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D3.3 – CROPS guidelines for stakeholder engagement

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Executive Summary

This deliverable provides CROPS' Guidelines for Stakeholder Engagement to support citizen science projects not only to design and implement stakeholder engagement strategies, but also to plan strategies ambitioning to upscale into broader limits. The deliverable is a result of Task 3.3 (WP3) and translates the evidence collected from multiple sources (a structured literature review (70+ sources) and CROPS empirical inputs (project mapping, two surveys and expert interviews)) into practical, context-adaptable guidance for citizen science practitioners and project coordinators. The guidelines are organised as a 5+1 step process—identify stakeholders; map and prioritise them; design engagement strategies by stakeholder group; adapt engagement for upscaling; communicate and build trust; and monitor, evaluate, and adapt—recognising that these steps are sequential in logic but iterative in practice.

The guidance is structured around the quadruple helix (citizens/civil society, academia, public authorities/policymakers, and industry/SMEs) and provides tailored approaches for each group, with cross-cutting attention to inclusivity, ethics and Responsible Research and Innovation. It highlights persistent gaps observed in practice (especially inconsistent policy engagement and rare, often funding-limited industry involvement) and proposes realistic ways to build coalitions, cultivate champions, protect open data and integrity, and sustain participation beyond initial recruitment.

A dedicated upscaling section addresses scaling out, up, deep and down; the growing importance of intermediaries and coordination infrastructure; and the standardisation–adaptation tension ("standardise what must be comparable, localise what must resonate").

The deliverable concludes with targeted recommendations for practitioners, funders, policymakers and researchers, and annexes with ready-to-use checklists and templates to operationalise stakeholder planning, communication and evaluation.

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1 Introduction

1.1 Context and purpose

Citizen science has moved from the margins of research practice to a recognised pillar of European science policy. The European Research Area (ERA) Policy Agenda, under Action 14, calls for bringing science closer to citizens, and the Horizon Europe programme increasingly positions citizen science as a mechanism for addressing societal challenges through the five EU Missions. **Yet as citizen science initiatives grow in ambition, they face a persistent challenge: how to engage the full range of stakeholders whose participation, support, and resources are needed to move projects from local pilots to transnational impact.**

Stakeholder engagement is not a luxury or an afterthought. It is a practical requirement for any citizen science project that seeks to produce credible data, influence policy, attract sustained funding, and reach participants beyond the usual demographic profiles. The literature on citizen science is rich with evidence that projects which neglect systematic engagement, particularly of actors beyond the immediate researcher-citizen dyad, tend to struggle with retention, data quality, institutional uptake, and long-term survival (Hecker et al., 2018; Fraisl et al., 2022; Maccani et al., 2020).

CROPS[1] project aims to support the upscaling of citizen science initiatives across Europe. One of its central commitments is to develop practical guidelines for stakeholder engagement, recognising that upscaling requires not only more participants but also broader coalitions of "quadruple helix" stakeholders: citizens and civil society, academia, public authorities and policymakers, and industry and SMEs.

This deliverable, D3.3, responds to that commitment. It is the output of *Task 3.3 - Guidelines for stakeholder engagement, including SMEs and industry*. **It was designed with the purpose of providing citizen science practitioners and project coordinators with a practical, step-by-step guide to identifying, prioritising, engaging, and maintaining relationships with stakeholders.** Evidence from the literature and from empirical data collected is woven directly into the practical guidance. The guide can be used across different citizen science contexts, from small community-based monitoring projects to large transnational campaigns.

1.2 Scope and approach

The scope of this deliverable covers stakeholder engagement across the full lifecycle of citizen science projects, with particular attention to the challenges that arise when projects attempt to scale geographically, organisationally, or in the depth of participant involvement.

The guidelines draw on two major complementary sources of evidence:

[1] Curating, Replicating, Orchestrating, and Propagating Citizen Science across Europe, GA 101131696, https://crops-cs.eu/.

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- **Literature review.** A structured review of over 70 publications was conducted, covering seven thematic areas: **(A)** stakeholder engagement foundations, **(B)** stakeholder engagement in citizen science, **(C)** engaging industry, SMEs, and non-traditional actors, **(D)** inclusivity, diversity, and equity, **(E)** ethics, responsible research and innovation (RRI), and accountability, **(F)** communication and trust-building, and **(G)** upscaling citizen science and stakeholder engagement. Source identification drew on multiple channels: targeted searches of academic databases (Scopus, Web of Science, Google Scholar), Cordis searches of outputs from prior and ongoing EU-funded citizen science projects (including EU-Citizen.Science, MICS), examination of institutional publications from the OECD, ECSA, and the European Commission, and expert recommendations from CROPS consortium partners. Search terms combined stakeholder engagement terminology ("stakeholder engagement," "stakeholder analysis," "stakeholder mapping") with citizen science terminology ("citizen science," "public participation in scientific research," "community-based monitoring") and the specific thematic areas outlined above. The search prioritised sources published from 2010 onwards, while incorporating foundational texts from earlier periods where these remain central to the field (e.g., Freeman, 1984; Mendelow, 1981). Sources ranged from journal articles, book chapters, edited volumes, to EU project deliverables, handbooks, conference papers, and institutional reports. Each source was analysed using a standardised extraction template covering bibliographic information, thematic classification, content summary, stakeholder engagement insights and upscaling relevance. Sources were classified against the seven thematic sections (A-G) to enable systematic cross-referencing.

- **CROPS empirical data.** Original data were collected through multiple instruments:

    - The *CROPS CS Projects Mapping - Extended* (Task 4.3, Task 3.3). Parters of CROPS' WP2 conducted systematic mapping of citizen science projects across the five Horizon Europe Missions between January and November 2024. Among other aspects, projects were assessed for funding type, organisational leadership, project status (ongoing/completed/discontinued), and scalability potential. As part of Task 4.3 and Task 3.3, this mapping was extended assessing 303 of its projects on accessibility, inclusiveness, and accountability features.

    - The *CROPS Scalability Survey* (implemented within Task 3.2) seeking to collect inputs from the projects mapped in *CROPS CS Projects Mapping* conducted in WP2. The survey got the response of 30 citizen science practitioners across EU Missions, from February to May 2025), and covered multiple dimensions, including questions focused on stakeholder engagement;

    - A *Stakeholder Engagement Survey* (implemented within Task 3.3, from December 2025 to January 2026): a short survey targeting Citizen Science projects (randomly selected from *WP2's CROPS CS Projects Mapping*) was implemented aiming to complement other data sources and collect further insights into how projects collaborate with stakeholders, their challenges or best practices identified. The survey got the response from 10 citizen science initiatives across environmental monitoring, health, agroecology, urban resilience, and open governance. The survey is referred in this deliverable as *CROPS Stakeholder Engagement Survey, 2026*;

- Two *expert consultation interviews*: one with representatives of CROPS partners OutBe and IFC/Ideas for Change (9 February 2026), and one with representatives of the Plastic Pirates (16 February 2026). These interviewees are referred in this deliverable as *Interviewees, 2026*. Annex H provides the interview script.

1.3 Structure of this Deliverable

The deliverable is organised as follows:

- **Chapter 1 (Introduction)** sets the context, explains the methodology, and defines key terms.
- **Chapter 2 (Step-by-Step Guide)** is the core of the document. It presents 5+1 sequential but iterative steps for stakeholder engagement:

  1. STEP 1: Identify your stakeholders;
  2. STEP 2: Map and prioritise them;
  3. STEP 3: Design engagement strategies by stakeholder group;
     - STEP 3+: Adapting Engagement for Upscaling: extra and dedicated section on adapting engagement for upscaling addressing the specific challenges of scaling citizen science across geographies and institutional contexts;
  4. STEP 4: Communicate and build trust;
  5. STEP 5: Monitor, evaluate, and adapt you stakeholder engagement strategies.

The steps are sequential in logic but iterative in practice: as your project evolves, you will return to earlier steps, revise your stakeholder maps, and adjust your strategies.

Each step is detailed following a consistent structure:

- **About this step** – a brief explanation of what the step involves and why it matters, grounded in the literature.
- **How to do it** – practical instructions, tools, checklists, and decision aids.
- **Common pitfalls** – warnings and failure modes drawn from evidence and experience.

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- **Step Recap** – a summary box.
- **Read more** – suggested sources for further detail.

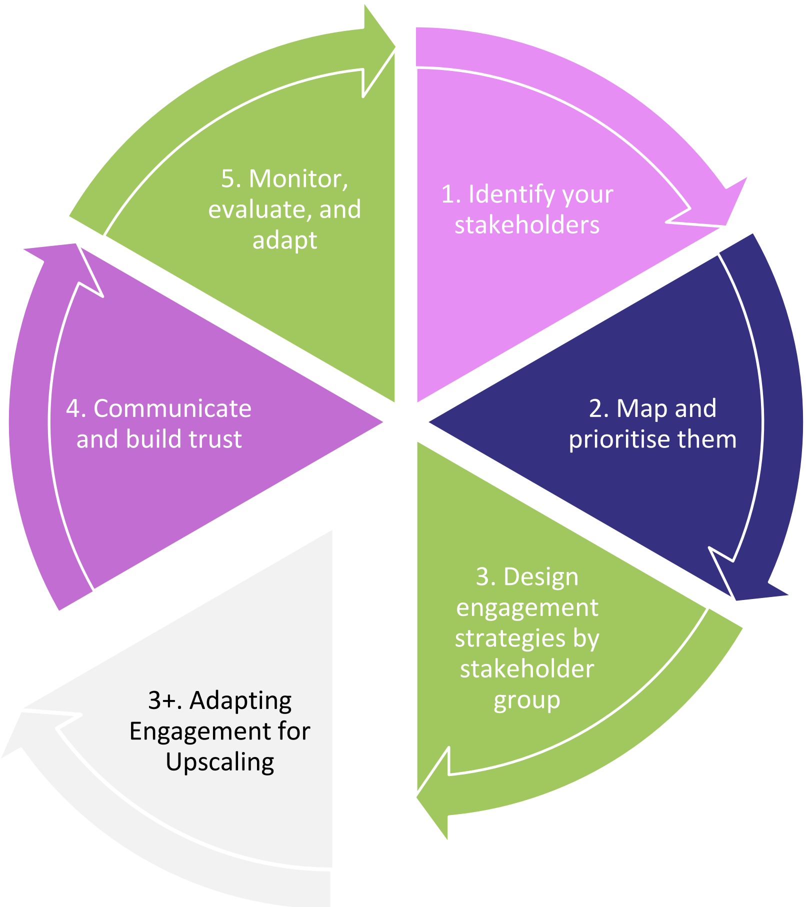

Figure 1.1. The 5+1 Steps for successful stakeholder engagement strategies

Note: The steps are sequential in logic but iterative in practice: as your project evolves, you will return to earlier steps, revise your stakeholder maps, and adjust your strategies.

- **Chapter 3 (Recommendations)** distils the guidelines into targeted recommendations for for key audiences audiences: citizen science practitioners, funders and Funding Agencies, policymakers, researchers.
- **Chapter 4 (Conclusions)** provides a brief closing reflection.
- **Chapter 5 (References)** lists all sources analysed in the literature review, organising the references between sources directly cited in this deliverable and the other sources analysed as well.
- **Chapter 6 (Annexes)** includes practical templates and checklists that can be extracted and used independently: a stakeholder identification checklist, mapping templates (including Value Proposition Canvas, RACI matrix), an engagement planning worksheet, a communication planning checklist, monitoring and evaluation indicators, and a glossary.

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The annexes also include the scripts used in *CROPS Stakeholder Engagement Survey (2026) and in the targeted expert consultation interviews (2026).*

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2 Step-by-Step Guide to Stakeholder Engagement in Citizen Science

2.1 STEP 1 – Identify Your Stakeholders

2.1.1 About This Step

Before you can engage stakeholders, you need to know who they are. This sounds obvious, but in practice many citizen science projects begin with a narrow view of their stakeholder landscape, focusing almost exclusively on the researcher-participant relationship and neglecting the broader constellation of actors who shape whether a project succeeds or fails.

Stakeholder identification is the process of systematically asking: *Who can affect or is affected by our project?* The question, originally formulated by Freeman (1984), is deliberately broad. It invites project teams to look beyond the usual suspects and consider actors who may not be immediately visible, but whose support, opposition, or indifference will shape project outcomes.

In citizen science, the stakeholder landscape is typically wider than project teams initially assume. Our *CROPS Stakeholder Engagement Survey* (2026) confirms that while all responding projects engaged citizens and researchers, engagement with policymakers was inconsistent, and engagement with industry and SMEs was rare and often limited to funding relationships. This pattern is found in the literature: Skarlatidou et al. (2019) observed that most citizen science projects engage a narrow set of stakeholders, and the OECD (2025) notes that citizen science remains under-connected to policymaking and private-sector innovation.

In CROPS, we structure stakeholder identification around the quadruple helix model, as a useful starting framework.

2.1.2 How to Do It

(A) Start with the quadruple helix, then go deeper

Use the four quadruple helix categories as your starting point, but treat them as a scaffold, not a ceiling. Within each category, identify specific sub-groups relevant to your project's context.

Table 2.1. Stakeholder sub-groups within the quadruple helix (illustrative, not exhaustive)

Quadruple helix category	Potential sub-groups in citizen science
Citizens and civil society	Individual volunteers; community groups; environmental NGOs; patient associations; youth organisations; schools and teachers; hobby and

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Quadruple helix category	Potential sub-groups in citizen science
	amateur expert communities; neighbourhood associations; cultural and religious organisations
Academia and research organisations	University researchers; research institutes; early career researchers; citizen science practitioners in academia; data scientists; ethics review boards; scientific societies and associations (e.g. ECSA); libraries and museums
Public authorities and policymakers	Local government (municipalities); regional government; national government ministries (environment, education, health); EU institutions (JRC, DG RTD); regulatory agencies; national statistical offices; public health authorities; educational authorities
Industry and SMEs	Technology companies (app/platform developers, sensor manufacturers); environmental consultancies; media and journalism outlets; corporate social responsibility divisions; social enterprises; data analytics firms; science communication agencies

This table is illustrative. Your project's stakeholder landscape will be shaped by your domain (biodiversity, health, water quality, air pollution), your geography, your institutional setting, and your stage of development.

(B) Use multiple identification methods

No single method will reveal all relevant stakeholders. Combine at least two of the following:

- **Brainstorming with the project team.** Convene your core team and systematically work through each quadruple helix category. Ask: who provides resources? Who uses our data? Who could block or enable our activities? Who is affected by the problem we study? Who has we not yet considered? Record all suggestions without filtering at this stage.
- **Reviewing existing stakeholder lists.** If your project builds on a previous initiative, consult prior stakeholder registers. The *CROPS expert interviews* highlighted that shared, updated stakeholder contact lists across project partners are valuable but often neglected:

> *"a shared contact list, updated by anyone, where anyone explained like this group of people I need for this workshop, I already contacted them and they will participate" was identified as a practical tool that would prevent duplication and improve coordination (CROPS Expert Interview 1).*

- **Consulting existing frameworks.** The EU-Citizen.Science project developed a stakeholder mapping that identifies seven groups: academia, educators, the public, NGOs and civil society organisations, industry and SMEs, press and media, and policymakers and funders

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(Latham and Ceccaroni, 2020). Ceccaroni and Piera (2018) propose a six-step stakeholder engagement process starting with stakeholder mapping. These frameworks can serve as checklists to ensure you have not overlooked a group.

- **Snowball identification.** Ask stakeholders you have already identified to suggest others you should engage. This is particularly useful for identifying less visible actors. Veeckman et al. (2019) recommend the snowball method specifically for reaching minority groups and communities not typically connected to citizen science networks.
- **Looking at who is affected by your research topic.** This is perhaps the most important and most frequently neglected approach. If your project monitors air quality, have you considered the residents of polluted neighbourhoods, local health services, urban planners, and transport authorities? If your project tracks plastic pollution in rivers, have you considered waste management companies, fishing communities, and tourism operators? Citizen science projects often identify stakeholders based on who can *contribute* to the project, but overlooking those who are *affected* by the issue being studied can result in missed opportunities for impact and, in some cases, ethical blind spots.

