Citizen science in France. Situation analysis, good practices & recommendations

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Citizen science in France

Situation analysis, good practices & recommendations

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[citizen science:
NOUN. The process of producing scientific knowledge in which non-scientific or non-professional actors — whether individuals or groups — actively and intentionally participate.
Related expressions: participatory science, participatory research, crowdsourcing, etc.]

Note — This document is a translation of a French report entitled "Sciences participatives" (literally "participatory sciences"). In French, this expression covers the wider scientific systems through which researchers and citizens work together. In English, the most frequently used equivalent is "citizen science", which is why we have opted to use this term.

Overview of the complete report

www.sciences-participatives.com/en

Booklet 1: Situation analysis & methods
Booklet 2: Good practices for project leaders
Booklet 3: Recommendations for institutions

Appendices

Citizen Science

The process and results of the mission

More than 150 people were interviewed and responses from 600-plus internet users were collected to create this report. The result is an impressive set of data that offers considerable new insights (www.sciences-participatives.com/en).

February 2015
Mission statement

Scientometric study
Reviews the literature that refers to citizen science and outlines the field's evolution from 1975 to today, in France and around the world with regards to volume, growth rate, scientific disciplines and practices.

Bibliographic analysis
Based on a large selection of literature, structured by major currents. Suggests mapping for each current: organisational structures, objectives, participant profiles, historical and bibliographical references.

Workshop with researchers and associations
The experiences of 14 researchers and individuals involved in associations were used to create a precise typology of the main factors leading to a project's success or failure.

Workshop with experts
The perspectives of 12 academic experts were combined to characterise the field of citizen science and its major aims and stakes.

Public discussions
Ideas were gathered from 90 French and foreign participants working in a range of areas – from scientific to political, economic, associative and educational – who met for public discussions. These ideas helped shed light on the points of convergence and divergence with regards to citizen science, the role of the different actors involved and good practices and recommendations to prioritise.

Online inventory and survey
The quantitative and qualitative data analysis that followed a broad online survey (responses from more than 600 individuals, 10 group dossiers submitted) makes it possible to identify and consider the various views on the opportunities, obstacles, risks and drivers associated with citizen science; to describe the existing French projects; and to determine good practices and recommendations.

February 2016
Report


Citizen
Science
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Citizen science in France

Report summary

Citizen science in six points

01 Balancing tradition and modernity

The idea of citizen science has existed for centuries. It has changed along with society and the way research is organised and its development has accelerated in recent decades.

16th century

Naturalists are pioneers of the field and are part of a privileged elite.

20th century

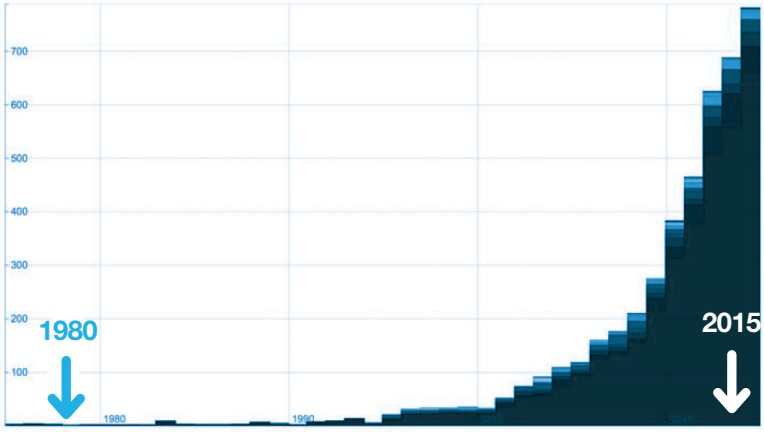
The practice opens to the general public and addresses new themes: psychology, health, education, workplace organisation, environment.

Today

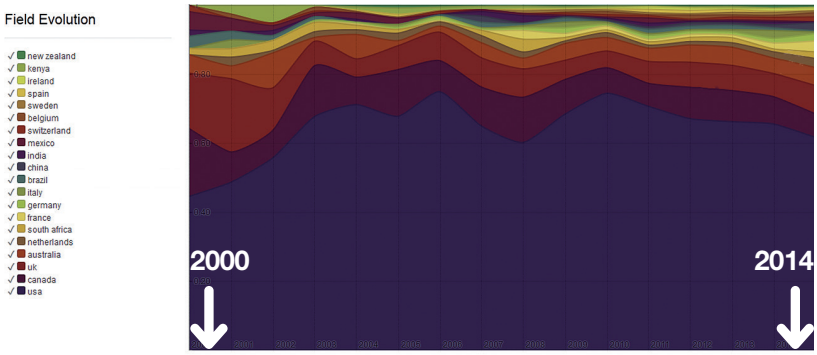
Most scientific disciplines call on citizens to participate. The rise in participatory democracy as well as national and European policies that open up research activities promote the development of science citizen.

