Citizen science: The international landscape

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Note: This content has not been peer-reviewed

Key messages

- Citizen science is, broadly, public participation in scientific research.
- Citizen science is growing – both in the number of participants and scale of impact.
- There are economic, social and scientific benefits to citizen science.
- Some countries, such as Australia, have boosted citizen science through unifying governance structures (i.e. associations) and strategies to strengthen activities and their impacts.
- Aotearoa New Zealand is active in the citizen science space but lacks overarching coordination or governance when compared to other countries.
- There is an opportunity to enhance citizen science in Aotearoa New Zealand with a national network or strategy.

What is citizen science?

Broadly, citizen science is public participation in scientific research. A selection of definitions is given in the table below.

Definition	Source
In citizen science, the public participates voluntarily in the scientific process, addressing real-world problems in ways that may include formulating research questions, conducting scientific experiments, collecting and analysing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems.	US Citizen Science and Crowdsourcing Act[1]
the collection and analysis of scientific data in relation to the natural world, performed predominantly by citizens, usually in collaboration with scientists and field experts. Citizen scientists work with scientists or the scientific framework to achieve scientific goals. Citizen science involves public participation and collaboration in scientific research with the aim to increase scientific knowledge.	Australian Citizen Science Association[2]
the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.	Oxford English Dictionary[3]

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[1] https://www.citizenscience.gov/about/#
[2] https://citizenscience.org.au/who-we-are/
[3] https://www.oed.com/view/Entry/33513?redirectedFrom=citizen+science#eid316619123

In the US, there is a growing movement to shift to more inclusive terminology, such as 'community science'.[4] Some believe that the word 'citizen' might discourage those who do not have official citizenship status.

Other names that may be used include 'crowd science', 'participatory science' and 'crowdsourcing science'.

The European Citizen Science Association developed ten principles for citizen science,[5] which have been adapted and adopted by the Australia Citizen Science Association.[6]

Further definitions and discussion of what is and is not 'citizen science' can be found elsewhere.[7]

Citizen science is growing

The number of peer-reviewed publications mentioning 'citizen science' or related concepts is increasing (Figure 1). The US and UK dominate the peer-reviewed citizen science research scene (Figure 2) but when adjusted for population, Aotearoa New Zealand has a relatively high 'activity index' (Figure 3).
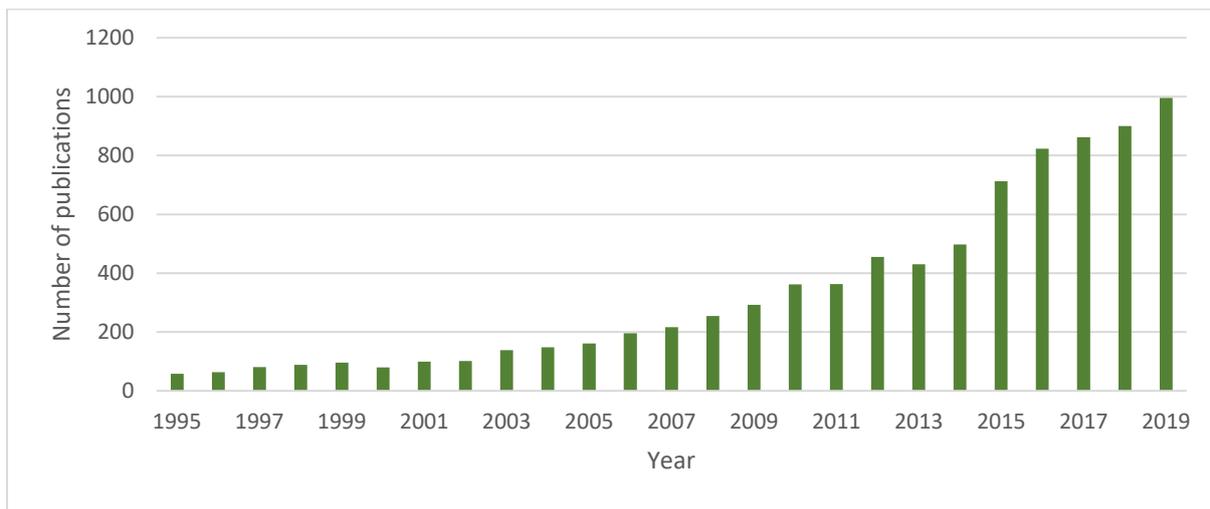