From the field: In the CROPS Stakeholder Engagement Survey (2026), one respondent from a community-based environmental project noted: *"Engaging with the local public is detrimental [i.e. essential] in order to create local networks and interest. People are curious and want to learn and having these friendly, local, open spaces where we can learn science without any expectations sets an ideal environment."*

(C) Do not forget intermediaries

A distinctive feature of citizen science stakeholder landscapes is the importance of *intermediary* actors: individuals or organisations who do not participate directly in data collection, but who connect the project to participants, resources, or decision-makers.

Teachers are perhaps the most important intermediary in citizen science projects that work with schools. The *Plastic Pirates* initiative, which scaled from Germany, Portugal, and Slovenia into 14 countries[2], found that teachers are the critical link between the research team and participating students. In Germany, the educational ministry played a further intermediary role by providing access to school networks and conferring institutional legitimacy through accredited teacher training credits (Interviewees, 2026).

[2] https://www.plastic-pirates.eu/en/why-participation-is-important

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Other important intermediaries include: community leaders who can vouch for a project within their networks; local government officials who can provide access to public spaces and communications channels; existing citizen science platforms and networks (such as EU-Citizen.Science, ECSA, SciStarter) that can amplify recruitment; and media contacts who can generate public awareness.

(D) Document what you find

As you identify stakeholders, record them in a structured format. At this stage, you need only basic information. A simple table, as presented in the example next, will suffice:

Table 2.2. Stakeholder identification register (template example)

Stakeholder group or organisation	Quadruple helix category	Sub-category	How they relate to our project	Contact person (if known)
e.g. Municipal Environment Department	*Public authorities*	*Local government*	*Responsible for local air quality monitoring; potential data user*	*To be identified*

This register will be expanded in Step 2 with information about interest, influence, and priorities. A fuller template is provided in **Annex A**.

> Tip: Stakeholder identification is not a one-time exercise. Return to this step whenever your project enters a new phase, expands to a new geography, or encounters unexpected barriers or opportunities. Stakeholder landscapes are dynamic; Reed et al. (2009) emphasise that stakeholder analysis must be iterative because power dynamics and interests shift over time.

2.1.3 Common Pitfalls

- **Stopping at the obvious.** Most project teams identify citizens and fellow researchers quickly but underestimate the importance of policymakers, media, and industry actors. The *CROPS Scalability Survey* (2025) found that while citizens and researchers were rated as the most critical stakeholders for upscaling, respondents also recognised the importance of local governments and NGOs, yet few had systematic engagement plans for these groups.
- **Confusing stakeholder categories with individual stakeholders.** "Policymakers" is not a stakeholder; a specific municipal environment officer, or the JRC's citizen science unit, is a stakeholder. Freeman (2001) argues that effective stakeholder management requires a

"names and faces" approach rather than dealing in generic role labels. At some point, abstract categories need to be translated into specific people and organisations.

- **Ignoring opponents and sceptics.** Stakeholders who are indifferent or hostile to your project are still stakeholders. Scientists who doubt the quality of citizen-collected data, community members who resent being studied, or industry actors who see citizen science data as a reputational risk all need to be identified, even if you do not plan to engage them immediately. Freeman (1984) explicitly argues for including even adversarial groups in stakeholder analysis if they can substantially affect project outcomes.
- **Over-reliance on digital identification.** Searching online databases and platforms is useful but insufficient. Many relevant stakeholders, particularly in underserved communities, are not visible online. Face-to-face conversations, local events, and partnerships with community organisations are essential complements (Varga et al., 2023; Paleco et al., 2021).

STEP 1 RECAP: Identify Your Stakeholders

- Use the quadruple helix (citizens, academia, public authorities, industry) as a starting scaffold, not a complete map.
- Within each category, identify specific sub-groups relevant to your project's domain, geography, and stage.
- Use multiple methods: team brainstorming, existing frameworks, snowball identification, and analysis of who is affected by your research topic.
- Pay special attention to intermediaries (teachers, community leaders, platform operators, media) who connect you to other stakeholders.
- Document all identified stakeholders in a structured register.
- Revisit this step regularly. Stakeholder landscapes change as projects evolve.

Read More…

- Freeman, R.E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman. – The foundational text on stakeholder identification and classification.
- Reed, M.S. et al. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933–1949. – A practical typology of identification and analysis methods.
- Latham, M. and Ceccaroni, L. (2020). D4.1: Guidelines and Recommendations Based on Best Practices for Achieving Societal and Policy-Maker Engagement. EU-Citizen.Science. – A stakeholder mapping directly applicable to citizen science.

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- Skarlatidou, A. et al. (2019). The Value of Stakeholder Mapping to Enhance Co-Creation in Citizen Science Initiatives. *Citizen Science: Theory and Practice*, 4(1). – Mapping approaches specific to the citizen science context.

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2.2 STEP 2 – Map and Prioritise

2.2.1 About This Step

Having identified your stakeholders, the next question is: *How do we decide where to invest our limited time and resources?* Not all stakeholders require the same level of attention. Some are critical to your project's success and need deep, ongoing engagement. Others need to be kept informed but do not require active collaboration. Still others may need to be monitored but not actively engaged at present.

Stakeholder mapping and prioritisation are established practices in project management and strategic planning. The basic idea dates to Mendelow (1981), who proposed classifying stakeholders along two dimensions: *their power* (ability to influence your project) and *the dynamism of their environment*. This was later adapted into the widely used power-interest matrix (also called the influence-interest matrix), which classifies stakeholders into four quadrants based on their level of interest in your project and their power to affect it.

In citizen science, these tools need to be used with care. Power-interest matrices were originally designed for corporate contexts, where the primary concern is managing stakeholders to achieve organisational objectives. Citizen science operates within a different value system, one that emphasises participation, mutual benefit, and democratic engagement (Hecker et al., 2018; ECSA Ten Principles). Prioritisation should therefore not be understood as deciding whose interests matter less, but as making realistic decisions about how to allocate engagement effort given resource constraints.

One of the Expert Interviewees (2026) underscored this tension. When discussing how to prioritise workshop participants, one interviewee noted the trade-off between reaching more stakeholders and achieving genuine engagement: *"quality over quantity, I think, like better to have like a small group, but that will participate for real."* This suggests that prioritisation in citizen science should attend not only to who is important but to the quality of engagement that is feasible.

2.2.2 How to Do It

(A) Assess interest and influence

For each stakeholder identified in Step 1, make a judgement about two dimensions:

- **Interest:** How much does this stakeholder care about your project or the issue it addresses? Interest can be driven by professional responsibility (a regulator whose mandate covers your research domain), personal motivation (a birdwatcher who wants to contribute to conservation), organisational mission (an NGO working on the same issue), or economic interest (a company that sells monitoring equipment).

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- **Influence (or power):** How much ability does this stakeholder have to affect your project's success, either positively or negatively? Influence can derive from formal authority (a funding body, a regulatory agency), control over resources (financial, human, or infrastructure), expertise and knowledge (scientific credibility, local knowledge), network position (access to other stakeholders), or public visibility (media, social media reach).

Rate each stakeholder on both dimensions using a simple scale (e.g. low, medium, high). Do not aim for precision; you are making informed judgements, not exact measurements. The value of the exercise lies in the structured discussion it provokes within your team, not in the specific scores assigned.

(B) Plot stakeholders on a power-interest matrix

Place each stakeholder in one of four quadrants:

Table 2.3. Power-interest matrix for citizen science stakeholder prioritisation (adapted from Mendelow, 1981)

	High interest	Low interest
High influence	**Key players** – Engage closely and actively. These stakeholders both care about your project and have the power to shape its success. Invest in building deep, collaborative relationships. *Examples: funding agencies, partner research institutions, key policy champions, lead teacher networks.*	**Context setters** – Keep satisfied and informed. These stakeholders have power but may not currently be engaged with your project. They can become allies or blockers, so maintain the relationship. *Examples: senior university management, ministry officials not directly involved, large NGOs with overlapping interests.*
Low influence	**Active supporters** – Keep informed and involved. These stakeholders are enthusiastic about your project but have limited power to influence its trajectory. They are often your most loyal advocates. Nurture their engagement. *Examples: individual volunteers, school students, local community members, early career researchers.*	**Wider community** – Monitor with minimal effort. These stakeholders are neither strongly interested nor influential at present, but their status may change. Provide general information through public channels. *Examples: general public, tangential industry sectors, unrelated government departments.*

This matrix is adapted from Mendelow (1981) and has been widely applied in stakeholder management (Reed et al., 2009; Durham et al., 2014). In citizen science, the labels "key players" and "keep satisfied" can feel uncomfortable when applied to citizens or communities. The point is not to rank stakeholders by importance in a moral sense, but to make pragmatic decisions about where to concentrate engagement effort.

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Warning: Power-interest matrices are useful but imperfect. Reed et al. (2009) caution that top-down analytical categorisation methods risk marginalising powerless groups. In citizen science, the individuals with the least institutional power, community members, patients, young people, residents of polluted areas, are often the ones most directly affected by the research question. Treat the matrix as a planning tool, not as a moral hierarchy. Be prepared to override it when equity and inclusion demand it.

(C) Consider additional dimensions

The two-dimensional matrix is a good starting point, but some situations call for a more nuanced assessment. You may want to consider:

- **Urgency:** Mitchell, Agle and Wood (1997) add urgency as a third dimension of stakeholder salience, alongside power and legitimacy. A stakeholder who is normally low-priority may become critical when a time-sensitive opportunity arises, such as a policy consultation window, a media event, or a funding call.
- **Cooperative potential vs. competitive threat:** Freeman (1984) proposes classifying stakeholders by their *cooperative potential* (what they can contribute to your project) and *competitive threat* (the degree to which their actions could hinder your project). This yields four generic strategies: *offensive* (for stakeholders with high cooperative potential and low threat), *defensive* (low cooperative potential, high threat), *swing* (high on both), and *hold* (low on both).
- **Dynamism:** Stakeholder positions change. A local government that showed little interest during your pilot phase may become highly engaged if your data reveals a politically salient environmental problem. One of interviewees (2026) illustrated how stakeholder dynamics shifted across project phases: *"We are actually discussing now a lot to actually cause change, I guess we have to work more to get the kids more involved than just the data collection."* The prioritisation of deeper participant engagement over sheer numbers represents a shift in how the project values different dimensions of engagement.

(D) Use the matrix to plan engagement intensity

The matrix should directly inform the level and type of engagement you plan for each stakeholder group. The *IAP2 Spectrum of Public Participation* provides a useful vocabulary for distinguishing engagement levels (Drigkopoulou et al., 2020; Ibrahim et al., 2025). Table 2.4. considers this proposition, matching it with the proposition in Table 2.3.

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Table 2.4. Matching stakeholder priority to engagement level

Matrix quadrant	Engagement level*	What this looks like in practice
Key players (high influence, high interest)	Collaborate OR Empower	Joint decision-making, co-design of protocols, shared governance, advisory boards, regular bilateral meetings
Context setters (high influence, low interest)	Consult OR Involve	Periodic briefings, invitation to steering group meetings, targeted reports demonstrating relevance to their agenda
Active supporters (low influence, high interest)	Involve OR Inform	Regular updates, feedback mechanisms, recognition of contributions, opportunities to participate in analysis and communication
Wider community (low influence, low interest)	Inform OR Monitor	Public reports, social media presence, website updates, press releases

*Levels of participation proposed by *IAP2 Spectrum of Public Participation.*

This is not a rigid prescription. The appropriate engagement level depends on your project's values, resources, and stage of development. Co-created citizen science projects, by definition, aspire to higher levels of engagement across the board (Shirk et al., 2012). Contributory projects may legitimately operate with lower engagement intensity for most stakeholders, but should still ensure that participants receive meaningful feedback and recognition.

(E) Create a stakeholder map (visual)

A visual stakeholder map can be more effective than a table for communicating priorities within your team and with external partners. There are several formats:

- **Concentric circles (target diagram):** Place the project at the centre. Arrange stakeholders in rings, with the most critical stakeholders closest to the centre. This was used in the RELU case studies in the UK, where semi-structured interviews and target diagrams were combined to map more than 60 organisations in a natural resource management context (Reed et al., 2009).
- **Colour-coded quadrant chart:** Use the power-interest matrix as a visual, with stakeholders represented as labelled points or circles (sized by importance). Colour-code by quadruple helix category.
- **Network map:** If relationships between stakeholders matter (e.g. which stakeholders influence each other), consider Social Network Analysis (SNA). Reed et al. (2009) demonstrate that SNA can identify influential individuals, marginalised groups, trust

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relationships, and structural equivalence within stakeholder networks. This is more analytically demanding but particularly valuable for complex, multi-actor projects.

From the field: Interviewees highlighted the practical value of shared stakeholder mapping across project partners. One interviewee noted that overlapping outreach to the same individuals, without coordination, caused fatigue and confusion: *"I feel like it's not very clear. And then I heard like, ah, this person has been contacted from this people for this thing. And I feel like maybe I shouldn't have contacted this one again for this workshop." (Interviewees, 2026)* A shared, visible stakeholder map, regularly updated, can help distributed project teams coordinate their engagement efforts.

(F) Using the Value Proposition Canvas for stakeholder analysis

A further tool that can complement the power-interest matrix is the *Value Proposition Canvas*, adapted from business model design (Osterwalder et al., 2014) and applied to citizen science by Koedel et al. (2024). The canvas consists of two sides. On the left, the project team describes what it offers: its services, the benefits it creates for stakeholders (gain creators), and the problems it helps to resolve (pain relievers). On the right, the stakeholder profile captures what each stakeholder group needs: their goals and tasks (jobs to be done), what they hope to gain, and what frustrates or hinders them (pains). When the two sides are aligned, there is a good fit between what the project offers and what the stakeholder values.

This tool is particularly useful for engaging industry and SMEs, where a clear mutual value proposition is often a precondition for sustained involvement (Koedel et al., 2024). It can also help project teams articulate why a **policymaker or a school network** should invest time in a citizen science initiative. The canvas can be completed as a worksheet during a team planning session or used as a structured conversation guide during early stakeholder consultations.

Tip: A blank Value Proposition Canvas template is provided in **Annex B**. Consider completing one canvas per stakeholder group during the planning phase, and revisiting it at least once during the project to check whether the value proposition still holds.

(G) Clarifying roles with the RACI model

Once stakeholders have been mapped and their expected level of involvement identified, it is helpful to formalise who does what using the RACI model. RACI stands for:

- *Responsible* (the person or group executing the task),
- *Accountable* (the person ultimately answerable for the outcome),

- *Consulted* (those whose input is sought before a decision), and
- *Informed* (those who need to be kept up to date after a decision is made).

The model is widely used in project management and can be applied to citizen science by assigning RACI designations to each stakeholder group for key project activities, such as data collection protocol design, recruitment, data validation, communication, and policy translation.

For instance, in a transnational citizen science project, researchers might be Responsible for data validation, the coordinating organisation Accountable, local community partners Consulted on whether the validation criteria make sense in their context, and policymakers Informed of the validated results. This kind of clarity reduces ambiguity, prevents duplication of effort, and is especially valuable in multi-partner consortia operating across borders (Skarzauskiene et al., 2023).

The RACI matrix need not be rigid. It should be reviewed periodically, particularly when new stakeholders join, when the project moves to a new phase, or when roles shift as a result of scaling. A simple RACI table template is included in **Annex B**.

2.2.3 Common Pitfalls

- **Treating mapping as a one-off exercise.** Stakeholder interest and influence change over time. A mapping completed at project launch may be outdated within a year. Schedule regular reviews, at minimum at the start of each new project phase, and update the matrix when significant external changes occur (new policy developments, funding decisions, staff turnover at partner organisations).