The field's role is modest in terms of scientific production but its development has accelerated in recent years and its societal impact has soared. France is currently ranked seventh in the world and third in Europe among countries publishing on the topic.

Evolution of the number of citizen science publications in the world



Share of publications in citizen science by leading countries



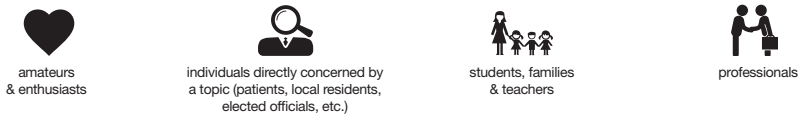
This development is likely to continue due to the combined effect of technological progress (especially that related to the digital revolution) and socio-political shifts (ambitions of being involved in citizen science, acknowledgement of citizen skills, recognition of the complex challenges, diversification of research actors and funding sources).

02 A range of initiatives and practices

Citizen science is a highly diverse field in terms of its various disciplines and research topics, actors working individually or collectively, and output and results.

Numerous disciplines and research topics adopt a citizen science approach:

In addition to the researchers, teacher-researchers, engineers and technicians who work in these different disciplines, citizen science involves a wide range of actors who can participate individually or as part of a group (associations, companies, regional authorities, etc.):



Results can take various forms:

03 Pitfalls on the horizon

While citizen science can generate original results and create strong connections with communities, there are also risks – in terms of methodologies, professional ethics and fairness – to consider to avoid or limit them.

Citizen science has already achieved some remarkable successes, such as the *Galaxy Zoo* platform and the serious game *Foldit*, which have given amateurs a chance to learn about new galaxy classifications and determine the structure of proteins linked to HIV transmission. These projects generated unique scientific results thanks to broader observation and analysis capabilities, wider observational coverage, and a considerable range of skills that are mobilised.

Citizen science also promotes connections with communities in different ways, such as resolving problems through stakeholder involvement or giving citizens a better understanding of the scientific approach and encouraging them to take ownership of a project.

However, there are some considerations to keep in mind in terms of various risks. Risks may be methodological (protocol and data quality, comprehensiveness of experimental or observational plans, etc.); professional (rigour, researcher independence, etc.); or relate to issues of fairness (mutual respect of partners involved, recognition of their contributions, etc.).

04 Staying the course through mutual respect

Leading citizen science projects and seeing through their development over time implies following six key principles that apply to both the scientific community as well as civil society actors.

1. **Guarantee a rigorous and open scientific approach,** from setting research objectives and creating experimental and observational protocols to managing data and publishing results.
2. **Ensure mutual respect and recognition of the various actors involved,** making sure to avoid any type of manipulation.
3. **Maintain motivation throughout the project** by adapting processes and methods to the various actors' individual needs and expectations.
4. **Adapt to the different timelines of the various actors,** taking into account their availabilities and ensuring the long-term viability of the citizen science initiative.
5. **Ensure effective and efficient resource management** by seeking out new funding sources as well as through training activities that will enable optimum collaboration between actors.
6. **Ensure effective governance and organisation** by clarifying the roles, rights and duties of the various participants and maintaining strong communication throughout the project.

The development of citizen science is an opportunity not only for students and teachers but for scientists as well thanks to the strong academic connections it creates. Because the educational environment has its own particular considerations, projects involving students should also include a seventh principle.

7. **Take into account the specific considerations of the educational environment:** scheduling, student ages, the role of teachers and national educational staff, etc.

05 Good practices for smooth sailing

Following the major principles identified above during a project implies sharing good practices. While several guides already exist for project leaders, they are adapted to thematic areas or specific disciplines. Because citizen science is such a diverse field, it would be impossible to create a general guide that covers all topics in detail. However, good practices can be built around a few major principles.

1. **Designing the research project:** identify the research issue and aims; verify whether a citizen science approach is appropriate; characterise the needs, necessary resources and possible constraints.
2. **Connecting with partners:** How do you find and choose them? How do you understand their aims and ensure the strength of their commitment?
3. **Project governance:** How do you structure the project from the start to ensure its long-term viability?
4. **Design and implementation of protocols:** When do you discuss them and with whom? What form should they take, how should they be written, how should they be shared and what kind of support is needed to implement them?
5. **Project leadership:** How do you maintain and recognise participant commitment? How do you fund the project? At the end of the project, how do you evaluate it and the related citizen science initiative, and how do you capitalise on the initiative?
6. **Data:** How do you optimise data collection and use? How do you ensure data protection, access and exploitation?
7. **Results:** How do you distribute, exploit and ensure the impact of results, both for participants and those outside this circle?

Because the educational environment has its own particular considerations, additional good practices should be included.