Figure 1: The number of citizen science peer-reviewed publications in Web of Science 1995-2019.[8]

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[4] Audubon, "Why We're Changing From "Citizen Science" to "Community Science"," (2018), https://debspark.audubon.org/news/why-were-changing-citizen-science-community-science.
[5] https://osf.io/xpr2n/
[6] https://citizenscience.org.au/10-principles-of-citizen-science/
[7] Haklay et al., "What Is Citizen Science? The Challenges of Definition," in *The Science of Citizen Science*, ed. Katrin Vohland, et al. (Cham: Springer International Publishing, 2021).
[8] Year 2020 is excluded since it is not a full year and the COVID-19 pandemic may affect the 2020's outputs.
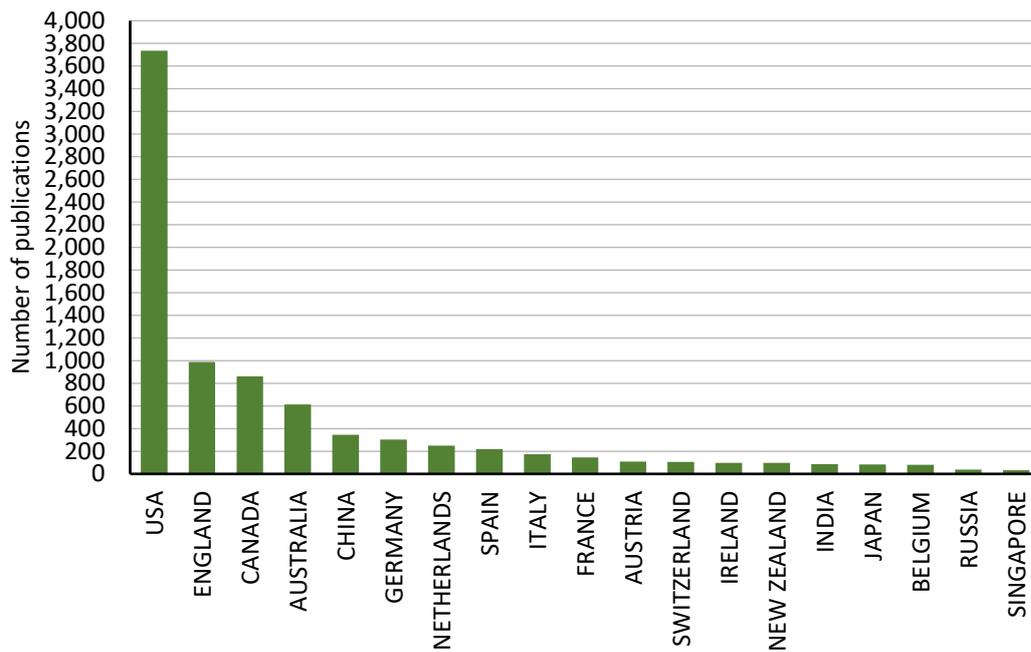
Figure 2: Citizen science publications in different countries in the period 1995 – May 2020.
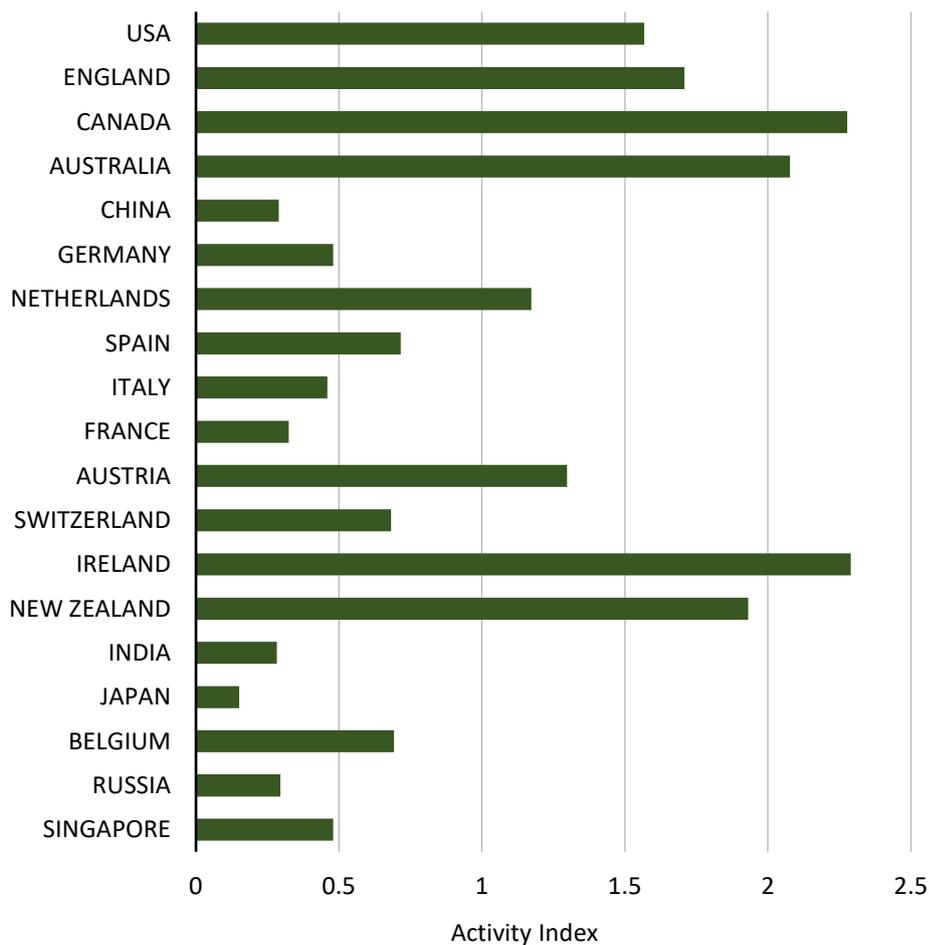