- **Over-reliance on assumptions.** Mapping is most reliable when informed by direct consultation with stakeholders, not just internal team assumptions. Even brief conversations can reveal that a stakeholder is more (or less) interested than you assumed. The participatory approach to stakeholder analysis recommended by Reed et al. (2009), where stakeholders themselves contribute to the mapping, produces more accurate and more legitimate results.

- **Neglecting low-power stakeholders who are highly affected.** As noted above, the matrix can inadvertently sideline the very communities that citizen science aims to serve. If your project studies air pollution, the residents of affected neighbourhoods may have low institutional power but high moral legitimacy and high need for engagement. Build in an explicit equity check: after completing your matrix, ask whether any groups that are significantly affected by your research topic have been placed in low-engagement quadrants, and consider whether this is justified.

- **Making the map too complex.** A map with 80 individual stakeholders plotted at different positions is hard to use. Aggregate where appropriate, e.g. “secondary school teachers in

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partner regions" rather than listing every teacher. You can always disaggregate later when planning specific activities.

STEP 2 RECAP: Identify Your Stakeholders

- Assess each stakeholder's interest in your project and their influence over its success.
- Use a power-interest matrix to classify stakeholders into four quadrants: key players, context setters, active supporters, and wider community.
- Match engagement intensity (inform, consult, involve, collaborate, empower) to stakeholder priority.
- Consider additional dimensions where useful: urgency, cooperative potential, dynamism.
- Create a visual stakeholder map to communicate priorities across your team.
- Consider Value Proposition CANVAS and RACI to further operationalize your ideas.
- Treat mapping as iterative: review and update regularly as your project and its context evolve.
- Apply an equity check: ensure that stakeholders most affected by your research topic are not inadvertently deprioritised.

Read More…

- Mendelow, A. (1981). Environmental Scanning: The Impact of the Stakeholder Concept. *ICIS 1981 Proceedings*, 20. – The original power-dynamism matrix.
- Reed, M.S. et al. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933–1949. – Comprehensive guide to mapping methods including SNA.
- Mitchell, R.K., Agle, B.R. and Wood, D.J. (1997). Toward a Theory of Stakeholder Identification and Salience. *Academy of Management Review*, 22(4), 853–886. – The power-legitimacy-urgency model.
- Freeman, R.E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman. – The cooperative potential vs. competitive threat framework.
- Drigkopoulou, I. et al. (2020). *Deliverable 5.1: Framework and Practical Guideline for Stakeholder Engagement.* UNITED Project (H2020 GA No. 862915). – Practical application of the IAP2 spectrum in a Horizon project.
- Durham, E. et al. (2014). *The BiodivERsA Stakeholder Engagement Handbook*. BiodivERsA. – A step-by-step handbook for biodiversity research stakeholder engagement.

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2.3 STEP 3 – Design Engagement Strategies by Stakeholder Group

2.3.1 About This Step

Steps 1 and 2 told you *who* your stakeholders are and *how much* attention each group warrants. Step 3 addresses the substantive question: *What do you actually do with each group?*

Effective engagement requires strategies tailored to the interests, motivations, constraints, and cultures of different stakeholder groups. A communication approach that works well for recruiting citizen volunteers is unlikely to resonate with a municipal official or a private-sector partner. The quadruple helix model provides a useful structure for organising these tailored strategies: citizens and civil society, academia and research organisations, public authorities and policymakers, and industry and SMEs each present distinct challenges and opportunities.

This step is the longest in the guide because it contains four dedicated sub-sections, one for each quadruple helix group. Each sub-section can be read independently. A project coordinator who needs guidance specifically on engaging policymakers can turn directly to section 2.3.3 without needing the full context of the preceding material. Two cross-cutting themes are integrated at the end, as separated sub-sections, given their transversal relevance for all four groups: **inclusivity and diversity** and **ethics and responsible research and innovation**.

2.3.2 How to Do It

For each stakeholder group, the sub-sections below address:

- why this group matters,
- what motivates them,
- what typical engagement activities look like,
- what the evidence says about common barriers, and
- what practical steps you can take.

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(A) Engaging Citizens and Civil Society

ENGAGING CITIZENS AND CIVIL SOCIETY	
Why this group matters	Citizens are the defining actors in citizen science. Without their participation, there is no citizen science. But "citizens" is not a monolithic group. It includes individual volunteers motivated by curiosity or environmental concern, members of NGOs and community organisations with specific advocacy goals, schools and teachers acting as intermediaries, youth groups, patient associations, amateur expert communities (birdwatchers, amateur astronomers, local historians), and neighbourhood associations. Each sub-group has different motivations, capacities, time constraints, and expectations. The *CROPS Scalability Survey* (2025) confirmed that citizens are rated as the most critical stakeholder group for upscaling. Yet the same survey revealed that most projects lack dedicated resources for citizen engagement beyond initial recruitment, and that retaining participants over time is one of the most frequently cited challenges.
Understanding motivations	Research on participant motivations consistently identifies a mix of intrinsic and extrinsic drivers (Land-Zandstra et al., 2021; Marques et al., 2024). The most commonly reported motivations include: - **Contributing to science or conservation:** the sense that one's observations or effort serve a larger purpose is, across multiple studies, the single most frequently cited motivation (Land-Zandstra et al., 2021; Raddick et al., 2013). - **Learning and curiosity:** participants want to deepen their understanding of a topic, whether it is local biodiversity, air quality, or linguistic patterns (Marques et al., 2024). - **Connection to place and community:** projects that address issues participants care about locally, such as the quality of water in their river or traffic-related pollution in their neighbourhood, generate stronger engagement (Hano et al., 2020; Veeckman et al., 2019). - **Social interaction:** meeting like-minded people, working alongside scientists, and belonging to a community of practice sustain participation over time (Hecker et al., 2018). - **Fun and enjoyment:** gamification elements, outdoor activities, and a sense of discovery all contribute to positive participant experience (Veeckman et al., 2019; Marques et al., 2024). Motivations are not static. They tend to shift from curiosity-driven in the early stages to norm-driven and community-oriented as participation deepens (Rotman et al., 2012; Land-Zandstra et al., 2021). Projects that

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	offer only one mode of engagement risk losing participants whose motivations evolve.
Practical engagement activities	**(1) Recruitment.** Generic open calls tend to attract what Veeckman et al. (2019) call the "archetypical" citizen science profile: white, well-educated, middle-aged males with spare time. Reaching a broader participant base requires targeted strategies: - Partner with existing networks and organisations (environmental NGOs, schools, community centres, patient associations, hobby clubs) rather than relying solely on social media or website announcements. - Use "project ambassadors," trusted local figures who can vouch for the project within their communities (Veeckman et al., 2019). - Frame participation around issues that resonate locally. The hackAIR project surveyed 370 potential citizen scientists before designing its engagement strategy, to understand what would motivate them specifically to monitor air quality (Veeckman et al., 2019). **(2) Training and onboarding.** Adequate training is essential for data quality and participant confidence, but over-complicated protocols deter participation. Turcati et al. (2025) found that simplifying tasks too much can also backfire, as participants may not feel their contribution is meaningful. Strike a balance: provide clear, accessible instructions (video tutorials, illustrated guides, hands-on workshops) and explain *why* each step matters for the science. The Plastic Pirates initiative invested in teacher training as its primary onboarding mechanism, offering workshops accredited by the education ministry so that teachers received professional development credits for participating (Interviewees, 2026). This embedded citizen science within an existing institutional incentive structure. **(3) Ongoing engagement and retention.** Dropout is highest at initial participation or shortly afterwards. Common causes include jargon, non-user-friendly technologies, lack of recognition, and, critically, lack of feedback on how data are being used (Veeckman et al., 2019; Turcati et al., 2025). To sustain engagement: - Provide regular, meaningful feedback. Tell participants what happened with their data. The Austrian team within the Plastic Pirates network communicated to teachers specifically which data sets could not be used and why, giving participants concrete guidance on improving data quality and reinforcing the message

that their contributions were being taken seriously (Interviewees, 2026).

- Offer multiple levels of involvement. Not all participants want the same depth of engagement. The DITOs "escalator model" (Paleco et al., 2021) provides a graduated pathway from passive consumption of science activities, through data collection, to creative analytical work and autonomous research. Design for flexibility.
- Recognise contributions. This can range from simple acknowledgements in publications and newsletters to co-authorship on papers, certificates, badges, or public recognition at events.
- Create social connections. Face-to-face events, online forums, and community gatherings strengthen participants' sense of belonging and their commitment to the project. In online platforms, social engagement opportunities are critical for sustainability (Marques et al., 2024).

Table 2.5. Summary of citizen and civil society engagement activities

Engagement activity	Purpose	Key considerations
Targeted recruitment through partner networks	Reach beyond "usual suspects"	Identify organisations trusted by target communities
Training workshops and materials	Build capacity and confidence	Balance simplicity with meaningful contribution; offer multiple formats
Regular data feedback	Sustain motivation and trust	Communicate both successes and limitations of data
Graduated participation pathways	Accommodate different commitment levels	Design for flexibility in time, skill, and depth of involvement
Recognition and acknowledgement	Reward contributions; build community	Co-authorship, certificates, public events, social media shout-outs
Inclusive design measures	Broaden participation demographics	Address language, accessibility, transport, timing, and digital barriers

Common pitfalls

- **Assuming recruitment equals engagement.** Signing up is not the same as participating, and participating once is not the same as sustained involvement. Collins et al. (2023) documented significant gaps between sign-up rates and active data submission in a precipitation monitoring project, highlighting the need for dedicated "activation" strategies after recruitment.

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- **Under-investing in feedback loops.** Bedessem et al. (2023) found that participants who consulted scientific results on project websites showed higher trust in science, yet many projects invest far more in recruitment than in communicating outcomes back to participants.
- **Treating all citizens the same.** A retired birdwatcher, a secondary school teacher, and a young person from a low-income neighbourhood have very different entry points, motivations, and constraints. One-size-fits-all approaches will reach only the most motivated segment.

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(B) Engaging Academia and Research Organisations

ENGAGING ACADEMIA AND RESEARCH ORGANISATIONS	
Why this group matters	Citizen science originates most frequently from academic settings. Researchers design protocols, analyse data, and seek to publish results in peer-reviewed journals. Universities and research institutes provide institutional homes for projects. Yet the relationship between citizen science and academia is not without tension. Citizen science challenges established norms about who produces knowledge, how data quality is ensured, and what counts as legitimate scientific output. Engaging academia effectively means addressing researchers' professional incentives and concerns, creating institutional conditions that support citizen science, and building a culture that values public engagement alongside traditional metrics of academic success.
Understanding motivations and barriers	Researchers are motivated to engage in citizen science by: - increased visibility and societal acceptance of their research (cited by 75% of coordinator respondents in von Goenner et al., 2023), - improved societal relevance (66%), and - access to datasets at spatial and temporal scales that would otherwise be unachievable. - Early career researchers may additionally see citizen science as an opportunity for professional development and public engagement experience. The barriers are equally well documented: - **Lack of academic recognition.** Citizen science activities are rarely counted in promotion and tenure decisions. Academic reputation systems tend to reward publications in high-impact journals rather than societal engagement (Serrano Sanz et al., 2014; von Goenner et al., 2023). - **Data quality concerns.** Professional scientists may be sceptical about whether data collected by non-experts meet standards for peer-reviewed research. One of the interviewees (2026) reported having to convince critical peer reviewers that ten-year-olds could collect reliable data, a challenge they described as substantial. - **Time and resource demands.** Coordinating citizen participation, providing training, and maintaining communication channels require significant effort beyond normal research activities (Pettibone et al., 2016; Turcati et al., 2025).

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	- **Ethical complexity.** Projects involving human participants add layers of ethical review, informed consent, and data protection that may be unfamiliar to researchers in some disciplines (Rasmussen & Cooper, 2019).
Practical engagement activities	**(1) Build institutional support.** Engage university leadership and research institute directors. Zourou and Tseliou (2020) recommend that higher education institutions formally recognise citizen science in research strategies, develop dedicated courses or modules, and provide institutional infrastructure (ethics review pathways, data management support, communications resources). The OECD (2025) further recommends that senior leadership commitment is critical for creating an enabling environment. **(2) Address data quality proactively.** Invest in data quality protocols from the project outset, not as a reactive measure. This may include: standardised collection protocols with clear visual guides; automated validation checks in data collection apps; structured verification processes (e.g. expert review of a sample of submissions, photo verification); and transparent documentation of data quality measures in publications. **(3) Create incentives aligned with academic culture.** Help researchers see citizen science outputs as academic outputs: - Support co-authored publications in peer-reviewed journals. - Facilitate connections with data repositories (Zenodo, EOSC, discipline-specific platforms) so that citizen science datasets gain *citability*. - Advocate for citizen science to be included in research assessment criteria at institutional and national levels. - Provide templates for including citizen science in grant applications. **(4) Build communities of practice.** Networks such as ECSA, the Citizen Science Association, and national citizen science platforms (e.g. Osterreich forscht in Austria, Scivil in Belgium, Ciencia Ciudadana in Spain) connect researchers with peers who share their challenges. Participation in conferences, working groups, and mutual learning events can reduce the isolation that individual citizen science researchers may experience. **(5) Involve researchers in guideline co-creation.** The quality criteria developed for the Austrian citizen science platform (Heigl et al., 2020) were produced through a one-year transdisciplinary process involving 17 institutions, iterative feedback loops, and a public consultation. This participatory approach ensured buy-in from the research

	community and produced standards that were both rigorous and practical. **From the field:** One of the Interviewees (2026) highlighted the importance of aligning research workshop objectives with participants' professional interests. When workshops were designed around domain expertise relevant to researchers' own work, engagement quality was notably higher than in workshops perceived as generic information-gathering exercises.
Common pitfalls	▪ **Assuming researchers will participate for altruistic reasons alone.** Researchers face real professional pressures. If citizen science engagement comes at the expense of publications, grant success, or career advancement, most will deprioritise it regardless of their personal enthusiasm. ▪ **Neglecting data management from the start.** Von Goenner et al. (2023) found that only about half of citizen science coordinators followed a dedicated data management plan, and only 19% used metadata standards. Without proper data management, the scientific credibility of citizen science outputs is undermined, which in turn makes it harder to engage quality-conscious researchers.

(C) Engaging Public Authorities and Policymakers

ENGAGING PUBLIC AUTHORITIES AND POLICYMAKERS	
Why this group matters	Public authorities and policymakers are essential for at least three reasons: - First, they are often the intended end-users of citizen science data: environmental monitoring data, biodiversity records, public health observations, and urban planning inputs are all most impactful when they inform public policy. - Second, they control resources and regulatory frameworks that can enable or constrain citizen science activities (access to public spaces, educational curricula, funding lines, data standards). - Third, their endorsement confers institutional legitimacy, which in turn aids recruitment of both citizens and other stakeholders. Yet engagement with policymakers remains one of the least developed areas of citizen science practice. One of the Interviewees was candid about this: *“Policy makers, I think is harder. Like, of course, I engage with them, but not that much in the context of citizen science projects.” (Interviewees, 2026)* Other Interviewee (2026) reported that meaningful policy engagement was something their team was only beginning to develop after years of operation, through connections with the JRC and discussions about data harmonisation.
Understanding motivations and barriers	Policymakers are motivated by evidence that helps them fulfil their mandates, respond to political pressures, and demonstrate accountability. Citizen science data becomes attractive to policymakers when it fills gaps in existing monitoring systems, when it is aligned with existing indicators and reporting requirements, and when it arrives in formats and timeframes that match the policy cycle (Nascimento et al., 2018; OECD, 2025). Key barriers include: - **Scepticism about data quality.** Policymakers, like academic researchers, may doubt whether citizen-collected data are rigorous enough for regulatory or decision-making purposes. The OECD (2025) identifies the integration of citizen science data into policymaking as a common policy challenge across countries.