8. **Educational stakeholders (students, teachers, administrators):** How do you train them? How do you engage them and prevent exclusion or self-censure of certain students?
9. **Partners within the school:** How do you build the project together? How do you plan for administrative constraints?
10. **Educational projects:** How do you fit the project into an educational programme? What kind of support will you need? How can you promote it and capitalise on it when the project is finished?

06

Supporting the development of citizen science

Beyond simply following the major principles and good practices of each research project, developing citizen science requires forming a comprehensive set of practices; identifying and adapting technical, financial and regulatory means; and the broad involvement of the educational community. This institutional mobilisation applies to research operators (organisations and universities), funding agencies, and regional and public authorities.

1. **Form a comprehensive set of practices that are open and active:** unite actors around shared principles by creating a citizen science charter and encouraging new forums for exchange and action; recognise and maintain participant commitment – both researchers and non-researchers, in their respective spheres; support training activities and research that support citizen science, especially in the areas of digital science and technology and social sciences.
2. **Adapt the technical, financial and regulatory resources:** manage and coordinate citizen science development at the national level (network, internet portal); facilitate funding of projects by adapting project evaluation and selection criteria and diversifying funding sources; promote the integration of participation in the strategies of research organisations and their partners; create or mobilise competent bodies to ensure project quality and implement systems to share the benefits of citizen science projects.
3. **Foster broad involvement of the educational community:** promote initiatives by recognising and engaging teachers involved in citizen science projects; support and perpetuate the initiatives; make the most of the potential for curricular innovation.

Citizen science in France

Focus

The stakes: benefits, risks and perceived expectations

1 Proven and expected benefits

Benefits for knowledge and societal impact

Existing literature on citizen science identifies two types of benefits[1]

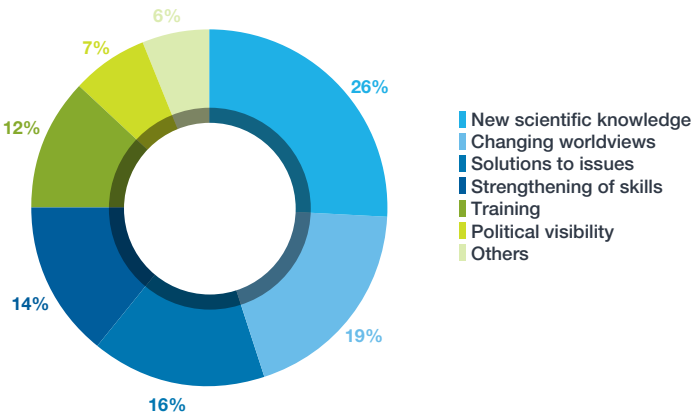
- Benefits for knowledge, confirmed in such fields as the environment, astronomy, biology, mathematics, archaeology and urban studies, and especially for:
  - Reduced costs: participation is generally motivated by the desire to contribute to society rather than receive financial compensation.
  - Time savings: a large number of contributors can participate simultaneously when projects require simple and distinct tasks.
  - Mobilisation of highly diverse skills and extremely specialised knowledge.
  - Engagement of communities at different times and locations, enhancing data observation and collection.

- Social or societal benefits:
  - Advantages for education; with regards to improving relationships between the scientific community and society; and encouraging people to take ownership of the scientific approach (with active participation, games, and simulation as favoured means).
  - Ambitions at the citizen level: the European Citizen Science Association (ECSA)[2] states that "citizens create knowledge, knowledge creates citizens".
  - Resolution of identified problems and strengthening the skills of involved actors.

The benefits that came to light through our survey are different to those expected from a non-participatory research programme or one that falls outside typical evaluation frameworks. Benefits are characterised in terms of data volume or acquired knowledge, the communication dynamic between actors and the dissemination of results. The share of observed benefits is interesting: while "new scientific knowledge" is the most frequent benefit, it accounts for only a quarter of the cited benefits. "Changing worldviews" or, in other terms, a shift in how a problem is presented, is a significant effect that is not identified in the existing literature. A deeper analysis of this benefit should be undertaken given the related stakes.

Proven benefits of French projects

Source: Online consultation, Appendix 8[3] (85 responses to this question)



1. Sauermann H., Franzoni C. 2015. Crowd science user contribution patterns and their implications. PNAS 2015 112 (3) 679-684: http://bit.ly/2elQgqr

Chevalier, J.M., Buckles, D.J. 2013. Participatory Action Research. Theory and methods for engaged inquiry, London: Routledge: http://bit.ly/2elRfae

2. http://bit.ly/2a2dh7V

3. Complete report: http://www.sciences-participatives.com/en

Extremely diverse intentions and output

According to our survey, the intentions that lie at the heart of citizen science projects are mainly concerned with the need for knowledge or expertise. The responses we gathered illustrate these two ambitions:

- Production of usable knowledge:
  - For scientific research: “increased data collection capabilities”, “multiple analyses (for research or creating indicators)”, “willingness to work with the general public and involve users” “innovation and regulations”, “new management tools”, “evaluation of technical systems and new designs”.
  - For civil society: “education and reinforcement of social connections (creation of knowledge ‘outside schools’, awareness building, accessible education)”, “shaping new policies”, “new benchmarks and indicators”.

