



Opportunities and Barriers for Citizen Science Growth in Brazil: Reflections from the First Workshop of the Brazilian Citizen Science Network

MEETING REPORT

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ABSTRACT

Citizen science networks can provide support and visibility to existing initiatives. Although citizen science is a growing practice in Brazil, several challenges still exist. A network can play an important role in overcoming these challenges, helping with the exchange of knowledge between initiatives or raising funding, for example. The Brazilian Citizen Science Network was created to advance citizen science in the country. The launch took place in March 2021 at a two-day online workshop focused on topics such as financial sustainability, technology, data quality, inter- and transdisciplinary infrastructure, engagement, and good practices. Based on the contents of the presentations and comments during the event, the authors of this report held follow-up meetings to identify favourable and unfavourable factors that can foster or constrain citizen science in Brazil. Afterwards, an open letter expressing these factors was produced and shared with the network members to register the status of challenges and opportunities we have discussed so far, to be used as a guide for future actions. This report provides an overview of the workshop. Despite depicting a local perspective, the challenges and opportunities discussed during the workshop and summarised in this report may also apply to fostering citizen science in other countries or establishing global practices. We consider that the Brazilian Citizen Science Network can play an important role in promoting the establishment of collaborative actions across the country.

KEYWORDS:

Brazilian Citizen Science
Network; citizen science
associations; community
science; Global South

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INTRODUCTION

Citizen science networks, such as the Citizen Science Association (CSA), the European Citizen Science Association (ECSA), and the Australian Citizen Science Association (ACSA), have a mission to promote and support the research and practice of citizen science locally and regionally (Storksdieck et al. 2016). Newer networks, such as CitizenScience.Asia, CitSciAfrica Association, and Iberoamerican Network of Participatory Science (RICAP), have similar agendas. Such networks have acted as important hubs to integrate public, academic, and policy communities. The networks also create helpful recommendations to advance policy and to foster capacity building among the citizen science community (Hecker et al. 2018). For example, the RICAP network integrates representatives from different countries to achieve citizen science goals through working groups with specific target actions from and beyond scientific knowledge production. In Brazil, where citizen science is a growing practice, the Brazilian Citizen Science Network (RBCC, from its name in Portuguese, *Rede Brasileira de Ciência Cidadã*) similarly aims to integrate existing initiatives and give support and visibility to this practice.

On 24th and 25th March 2021, the 1st Workshop of the RBCC (hereafter, workshop) launched the Brazilian network and discussed what is needed to advance citizen science in the country, considering current challenges and opportunities. The event involved researchers from social, ecological, and technological fields, funding agency staff, public officials, and other people interested in the topic.

This meeting report provides an overview of the workshop to inform an understanding of citizen science theory and practice in Brazil. The workshop was composed of online panels and discussion between speakers and participants. Guided by a strengths, weaknesses, opportunities, and threats (SWOT) matrix (Valentin 2001), we explored what factors highlighted in the workshop can foster or constrain the advancement of citizen science in Brazil.

Different experiences about citizen science were shared with our context in mind to identify areas where Brazilian initiatives need attention and others where they are performing well. The activities resulted in an open letter written by the authors of this report, which was shared among the network community to summarise the main opportunities and challenges in our country (Supplementary File 1: Appendix A). The letter is a guide for the RBCC's future actions, making explicit the RBCC's governance, practice, and values. This meeting report summarises the workshop's design, session goals, and discussions. We then present the workshop's SWOT framework, where

we identified the challenges and opportunities of a new network in Brazil. Finally, we discuss why a Brazilian citizen science network matters and how we can overcome challenges and harness opportunities. A connection with other networks is also presented.