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	- **Lack of awareness.** Many public officials are simply unfamiliar with what citizen science is or what it can offer. Awareness varies considerably across governance levels and policy domains. - **Institutional inertia and risk aversion.** Public institutions have established data collection systems and reporting obligations. Integrating citizen science data requires changes to procedures, data management systems, and sometimes legal frameworks, which bureaucracies are typically slow to adopt (Nascimento et al., 2018; Maccani et al., 2020). - **Political sensitivity.** Citizen science can generate data that is politically inconvenient (e.g. pollution levels that exceed official measurements, or biodiversity losses in politically sensitive areas). Some public authorities may resist engagement for this reason.
Practical engagement activities	**(1) Speak the policy language.** Frame citizen science contributions in terms that policymakers understand: contribution to monitoring obligations, compliance with EU directives, cost savings compared to professional monitoring, alignment with Sustainable Development Goals (SDGs), or support for EU Mission objectives. The OECD (2025) recommends that citizen science projects explicitly map their outputs to specific policy needs and reporting requirements. **(2) Engage early and at the right level.** Ceccaroni and Piera (2018) emphasise that decision-makers should be involved from the earliest planning stages, both to secure their commitment and to identify how project outputs can feed into decision-making processes. Target the specific officials or units whose mandate aligns with your research topic, not generic "government." **(3) Identify and cultivate CS champions.** Finding an ally within a ministry, a municipal department, or a regulatory agency who understands and advocates for citizen science can be transformative. CS Champions may help you raising awareness, connect with institutions, and secure high-level commitments. The Plastic Pirates initiative benefited from having the German education ministry actively involved, sending letters to all schools in the country and embedding the project within the ministry's annual research year programme (Interviewees, 2026). **(4) Demonstrate fitness for use.** Provide policymakers with evidence that your data meet the quality standards required for their specific purposes. This may involve: publishing data quality assessments alongside the data itself; aligning data formats with existing government data systems; producing summary reports and policy briefs rather than academic papers; and offering to present findings in person at relevant committee meetings or consultation events.

(5) **Build long-term relationships, not transactional ones.** Policy influence is rarely immediate. It requires sustained presence and credibility-building over multiple policy cycles. Invite policymakers to advisory boards, steering committees, or project events. Share interim results. Offer to contribute to consultations.

Table 2.6. Engagement approaches by policy level

Policy level	Key actors	Entry points	Example activities
Local / municipal	Environment officers, urban planners, education coordinators, public health staff	Local environmental issues, urban planning consultations, school partnerships	Present data at council meetings; contribute to local environmental assessments; collaborate on school curricula
National	Ministry officials, national agencies, parliamentary committees	National monitoring obligations, SDG reporting, education policy	Policy briefs, participation in national consultations, contributions to national monitoring databases
EU / International	JRC, DG RTD, DG ENV, EEA, Mission boards	EU Mission objectives, Horizon Europe calls, European Environment Agency reporting	Participation in EU-level networks (ECSA, EU-Citizen.Science), contribution to JRC data harmonisation efforts

Common pitfalls

- **Approaching policymakers only when you need something.** If the first time you contact a government official is to ask for funding or endorsement, the relationship starts on a transactional footing. Invest in the relationship before you need to draw on it.
- **Presenting raw data without interpretation.** Policymakers rarely have the time or technical capacity to interpret complex datasets. Provide clear, contextualised summaries with policy-relevant conclusions. Visual summaries, infographics, and short briefing documents are more effective than lengthy technical reports.
- **Ignoring the political context.** Citizen science data that contradicts official narratives may be welcomed by some and resisted by others. Be prepared for political sensitivities and have a plan for how to communicate findings that may be contentious.

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(D) Engaging Industry and SMEs

ENGAGING INDUSTRY AND SMES	
Why this group matters	Industry and SMEs are the least engaged quadruple helix group in citizen science. This is not a contested claim; it emerges consistently from the literature (Skarlatidou et al., 2019; Hecker et al., 2018) and from our collected empirical data along experienced practitioners. One of our Interviewees was direct: *"out of these four, the SME industry is the one we least interacted with." (Interviewees, 2026)* Another Interviewee (2026) linked it primarily to funding: *"for industry, I will tell mostly about funding."* Yet there are legitimate reasons to pursue the engagement with SMEs and industry. Industry can provide financial sponsorship, technological resources (sensors, platforms, data analytics), access to employee volunteer networks, and pathways to commercial application of citizen science outputs. The CROPS D4.3 deliverable on funding models found that 77% of CROPS Scalability Survey respondents considered private funding important or very important, despite only 6% of mapped projects having private sector involvement as a main funding source. The challenge is to engage industry in ways that add genuine value to citizen science without compromising scientific integrity, public trust, or community ownership.
Understanding motivations and barriers	Industry actors may be motivated by: - **Corporate Social Responsibility (CSR) and sustainability goals:** Citizen science projects aligned with a company's environmental or social commitments can serve CSR reporting needs. Earthwatch's FreshWater Watch, for example, began as an HSBC employee engagement programme (Maccani et al., 2020). - **Data and market intelligence:** Companies in environmental monitoring, urban planning, agriculture, or health may see citizen science data as valuable for product development or service design. - **Employer branding and employee engagement:** Participation in citizen science can enhance a company's public image and provide meaningful team-building activities. - **Technology co-development:** SMEs developing sensors, apps, or data platforms may benefit from real-world testing and user feedback provided by citizen science projects.

	Barriers are substantial: - **Cultural distance.** The citizen science community and the business world operate with different values, timelines, and success metrics. Skarzauskiene et al. (2023) found that in some countries (notably Lithuania), the private sector showed the highest rejection rates for joining citizen science activities. - **Reputational risk.** Companies fear association with research that might produce politically or commercially inconvenient findings. Conversely, the citizen science community fears "greenwashing," where industry involvement is used to create an impression of environmental responsibility without genuine commitment. CROPS D4.3 cites an interviewee who recalled a chemical company attempting to sponsor a water pollution project, which was rejected because the company was itself a known polluter in the region. *"They risk being used for greenwashing or diversity washing... I remember a project that said we're working on water pollution and there was a chemical industry that wanted to finance us, but because it's a main polluter in our region, we didn't want to." (Interviewee 5, CROPS D4.3, 2025)* - **Misalignment of goals.** Industry timelines tend to be shorter, results-oriented, and profit-focused. Citizen science timelines are often longer, process-oriented, and public-interest-focused. Koedel et al. (2024) documented that municipal enterprises faced mismatches between their operational goals and citizen science project objectives. - **Intellectual property and data concerns.** Industry actors may want exclusive access to data or may be uncomfortable with open data principles central to citizen science ethics (ECSA Principle 7). Negotiating data governance arrangements requires clarity and firmness from the outset. - **Brand misuse risk.** One of the Interviewees reported an incident where an industry actor attempted to co-opt the project's brand: one company *"developed together with us the [project] sampling net to analyse microplastics and they sold it afterwards,"* raising questions about commercial exploitation of a publicly funded initiative (Interviewees, 2026).
Practical engagement activities	**(1) Start with alignment on mutual benefits, not with a funding ask.** Identify companies whose core business or sustainability strategy genuinely aligns with your project's domain. A sensor manufacturer may have a natural interest in a citizen science air quality project; a water utility may see value in citizen-generated water quality data.

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	The relationship should offer mutual value, not merely extract resources. **(2) Establish clear governance and data agreements.** Before formalising any partnership, agree in writing on: data ownership and access (citizen science data should remain open and publicly available); branding and attribution rules; limits on commercial exploitation of project outputs; and procedures for managing conflicts of interest. This protects both the project and the company. **(3) Offer concrete, bounded roles.** Industry partners are more likely to engage when the ask is specific and manageable: sponsoring a specific sampling campaign, providing equipment for a defined pilot, offering pro-bono technical support, or hosting a data analysis workshop. Open-ended "partnerships" without clear deliverables and timelines tend to dissipate. **(4) Consider technology co-development.** SMEs that develop environmental sensors, mobile apps, or data platforms may be interested in co-designing tools with citizen science communities. This can create genuine innovation partnerships, but requires careful management to ensure that the technology serves the project's scientific and social goals, not only the company's commercial interests. **(5) Explore employee volunteering programmes.** Some large companies have established employee volunteering or CSR programmes that can be channelled towards citizen science. This can provide a ready-made participant base, as demonstrated by the Earthwatch-HSBC FreshWater Watch partnership (Maccani et al., 2020). Be realistic about the depth of engagement: employee volunteers may participate for a single event rather than committing long-term. **(6) Be honest about the state of the field.** Industry engagement in citizen science is genuinely underdeveloped. Few proven models exist. Projects entering this space should treat it as experimental, document what works and what does not, and share lessons with the wider community.
Common pitfalls	▪ **Treating industry as a cash dispenser.** If the only role offered to industry is "provide funding," the relationship will be shallow and short-lived. Genuine partnerships involve shared problem-solving, not just resource extraction. ▪ **Compromising open data principles.** Any agreement that restricts public access to citizen science data undermines the core values of the practice. Be willing to walk away from partnerships that require data exclusivity.

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- **Ignoring reputational risks.** A partnership with a company perceived as environmentally or socially irresponsible can damage a project's credibility with participants and the public. Conduct due diligence on prospective industry partners.
- **Over-promising impact.** Industry partners accustomed to marketing metrics may expect quantified return-on-investment. Be transparent about what citizen science can and cannot deliver in business terms.

Table 2.7. Industry engagement: realistic opportunities and honest limitations

Opportunity	What it requires	Realistic limitations
CSR sponsorship	Alignment with company sustainability goals; clear branding rules	Vulnerable to corporate strategy changes; may be one-off
Technology co-development	Shared interest in tool innovation; clear IP arrangements	Risk of commercial capture; must ensure tools serve project goals
Employee volunteering	Access to company's internal communications; event coordination	Typically shallow engagement; one-off participation
Data partnerships	Mutual data needs; governance agreements	Open data principle must be non-negotiable
In-kind support (venues, logistics, equipment)	Clear specification of what is needed	May create dependency; company may expect brand visibility in return

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(E) Cross-cutting: Inclusivity and diversity

Citizen science participation does not reflect population demographics. Across multiple studies, participants tend to be disproportionately white, highly educated, older, and from higher socioeconomic backgrounds (Pateman et al., 2023; Paleco et al., 2021). The CROPS CS Projects Mapping we complemented in CROPS' Task 4.3 allowed us to understand that just a few of +300 mapped projects offered accessible materials for people with disabilities, and most operated in only one or two languages.

This matters for two reasons. First, it limits the scientific validity of data collected, introducing geographic, socioeconomic, and demographic biases that can distort findings (Pateman et al., 2023). Second, it means that the people most affected by the environmental or health issues under study, often those from marginalised communities, are the least likely to participate.

Addressing this requires deliberate effort at every stage of project design:

- **Design from the margins.** Varga et al. (2023) recommend centring inclusivity strategy around the most excluded groups: if a project is accessible to vulnerable populations, it will likely be accessible to all.
- **Partner with intermediary organisations** that already have trust and access within underrepresented communities (cultural organisations, welfare services, community health centres, religious institutions).
- **Address practical barriers:** transport costs, childcare, accessibility of venues, language of materials, digital literacy requirements, time of events.
- **Use inclusive language.** Avoid academic jargon. Consider that the word "science" itself can be a barrier for people who do not identify with scientific culture (Paleco et al., 2021).
- **Publish participant demographics** to make the diversity profile of your project transparent (Varga et al., 2023).

From the field: In the CROPS Stakeholder Engagement Survey (2026), one respondent emphasised the value of creating non-hierarchical learning spaces:

> *"When we are all learning together, standing at the same level, we create an inclusive, safe space for discovery, learning and of making mistakes. So it is important that this is a core value to the stakeholders involved." (Respondent of CROPS Stakeholder Engagement Survey, 2026)*

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(F) Cross-cutting: Ethics and RRI

The ECSA Ten Principles of Citizen Science (Robinson et al., 2018) provide a widely referenced ethical framework. Several principles are directly relevant to citizen engagement:

- Citizen scientists should receive feedback on results (Principle 5).
- Data and metadata are made publicly available, and results published in open-access format where possible (Principle 7).
- Citizen scientists are acknowledged in project results and publications (Principle 8).
- Ethical and legal aspects of participant involvement, including intellectual property, data sharing, confidentiality, and attribution, are addressed (Principle 10).

Heigl et al. (2020) describe a co-creative process for developing quality criteria for citizen science in Austria that addressed scientific standards, collaboration, open science, communication, ethics, and data management. Such participatory quality frameworks can serve as a model for building ethical practice into the project from the outset rather than treating it as a compliance afterthought.

Informed consent should be obtained clearly and in accessible language. When working with vulnerable groups, additional protections may be required; consulting ethics or legal experts is advisable (Varga et al., 2023; Rasmussen & Cooper, 2019).

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2.4 STEP3+ – Adapting Engagement for Upscaling

2.4.1 About This Section

The preceding steps and sub-sections have described stakeholder engagement in general terms, applicable to citizen science projects at any scale. But this deliverable exists specifically because CROPS is concerned with *upscaling*, the process of expanding citizen science initiatives beyond their original scope. Upscaling introduces distinct challenges for stakeholder engagement that deserve dedicated treatment.

This section addresses: what changes when engagement scales, the different dimensions of scaling and their implications for engagement, practical models for managing engagement at scale, and the persistent tension between standardisation and local adaptation.

2.4.2 What changes when engagement scales

When a citizen science project moves from a local pilot to a national or transnational initiative, nearly every aspect of stakeholder engagement becomes more complex:

- **More stakeholders, more diversity.** Scaling out geographically means engaging stakeholders in new cultural, linguistic, institutional, and political contexts. What works in Germany may not work in Portugal. What motivates teachers in one educational system may not apply in another. The Plastic Pirates experience of scaling from Germany, Portugal, and Slovenia into 14 countries illustrated this vividly: the research approach could be largely standardised, but communication had to be localised, and the team acknowledged they could not dictate how communication would work in countries whose languages they did not speak (Interviewees, 2026).

- **Intermediaries become essential.** At local scale, a project coordinator can maintain personal relationships with most stakeholders. At national or transnational scale, this is no longer possible. The project must work through intermediaries: national coordinators, teacher networks, local NGO partners, municipal officials. The quality of these intermediary relationships becomes the primary determinant of engagement quality. The Plastic Pirates team noted that country-level participation varied enormously depending on national funding and the strength of local institutional support (Interviewees, 2026).

- **Coordination costs increase non-linearly.** The CROPS Expert Interviews (2026) described the practical difficulties of coordinating stakeholder outreach across multiple project partners: overlapping contact lists, inconsistent messaging, and stakeholder fatigue from being contacted by multiple people for different purposes. At scale, these coordination failures multiply.

- **Depth and breadth trade off.** One of the most thought-provoking reflections from the interviewees concerned the tension between scaling out (more participants across more

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countries) and scaling deep (more meaningful involvement per participant). As one researcher put it: *"if we only discuss about scaling and then making it bigger sense, then do projects who want to scale to deeper involvement, are they seen in a different way?"* A project may be celebrated for reaching thousands of participants across 13 countries while simultaneously struggling to move beyond contributory data collection to genuine collaboration with its participants (Interviewees, 2026).

2.4.3 The dimensions of scaling and their engagement implications

Following the framework adopted by the MLE CSI-PP (Radicchi et al., 2023) and the CROPS project (Sprinks et al., 2024), four dimensions of scaling have distinct implications for stakeholder engagement:

Table 2.8. Scaling dimensions and engagement implications

Scaling dimension	What it means	Key engagement implications
Scaling out	Geographic replication; more sites, regions, or countries	Need for local intermediaries; translation and cultural adaptation of materials; coordination mechanisms across partners; managing variable funding and institutional support.
Scaling up	Institutional embedding; policy influence	Sustained engagement with policymakers; alignment of data with regulatory requirements; building CS champions in public authorities; long-term relationship investment.
Scaling deep	Cultural change; deeper participant involvement	Shifting from contributory to collaborative/co-created models; investing in participant capacity-building; allowing participants to shape research questions; rethinking what "success" means.
Scaling down	Deliberate reduction in scope for quality	Honest communication with stakeholders about scope changes; potential loss of participants or partners; focus on maintaining core relationships.