- Impact on public policies and mobilisation to address needs: “citizenship and consideration of disadvantaged populations”, “transmission of an affinity for science”, “cooperation between groups and recognition of actors”, “response to pressing social issues requiring rapid acquisition of knowledge (societal or scientific challenges)”, “mediation of conflicting uses”, “supporting an innovative or emerging activity”, “analysis of a new technology”, “improved ergonomics”, “response to a lack of means from state-run agencies (health, environment, etc.)”

Output derived from these initiatives combine traditional and very specific or innovative formats[4] :

- Traditional means are often used when the project objective is to “collect data”: in descending order from our survey: “publications”, “databases”, “inventories and mapping”, “training programmes”, “thesis”, etc.
- However, they tend to be more original in other situations: “methodological guide and handbook”, “film”, “observatory”, “inventories and monitoring shared with citizens”, “press campaign”, “management scenarios”, “regulatory action plans”, “reports to administrations”, “medical devices”, “concerted development plan”, “tourism development strategy”, “creation of niche markets”, “guide to analyse employment situations”, “implementation of auxiliary employment”, “negotiation platform”, “creation of products and services in companies”, etc.
- Lastly, they are often more generic rather than scientific or specifically applicable to related stakes: “sharing of views”, “creation of trusted groups”, “change in actor behaviour”, etc.

4. Details on output type based on project expectations or objectives; evaluation criteria for expected impacts, unexpected impacts and benefits can be found in the Summary of the online consultation, Appendix 8.

Complete report: http://www.sciences-participatives.com/en

2 Risks and difficulties project leaders should be aware of

The proven or expected benefits of citizen science projects must not overshadow the challenges and risks. By being aware of these issues, project leaders can incorporate things to watch out for in the design and implementation of projects and improve their overall practices.

Collected responses showed that the development of specific methods and protocols, the adaptation of tools, participants' involvement in processes, and data management and analysis (standardisation, validation, analysis, etc.) can often be improved upon. With regards to the risks associated with citizen science, many of those surveyed stated that all sciences are subject to risks and that citizen science should not be singled out. Nevertheless, the survey did bring to light several recurring issues:

- Difficulties in keeping actors engaged over the long term (researchers, amateurs, general public).
- Difficulties in collecting data, especially over long periods of time.
- Difficulties in analysing and interpreting collected data given their diverse nature and sources of interference
- Difficulties related to project management when many actors – with very different logics, values and action frameworks – are involved.

Most of these Difficulties can be overcome if those involved in citizen science have the necessary tools and are able to build a range of adequate skills. These points have been developed based on the online survey results.

3 Risks for bias and disillusionment for science and society

Both perceived and real risks depend on observers' experiences and beliefs, the fields of application and the type of participation (active or passive, paid or voluntary). Our survey showed that the main perceived risks for citizen science relate to "science as an institution" (29.2%): these risks are chiefly cited by scientists who have "little" or "some" involvement in citizen science initiatives. Scientists who have "significant" involvement perceive the most risks related to "data quality" (28.6%) and risks "for citizens". It is interesting to note that in all cases, only 10% of respondents felt that there were "no more risks" associated with this approach than with another. Being aware of these issues will make it easier to limit their effects.

Concerns about losses to researcher autonomy and diminished data quality

Concerns, of which there are many, are first and foremost directed at the institution of science: manipulation of research ("directing research towards desired outcomes", "bias skewed towards weak consensus and short-term aims", "devaluation of basic research", "politicalisation", "risk of lobbying", "spread of relativistic attitudes", "pseudo-science", "difficulties in managing conflict regarding controversial themes", "representational issues"), banalisation of science and devaluation of researchers' work ("cheap labour", "part-time researchers pretending to do science").

Concerns are also related to the quality of data produced ("loss of objectivity or scientific rigour", "hurried data production", "bias", etc.), a lack of means ("overworked researchers", "tedious tasks", "competition with other public research missions", "high risk of failure", etc.) or the desire of scientific organisations to use citizen science as an "institutional communication tool".

These results can be explained by the many types of involvement and experiences in citizen science projects. The analysis reveals a strong correlation between opinions on the risks and benefits of citizen science for research and respondents' experiences: those who were most involved were more aware of both risks and benefits.