WORKSHOP DESIGN

An initial group of researchers and citizen science project coordinators with technology and natural sciences backgrounds (the authors of this report) started a series of online meetings in 2020 to discuss citizen science research and practice in Brazil, and as a result, a network was proposed to include diverse stakeholders involved with citizen science in the country. On the basis of these discussions and shared experiences, we decided to plan and promote the workshop to launch RBCC and to identify important factors for establishing it in Brazil. The two-day workshop was divided into an opening session and four online panels, which encompassed the following themes: financial sustainability, technology and data quality, inter- and transdisciplinary infrastructure, engagement, and good practices. In each panel, four experts gave a short talk followed by a discussion with the audience (see Table 1). Speakers from each online panel were invited by email and asked to mention the challenges and lessons learned from their experience in relation to the panels' respective themes. They were also invited to explicitly share their viewpoint about broader concepts in citizen science (e.g., citizen science principles, good practices, etc.) in relation to the themes. Because of the COVID-19 pandemic, the meeting was totally virtual, which allowed us to reach a broader audience and to invite speakers from abroad. All presentations were live-streamed and had simultaneous translation to English or Portuguese, whenever appropriate.

WORKSHOP SUMMARY

The event was attended by 395 people, including scientists, decision-makers, private sector agents, representatives of funding agencies, and citizen scientists. During the opening session, speakers from Brazilian scientific institutions highlighted citizen science potential to promote science education, to improve trust in science, and to ultimately democratise the scientific process. Citizen science for and beyond data collection was advocated as an approach to deal with complex societal issues while coping with the challenge of incorporating different knowledge systems. This session was followed by a talk launching the RBCC.

SESSIONS	GOALS OF THE SESSION	SPEAKERS' PROFILES
Opening session	To present the event and the opinions of key institutions to support citizen science in Brazil.	One representative of Minister of Science and Technology of Brazil, one funding agency member, one representative of Brazilian Society for Science progress and one RBCC co-founding member (Brazil).
Presentation of the Brazilian Citizen Science Network	To present the RBCC and people's perceptions about citizen science in Brazil, as well their level of agreement with ECSA principles.	One RBCC co-founding member (Brazil).
Financial sustainability	To discuss costs and funding of citizen science in Brazil, identifying the main demands of current initiatives. To help public/private agencies understand the diversity of citizen science and evaluate their willingness to support it.	Two private sector and two funding agency representatives (Brazil).
Technology and data quality	To discuss the requirements, accessibility and sustainability of citizen science platforms, as well as how technological issues and infrastructure are related to the quality of data produced by citizen science initiatives.	Three projects' coordinators and one researcher (US, Brazil)
Inter- and transdisciplinarity infrastructure ¹	To discuss the challenges of running citizen science projects in discipline-oriented institutions and which kind of infrastructure would be necessary to promote different types of citizen science.	Three researchers and one funding agency representative (US, Brazil)
Engagement and good practices	To discuss how citizen science projects can raise the public engagement in scientific endeavours, to share good practices related to citizen science in different contexts, and to debate the evaluation of their impacts and outcomes.	Three citizen science network coordinators and one project coordinator (US, Spain, Brazil)

Table 1 Sessions, goals and social sector/role of the recruited speakers of the 1st Workshop of the Brazilian Citizen Science Network (RBCC).

¹ We adopted the concept of inter- and transdisciplinarity from Tress, Tress and Fry (2005), who define these terms as integration of different disciplines in order to explore the same goal, and integration of academic and nonacademic knowledge towards one same goal, respectively.

The talk included an overview of how the RBCC defines citizen science, the network's aims, future actions, and the results from a previous survey about characteristics of Brazilian citizen science initiatives. For RBCC, citizen science encompasses a broad range of partnerships between scientists and those interested in science in order to produce shared knowledge based on scientific practice and integration with other types of knowledge. This approach has the potential to promote public engagement at different stages of scientific practice, scientific and technological education, and the co-development and implementation of public policies on topics of social and environmental relevance. Thematic sessions followed and are described below.