2.4.4 Practical models for engagement at scale

- **The hub-and-spoke model.** A central coordinating team (the hub) provides core resources: standardised protocols, training materials, data infrastructure, branding, and quality assurance frameworks. Local partners (the spokes) adapt and deliver these resources within their own contexts, handling recruitment, training, and community engagement locally. This model is used by Earthwatch's FreshWater Watch (active in over 30 countries) and, to a degree, by the Plastic Pirates. The key to success is giving spokes sufficient autonomy to adapt while maintaining enough standardisation for data comparability (Maccani et al., 2020; Sprinks et al., 2025).

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- **Train-the-trainer approaches.** Rather than training all participants centrally, train a cadre of local trainers or "champions" who then train participants in their own communities. This scales capacity without requiring proportional increases in central coordination effort. Maccani et al. (2020) identify this as one of the most effective scaling strategies across the case studies they reviewed.
- **Platform-enabled community building.** Digital platforms (such as EU-Citizen.Science, iNaturalist, or Zooniverse) can serve as shared infrastructure for stakeholder engagement at scale, providing onboarding resources, data submission tools, community forums, and results dissemination. The platform approach enables distributed communities to develop local applications and adapt the initiative to their context without centralised support (Maccani et al., 2020).
- **Graduated engagement pathways.** Design participation so that stakeholders can enter at different levels of commitment and move between them over time. Not everyone needs to (or can) participate at the same intensity. This is particularly important at scale, where the diversity of participant contexts makes one-size-fits-all engagement unrealistic.

2.4.5 The standardisation-adaptation tension

Perhaps the most persistent challenge in scaling citizen science engagement is balancing standardisation (necessary for data comparability, quality assurance, and coordination) with adaptation (necessary for relevance, inclusivity, and local ownership).

The Plastic Pirates case provides a clear illustration. The research protocols were standardised across participating countries to ensure data comparability. But the communication approach was explicitly localised. Even within the standardised research protocols, countries faced pressure to adapt, with some countries' protocol development involving negotiation about which local environmental features to include or exclude (Interviewees, 2026).

Useful guiding principle: **standardise what must be comparable, localise what must resonate.** Data collection protocols, quality criteria, and core ethical standards should be standardised. Recruitment strategies, communication materials, event formats, and partnership models should be adapted to local contexts.

2.4.6 Common pitfalls for engagement at scale

- **Assuming that what worked locally will work everywhere.** Local success is necessary but not sufficient evidence that a model will scale. Test engagement strategies in at least two or three distinct contexts before committing to a standard approach.

- **Under-investing in coordination infrastructure.** Shared contact databases, communication templates, regular cross-partner meetings, and clear role definitions may seem like administrative overhead, but they are the infrastructure that makes scaled engagement possible. Interviewees (2026) identified the lack of shared, updated stakeholder contact lists as a concrete source of coordination problems.
- **Privileging quantity over quality.** Large participant numbers look impressive in project reports, but if most participants disengage after a single contribution, the project has not built a stakeholder base; it has generated a mailing list. Interviewees (2026) were emphatic on this point: genuine engagement is visible when participants are reluctant to leave a workshop, not when headcounts are high.
- **Neglecting the sustainability question.** What happens when the project funding ends? The Plastic Pirates team reflected that teachers kept asking whether they could participate again, but the project could not always promise continuity due to funding uncertainty. Engagement strategies for upscaled projects must include a sustainability plan that addresses what happens to stakeholder relationships beyond the funded period. Anchoring projects within institutions, rather than treating them as time-limited funded activities, was identified as a priority (Interviewees, 2026).

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STEP 3 & 3+ RECAP: Design Engagement Strategies and Adapt for Upscale

Citizens and civil society:

- Understand diverse motivations (contribution to science, learning, community, fun); design for motivation evolution over time.
- Recruit through existing networks and intermediaries, not only open calls.
- Invest in onboarding, feedback, recognition, and graduated participation pathways.
- Address inclusivity deliberately: design from the margins, partner with trusted intermediary organisations, remove practical barriers.

Academia and research organisations:

- Address professional incentives: co-authorship, data citability, institutional recognition.
- Invest in data quality protocols from the outset.
- Build communities of practice to reduce researcher isolation.

Public authorities and policymakers:

- Frame contributions in policy-relevant terms; align data with existing reporting requirements.
- Engage early and cultivate CS champions within public institutions.
- Demonstrate data fitness for use; provide interpreted summaries, not raw data.
- Build long-term relationships, not transactional ones.

Industry and SMEs:

- Start with genuine alignment, not funding requests.
- Establish clear governance and data agreements protecting open data principles.
- Offer concrete, bounded roles; explore CSR programmes and technology co-development.
- Be honest about the limited evidence base; treat industry engagement as experimental.

Upscaling:

- Intermediaries become essential at scale; invest in their capacity and autonomy.
- Standardise what must be comparable; localise what must resonate.
- Use hub-and-spoke models, train-the-trainer approaches, and platform-enabled communities.
- Prioritise engagement quality over participant quantity.
- Plan for sustainability beyond the funded period.

Read More…

- Land-Zandstra, A., Agnello, G. and Gültekin, Y.S. (2021). Participants in Citizen Science. In Vohland et al. (Eds.), *The Science of Citizen Science* (chapter 13). Springer. – Comprehensive overview of participant motivations and engagement lifecycle.

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- Veeckman, C. et al. (2019). *Communication in Citizen Science. A practical guide to communication and engagement in citizen science*. Scivil. – Six tactics for recruitment and retention; communication plan template.
- Paleco, C. et al. (2021). Inclusiveness and Diversity in Citizen Science. In Vohland et al. (Eds.), *The Science of Citizen Science* (chapter 14). Springer. – Empirical data on participation demographics and inclusive engagement models.
- Varga, K. et al. (2023). How can Inclusive Citizen Science Transform the Sustainable Development Agenda? Recommendations for a Wider and More Meaningful Inclusion in the Design of Citizen Science Initiatives. *Citizen Science: Theory and Practice*, 8(1). – Twelve recommendations for inclusive citizen science.
- Koedel, U. et al. (2024). Enhancing citizen science impact in environmental monitoring: Targeted engagement strategies with stakeholder groups. *Frontiers in Environmental Science*, 12. – Value Proposition Canvas applied to citizen science stakeholder groups including municipal enterprises.
- OECD (2025). *Embedding Citizen Science into Research Policy*. OECD Publishing. – Ten recommendations for policymakers.
- Maccani, G. et al. (2020). *Scaling Up Citizen Science*. JRC/European Commission. – Nine drivers framework; hub-and-spoke model; case studies of scaled initiatives.
- Radicchi, A. et al. (2023). *Mutual Learning Exercise on Citizen Science Initiatives - Policy and Practice. Fifth Thematic Report: Scaling up citizen science*. European Commission. – Four-dimensional scaling framework (out, up, deep, down).
- Sprinks, J. et al. (2024). CROPS: changing the scale of citizen science towards the transnational level. *Proceedings ECSA-ÖCSK-2024*. – CROPS conceptual approach and 9-enablers framework.

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2.5 Step 4 – Communicate and Build Trust

2.5.1 About This Step

Communication is not a separate activity that happens alongside stakeholder engagement; it is the medium through which engagement occurs. Every interaction with a stakeholder, from a recruitment email to a policy brief, from a training workshop to a social media post, is an act of communication. **How well you communicate determines whether stakeholders join, stay, contribute meaningfully, and trust the project.**

Trust, in turn, is not a binary state but a multi-dimensional construct. Bedessem et al. (2023) identified at least five distinct dimensions of trust in science relevant to citizen science: trust in the honesty of scientific information, in science as a factor of social progress, in science's ability to solve concrete problems, in the utility of science for public policy, and in the integrity of scientists. A citizen science project may build trust along some of these dimensions while inadvertently undermining it along others, particularly if communication is inconsistent or if feedback is lacking.

This step addresses how to design and implement communication strategies that serve stakeholder engagement and build the trust necessary for sustainable participation.

2.5.2 How to Do It

(A) Develop a communication plan

A communication plan does not need to be a lengthy document. It does need to answer five questions, adapted from Veeckman et al. (2019):

1. **What are the project objectives?** Clarify whether the primary goal is scientific data collection, education, community empowerment, policy influence, or a combination. Communication should serve these objectives, not exist in isolation.
2. **What level of engagement are you aiming for?** A contributory project (citizens collect data) needs different communication from a co-created project (citizens shape the research question). Match the communication intensity and style to the engagement model.
3. **Who are your target audiences?** Different stakeholder groups need different messages, channels, and frequencies. A message that works for prospective citizen volunteers will not work for a government official or a corporate partner.
4. **What are stakeholders' motivations and concerns?** Use the insights gathered in Steps 1-3. If participants are primarily motivated by learning, emphasise educational content. If policymakers care about regulatory compliance data, present results in those terms.

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5. **How will you communicate, and how will you evaluate success?** Select channels, define frequency, assign responsibility, and identify how you will know if communication is working.

The *CROPS Scalability Survey* (2025) found that a majority of responding projects had communication strategies in place, but targets and approaches varied widely. Importantly, several projects acknowledged that they lacked dedicated communication staff, relying instead on researchers to handle communication alongside their scientific duties. This is a common constraint. Even minimal planning, however, produces better results than ad hoc communication.

(B) Move beyond one-way dissemination

A persistent weakness in citizen science communication is the tendency to treat it as dissemination: the project team produces information and pushes it outward. Golumbic et al. (2024) found that many citizen science project descriptions mimic scientific abstracts and neglect the practical and community-related aspects that participants actually care about. The NEWSERA project similarly found that many citizen science initiatives interpret communication primarily as a dissemination activity without harnessing its potential for deeper engagement.

Effective communication in citizen science is multi-directional:

- **Outward (project to stakeholders):** recruitment messages, training materials, progress updates, results reporting, policy briefs, media engagement.
- **Inward (stakeholders to project):** participant feedback on protocols, reports of local observations or concerns, suggestions for improvement, complaints.
- **Lateral (between stakeholders):** peer-to-peer learning among participants, cross-institutional sharing between partner organisations, community discussions.

Designing for two-way and lateral communication requires infrastructure: feedback mechanisms within data collection platforms, community forums or chat groups, regular question-and-answer sessions with the project team, and mechanisms for participants to share stories and experiences with each other.

(C) Tailor messages by stakeholder group

The following table summarises how communication emphasis and channels may differ across the quadruple helix groups:

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Table 2.9. Communication approaches by stakeholder group

Stakeholder group	Key messages	Preferred channels	Frequency
Citizens / volunteers	How to participate; why it matters; what happened with their data; recognition	Social media, newsletters, project website, in-person events, community forums	Regular (weekly to monthly); immediate after key milestones
Academia / researchers	Data quality evidence; publication opportunities; methodology updates; citation of datasets	Academic networks, conferences, email, peer-reviewed publications	As needed; aligned with academic calendar
Public authorities / policymakers	Policy-relevant findings; data fitness for use; alignment with reporting requirements	Policy briefs, face-to-face meetings, formal presentations, targeted email	Aligned with policy cycles; before consultation deadlines
Industry / SMEs	Mutual value proposition; partnership terms; visibility/CSR benefits	Direct contact, sector events, business-oriented summaries	At partnership milestones; aligned with business planning cycles

One of the Interviewees (2026) offered a practical insight on broadening the audience for citizen science communication: rather than always branding events as “citizen science,” consider framing them around the topic itself. In their experience, running a workshop on “Ocean Futures” attracted a broader audience than one labelled as a citizen science event, because people were drawn by the subject matter rather than the methodology.

(D) Build trust through feedback and transparency

The single most cited trust-building mechanism in the literature is *feedback*: telling participants what happened with their data. Bedessem et al. (2023) found that participants who consulted scientific results published on project websites showed higher trust in science across multiple dimensions. ECSA Principle 5 states explicitly that citizen scientists should receive feedback from the project, including information on how their data are being used and what the research, policy, or societal outcomes are.

Yet feedback is where many projects fall short. The *CROPS Scalability Survey* (2025) rated “feedback to participants” as one of the most important communication activities, but several respondents acknowledged that they did not have systematic processes in place for delivering it.

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Practical approaches to building trust through feedback:

- Publish regular data summaries accessible to non-specialists. Use visualisations, maps, and plain-language narratives.
- Communicate both successes *and* limitations honestly. If some data could not be used, explain why and what could be done differently. The Austrian Plastic Pirates team's practice of explaining to teachers which data sets were unusable, and why, is a strong example of honest feedback that strengthened rather than weakened the relationship (Interviewees, 2026).
- Share interim findings, not just final results. Participants should not have to wait years for their contribution to be visible.
- Make data accessible. Consistent with ECSA Principle 7 and FAIR data principles, datasets and metadata should be publicly available where possible.

(E) Use storytelling and creative communication

Science communication research increasingly emphasises the power of narrative. Hecker et al. (2018, Chapter 30) recommend using storytelling and creative formats to bridge the gap between science, society, and policy. Stories help participants see themselves in the project, connect emotionally with the research topic, and share their experience with others.

The STORCIT framework, tested with vulnerable youth groups in Belgium, demonstrated how storytelling-based approaches can make citizen science accessible and engaging for populations that traditional science communication rarely reaches (Golumbic et al., 2024). Similarly, the Danish "Our Nature" campaign used cross-sectoral partnerships to achieve demographic diversity in participation, partly through narrative-driven communication.

Practical applications: participant testimonials on project websites; short video documentaries of sampling campaigns; "day in the life" social media posts from active participants; illustrated guides rather than text-heavy manuals.

2.5.3 Common Pitfalls

- **Treating communication as an afterthought.** If the communication plan is written after the project is already running, opportunities for early stakeholder engagement have been missed. Plan communication alongside project design.
- **Relying on a single channel.** Social media received mixed ratings in the CROPS Scalability Survey (2025), reminding us that no single channel reaches all audiences. Combine digital and in-person, formal and informal approaches.

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- **Communicating only good news.** Selective communication erodes trust over time. When problems arise, being transparent about them demonstrates integrity and, paradoxically, can strengthen stakeholder relationships.
- **Neglecting internal communication.** In multi-partner projects, inconsistent messaging between partners confuses stakeholders and fragments the project identity. Interviewees (2026) highlighted that partner organisations sometimes contacted the same stakeholders independently with different messages, creating frustration and disengagement.

STEP 4 RECAP: Communicate and Build Trust

- Develop a communication plan that addresses objectives, engagement level, audiences, motivations, and evaluation.
- Move beyond one-way dissemination: design for two-way and lateral communication.
- Tailor messages by stakeholder group; adapt channels, frequency, and framing.
- Build trust through regular, honest feedback on data use and project outcomes.
- Use storytelling and creative formats to connect with diverse audiences.
- Plan communication from the beginning, not as an afterthought.
- Coordinate communication across project partners to avoid conflicting messages.

Read More…

- Veeckman, C. et al. (2019). *Communication in Citizen Science. A practical guide to communication and engagement in citizen science*. Scivil. – Six-step communication plan template with worksheets.
- Hecker, S. et al. (2018). Stories can change the world – citizen science communication in practice. In Hecker et al. (Eds.), *Citizen Science: Innovation in Open Science, Society and Policy*. UCL Press. Chapter 30. – Tips for communicating citizen science.
- Bedessem, B. et al. (2023). Science knowledge and trust in science in biodiversity citizen science projects. JCOM 22(01), A05. – Multi-dimensional trust framework.
- Golumbic, Y.N. et al. (2024). Editorial: Bridging citizen science and science communication. *Frontiers in Environmental Science*, 12, 1474221. – Editorial on integration of CS and science communication.

