamification  
ambassadors



**Describe how you will apply them for each strategy you choose: for each strategy you choose set the budget you have to spare. Take potential adjustments of the plan into consideration.**



**What channels are most suitable for your target audiences? What exactly do you intend to organise (potential overlap between target audiences and channels)?**

	Target audience I	Target audience II	Target audience III
Social media			
Event			
Campaign			
Printed material			
Website			
Press			
Newsletter			
Other			





**Write up a microschedule. With what frequency will you use the channels above?  
For each communication step, put someone in charge, set a deadline and assign a status.  
Agree on steps to take and create workflows. Now complete the following schedule:**

Target audience					
Message (content)					
What?					
How? (channel, tactic)					
When? (phase, timing, frequency)					
Goal					
Who executes?					
Cost estimate					





# 6

## Evaluate (see also page 19)



**When will you evaluate your project and what indicators will you use?**

Evaluation in planning phase

Evaluation in live phase

Evaluation afterwards



**Which quantitative and qualitative indicators do you want to check in your evaluation?**



# The authors

The **SMIT** research group (Studies in Media, Information & Technology) is part of the **Vrije Universiteit Brussel** and **imec** and specialises in socio-economic research in the field of digital innovation and media. The SMIT's 'data, communities & governance' unit has developed expertise in the recruitment and engagement of citizens with science, the organisation of impact measurements and the evaluation of citizen science tools. SMIT partners the following citizen science projects: hackAIR, Flood-CitiSense, Oog voor Diabetes and the SBO project Flamenco.

**Carina Veeckman** (senior researcher, Bachelor & Master of Communication Science) and Sarah Talboom (researcher, Master of Communication Science), both researchers at SMIT, are members of the working group on communication and participation and the Scivil steering group.

**Eos Wetenschap** is a not-for-profit organisation in the area of science journalism. **Eos Wetenschap** publishes science articles for the general public on its news website and in newspapers. In 2015 **Eos Wetenschap**, in collaboration with the **Flemish Young Academy**, launched **Iedereen Wetenschapper**, a digital platform for citizen science. Coordinator for the platform, science journalist **Liesbeth Gijssels** is a member of the working group on communication

and participation and the Scivil steering group. She is co-author of the book 'Citizen Science – How Citizens Challenge Science' (Pelckmans Pro, 2019).

**Eos Wetenschap** partners the citizen science project Grote Schelpenteldag.

Under the name of **Tales and Talks** **Hilde Devoghel** works as an editor, moderator and communication specialist in the areas of science, technology and citizen science. She developed her focus on content as science communication coordinator for KU Leuven, founder of the KU Leuven Children's University and subeditor of the regional television station ROBTv.

In 2018 the Government of Flanders ran a call for citizen science projects through the Department of Economy, Science & Innovation (EWI). As a result of that call the EWI commissioned the RVO-Society to found a knowledge centre for citizen science. **Scivil** was set up in January 2019 as the Flemish Knowledge Centre for Citizen Science and, in its role as a networking organisation, aims to document and consolidate expertise on citizen science in Flanders. Scivil has several thematic working groups, among them the working group on 'Communication and Participation', which authors manuals and guidelines in support of citizen science projects. **Annelies Duerinckx** is the coordinator of Scivil.

# Bibliography

## Introduction

1. Soen, V., Huyse, T. (2016). Citizen Science in Flanders: Can we count on you? (Young Academy position papers, nr. 2) Retrieved from <https://lirias.kuleuven.be/retrieve/462835>
2. Lemma Burgerwetenschap at Wikipedia. <https://nl.wikipedia.org/wiki/Burgerwetenschap>.
3. Lemma citizen science in Cambridge English Dictionary. Retrieved 2018-02-23, from [dictionary.cambridge.org](http://dictionary.cambridge.org).
4. Definition of citizen science. Retrieved 2018-02-23 from [Dictionary.com](http://Dictionary.com).