FINANCIAL SUSTAINABILITY

In this session, the speakers discussed the financial sustainability of citizen science initiatives, presenting existing institutional funding programs that could incorporate citizen science initiatives, even if these programs were not aiming for citizen science explicitly. Strategic actions for funders to deal with the specificities of citizen science were suggested by the presenters.

For example, flexibility in resource use during project development, incorporating capacity building on open innovation programs in partnership with the private sector, and explicitly including citizen science in already established research programs and synthesis centres (e.g., the [Brazilian Platform on Biodiversity and Ecosystem Services \[BPBES\]](#)). The main financial challenges discussed by the speakers were to keep initiatives and their infrastructure in the long-term. This thematic session revealed that funding agencies know citizen science initiatives and understand their importance. However, there are still gaps regarding the broad range of the definition of citizen science, which may hinder funding opportunities for projects. Thus, RBCC may act as a key stakeholder informing the complexity of citizen science initiatives and assuring its recognition as a research and practice field.

TECHNOLOGY AND DATA QUALITY

The second session approached technology and data quality in citizen science. For the former, speakers highlighted the importance of interacting with citizen scientists and project managers to improve platforms. They suggested data governance principles should be followed, ensuring that

data are findable, accessible, interoperable, and reusable (FAIR) (Carroll et al. 2021). They also suggested that new projects should prioritize the use of already existing platforms and consider quality control mechanisms in all steps of project development. Although often related to a technology product, infrastructure was also considered as a social process that should be able to incorporate both top-down and bottom-up initiatives. Several challenges were highlighted during the discussion, such as the availability of open-source codes, privacy issues, data standards and standardisation in licensing, and promoting data use by scientists and citizens. Next, the relation between technology infrastructure and data quality was discussed. Speakers mentioned that aesthetics, language, and training are very relevant to improve data quality. This thematic session closed the first day of the workshop, showing that citizen science initiatives are complex and demand transdisciplinary efforts even when dealing with specific subjects such as technology and infrastructure. Creating a network at the national level may contribute to further investigation of this issue and may even promote the centralization of local initiatives.

INTER- AND TRANSDISCIPLINARY INFRASTRUCTURE

At the inter- and transdisciplinary infrastructure session, speakers shared experiences and presented opportunities to promote the inter- and transdisciplinary infrastructure in educational and research institutions. Regarding Brazilian scientific institutions, speakers discussed traditional disciplinary teaching and research constraints, such as the hierarchical governance structures that hinder collaboration with society and relevant societal challenges that are not generally addressed by universities and research institutes. Current initiatives of inter- and transdisciplinary programs and funding opportunities across Brazil revealed that working towards a scientific model with the society and promoting the scientific culture are promising directions. Thus, including diverse stakeholders in the scientific process and going beyond institutional barriers seem to be key features to promote inter- and transdisciplinary actions. Inclusiveness and diversity were also recommended because, despite RBCC being diverse in gender, career experience, and regionality, it is formed mainly by academic members with technology and natural sciences backgrounds. This thematic session revealed several institutional and cultural challenges to implementing inter- and transdisciplinary citizen science actions. Citizen science programs integrating society and research institutions might positively affect this broader movement and help mainstream inter- and transdisciplinarity. Further, recommendations for diversity

and inclusion of the society at all levels while promoting two-way communication channels will be incorporated into RBCC's governance structure.

ENGAGEMENT AND GOOD PRACTICES

During the engagement and good practices session, speakers shared their experiences with citizen science initiatives and associations. They highlighted the main challenges and strategies to overcome them. Some examples of challenges are the lack of trust in citizen science data, funding and resources, imbalance in the proportion of environmental scientists compared with social scientists, lack of implementation of inter- and transdisciplinarity, lack of practice of projects/associations staff in science communication, inequalities in digital access, digital illiteracy, and language barriers. Building upon previous experiences, speakers presented recommendations to RBCC, including the adaptation of existing guides and governance systems created by other networks and associations, the maintenance of an active network between members, and the promotion of partnerships with small- and large-scale initiatives. The establishment of a governance structure and the existence of well-defined working groups at RBCC were considered positive. This thematic session closed the workshop. Robust governance structure, strategic division of labour, and commitment by members and the management committee will be key to establishing the RBCC as a significant stakeholder in the promotion of citizen science in Brazil.