Figure 3: Activity index of different countries in publishing research related to citizen science.

Some countries have a central platform or inventory listing citizen science projects. The US and Australia have the most individual citizen science projects listed in their inventories (Figure 4).

Aotearoa New Zealand does not have a central, regularly updated platform for citizen science, but the NZ Landcare Trust commissioned an inventory publication in 2016 that has subsequently been updated in 2018.[9]
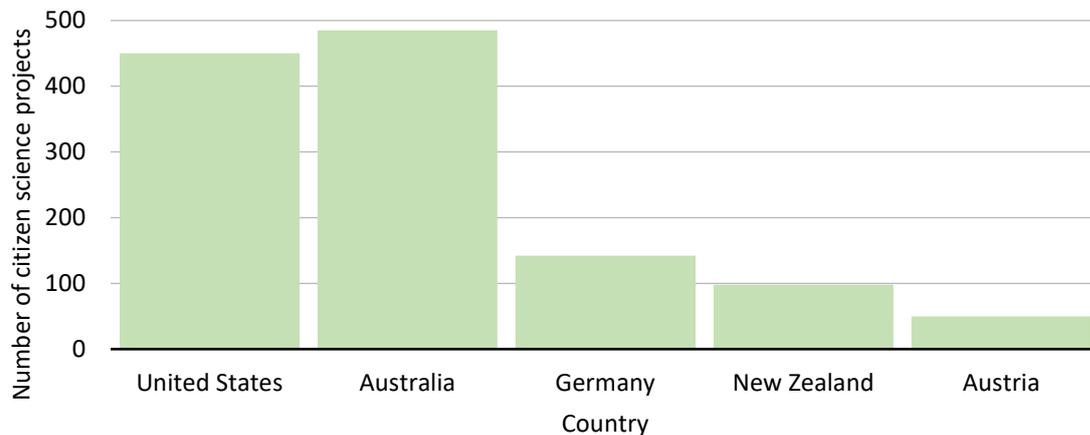