2.6 Step 5 – Monitor, Evaluate, and Adapt

2.6.1 About This Step

Stakeholder engagement is not a set-and-forget activity. It requires ongoing monitoring to understand what is working, periodic evaluation to assess outcomes and impact, and adaptive management to adjust strategies in response to evidence.

Yet evaluation remains one of the weakest areas of citizen science practice. Von Goenner et al. (2023) found that only half of citizen science coordinators in Germany reported conducting systematic internal or external evaluations. The *CROPS CS Projects Mapping* (Task 4.3) confirmed that explicit reference to evaluation frameworks, accountability mechanisms, or quality criteria is uncommon across the approximately 300 mapped European projects.

This step provides practical guidance on what to monitor, how to evaluate, and how to use evaluation findings to improve engagement.

2.6.2 How to Do It

(A) Define what success looks like, early

Evaluation is only possible if you have defined what you are trying to achieve. At the project outset, alongside Steps 1-3, articulate clear engagement objectives. These should be specific enough to be measurable but flexible enough to evolve. Examples:

- "At least 200 active data contributors in the first sampling season" (participation quantity).
- "Participants submit data meeting the quality threshold on at least 80% of submissions" (data quality).
- "At least three municipal authorities use project data in their annual environmental report" (policy uptake).
- "At least 30% of initial participants return for a second year of participation" (retention).
- "Participant demographics reflect the local population within a 10% margin on key indicators" (inclusivity).

The Kieslinger et al. (2018) evaluation framework, referenced across several sources in the literature, recommends defining objectives across three dimensions:

- scientific advancement,
- participant engagement, and
- socio-ecological/economic impact.

This three-dimensional approach helps avoid the common trap of evaluating only scientific outputs while neglecting the people and communities involved.

(B) Monitor engagement continuously

Monitoring means tracking indicators regularly enough to enable course corrections. Key areas to monitor:

- **Participation metrics.** Number of active participants (not just sign-ups); frequency and volume of contributions; geographic distribution of participation; retention rates over time; demographic profile of participants. The distinction between sign-ups and active contributors is critical. Collins et al. (2023) documented substantial gaps between the two in their precipitation monitoring project.
- **Data quality metrics.** Koedel et al. (2024) developed a practical set of KPIs for citizen science data quality, including raw data points collected, quality-controlled data points retained, and spatial/temporal coverage. They found, for instance, that 54.2% of data were collected during rush hours and 88.2% on working days, revealing gaps that informed targeted recruitment of participants who could collect data at other times.
- **Stakeholder satisfaction.** Regular, lightweight check-ins with key stakeholders: brief surveys after events, informal feedback conversations, analysis of community forum sentiment. Interviewees (2026) suggested a simple but telling indicator: *"you can tell if people don't want to leave"* a workshop, contrasted with events where participants disengage early.
- **Communication effectiveness.** Open rates for newsletters, social media engagement, website traffic to results pages, media coverage. These are proxy indicators; they measure reach rather than impact, but they can flag problems early (e.g. declining open rates suggesting message fatigue).

Table 2.10. Suggested monitoring indicators for stakeholder engagement

Dimension	Indicator	Data source	Frequency
Participation	Active contributors vs. registered users	Project database	Monthly
Participation	Retention rate (% returning after first contribution)	Project database	Quarterly / annually
Participation	Demographic profile of participants	Registration data; optional surveys	Annually
Data quality	% of submissions meeting quality threshold	Data validation system	Monthly
Data quality	Spatial and temporal coverage	GIS analysis; timestamped data	Monthly
Stakeholder satisfaction	Net satisfaction score	Post-event surveys; annual survey	After events; annually

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Communication	Newsletter open rate; social media engagement	Communications platform analytics	Monthly
Policy uptake	Number of policy documents referencing project data	Desk review; stakeholder interviews	Annually
Inclusivity	Representation of underrepresented groups	Demographic data; partner feedback	Annually

(C) Evaluate outcomes periodically

While monitoring is continuous, evaluation is periodic and more in-depth. Plan for evaluation at project milestones (e.g. end of each sampling season, mid-project review, final assessment).

Evaluation should address the three dimensions identified by Kieslinger et al. (2018):

1. **Scientific outcomes.** Did the engagement strategy produce data of sufficient quality and quantity for the project's research questions? Were citizen science datasets published, cited, or used in policy?
2. **Participant outcomes.** Did participants report learning gains, increased interest, behaviour change, or a sense of empowerment? Von Goenner et al. (2023) found that the strongest participant impact was the experience of collective efficacy, the feeling of making a difference together with others.
3. **Broader societal outcomes ('Socio-ecological and economic outcomes').** Did the project contribute to community capacity, policy change, public awareness, or shifts in the science-society relationship? These are the hardest to measure and may require longer timeframes.

Tools available for evaluation include:

- **MICS Impact Indicator Explorer** (Measuring Impact of Citizen Science): a curated set of indicators grouped by domain (science/technology, society, economy, environment, governance), referenced by the OECD (2025).
- **Theory of Change and logic models:** articulate the assumed causal chain from activities to outcomes, then test whether each link held. The Center for Theory of Change provides open-access guidance (Pateman et al., 2023).
- **ECSA Principle 9:** citizen science programmes should be evaluated for their scientific output, data quality, participant experience, and wider societal or policy impact (Robinson et al., 2018).

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From the field: In the CROPS Stakeholder Engagement Survey (2026), we asked respondents how they measure the success of stakeholder engagement. Responses varied widely: some cited participant numbers and data volume; others pointed to qualitative indicators such as the depth of participant involvement, the quality of feedback received, or whether stakeholder relationships persisted beyond individual project events. This diversity of approaches reflects both the context-dependency of evaluation and the lack of widely adopted standard indicators.

(D) Adapt based on evidence

Monitoring and evaluation are only useful if findings lead to action. Build in structured "reflection points" at regular intervals where the project team reviews engagement data and decides what to adjust.

Common adaptations based on monitoring findings include:

- Shifting recruitment channels when current channels are not reaching target demographics.
- Simplifying or adjusting data collection protocols when quality metrics indicate persistent errors.
- Increasing feedback frequency when retention rates drop.
- Reallocating resources from stakeholder groups that are not responding to those where engagement is gaining traction.
- Revising partnership terms with industry or institutional partners based on mid-term performance.

Adaptation requires honesty and a willingness to abandon strategies that are not working. Turcati et al. (2025) argue that the citizen science community needs a stronger "culture of error," acknowledging that failure is a normal part of project development and that sharing lessons from mistakes is as valuable as sharing successes.

2.6.3 Common Pitfalls

- **Measuring only what is easy to count.** Participant numbers and data volumes are easy metrics but poor proxies for engagement quality. Interviewees (2026) emphasised that genuine engagement is visible in behaviour (participants who stay late, return unprompted, recruit others), not in headcounts.
- **Evaluating only at the end.** If evaluation happens only at project completion, it is too late to make changes. Build evaluation into the project lifecycle from the start.

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- **Ignoring negative findings.** Evaluation results that reveal poor engagement or unexpected failures are the most valuable, because they point to areas for improvement. Suppressing or downplaying negative findings undermines the learning function of evaluation.
- **Failing to close the loop.** Evaluation that does not lead to visible changes in project practice signals to stakeholders that their feedback is not valued. Communicate what you learned from evaluation and what you changed as a result.

STEP 5 RECAP: Monitor, Evaluate, and Adapt

- Define engagement objectives at the project outset; make them specific and measurable across scientific, participant, and societal dimensions.
- Monitor engagement continuously using a mix of quantitative indicators (participation, data quality, communication reach) and qualitative insights (satisfaction, relationship quality).
- Evaluate outcomes periodically using established frameworks (Kieslinger et al., 2018; MICS; Theory of Change).
- Adapt strategies based on evidence; build in regular reflection points and be willing to change course.
- Embrace a culture of error: share lessons from what did not work alongside successes.

Read More…

- Kieslinger, B. et al. (2018). Evaluating citizen science. In Hecker et al. (Eds.), *Citizen Science: Innovation in Open Science, Society and Policy*. UCL Press. Chapter 6. – Three-dimensional evaluation framework.
- Koedel, U. et al. (2024). Enhancing citizen science impact in environmental monitoring. *Frontiers in Environmental Science*. – KPIs for data quality and engagement.
- Von Goenner, J. et al. (2023). Citizen science's transformative impact on science, citizen empowerment and socio-political processes. *Socio-Ecological Practice Research*. – Empirical study of CS impacts in Germany.
- OECD (2025). *Embedding Citizen Science into Research Policy*. OECD Publishing. – Monitoring and evaluation guidance; MICS framework.
- Turcati, L. et al. (2025). Citizen Science in Practice: How (not) to Fail? *Citizen Science: Theory and Practice*, 10(1). – Culture of error; lessons from French CS projects.

3 Recommendations

This chapter filters the preceding guidance into targeted recommendations for four key audiences. The recommendations draw on the full evidence base reviewed in this deliverable: the literature, the CROPS empirical data (surveys, expert interviews, and project mapping), and the practical experience accumulated during the CROPS project.

3.1 For CS Practitioners and Project Coordinators

1. **Treat stakeholder engagement as a core project activity, not a side task.** Allocate dedicated resources (time, budget, personnel) for engagement from project inception. Projects that treat engagement as an afterthought consistently underperform on participation, data quality, and impact.

2. **Invest in stakeholder identification and mapping before recruitment.** Use the structured approach described in Steps 1 and 2. Move beyond the usual suspects: identify intermediaries, potential opponents, and less visible stakeholder groups.

3. **Design for diversity from the outset.** Generic recruitment attracts homogeneous participants. Partner with intermediary organisations, remove practical barriers (language, accessibility, timing, cost), and publish demographic data to monitor your progress.

4. **Provide regular, honest feedback to participants.** This is the single most consistent recommendation across the literature and the CROPS empirical data. Communicate both successes and limitations. Transparency builds trust; silence erodes it.

5. **Plan for engagement at scale differently from engagement locally.** If your project is scaling, invest in intermediaries (local coordinators, trained trainers, institutional partners). Standardise research protocols but localise communication. Build coordination infrastructure (shared contact lists, communication templates, regular cross-partner meetings).

6. **Monitor and evaluate engagement systematically.** Define engagement objectives at the start. Track key indicators. Evaluate against them periodically. Adapt based on what you learn. Share lessons, including failures.

7. **Be cautious but not dismissive of industry partnerships.** Establish clear governance and data agreements before engaging. Protect open data principles. Explore alignment-based partnerships rather than transactional funding relationships.

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3.2 For Funders and Funding Agencies

1. **Fund engagement, not just data collection.** Citizen science budgets often allocate the majority of resources to research activities and technology, with minimal provision for stakeholder engagement, communication, and evaluation. Require and fund dedicated engagement work packages.

2. **Recognise that meaningful engagement takes time.** Three-year project funding cycles are often insufficient for building the relationships, trust, and institutional embedding that meaningful engagement requires (von Goenner et al., 2023). Interviewees (2026) reflected that co-created and policy-impactful citizen science may need six to eight years. Consider longer funding periods or follow-up mechanisms.

3. **Require evaluation of engagement alongside evaluation of scientific outputs.** Funding conditions should include engagement KPIs (retention rates, demographic diversity, stakeholder satisfaction) alongside traditional scientific metrics (publications, data volume).

4. **Support infrastructure that serves multiple projects.** Shared platforms (such as EU-Citizen.Science), training resources, and networks reduce the per-project cost of engagement and enable knowledge transfer between initiatives. Invest in these common goods.

5. **Create funding mechanisms accessible to non-academic actors.** Bureaucratic application procedures and strict eligibility criteria can exclude precisely the organisations (NGOs, community groups, small companies) whose participation enriches citizen science. Simplify access where possible.

3.3 For Policymakers and Public Authorities

1. **Appoint citizen science champions within public institutions.** Officials who understand citizen science and can advocate for it internally are the most effective bridge between projects and policy processes.

2. **Signal demand for citizen science data.** When public authorities indicate which data gaps citizen science could help fill, and in what formats, they provide projects with a clear pathway to policy relevance. The OECD (2025) recommends that policymakers explicitly map data needs to citizen science potential.

3. **Integrate citizen science into monitoring and reporting frameworks.** Where citizen science data meets quality standards, incorporate it into official environmental, health, or planning assessments. This gives projects a tangible impact and incentivises continued participation.

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4. **Support institutional capacity for citizen science.** Train civil servants in citizen science methods. Establish interagency working groups or communities of practice. The US Federal Community of Practice on Crowdsourcing and Citizen Science provides a model (Nascimento et al., 2018).
5. **Engage citizens in policy design, not only data collection.** Citizen science has the potential to inform policy formulation, not just implementation monitoring. Invite citizen science communities to contribute to consultations, strategy development, and regulatory reviews.

3.4 For Researchers and Academic Institutions

1. **Recognise citizen science in research assessment.** Promotion and tenure criteria should value citizen science activities, including public engagement, co-authored publications with citizen scientists, and open datasets. Institutional leaders have a role in driving this change.
2. **Invest in data quality from the start.** Design rigorous protocols, implement validation procedures, use metadata standards, and publish data management plans. Proactive data quality investment is more effective and less costly than retroactive quality repair.
3. **Build citizen science into teaching and training.** University courses on citizen science methodology, ethics, and communication can prepare the next generation of researchers for public engagement. Zourou and Tseliou (2020) provide nine concrete recommendations for higher education institutions.
4. **Participate in citizen science networks and communities of practice.** Isolation is a barrier to institutional learning. Engage with ECSA, national citizen science associations, and cross-project networks to share experience and adopt proven approaches.
5. **Publish citizen science findings in open-access formats.** Consistent with ECSA Principle 7, make data, metadata, and publications available to participants and the public. Open access is not only an ethical obligation; it is also a trust-building measure.

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4 Conclusions

This deliverable presents a step-by-step guide to stakeholder engagement for citizen science projects, with particular attention to the challenges of upscaling across geographic, institutional, and participatory dimensions.

Five core messages emerge from the evidence:

1. **First, stakeholder engagement is not optional; it is constitutive of citizen science.** Citizen science, by definition, involves the public in scientific research. How that involvement is designed, managed, and sustained determines whether a project produces trustworthy data, meaningful participant experiences, and lasting societal impact.
2. **Second, engagement must be differentiated by stakeholder group.** Citizens, researchers, policymakers, and industry actors have different motivations, constraints, and cultural norms. The guidelines presented in Step 3 provide tailored approaches for each quadruple helix group. Among these groups, citizens and researchers are well established as core participants, policymaker engagement is developing but under-invested, and industry/SME engagement remains genuinely underdeveloped with a thin evidence base.
3. **Third, upscaling changes everything about engagement.** What works at local scale, where personal relationships and informal coordination suffice, breaks down at national or transnational scale. Intermediaries, coordination infrastructure, and explicit governance arrangements become essential. The tension between standardisation (needed for data comparability) and local adaptation (needed for relevance and inclusivity) is perhaps the central challenge of scaled engagement.
4. **Fourth, trust is built through communication, transparency, and feedback, and it is easily lost.** The evidence consistently points to regular feedback on data use as the most important trust-building mechanism. Projects that invest in recruitment but neglect communication of outcomes undermine the very relationships they worked to build.
5. **Fifth, monitoring and evaluation of engagement remain weak points across the citizen science community.** Few projects define engagement objectives upfront, fewer track them systematically, and fewer still adapt their strategies based on evidence. Establishing a culture of systematic evaluation, including honest acknowledgement of what does not work, would represent a significant advance for the field.