## Part 1

5. Beza, E., Steinke, J., van Etten, J., Reidsma, P., Fadda, C., Mitra, S., Kooistra, L. (2017). "What are the prospects for citizen science in agriculture? Evidence from three continents on motivation and mobile telephone use of resource-poor farmers". Plos One, vol. 12, nr. 5, e0175700. <http://doi.org/10.1371/journal.pone.0175700>
6. Haywood, B.K., & Besley, J.C. (2014). "Education, Outreach, and Inclusive Engagement: Towards Integrated Indicators of Successful Program Outcomes in Participatory Science.". Public Understanding of Science, vol. 23, nr. 1, pp. 92–106.
7. Lakeman-Fraser, P., Gosling, L., Moffat, A.J., West, S.E., Fradera, R., Davies, L., Ayamba, M.A., van der Wal, R. (2016). "To Have Your Citizen Science Cake and Eat It? Delivering Research and Outreach through Open Air Laboratories (OPAL)". BMC Ecology, vol. 16, nr. 1.
8. Bonney, R., Ballard, H., Jordan, R., McCallie, E., Phillips, T., Shirk, J., & Wilderman, C. C. (2009). "Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education". CAISE Public Participation in Scientific Research Inquiry Group Participants. Washington. <https://eric.ed.gov/?id=ED519688>
9. Haklay, M. (2013). "Citizen Science and Volunteered Geographic Information: Overview and Typology of Participation". In Sui, D., Elwood, S., Goodchild M. (Eds.), Crowdsourcing Geographic Knowledge (pp. 105–122). Dordrecht: Springer Netherlands. <http://doi.org/10.1007/978-94-007-4587-2>
10. Hecker, S., Bonney, R., Haklay, M., Hölker, F., Hofer, H., Goebel, C., Gold, M., et al. (2018). "Innovation in Citizen Science - Perspectives on Science-Policy Advances.". Citizen Science: Theory and Practice, vol. 3, nr. 1, pp. 1–14.
11. VLOR (2007). Advies ten gronde over onderwijsonderzoek. Retrieved from <https://www.vlor.be/adviezen/advies-ten-gronde-over-onderwijsonderzoek>
12. Bosch, T., Fijen, T.P.M., de Laat, H.H.A., Nieuwpoort, D. van, Reinders, M., Scheen, M., Scheepens, S., Alebeek, F.A.N. van (2014). "Citizen science projecten effectief inzetten en uitvoeren voor ecologische studies in Nederland". Lelystad: ProPolis Ecologisch Adviesbureau, Wageningen & Praktijkonderzoek Plant en Omgeving.
13. Harlin, J., Kloetzer, L., Patton, D., Leonhard, C., Leysin American School students. (2018). "Turning students into citizen scientists". In Hecker, S., Haklay, M., Bowser, A., Makuch, Z., Vogel, J., Bonn, A. (Eds), Citizen Science: Innovation in Open Science, Society and Policy. UCL Press, London. <https://doi.org/10.14324/111.9781787352339>
14. Nistor et.al. (2019). "Bringing Research into the Classroom – The Citizen Science approach in schools.". Scientix Observatory report. 2019, European Schoolnet, Brussels.
15. Evans, C., Abrams, E., Reitsma, R., Roux, K., Salmonsens, L., Marra, P.P. (2005). "The neighborhood nestwatch program: participant outcomes of a citizen-science ecological research project". Conservation Biology, vol.19, pp. 589–594.
16. Da Schio, N., Boussauw, K., van Heur, B., Cassiers, T., Chemin, L. (2019). Smarter Labs report on



Living Lab experiment – Brussels. JPI Urban Europe.