Figure 4: Number of citizen science projects in different countries.[10]

Citizen science has many benefits

Economic benefits
Citizen science can be a cost-effective way to gather data and fill knowledge gaps.

In the US, an analysis of 388 citizen science projects estimated that 1.36 million-2.28 million volunteers contributed between US$667 million and US$2.5 billion in-kind every year.[11]

In France, the Citizen Science Biodiversity Monitoring Programme of the French National Museum for Natural History led to estimated annual savings of €1–4 million for the government.[12]

Scientific benefits
Citizen science has allowed the collection of vast biological datasets (e.g. eBird, iNaturalist) and facilitates data collection in places and at scales that would have been impossible otherwise. Data collected by citizen scientists can be of sufficient quality for peer-reviewed publication.

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[9] Peters, "Citizen Science Inventory: Programmes, projects, resources and learning opportunities in New Zealand", 2018.

[10] The number of citizen science projects are taken until June 2020 for all the countries except Aotearoa New Zealand. The Aotearoa New Zealand data was last updated in 2018.

[11] Theobald et al., "Global change and local solutions: Tapping the unrealized potential of citizen science for biodiversity research," *Biological Conservation* 181 (2015).

[12] Levrel et al., "Balancing state and volunteer investment in biodiversity monitoring for the implementation of CBD indicators: A French example," *Ecological Economics* 69, no. 7 (2010).

Educational benefits

Citizen science has educational value in both formal settings (e.g. school) and in informal learning situations. These can include knowledge gain, enhanced awareness of issues, better understanding of the scientific process, and even positive behaviour change.[13]

Policy making benefits

Recent papers have explored the benefits of incorporating citizen science principles into policy making.[14] Citizen science in this context "offers a unique opportunity to jointly explore, experience and exploit a topic of shared interest and thereby develop a common mutual understanding of the underlying issues and possible solutions".[15]

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[13] Science Communication Unit University of West England, "Science for environment policy in-depth report: Environmental citizen science", 2013.

[14] Nascimento et al., "Citizen science for policy formulation and policy implementation," ed. Susanne Hecker, et al., *Citizen science: Innovation in open science, society and policy* (London, UK: UCL Press, 2018), https://discovery.ucl.ac.uk/id/eprint/10058422/1/Citizen-Science.pdf.

[15] Schade et al., "Using new data sources for policymaking", 2017.

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Case studies

Several jurisdictions have strengthened citizen science through governance structures, strategies, funding, and unifying organisations. These are outlined below as case studies with potential lessons and ideas for Aotearoa New Zealand.