These guidelines are not intended as a rigid prescription. Citizen science operates across a vast range of disciplines, geographies, institutional contexts, and scales. No single document can anticipate every situation. What these guidelines do offer is a structured process, grounded in evidence, that can be adapted to the specificities of each project. The 5+1 steps (identify your stakeholders, map and prioritise them, design tailored engagement strategies,

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communicate and build trust, and monitor, evaluate, and adapt) provide a framework within which context-specific decisions can be made with greater confidence and clarity.

The CROPS project will continue to generate empirical evidence on stakeholder engagement as its activities progress through 2026. These guidelines will be treated as a living resource, to be revisited and refined as new lessons emerge from the consortium's work with citizen science initiatives across Europe.

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5 References

1. Athavale, S. et al. (2021). *D4.1. Guidelines for local authorities on stakeholder engagement*. EXCITE Project (H2020, GA 892034). Austrian Energy Agency / EnEffect.
2. Bedessem, B. et al. (2023). Science knowledge and trust in science in biodiversity citizen science projects. *JCOM*, 22(01), A05. https://doi.org/10.22323/2.22010205
3. Bonney, R. et al. (2009). Citizen science: A developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.
4. Carayannis, E.G. and Campbell, D.F.J. (2010). Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? *International Journal of Social Ecology and Sustainable Development*, 1(1).
5. Collins, M. et al. (2023). Effective engagement while scaling up: lessons from a citizen science program transitioning from single- to multi-region scale. *Citizen Science: Theory and Practice*, 8(1). DOI: 10.5334/cstp.622
6. Drigkopoulou, I. et al. (2020). *Deliverable 5.1: Framework and Practical Guideline for Stakeholder Engagement.* UNITED Project (H2020 GA No. 862915).
7. Durham, E. et al. (2014). *The BiodivERsA Stakeholder Engagement Handbook*. BiodivERsA.
8. Fraisl, D. et al. (2022). Citizen science in environmental and ecological sciences. *Nature Reviews Methods Primers*, 2(1), 64. https://doi.org/10.1038/s43586-022-00144-4
9. Freeman, R.E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman.
10. Freeman, R.E. (2001). Stakeholder approach: A strategic analysis. In Hartman, L.P. (Ed.), *Perspectives in Business Ethics*. McGraw-Hill.
11. Golumbic, Y.N. et al. (2024). Editorial: Bridging citizen science and science communication. *Frontiers in Environmental Science*, 12, 1474221. DOI: 10.3389/fenvs.2024.1474221.
12. Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In Sui, D. et al. (Eds.), *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice*. Springer.
13. Hano, M.C. et al. (2020). Scaling Up: Citizen Science Engagement and Impacts Beyond the Individual. *Citizen Science: Theory and Practice*, 5(1). DOI: 10.5334/cstp.244.
14. Hecker, S. et al. (2018). Stories can change the world – citizen science communication in practice. In Hecker et al. (Eds.), *Citizen Science: Innovation in Open Science, Society and Policy*. UCL Press. Chapter 30.
15. Hecker, S. et al. (Eds.). (2018). *Citizen Science: Innovation in Open Science, Society and Policy*. UCL Press.
16. Heigl, F. et al. (2020). Co-Creating and Implementing Quality Criteria for Citizen Science. *Citizen Science: Theory and Practice*, 5(1): 23, pp. 1–11. DOI: 10.5334/cstp.294.

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Project funded by the European Union (GA 101131696). Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority (REA). Neither the European Union nor the granting authority can be held responsible for them.

17. Ibrahim, Y.Z. et al. (2025). Raising standards for stakeholder engagement in Nature-based Solutions: Navigating the why, when, who and how. *Environmental Science and Policy*, 163.

18. Kieslinger, B. et al. (2018). Evaluating citizen science. In Hecker, S. et al. (Eds.), *Citizen Science: Innovation in Open Science, Society and Policy* (pp. 81-95). UCL Press.

19. Koedel, U. et al. (2024). Enhancing citizen science impact in environmental monitoring: Targeted engagement strategies with stakeholder groups. *Frontiers in Environmental Science*, 12, 1375675.

20. Land-Zandstra, A., Agnello, G. and Gültekin, Y.S. (2021). Participants in Citizen Science. In Vohland et al. (Eds.), *The Science of Citizen Science* (chapter 13). Springer.

21. Latham, M. and Ceccaroni, L. (2020). D4.1: Guidelines and Recommendations Based on Best Practices for Achieving Societal and Policy-Maker Engagement. EU-Citizen.Science.

22. Maccani, G. et al. (2020). *Scaling Up Citizen Science: What Are the Factors Associated with Increased Reach and How to Lever Them to Achieve Impact*. JRC/European Commission.

23. Marques, D. et al. (2024). Citizen Science: Exploring the underlying dimensions of citizen engagement and value co-creation through the lens of marketing. *Biological Conservation*, 296, 110711. https://doi.org/10.1016/j.biocon.2024.110711

24. Mendelow, A.L. (1981). Environmental scanning: The impact of the stakeholder concept. In *Proceedings of the International Conference on Information Systems*, 407-418.

25. Mitchell, R.K., Agle, B.R. and Wood, D.J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, 22(4), 853-886.

26. OECD (2025). *Embedding Citizen Science into Research Policy*. OECD Science, Technology and Industry Policy Papers. OECD Publishing.

27. Osterwalder, A. et al. (2014) Value Proposition Canvas. Wiley, Hoboken. https://www.strategyzer.com/library/value-proposition-design-2

28. Paleco, C. et al. (2021). Inclusiveness and Diversity in Citizen Science. In Vohland et al. (Eds.), *The Science of Citizen Science* (chapter 14). Springer.

29. Pateman, R. et al. (2023). Citizen Science: Pathways to Impact and why Participant Diversity Matters. *Citizen Science: Theory and Practice*, 8(1): 50. DOI: https://doi.org/10.5334/cstp.569

30. Pettibone, L. et al. (2016). *Citizen Science for All: A Guide for Citizen Science Practitioners*. GEWISS/BürGEr schaffen WISSen.

31. Radicchi, A. et al. (2023). *Mutual Learning Exercise on Citizen Science Initiatives - Policy and Practice. Fifth Thematic Report: Scaling up citizen science*. European Commission.

32. Rasmussen, L.M. & Cooper, C. (2019). Citizen Science Ethics. *Citizen Science: Theory and Practice*, 4(1). https://doi.org/10.5334/cstp.235

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Project funded by the European Union (GA 101131696). Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority (REA). Neither the European Union nor the granting authority can be held responsible for them.

33. Reed, M.S. et al. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management*, 90(5), 1933–1949. DOI: 10.1016/j.jenvman.2009.01.001

34. Robinson, L.D. et al. (2018). Ten principles of citizen science. In Hecker, S. et al. (Eds.), *Citizen Science: Innovation in Open Science, Society and Policy* (pp. 27-40). UCL Press.

35. Rotman, D. et al. (2012). Dynamic changes in motivation in collaborative citizen-science projects. In *Proceedings of the ACM Conference on Computer-Supported Cooperative Work* (pp. 217-226). ACM.

36. Serrano Sanz, F. et al. (2014). *White Paper on Citizen Science for Europe*. Socientize Project (EU FP7).

37. Shirk, J.L. et al. (2012). Public participation in scientific research: A framework for deliberate design. *Ecology and Society*, 17(2), 29.

38. Skarlatidou, A. et al. (2019). The Value of Stakeholder Mapping to Enhance Co-Creation in Citizen Science Initiatives. *Citizen Science: Theory and Practice*, 4(1): 24, pp. 1–10. DOI: 10.5334/cstp.226.

39. Skarzauskiene, A. et al. (2023). Developing citizen science ecosystem: Critical factors for quadruple helix stakeholders engagement. *Journal of Enterprising Communities*.

40. Sprinks, J. et al. (2024). CROPS: changing the scale of citizen science towards the transnational level. *Proceedings ECSA-ÖCSK-2024*, 0101–0105.

41. Sprinks, J. et al. (2025). Supporting the Upscaling of Citizen Science to Address Global Challenges. *Citizen Science: Theory and Practice*, 10(1): 23. https://doi.org/10.5334/cstp.837

42. Turcati, L. et al. (2025). Citizen Science in Practice: How (not) to Fail? Citizen Science: Theory and Practice, 10(1). DOI: https://doi.org/10.5334/cstp.769

43. Varga, K. et al. (2023). How can Inclusive Citizen Science Transform the Sustainable Development Agenda? Recommendations for a Wider and More Meaningful Inclusion in the Design of Citizen Science Initiatives. *Citizen Science: Theory and Practice*, 8(1).

44. Veeckman, C. et al. (2019). *Communication in Citizen Science. A practical guide to communication and engagement in citizen science*. Scivil.

45. Von Goenner, J. et al. (2023). Citizen science's transformative impact on science, citizen empowerment and socio-political processes. *Socio-Ecological Practice Research*, 5, 11-33.

46. Zourou, K. & Tseliou, A. (2020). *Academia permeating society through Citizen Science: recommendations for Higher Education Institutions*. INOS Consortium (Erasmus+ Project 2019-1-DK01-KA203-060268).

5.1 Additional Publications Consulted and Analysed in Literature Review

The following publications were analysed as part of the systematic literature review for this deliverable. While not directly cited in the text above, they informed the overall evidence base and analysis.

47. Albagli, S. & Iwama, A.Y. (2022). Citizen science and the right to research: building local knowledge of climate change impacts. *Humanities and Social Sciences Communications*, 9. https://doi.org/10.1057/s41599-022-01040-8
48. Angelidou, M. & Psaltoglou, A. (2017). An empirical investigation of social innovation initiatives for sustainable urban development. Sustainable Cities and Society, 33, 113–125. DOI: 10.1016/j.scs.2017.05.016.
49. Aristimuno, M. & Honrado, A. (2024). Plan for stakeholder engagement. Deliverable 7.3, SINCRONY project (Grant Agreement No. 101132459). WeDo.
50. Bautista-Puig, N.; Orduna-Malea, E. (2024). How do citizens engage with science. Challenges and recommendations. *Profesional de la informacion*, v. 33, n. 6, e330601. https://doi.org/10.3145/epi.2024.0601
51. Bowser, A. et al. (2020). Still in Need of Norms: The State of the Data in Citizen Science. *Citizen Science: Theory and Practice*, 5(1): 18, pp. 1–16. https://doi.org/10.5334/cstp.303
52. Buhmann, K. et al. (Eds.). (2025). *The Routledge Handbook on Meaningful Stakeholder Engagement*. Routledge.
53. Fejzic, E.; Usher, W. (2025). Stakeholder engagement for co-designing European climate and energy research priorities. *Renewable and Sustainable Energy Reviews*, 215, 115574. https://doi.org/10.1016/j.rser.2025.115574
54. Fernandes, J.L. et al. (2019). Improving stakeholder engagement in local strategic planning – experience sharing based on Portuguese examples. Policy Studies. DOI: 10.1080/01442872.2019.1634186.
55. Fraisl, D. et al. (2023). The Contributions of Citizen Science to the United Nations Sustainable Development Goals and Other International Agreements and Frameworks. *Citizen Science: Theory and Practice*, 8(1). DOI: 10.5334/cstp.643.
56. Göbel, C. et al. (2019). How Does Citizen Science "Do" Governance? Reflections from the DITOs Project. *Citizen Science: Theory and Practice*, 4(1). DOI: 10.5334/cstp.204
57. Goodman, M.S. & Sanders Thompson, V.L. (2017). The science of stakeholder engagement in research: classification, implementation, and evaluation. *Translational Behavioral Medicine*, 7(3), 486–491. DOI: 10.1007/s13142-017-0495-z
58. Gudek, L., Rao, M., & Broerse, J. (2025). Stakeholder engagement in European research and innovation: An investigation into how and why EU R&I projects develop engagement tools. *Open Research Europe*, 5, 107. https://doi.org/10.12688/openreseurope.19907.1
59. Haklay, M. et al. (2021). Contours of citizen science: a vignette study. *Royal Society Open Science*, 8, 202108. DOI: 10.1098/rsos.202108.

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60. Humm, C. and Schrögel, P. (2020). Science for All? Practical Recommendations on Reaching Underserved Audiences. *Frontiers in Communication*, 5, Article 42. doi: 10.3389/fcomm.2020.00042
61. Jensen, E. et al. (2020). *D 4.2. Stakeholder Engagement Guidelines*. GRRIP Project (Horizon 2020, GA No 820283).
62. Kujala, J. et al. (2022). Stakeholder engagement: Past, present, and future. *Business and Society*, 61(5), 1136-1196.
63. Kujala, J., & Sachs, S. (2019). The Practice of Stakeholder Engagement1. In J. S. Harrison, J. B. Barney, R. E. Freeman, & R. A. Phillips (Eds.), *The Cambridge Handbook of Stakeholder Theory* (pp. 227–242). Cambridge: Cambridge University Press.
64. MacLeod, C.J. and Scott, K. (2020). Mechanisms for enhancing public engagement with citizen science results. *People and Nature*, 3, 32-50.
65. Osimanti, F., Ferguson, N. & Bøgh, S.A. (2022). *D4.1 – Stakeholder Engagement Plan*. HSbooster.eu (GA No. 101058391).
66. Petkovic, J. et al. (2020). Protocol for the development of guidance for stakeholder engagement in health and healthcare guideline development and implementation. *Systematic Reviews*, 9: 21. DOI: https://doi.org/10.1186/s13643-020-1272-5
67. Petkovic, J. et al. (2022). PROTOCOL: Guidance for stakeholder engagement in guideline development: A scoping review. *Campbell Systematic Reviews*, 18.
68. Ray, K.N. & Miller, E. (2017). Strengthening stakeholder-engaged research and research on stakeholder engagement. *Journal of Comparative Effectiveness Research*, 6(4).
69. Resnik, D.B. (2019). Citizen Scientists as Human Subjects: Ethical Issues. *Citizen Science: Theory and Practice*, 4(1). https://doi.org/10.5334/cstp.150
70. Roche, J. et al. (2023). Bridging citizen science and science communication: Insights from a global study of science communicators. *Frontiers in Environmental Science*, 11. doi: 10.3389/fenvs.2023.1259422
71. Sauermann, H. et al. (2020). Citizen science and sustainability transitions. *Research Policy*, 49. https://doi.org/10.1016/j.respol.2020.103978
72. Schutz, F. et al. (2019). Co-shaping the future in quadruple helix innovation systems. *She Ji: The Journal of Design, Economics, and Innovation, 5(2), 128–146*.
73. Starkbaum, J. et al. (2024). Responsible innovation across societal sectors: A practice perspective on quadruple helix collaboration. *Journal of Responsible Innovation*, 11(1).
74. Tauginiene, L. et al. (2025). Making responsible research and innovation meaningful in citizen science. *Science and Public Policy*, 52(3).
75. Thijs, J. (2023). *D6.1 – Stakeholder Engagement, Dissemination and Communication Plan*. URBANE Project (GA No. 101069782).
76. Vohland, K. et al. (Eds.). *The Science of Citizen Science*. Springer.

77. Watson, R. et al. (2017). Harnessing difference: A capability-based framework for stakeholder engagement in environmental innovation. *Journal of Product Innovation Management*.

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6 Annexes

6.1 Annex A: Stakeholder Identification Checklist

Use may this checklist at the start of your project (Step 1) to ensure you have considered a broad range of potential stakeholders.