A study by Inserm[5] in the field of medical research recently looked at how researchers view citizen science. The 651 responses to an online questionnaire brought to light four types of researchers: those who are "highly involved" (18%), who generally have experience cooperating with associations and are convinced of the mutual interest of maintaining relationships between research and associations; "pragmatic" (29%), who have a fairly positive view of associations for clinical research, but less so for basic research; "reluctant" (27%), who have a rather negative view of relationships with associations, given that they are often influenced by pharmaceutical companies and that these relationships can threaten their research freedom and conditions; and "detached" (26%), who tend to be significantly younger and have no firm opinion on these relationships.

Fear of exploiting citizens

Some of our survey respondents also mentioned risks for involved citizens: "disillusionment due to overly high expectations", "exploitation", "demotivation" and "problems related to intellectual property and use of results".

How roles are assigned to participants (professional scientists, amateurs, curious citizens, etc.) is also a source of concern. Two views discussed during our workshops had their respective detractors: "participation blurs the notions of hierarchy and encourages equality among stakeholders", and "citizens participate in research, [but] scientific production remains a specialised field."

5. Bungener et al. 2014: http://bit.ly/2dOcJRb

4 Expectations

Although the previously identified risks have not discouraged actors' involvement in citizen science projects, more than a hundred individuals shared suggestions to improve project impact and efficiency. Depending on the project, the priorities can be determined based on feedback and declared expectations. By analysing these points, several suggestions according to seven major principles can be made.

1 Ensure a rigorous scientific approach

Actors expressed strong expectations regarding the management and support of citizen science projects with a view to making the initiatives more reliable:

- **"Updating standards and initiatives for high-quality project support"** is the main area of focus based on survey respondents (37%). The most frequently suggested tools are "charters, good practice guides" or "certification programmes". They also mentioned the "professional abilities" of all participants (16%), while scientists who are "highly" or "somewhat" involved underlined the need to "do more research on citizen science".

- **Supporting digital science and tools, as well as their further development, is necessary** because a lack of "appropriate platforms" and "high-quality statistical processing" is the second obstacle (20%) to the development of citizen science cited by respondents. In addition to material means (storage, collection and aggregation of contributions), digital science provides work distribution tools and cooperative organisational set-ups (task allocation, synchronisation, validation, etc.) and support for reliable collection (statistical data and field observations, interactive annotation of data sets by labelling or image tagging, recognition of characters or identification of people in a scene, explicit or implicit feedback on use via qualitative evaluation of scenes or objects, the frequency at which a resource is accessed, how long a page is viewed, etc.) and analysis (big data, data mining techniques, algorithms that automate statistical data validation, etc.).

- **The issue of ownership, use and application of data** should be clarified according to 9% of respondents, who feel that this is a major risk that can affect a project's performance.

Ensuring the scientific rigour and quality of citizen science approaches depends especially on:

1. **Clarifying the research objectives**
2. **Identifying a problem and developing a common language**
3. **The quality and transparency of the protocol**
4. **The adaptation of tools and equipment**
5. **The reliability and reproducibility of data**
6. **Assistance provided to participants**
7. **The respect of scientific ethics**
8. **The adaptation of digital tools for data management**
9. **The opening and sharing of data and results with stakeholders' agreement**

2 Ensure mutual respect and recognition of the various actors

Project actors have expectations regarding recognition of their respective roles and contributions as well as the respect for their private lives. They apply to both the working group level as well as the institutional level during the project and during the application of the research results:

- **Better comprehensive recognition and a balance of expertise** are expected, with some observers citing mistrust between scientists who may come off as "exploitative" and project partners as "manipulators". The "politicising of actors" and sticking points due to "their cultural differences" were cited by 12% of survey respondents. To alleviate this issue, participants expect actions that will ensure "equal partnerships" (17%) and the creation of "new forms of acknowledgement and ownership as well as showcasing of researchers' investments" (8%). Several respondents pointed out the need to "appropriately regulate the issue of participant remuneration" to avoid conflicts.
- **Better academic recognition** could help prevent citizen science-based output from being "marginalised and generally unrecognised by the academic community", thereby impacting funding and the assessment of project leaders' careers.
- **Guarantees with regards to data use are expected by participants,** in keeping with their values, and especially concerning:
  - Passive data collection – especially for health – via connected devices is becoming more widespread: sensors encroach on personal boundaries. While the use of personal data for research purposes can be justified when people give their explicit and informed consent, their sale or distribution would be problematic. The exceptional nature of personal data hat are collated and processed for research purposes requires researchers to follow explicit moral obligations.
  - Collecting social knowledge by professionals is promoted by the necessary division of tasks in the citizen science initiatives, which can lead to genuine unease among participants who may find such divisions unfair.