Australia

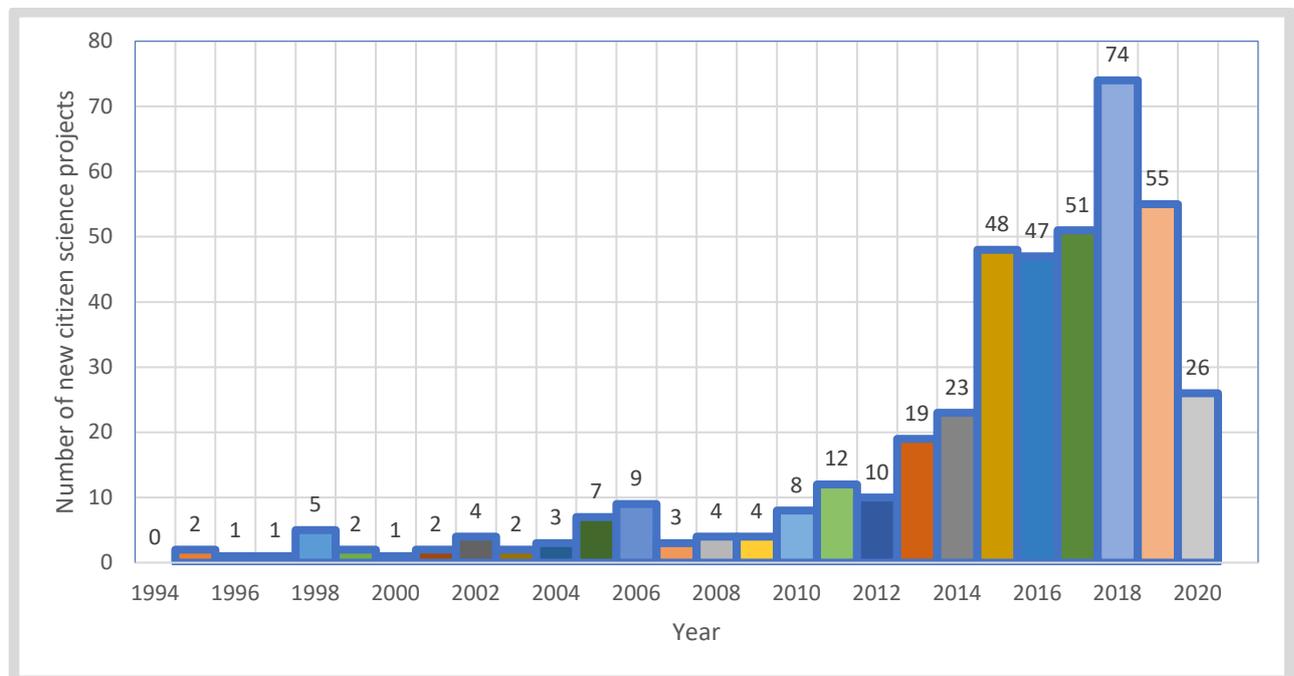Citizen science has been booming in Australia for the past decade (Figure 5).

Figure 5: *Number of new citizen science projects in Australia from 1994–2020.*

Central inventory platform

The Australian Citizen Science Association maintains a central inventory[16] in conjunction with the Atlas of Living Australia.

Government support

Inspiring Australia, founded in 2009, is a capacity-building programme formed to identify the best-practice approaches for science engagement in Australia.

A national network was formed to improve the coordination of science engagement activities across the country. Each state and territory have a dedicated *Inspiring Australia* manager with local expertise and connections. The managers are co-funded by the Australian Government in partnership with state/territory governments and local institutions.

Inspiring Australia provides funding for five main streams:

- National Science Week,
- the Prime Minister's Prizes for Science,
- Maker projects: Community STEM engagement grants,
- citizen science grants, and

- sponsorship for student science engagement and international competitions.[17]

Programme name: *Inspiring Australia –* Science Engagement Programme[18]	Start: 2009 Current status: Ongoing
	Funding: AU$8.4 million/year (in 2020 estimated budget) Started with AU$6 million/year in 2011
	Citizen science grant: Grants of AU$50,000 to AU$500,000 for science research projects with a maximum duration of three years. The Australia Government provide funding of AU$1 million per year for citizen science grants.
	Managed by: Questacon, part of the Australian Government Department of Innovation, Industry, Science and Research

Australian state-based government initiatives

In 2016, both Queensland and New South Wales (NSW) developed STEM engagement strategies with implications for citizen science.