Citizens and civil society: ☐ Individual volunteers (general public) ☐ Members of environmental or community NGOs ☐ Schools: teachers, pupils, school administrators ☐ Youth organisations ☐ Patient or health associations ☐ Amateur expert communities (naturalists, hobbyist groups) ☐ Neighbourhood or residents' associations ☐ Cultural and religious organisations ☐ Social enterprises and cooperatives ☐ Disability and accessibility advocacy groups ☐ Retired professionals ☐ Other: ___________________________	**Academia and research organisations:** ☐ Principal investigators and lead researchers ☐ Early career researchers and doctoral students ☐ University departments with relevant expertise ☐ Research institutes and centres ☐ National academies of science ☐ Citizen science networks (ECSA, national platforms) ☐ Libraries, museums, and science centres ☐ Other: ___________________________
Public authorities and policymakers: ☐ Local/municipal government: environment, planning, education, health ☐ Regional government officials ☐ National ministry officials (environment, education, research, health) ☐ Regulatory agencies (environment agencies, public health authorities) ☐ EU institutions (DG RTD, DG ENV, EEA, JRC) ☐ Elected representatives (councillors, parliamentarians) ☐ International organisations (OECD, UN agencies) ☐ Other: ___________________________	**Industry and SMEs:** ☐ Companies with aligned sustainability or CSR goals ☐ Technology providers (sensors, platforms, data analytics) ☐ Media organisations and science journalists ☐ Consulting firms with relevant expertise ☐ Sector associations (e.g. industry trade bodies) ☐ Social enterprises and impact investors ☐ Municipal utilities and service companies ☐ Other: ___________________________
Intermediaries (may span multiple categories): ☐ Teacher networks and education authorities ☐ Community health workers ☐ Local NGO coordinators ☐ Volunteer coordination platforms (SciStarter, EU-Citizen.Science) ☐ Science communicators and journalists ☐ Other: ___________________________	**Observations:**

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6.2 Annex B: Stakeholder Mapping Template (Power-Interest Matrix, Value Proposition CANVAS, RACI)

Instructions: For each identified stakeholder (or stakeholder group), assess their level of interest in your project and their level of influence over your project. Place them on the matrix. Use the quadrant labels to guide your engagement approach.

6.2.1 Power-Interest Matrix template:

	High interest	Low interest
High influence	**Key players** (Collaborate closely: involve in decision-making, regular engagement) *add*	**Context setters** (Keep satisfied: monitor, inform, consult as needed) *add*
Low influence	**Active supporters** (Keep informed: regular updates, invite feedback, recognise contributions) *add*	**Wider community** (Monitor: provide general information, be accessible) *add*

6.2.2 Stakeholder register template:

Stakeholder name / group	Interest (1-5)	Influence (1-5)	Quadrant	Engagement level* (inform / consult / involve / collaborate / empower)	Lead contact	Notes
…						

*Levels of participation proposed by *IAP2 Spectrum of Public Participation*

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6.2.3 Value Proposition Canvas for Citizen Science Stakeholder Analysis:

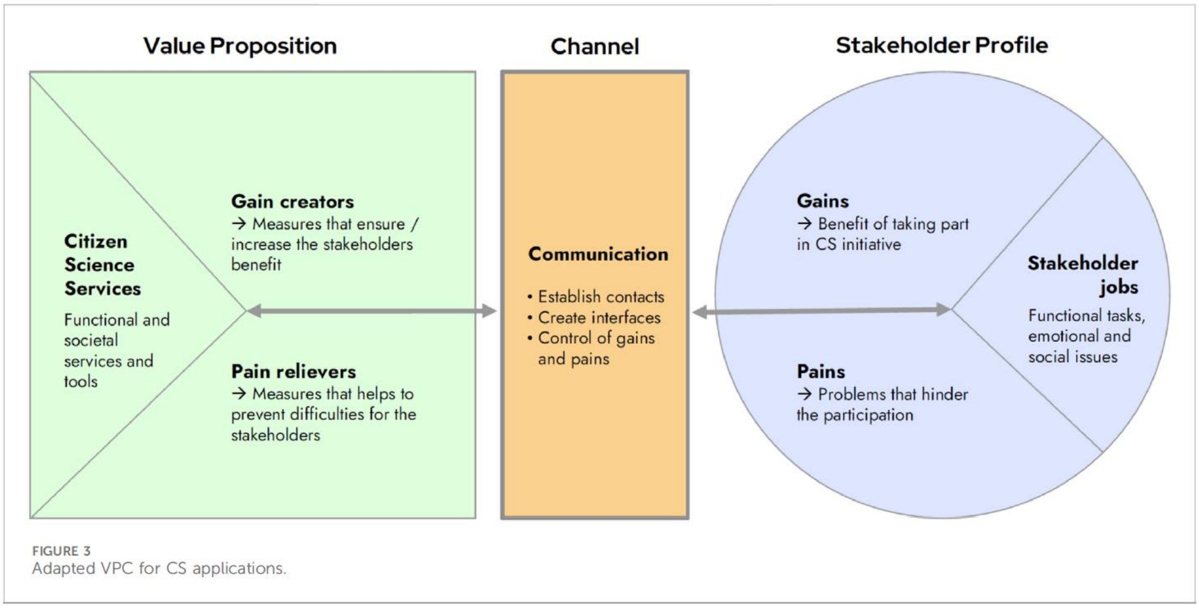

Figure 6.1. Value Proposition Canvas, proposed by Koedel et al. (2024), which is adapted from Osterwalder et al. (2014).

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Proposed templated based on Osterwalder et al. (2014) and Koedel et al. (2024):

Complete one canvas per key stakeholder group. Revisit the canvas at least once during the project to check whether the value proposition still holds.

Stakeholder group: ____

<table>
<tr><td colspan="2">STAKEHOLDER PROFILE
What the stakeholder needs (complete this section first, ideally with input from the stakeholder group itself or from intermediaries who know them well).</td><td colspan="2">PROJECT VALUE PROPOSITION
What your project offers this stakeholder (complete this section in second).</td></tr>
<tr><td colspan="2">Jobs to be done
What tasks, goals, or responsibilities does this stakeholder have that your project could relate to?</td><td colspan="2">Products and services
What does your project concretely offer this stakeholder? Data, training, networking, visibility, tools, policy evidence?</td></tr>
<tr><td>Gains
What outcomes or benefits would this stakeholder value? What would make their work easier, more visible, or more effective?</td><td>Pains
What frustrations, risks, or obstacles does this stakeholder face? What do they want to avoid?</td><td>Gain creators
How does your project help this stakeholder achieve their desired outcomes?</td><td>Pain relievers
How does your project reduce or eliminate the stakeholder's frustrations or risks?</td></tr>
<tr><td colspan="4">FIT ASSESSMENT
Complete this in last. Where the fit is weak, consider whether the project can adjust its offer, or whether this stakeholder group is not a priority at this stage.</td></tr>
<tr><td>Is there a clear match between what the stakeholder needs and what the project offers?
[Yes / Partial / No]</td><td>Which gains are strongest?</td><td>Which pains remain unaddressed?</td><td>What would need to change to improve the fit?</td></tr>
<tr><td colspan="4">Communication channel(s) most likely to reach this stakeholder:</td></tr>
</table>

6.2.4 RACI Matrix for Citizen Science Project Activities

RACI stands for Responsible (executes the task), Accountable (ultimately answerable for the outcome), Consulted (provides input before a decision), and Informed (notified after a decision). Assign one letter per cell. Each row must have exactly one 'A'.

Project name: ____

Project activity	**Coordination team**	**Stakeholder Name**	**Stakeholder Name**	**....**
Research question definition				
Data collection protocol design				
Recruitment of participants				
Training and onboarding				
Data collection				
Data validation and quality control				
Data analysis and interpretation				
Communication and dissemination				
Policy engagement				
Ethical review and data governance				
Monitoring and evaluation				
Financial and in-kind resource provision				

Key: **R** = Responsible **A** = Accountable **C** = Consulted **I** = Informed **–** = Not involved

6.3 Annex C: Engagement Planning Worksheet (by Stakeholder Group)

Complete one worksheet per key stakeholder group.

Stakeholder group:	
Key motivations (from Step 3 analysis):	
Key concerns or barriers:	
Engagement objective (what do you want to achieve with this group?):	
Engagement activities planned:	

Activity	Timeline	Responsible person	Resources needed	Success indicator

Communication approach (channels, frequency, key messages):	
Risks and mitigation:	

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6.4 Annex D: Communication Planning Checklist

Adapted from Veeckman et al. (2019) and Hecker et al. (2018, Chapter 30).This is a non-exhaustive list; other items might be added.

Communication Planning Checklist	Observations
☐ Objectives defined (recruitment, retention, awareness, policy influence, etc.)	
☐ Target audiences identified and characterised	
☐ Key messages developed for each audience	
☐ Communication channels selected (social media, email, website, events, media, print)	
☐ Frequency and timing of communication planned	
☐ Roles and responsibilities assigned (who creates content, who approves, who distributes)	
☐ Feedback mechanisms designed (surveys, forums, helpdesk, social media monitoring)	
☐ Storytelling elements prepared (participant testimonials, case studies, videos)	
☐ Language and accessibility reviewed (plain language, multilingual where needed, accessible formats)	
☐ Internal communication protocols established (especially in multi-partner projects)	
☐ Evaluation criteria defined (open rates, engagement metrics, satisfaction scores)	
☐ Budget allocated	

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6.5 Annex E: Monitoring and Evaluation Indicators

Adapted from Kieslinger et al. (2018), Koedel et al. (2024), OECD (2025), and CROPS empirical data.

Participation and engagement indicators: • Number of registered participants • Number of active contributors (defined threshold: e.g. at least one submission per month) • Retention rate (% of participants active in consecutive periods) • Conversion rate (% of registered users who make at least one contribution) • Geographic distribution of participation • Demographic profile (age, gender, education, socioeconomic status) compared to target population	**Data quality indicators:** • Total data points submitted • % of data points passing quality control • Spatial coverage (% of target area with data) • Temporal coverage (% of target time periods with data) • Inter-observer reliability (where applicable)
Stakeholder relationship indicators: • Number of active partnerships (by stakeholder type) • Frequency and quality of stakeholder interactions (meetings, workshops, consultations) • Stakeholder satisfaction (from periodic surveys) • Evidence of policy uptake (references to project data in policy documents, invitations to advisory roles)	**Communication indicators:** • Newsletter subscriber count and open rate • Social media reach and engagement rate • Website unique visitors and page views (especially results pages) • Media mentions
Impact indicators (longer-term, for periodic evaluation): • Publications arising from citizen science data • Datasets published in open repositories • Policy decisions informed by project data • Participant-reported learning outcomes • Participant-reported behaviour change • Community capacity built (new partnerships, institutions, networks)	

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6.6 Annex F: Glossary of Key Terms

Term	Definition
Citizen science	The active participation of non-professional scientists in scientific knowledge production, encompassing the full range from data collection to research co-design (Serrano Sanz et al., 2014; Shirk et al., 2012; Haklay, 2013).
Quadruple helix	An innovation model involving four societal actor groups: academia, industry, government, and civil society (Carayannis and Campbell, 2010).
Stakeholder	Any individual, group, or organisation that can affect or is affected by a project's objectives and activities (Freeman, 1984).
Stakeholder engagement	A purposeful process of interaction and dialogue with stakeholders to inform, consult, involve, collaborate, or empower them in relation to a project or decision (Durham et al., 2014; IAP2).
Upscaling (scaling)	The process of expanding a citizen science initiative beyond its original scope, encompassing four dimensions: scaling out (geographic replication), scaling up (institutional embedding and policy influence), scaling deep (increased depth of participant involvement), and scaling down (deliberate scope reduction for quality) (Radicchi et al., 2023; Sprinks et al., 2024).
Responsible Research and Innovation (RRI)	An approach to research governance that anticipates and assesses implications and societal expectations regarding research and innovation, with the aim of fostering inclusive, transparent, and accountable R&I processes (European Commission).
ECSA Ten Principles	A set of ten principles developed by the European Citizen Science Association to set out core elements of good practice in citizen science (Robinson et al., 2018).
FAIR data principles	A set of guiding principles for data management: Findable, Accessible, Interoperable, and Reusable (Wilkinson et al., 2016).
Intermediary	An actor who connects a citizen science project with a stakeholder group, such as teachers connecting projects with students, or NGOs connecting projects with community members.
Power-interest matrix	A stakeholder mapping tool that classifies stakeholders according to their level of interest in and influence over a project (Mendelow, 1981).
Contributory citizen science	A model in which scientists design the research and citizens contribute primarily through data collection (Bonney et al., 2009; Shirk et al., 2012).
Collaborative citizen science	A model in which citizens are involved in data analysis, interpretation, and/or dissemination alongside scientists (Shirk et al., 2012).
Co-created citizen science	A model in which citizens participate in all or most stages of the research process, including problem definition and research design (Shirk et al., 2012).

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6.7 Annex G: CROPS Stakeholder Survey

1. Project/initiative name: ________________

2. Please select one or more groups of stakeholders that you have interacted with in your CS project:
   - ☐ SMEs/Industry
   - ☐ Research Organisations
   - ☐ Civil society/Citizen groups
   - ☐ Policymakers and Public authorities
   - ☐ Other: _______________________

3. Could you further elaborate on your last answer?

4. Based on the stakeholder group(s) you have selected, what are the most effective engagement activities for each stakeholder group (e.g.: SMEs: networking events, scientific conferences, Civil Society: awareness campaigns, etc.)? If you have selected more than two groups, please specify which group you are referring to.

5. What challenges have you encountered when engaging stakeholders during the scaling of your CS initiatives? (Select up to 3)
   - ☐ Lack of funding
   - ☐ Communication barriers
   - ☐ Low stakeholder interest
   - ☐ Mismatched expectations
   - ☐ Difficulty in coordination between stakeholders
   - ☐ Lack of time or resources
   - ☐ Other: _______________________

6. How do you measure the success of stakeholder engagement in your project?
   - ☐ Surveys/Feedback from stakeholders
   - ☐ Participation rates
   - ☐ Stakeholder satisfaction
   - ☐ Project outcomes (e.g., policy changes, data use)
   - ☐ Other: _______________________

7. How would you define the roles and responsibilities of different stakeholders in your project? Select all that apply.

SME's and Industry	**Research Organisations**
☐ Provide technical support ☐ Offer resources and infrastructure ☐ Help with data analysis ☐ Other: _______________________	☐ Conduct scientific validation ☐ Lead data analysis ☐ Develop methodology ☐ Other: _______________________
Civil Society and Citizen Groups	**Policymakers and Public Authorities**
☐ Community involvement and participation ☐ Local knowledge and cultural insights ☐ Public outreach and education ☐ Other: _______________________	☐ Policy recommendations ☐ Provide funding or support ☐ Legislative or regulatory support ☐ Other: _______________________

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8. What kind of tools, elements or formats would make these guidelines practical and easy to implement in your work? Select all that apply.

☐ Step-by-step guides
☐ Case studies of successful stakeholder engagement
☐ Project Specific engagement templates (for example stakeholder engagement matrix and others)
☐ Other: ________________________

12.What are the most important lessons you have learned about stakeholder engagement in your citizen science project? If possible, please be specific.

13.If there is anything you would like to share with us or think might be useful for our research, please use this box. Thank you!

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6.8 Annex H: Interview Protocol (semi-structured interview script)

Introduction

- About CROPS project
- Goal of interview
- Consent request

Questions

1. Which stakeholder groups have you interacted with in the context of CS projects?
    - SMEs/Industry
    - Research Organisations
    - Civil Society/Citizen groups
    - Policymakers/Public authorities
2. From your experience, what are the most effective engagement activities for each stakeholder group?
    - SMEs/Industry
    - Research Organisations
    - Civil Society/Citizen groups
    - Policymakers/Public authorities
3. What challenges have you encountered when engaging stakeholders during the scaling of CS initiatives? *[Examples: Lack of funding, Communication barriers, Low stakeholder interest, Mismatched expectations, Difficulty in coordination between stakeholders, Lack of time/resources, …]*
4. How do you measure the success of stakeholder engagement in your project? *[Examples: Surveys/Feedback from stakeholders, Participation rates, Stakeholder satisfaction, Project outcomes (e.g. policy changes, data use), …]*
5. How would you define the roles and responsibilities of different stakeholders in your project?
6. What kind of tools, elements or formats would make stakeholder guidelines practical and easy to implement in your work?
7. What are the most important lessons you've learned about stakeholder engagement in CS projects?

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