DISTILLING INSIGHTS FROM THE WORKSHOP

We have taken notes from the participants' comments on the chats during the workshop and identified key factors (e.g., recommendations, previous successful cases, challenges) in the talks of the invited speakers on the video recordings. We then classified the factors using a SWOT matrix (Valentin 2001). The matrix considers internal factors, that is, issues that are under RBCC agency or governance (strengths and weaknesses), and external factors, that is, issues outside the governance of RBCC (opportunities and threats) (Table 2). Two people separately filled in one SWOT matrix for the same thematic subject. After that, the same two people for each thematic subject discussed their matrices in pairs and excluded factors that were redundant, misunderstood, and unrelated to the matrix labels. The resulting items remaining were intended to provide an overview of each unique topic illuminated in relation to each of the four themes.

When necessary, the video recordings were used to verify the ideas that workshop participants conveyed. At the end of this step, we had one matrix for each thematic subject. We then consolidated all four matrices into one overall matrix that was representative of the whole workshop. The participants' and speakers' names and any other personal data were omitted. A total of forty-four factors were kept into the overall matrix (Table 2).

CHALLENGES AND POSSIBILITIES FOR CITIZEN SCIENCE IN BRAZIL

The consolidated SWOT matrix included 44 key strategic factors for advancing citizen science in Brazil (Table 2).

OPEN LETTER RECOMMENDING ACTIONS

Finally, content from the SWOT matrix was organised in an open letter. The letter was written by the authors in

FAVOURABLE	
STRENGTHS (INTERNAL FACTORS)	OPPORTUNITIES (EXTERNAL FACTORS)
A broad definition of CS is adopted and clearly explains principles and values, allows the inclusion of various initiatives, facilitates the understanding by potential members and funders, and highlights the values of the RBCC.	Funding agencies and research institutions are currently more sensitive to the free circulation of scientific information and public involvement (open science), and more flexible in using resources to support these initiatives.
Detailed management and governance system is under discussion.	People and institutions are interested in promoting scientific literacy and working against fake news and denialism.
RBCC members have extensive contact networks and open channels of dialogue with members of funding agencies.	Researchers and staff acting as managers in research institutes, government agencies, and funding agencies are sensitive to transdisciplinary approaches and can gradually promote CS.
RBCC members have previous successful experiences in management, inter- and transdisciplinary research, data science, and computational technologies.	Federal infrastructure for inter- and transdisciplinary research, with logistics and technical support and human resources.
RBCC members, who already work with the CS approach, are more predisposed to interact with other knowledge areas and with social actors, and are thus able to act as influencers to engage other colleagues and to incorporate indicators of sociocultural relevance in the institutional agenda of teaching, research, and outreach.	Initiatives decentralizing interdisciplinarity and moving from projects “for society” to projects “with society,” focusing on scientific culture (which includes common values and objectives) and not on scientific knowledge (which has a focus on information and education).
There are already means for the dissemination of initiatives and good practices created by the network (e.g., email group, website, and social networks).	Guides and other support materials from other institutions and national and international networks available for use and adaptation.
RBCC has already organized an event to discuss opportunities/barriers for CS in Brazil, consolidating itself as a legitimate representation of the area in the country.	Many studies, inter- and transdisciplinary, being carried out at the intersection between science and society, seeking to improve the path towards this approach.
	Platforms (including open source) for Brazilian CS projects.
	Interest and willingness to promote collaborations with international platforms for regionalization.
	Demand from the public and project coordinators for (theoretical-practical) training places and opportunities in CS (e.g., project planning, ethical aspects).
UNFAVOURABLE	
WEAKNESSES (INTERNAL FACTORS)	THREATS (EXTERNAL FACTORS)
A comprehensive definition of CS can generate different correlations of forces between multiple views on CS and create difficulties for RBCC management.	Funders and decision makers do not grasp the broad meaning of the concept of citizen science in the RBCC (e.g., difference between CS and scientific dissemination and environmental education).
Current composition of RBCC is a little diversified in terms of profile (high proportion of academic scientists compared with nonacademic members) and area of activity (predominantly biodiversity and environment).	No short- and medium-term financial incentives to support CS initiatives (funding agencies are not considering the creation of specific calls to support CS projects).
The time available by members to dedicate to RBCC is limited, and may discourage some participants who want more frequent interaction and continued engagement of network participants.	Lack of support/policy for informational infrastructure and sustainable data management in the short and long term (financial and human resources—data curators, for example);