Ensuring the mutual respect of the various actors involved in citizen science approaches implies that their skills, activities and roles are complementary and that they are explicitly communicated and recognised as such. There is no need for actors to turn away from their respective professions or refuse to share their own expertise, but simply to clarify the aims of collaboration to achieve objectives that are in everyone's best interest. As such, it may be necessary for actors' to acquire new skills that will facilitate this collaboration. The respect of knowledge and complementarity of roles can be ensured by:

1. **Not manipulating participants (researchers, citizens, etc.)**
2. **The respect for diversity and otherness of skills and expertise**
3. **Including all actors in decision-making processes**
4. **Crediting participants in publications**
5. **Recognition of citizen science research by the scientific community and in researchers' careers.**

❸ Maintain motivation throughout the project

The general public has a very favourable opinion of citizen science: 93% of survey respondents indicated they were willing to participate. It should come as no surprise that scientists who are "highly" and "somewhat" involved are the most willing to be involved. There are two main motivations: "sharing knowledge" and "opening research to interested stakeholders" (38.6%) and optimising research programmes (31.4%; "acquiring of data at a low cost", "superior quality of knowledge output", "annotation work").

However, stakeholders are not as available or committed: "the limited availability of research stakeholders" was cited as the main obstacle to developing citizen science programmes (23.7%), followed by "the lack of tools or appropriate skills" (20.1%). "The lack of continued involvement by non-professionals" was cited by 13% of respondents ("loss of motivation, "citizen fatigue", "lack of recognition for their contributions") and "disillusionment compared to overly optimistic expectations". Another 10% would like to see dedicated organisations to sidestep such issues ("intervention by specialised organisations in citizen science projects", "inter-institutional partnerships", etc.). The existing literature also notes that there is a risk

for certain communities to simply be a research subject or to be "over studied", thereby contributing to a loss in motivation.

Expectations in terms of motivation, given that the various actors have expressed a genuine interest in citizen science initiatives, consist in encouraging long-term commitment through:

- **"Stronger incentives for researchers"**, which is the main driver mentioned (19.7%), followed by "actions ensuring quality and tools".

Communication actions received only marginal attention.

- **Consideration of the amount of interest in participating before launching project.** The workshop with experts showed that the main goal is to clarify an issue or problem rather than to create tasks for a community that may lose interest.
- **Developing entertaining tools** that are also intellectually stimulating for the task at hand, and fostering the stimulation generated by the desire to contribute to advancing science or the thirst for knowledge, as indicated by those participating in our workshop.

Maintaining motivation throughout the project is particularly dependant on:

1. **Adapting expectations to participants' ages and availability.**
2. **Adapting the project to the level of interest shown by participants.**
3. **The recognition of individual and collective contributions.**
4. **The use of new technologies suitable for the target audiences.**
5. **Adapting to innovative and entertaining educational approaches.**

4 Adapt to the different timelines of the various actors

Actors' expectations related to timeline differences concern both flexibility in implementing the project as well as adapting to their availabilities. In our survey, the limited availability of the scientific community was the leading obstacle to developing citizen science (24%). There are a number of very different reasons behind this concern: "conservatism", "distrust of research environments", "over-solicitation of researchers", "pressure to publish" and "evaluation conditions".

Adapting to different timelines is an inherent concern with citizen science programmes, because those involved do not have the same availabilities, with some participating as part of their work and others during their free time. Certain project leaders explain that research could only be set up outside of working hours to not interfere with their jobs. In contrast, programmes that involve schools must work around class and teacher schedules. Depending on the project, research programmes for scientific organisations and their funding processes are much longer than for most associations, which hope to see rapid results and impacts.

Adapting to the different timelines of the various actors affects several aspects of citizen science:

1. **The timelines of scientific processes, participants and funding.**
2. **The availability of different actors and the coordination of their schedules.**
3. **Programme longevity and capitalisation on the results after the project has concluded.**

5 Ensure effective and efficient resource management

Actors expressed several types of needs in terms of resources:

- **With regards to inadequate resources, the leading responses were "financial means", "human resources", and "available time".** Additionally, the analysis of factors that contributed to failure cited in feedback collected showed that "an overly ambitious project compared to institutions' and partners' investment capabilities" was frequently noted, especially for programmes where participants were involved after the data collection phase (which are therefore more costly). Funding needs are also dependent on partners; having access to the necessary equipment, for example, is rarely a problem when institutions or companies collaborate on a project.
- **Being open to alternative funding sources**, such as *crowdfunding*, is an oft-cited expectation, especially given that our workshop of experts considered citizen science programmes "that introduce new economic models an opportunity".
- **A major expectation deals with funding agencies**, which are, according to survey responses, hesitant to support projects "without a guarantee of results, the duration of the citizen science research, and the role of a researcher committed to a citizen science programme". This observation appears to be more problematic for small organisations. Highly technical or inadequate calls for tender were also cited.
- **The "training and professionalisation of researchers and citizens"** in citizen science was the second driver cited to limit programme risks (16%). Scientists especially must "have expertise in the field, be able to communicate that knowledge and support change". Building participants' capacities during the programme and allowing them to enter data and research results directly are also general aims of citizen science approaches.