17. The Cornell Lab of Ornithology (2019). "Citizen Science Toolkit". <http://www.birds.cornell.edu/citscitoolkit/toolkit>
18. Mariën, I. (2016). De dichotomie van de digitale kloof doorprikt: Een onderzoek naar de oorzaken van digitale uitsluiting en naar strategieën voor een duurzaam e-inclusiebeleid. Non published dissertation, obtained on 29 Februari 2016 at de Vrije Universiteit Brussel.
19. Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25(1), 54–67. <https://mmrg.pbworks.com/f/Ryan,+Deci+00.pdf>
20. Soleri, D., Long, J. W., Ramirez-Andreotta, M. D., Eitemiller, R., Pandya, R. E. (2016). Finding pathways to more equitable and meaningful public-scientist partnerships. *Citizen Science: Theory and Practice*, 1(1), 9. <https://theoryandpractice.citizenscienceassociation.org/articles/10.5334/cstp.46/>
21. Nov, O., Arazy, O., Anderson, D. (2011). "Dusting for science: motivation and participation of digital citizen science volunteers". *Proceedings of the 2011 iConference: Inspiration, Integrity and Intrepidity*, 68–74.
22. Aggett, S., Dunn, A., Vincent, R. (2012). "Engaging with Impact: How Do We Know If We Have Made a Difference?". *International Public Engagement Workshop Report*. Welcome Trust. [https://welcome.ac.uk/sites/default/files/wtp052364\\_0.pdf](https://welcome.ac.uk/sites/default/files/wtp052364_0.pdf)
23. Phillips, T., Ferguson, M., Minarchek, M., Porticella, N., Bonney, R. (2014). "User's Guide for Evaluating Learning Outcomes from Citizen Science." Ithaca, NY: Cornell Lab of Ornithology.
24. Sale, D., Safford, S., Davis, S. (2007). "Measuring the Success of Public Involvement." *Participation Quarterly*, pp.12-15.
25. Larson, S., Williams, L.J. (2009). "Monitoring the Success of Stakeholder Engagement: Literature Review." *Research Report 45. People, Communities and Economies of the Lake Eyre Basin*. Alice Springs: Desert Knowledge Cooperative Research Centre. [https://www.researchgate.net/publication/285738260\\_Monitoring\\_the\\_success\\_of\\_stakeholder\\_engagement\\_Literature\\_review](https://www.researchgate.net/publication/285738260_Monitoring_the_success_of_stakeholder_engagement_Literature_review)
26. Kieslinger, B., Schäfer, T., Heigl, F., Dörler, D., Richter, A., Bonn, A. (2017). "The Challenge of Evaluation: An Open Framework for Evaluating Citizen Science Activities." <https://osf.io/preprints/socarxiv/enzc9>
27. Allen, S., Campbell, P.B., Dierking, L.D., Flagg, B.N., Friedman, A.J., Garibay, C., Korn, R., Silverstein, G., Ucko, D.A. (2008). "Framework for Evaluating Impacts of Informal Science Education Projects." *Report from a National Science Foundation Workshop*. Alan J. Friedman (ed). The National Science Foundation.
28. Phillips, T., Bonney, R., Shirk, J.L. (2012). "What Is Our Impact? Toward a Unified Framework for Evaluating Outcomes of Citizen Science Participation." In Dickinson, J.L. & Bonney, R. (Eds). *Citizen Science: Public Participation in Environmental Research*, pp. 82–96. Cornell University Press.

## Part 2

29. Brouwer, S., & Hessels, L. K. (2019). Increasing research impact with citizen science: The influence of recruitment strategies on sample diversity. *Public Understanding of Science*, 28(5), 606–621. <https://doi.org/10.1177/0963662519840934>
30. H., Dyke, A., Pateman, R., West, S., Everett, G. (2016). Understanding motivations for citizen science. Final Report on Behalf of UKEOF, University of Reading, Stockholm Environment Institute (University of York) and University of the West of England.
31. Rotman, D., Hammock, J., Preece, J., Hansen, D., Boston, C., Bowser, A., He, Y. (2014). Motivations Affecting Initial and Long-Term Participation in Citizen Science Projects in Three Countries. <https://doi.org/10.9776/14054>
32. Vanhaelewyn, B., & De Marez, L. (2018). imec.digimeter 2018 - Digital mediatrends in Flanders. Gent: imec. Retrieved from <https://www.imec-int.com/en/digimeter2018>
33. Robin, B. (2006). The Educational Uses of Digital Storytelling. 709–716. Retrieved from <https://www.learntechlib.org/primary/p/22129/>

34. Scientific Storytelling in and around the classroom! Retrieved from <https://ecsa.citizen-science.net/blog/scientific-storytelling-and-around-classroom>
35. Deterding, S., Dixon, D., Khaled, R., Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification." Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments, 9–15. <https://doi.org/10.1145/2181037.2181040>
36. Blohm, I., Leimeister, J. M. (2013). Gamificationn "Design of IT-Based Enhancing Services for Motivational Support and Behavioral Change. Business & Information Systems Engineering, 5, 275–278. <https://doi.org/10.1007/s12599-013-0273-5>
37. Bowser, A., Hansen, D., Preece, J., He, Y., Boston, C., Hammock, J. (2014). Gamifying citizen science: A study of two user groups. Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW Companion '14, 137–140. <https://doi.org/10.1145/2556420.2556502>
38. Massung, E., Coyle, D., Cater, K. F., Jay, M., Preist, C. (2013). Using Crowdsourcing to Support Pro-environmental Community Activism. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 371–380. <https://doi.org/10.1145/2470654.2470708>