(Contd.)

UNFAVOURABLE	
WEAKNESSES (INTERNAL FACTORS)	THREATS (EXTERNAL FACTORS)
Lack of financial resources to hire human resources that can dedicate themselves exclusively to the network.	No integration between existing platforms and databases, leading to fragmentation/duplication of initiatives (most of them were created for specific projects).
Lack of governability to influence changes in the institutional structure (RBCC has no representation in decision-making spheres).	Lack of decentralized institutional policies to support and encourage the participation of social actors with a greater leading role (e.g., popular communicators, community agents, local leaders, etc.).
Lack of information and data on multiple factors mediating science and society in Brazil, necessary to improve actions and expand their reach (e.g., there are still no assessments of the potential social impact of Brazilian CS projects).	Lack of scientists' training to work with transdisciplinary proposals and scientific public communication.
Lack of a forum for regular communication with members about aspects of the network.	Lack of training and access to technologies and internet so that less-favoured social actors (e.g., traditional communities, inhabitants of rural areas) participate in CS initiatives.
	No metrics and indicators encouraging and valuing the participation of scientists in interaction works with the society, such as the CS.
	Distrust in data collected by nonacademics.
	Concentration of initiatives and structures to support CS initiatives aimed at data accumulation (crowdsourcing projects).
	Lack of materials/resources (particularly in Portuguese) on experiences and protocols to guide new CS initiatives.

Table 2 The SWOT matrix of ideas discussed during the 1st Workshop of the Brazilian Citizen Science Network (RBCC).

Notes: CS: citizen science.

an effort to galvanize guidelines and to serve as a call for action for promoting citizen science in Brazil. The letter also maps out plans for assessing and evaluating RBCC's performance in the medium and long term. The final letter draft was sent to all RBCC members and other stakeholders, with an invitation to sign the letter as a show of support towards advocating for further development strategic citizen science across Brazil (Supplemental File 1: Appendix A). The letter was signed by 122 stakeholders across Brazil.

DISCUSSION

The RBCC workshop allowed for an exchange of experiences and the highlighting of challenges and possibilities, while identifying context-dependent factors that can foster or constrain citizen science in Brazil. Although the literature contains diverse sources of useful information and recommendations for citizen science design (see, for example, [Vohland et al. 2021](#)) and evaluation (e.g., [Phillips et al. 2014](#)), networks are needed to address specific requirements ([Storksdieck et al. 2016](#)).

WHY DOES A CITIZEN SCIENCE NETWORK MATTER?

Navigating challenges and proposing possibilities are helpful when thinking about strategies and governance ([Pocock et al. 2019](#)). According to [Storksdieck et al. \(2016 p. 2\)](#), “associations for citizen science can become hubs for sharing the existing knowledge on citizen science practice and can provide support for mutual learning among practitioners, helping to inform effective use of citizen science initiatives and to identify and address common challenges across the field.” In this sense, identifying internal and external factors is an important step to inform a strategic plan for an embryonic citizen science network such as the RBCC.