Ensuring effective and efficient management of shared resources depends especially on:

1. **Adapted, long-term management of time and human resources.**
2. **The use of financial resources by segment.**
3. **New types of funding.**
4. **The recruitment of existing communities and local actors.**
5. **Tools and programmes for training, mediation and management.**

6 Ensure effective governance and organisation

Expectations expressed by the different actors are focused on two aspects, although issues of governance and organisation are quite broad:

- **The quality of project management:** the second driver (17%) cited to reduce obstacles to developing citizen science is "project quality". Actors expect "[more] equal partnerships by involving amateurs from the start", "agreements to share the benefits", "promotion of open science", "more time to create partnerships", "more feedback and transparency from scientists with respect to participants" and "process certification".
- **The publishing and use of results was more important than communication** (also 17%) : needs are as important as the means, which must be adapted to the relevant audiences ("application means linked to relevant audiences to achieve concrete improvements in quality of life and social participation", "shorter deadlines to maintain partner involvement"). The "willingness to showcase certain actors or sponsors over impacts", "paid-only accessibility of certain scientific resources" which prevent distribution and recognition of results, and "the concordance of distribution with the end of the project – and therefore funding" must all be taken into consideration.

Ensuring effective governance and organisation depends on:

1. **Clarifying the scope of the various participants' roles.**
2. **Clearly distributing ownership and benefits between participant categories.**
3. **Involving actors on the ground in governance processes.**
4. **Including policies in projects that require them.**
5. **Frequent communication between stakeholders.**
6. **Recognition of results, especially through communication.**
7. **A detailed evaluation of the programmes and results.**

7 Stimulating the development of citizen science in the educational environment and taking account of its specific considerations

Citizen science presents a real opportunity for students as it is an original way to teach the scientific approach, provides insight into research professions, fosters engagement in a concrete and uniting project, exposes students to an inter-disciplinary approach (science, French, English, communication), etc. The French education system has many strengths to further students' development with its tightly knit academic world, a high number potential participants (students), the presence and skills of teachers and consistency in their jobs, and young peoples' curiosity. These advantages must be balanced against other specific considerations that any programme should take into account: student ages and the natural asymmetry of the school environment; the educational aim of the project and its inclusion in school curricula; constraints related to the school year schedule, students' course loads and limited mobility; the risk of confusion between (entertaining) activities to increase interest in science and citizen science projects.

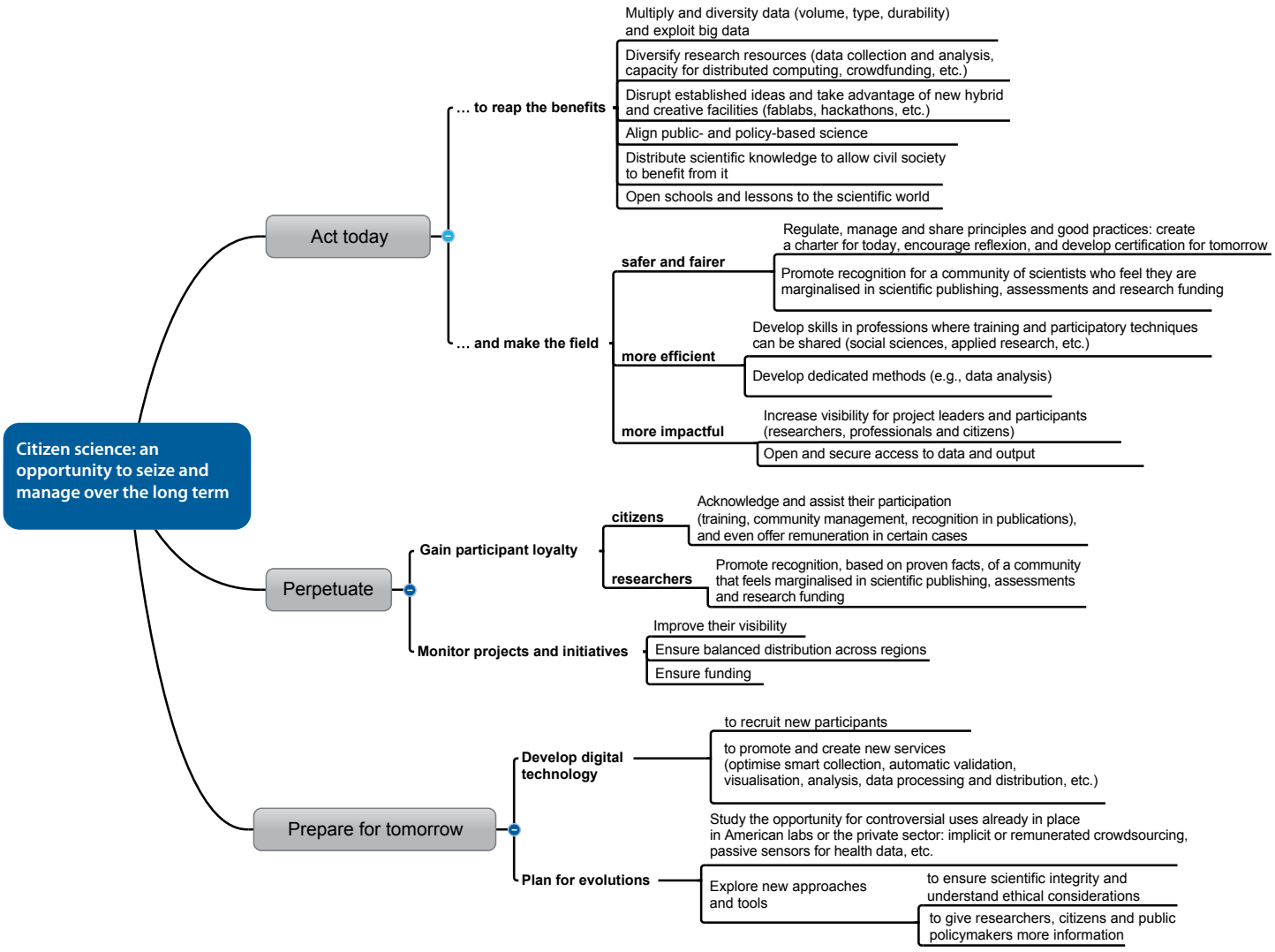
Beyond the expectations that overlap with projects carried out with other audiences (e.g., promotion of the approach by institutions, both educational and scientific; availability of means, a crucial issue as schools have limited budgets and, unlike volunteers, students do not contribute to costs), the educational environment has special considerations that also lead to specific expectations:

- **Information is key,** as a considerable share of France's 850,000 school teachers are unaware of the programmes they can participate in with their classes on a remote basis and that can be perfectly integrated into their general curriculum. It is especially important to communicate the possibilities that new lessons or changes in established lesson plans offer as well as the energy scientific associations that work with schools can bring to a lesson.
- **Professionalisation as part of the academic offer**, through teacher training, not only on a particular project but more generally on citizen science in schools; the availability of library resources; or the creation of networks to exchange ideas between teachers.
- **The study and monitoring of the impact on students**, as experiences of actors involved in such projects have shown that students are more likely to opt for a scientific diploma or degree in high school or university if they have taken part in a citizen science programme.

The development of citizen science in the educational environment depends on:

1. **Respecting timelines of speakers, schools (plan for school projects, a balanced schedule, etc.) and school curricula (suitable lesson slots, etc.).**
2. **The training of and communicating information to stakeholders (teachers, students, scientists, volunteers).**
3. **Including all students in a class and preventing student self-censure.**
4. **The insertion of the programme into cross-disciplinary actions during school hours (ethics and civic lessons, courses on inter-disciplinary practices, etc.).**
5. **Building a multi-disciplinary project with input from various teachers.**
6. **Planning for administrative and regulatory constraints.**

5 Overview of the stakes for research and society




Citizen
Science
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Citizen science in France

Focus

Recommendations for institutions

3 Drivers

7 recommendations

1 Form a set of practices

2 recommendations
5 actions

Recommendation 1
Unite actors around shared principles

Recommendation 2
Recognise and uphold commitments

2 Adapt the technical, financial and regulatory resources

3 recommendations
7 actions

Recommendation 3
Coordinate the field of citizen science at a national level

Recommendation 4
Identify alternative financing approaches

Recommendation 5
Ensure project quality and the establishment of ethical and fairness principles

3 Associate the educational sector

2 recommendations
4 actions

Recommendation 6
Promote initiatives to open the field

Recommendation 7
Create long-term partnerships between research and schools

16 actions

Action 1.1 — Create a French charter for citizen science
Action 1.2 — Develop new forums for exchange and action

Action 2.1 — Recognise participants' engagement
Action 2.2 — Make research a support tool for citizen science
Action 2.3 — Organise training and recruitment

Action 3.1 — Create a national network for oversight and resource pooling
Action 3.2 — Roll out a national internet portal for promotion and management

Action 4.1 — Adapt project evaluation and selection criteria for public funding
Action 4.2 — Diversify, secure and open to new funding sources

Action 5.1 — Create or mobilise competent organisations
Action 5.2 — Incorporate participation into the strategies of research institutions and partners
Action 5.3 — Formalise the sharing of benefits and data ownership

Action 6.1 — Recognise and engage committed teachers
Action 6.2 — Study and support the programmes

Action 7.1 — Perpetuate the programmes
Action 7.2 — Make the most of the potential for educational innovation

Citizen Science

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Complete report and additional information at:
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