The RBCC will be pivotal for fostering citizen science in Brazil, allowing the institutionalisation of a community with shared interests and values that can enhance the benefits of citizen science in the country. Citizen science in Brazil promises to increase public participation in science, scientific education, and knowledge. With the support of the RBCC, the favourable factors can be reinforced and sustained while overcoming the unfavourable ones. For instance, we adopted a wide definition of citizen science,

encompassing diverse partnerships between scientists and people interested in science. Given the range of views, a broad definition was identified as a strength, because it captures diverse initiatives while explicitly promoting a scientific commitment with social impact (Eitzel et al. 2017). This broader view was inspired by ECSA's (2015) characteristics of citizen science, and approaches not only projects focused on data collection, but also knowledge sharing, public engagement in the scientific process, scientific and technological literacy, and co-production and implementation of relevant public policies (Haklay et al. 2020a, 2020b). Even if the definition changes in the future, the current one is helpful for mapping existing projects, including those not currently labelled as citizen science by project leaders.

One weakness is that the current composition of the RBCC is little diversified in terms of profile (high proportion of academic scientists compared with non-academic members) and area of activity (predominantly biodiversity and environment), and we identified an internal bias in RBCC. Thus, strategies that widen participation are needed to diversify RBCC's composition. In addition, increasing representation in our events should also be set as a medium-term goal, following the example of other associations (Storksdieck et al. 2016; Dörler and Heigl 2021). RBCC also could be included as an emergent group in the Memorandum of Understanding that was signed by other national/regional associations, aiming to facilitate cross-association collaborations and communications (Memorandum of Understanding 2021). However, considering the identified opportunity, two potential outcomes are possible. It may decrease the lack of financial support that affects initiatives in Brazil, in which most of the financial budget comes from public funding, and it may increase the potential to create a long-term culture to foster projects of public participation in science.

Information gathered from this workshop, combined with ongoing citizen science initiatives in Brazil, enables evaluation of which caveats can be overcome and allows for the identification of new challenges. Future steps for the Brazilian Citizen Science Network include: 1) developing a governance system to assure democratic and inclusive organisation, with long-lasting impact; 2) implementing thematic working groups to plan strategic actions and research, and to support the production of educational materials; 3) organising workshops and events with diverse stakeholders to promote citizen science in Brazil, share experiences, and assess the RBCC actions. People exchanging their experiences with citizen science and information about projects holds promise to elicit mutual learning, invalidation, and solutions, which may help to

ensure efforts are financially sustainable and useful for both people and the natural world. While contributing to the establishment of citizen science practice and research in Brazil, RBCC may also promote other actions globally, stimulating international partnerships and integrating initiatives with other citizen science networks.

CONCLUSIONS

The workshop raised important priorities for citizen science in Brazil. First, it consolidated the RBCC as a network acting like a hub to promote a change from individual to collective action. Second, it highlighted the importance of Brazilian institutional recognition of citizen science within Brazil. Having formal support for citizen science summed with non-institutional initiatives is likely to foster growth of new projects, to allow data harmonisation and standardisation within and across different projects, and to promote long-term financial aid, which we expect will increase impacts and outcomes that benefit society.

Our workshop also has put national and international communities together, improving our learning about the structure and mechanisms of other networks. We are hopeful that the revelations we've had in regard to the RBCC will inspire those from broader citizen science networks. For example, people from other networks may use the factors we identified to compare the similarities and differences in their social context, which may help to reveal targeted actions needed. In general, the workshop and the RBCC might advance interdisciplinary collaborations and contribute to the citizen science community goals of public participation and awareness of science.

SUPPLEMENTARY FILE

The supplementary file for this article can be found as follows:

- **Supplemental File 1: Appendix A.** Open Letter shared with RBCC members with the results of the analysis of the workshop. DOI: <https://doi.org/10.5334/cstp.521.s1>

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

CQS took the lead in writing the manuscript. All authors contributed equally in conducting SWOT analysis. All authors contributed to paper writing and approved the final version on the manuscript.

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