The *Queensland citizen science strategy*,[19] developed by the Office of the Queensland Chief Scientist, was published in 2018 and aims to (1) encourage Queenslanders to be aware of and participate in citizen science projects, and (2) support scientists to seek ways of involving the community in their research projects. It followed on from an earlier strategy *Engaging Queenslanders in science[20]* and associated research.

The *Queensland citizen science strategy* is accompanied by a grant programme, comprising a total of AU$500,000 over three years and an additional AU$180,000 for citizen science projects specifically focused on protection of the Great Barrier Reef.[21] Each individual grant is up to AU$30,000.

Australian Citizen Science Association

The Australian Citizen Science Association (ACSA) was formed in 2014 with a vision to become 'a community that supports, informs and develops citizen science'.

The ACSA currently has more than 440 individual members, 15 member organisations, four state-based chapters, and several working groups. They also have a large social media following (more than 4,000 Facebook followers, 70+ YouTube videos, 4,500 Twitter followers) as well as a popular newsletter with more than 1,100 subscribers.

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[17] https://www.industry.gov.au/funding-and-incentives/inspiring-australia-science-engagement-in-australia
[18] https://www.industry.gov.au/data-and-publications/science-research-and-innovation-sri-budget-tables
[19] https://www.chiefscientist.qld.gov.au/__data/assets/pdf_file/0039/49998/queensland-citizen-science-strategy.pdf
[20] https://advance.qld.gov.au/assets/includes/docs/esg.pdf
[21] https://www.chiefscientist.qld.gov.au/science-comms/citizen-science-grants/guidelines

The ACSA is financially supported by Inspiring Australia grants ($75,000 in the first year and $375,000 for three years) as well as sponsorship and membership revenue.

In 2015, the ACSA created a three-year strategy, outlining a roadmap to advance citizen science.[22] The strategy was reviewed in 2018, and a new three-year strategy was implemented in 2019.[23]

In NSW, the Office of Environment and Heritage (OEH) published its citizen science strategy in 2016, aiming to "drive a new era of public participation in science by developing collaborative projects that support decision making and are engaging for the public".[24]

United States

Central inventory platform

The website citizenscience.gov has a catalogue section.[25] It is managed by the General Services Administration in partnership with the Woodrow Wilson International Center for Scholars.

Government support

Federal support for citizen science projects in the US is underpinned by legislation including the Crowdsourcing and Citizen Science Act of 2016.[26] The Federal Community of Practice on Crowdsourcing and Citizen Science (FedCCS) works across government agencies to share lessons learned and develop best practices for designing, implementing, and evaluating crowdsourcing and citizen science initiatives. Over 350 people from 60+ agencies already participate.

The *Implementation of Federal Prize and Citizen Science Authority: Fiscal Years 2017-18* report from the White House Office of Science and Technology Policy is the first report on crowdsourcing and citizen science activities conducted by Federal agencies in United States.[27]

Citizen Science Association

The Citizen Science Association (CSA) is a member-driven organization based in the United States which connects over 6000 people involved in citizen science. The CSA was launched formally in 2015 with the election of a 12-member board of directors. The CSA has launched a Strategic Plan 2019 to make strengthen citizen science over three years.[28]

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[22] https://citizenscience.org.au/wp-content/uploads/2019/11/ACSA-Strategic-Plan-Review-2015-18_FINAL.pdf
[23] https://citizenscience.org.au/wp-content/uploads/2020/02/ACSA-Strategic-Plan-2019-21.pdf
[24] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Research/Citizen-science/oeh-citizen-science-strategy-2016-2018-150859.pdf
[25] https://www.citizenscience.gov/catalog/#
[26] http://bit.ly/2BluIAG
[27] https://trumpwhitehouse.archives.gov/wp-content/uploads/2019/06/Federal-Prize-and-Citizen-Science-Implementation-FY17-18-Report-June-2019.pdf
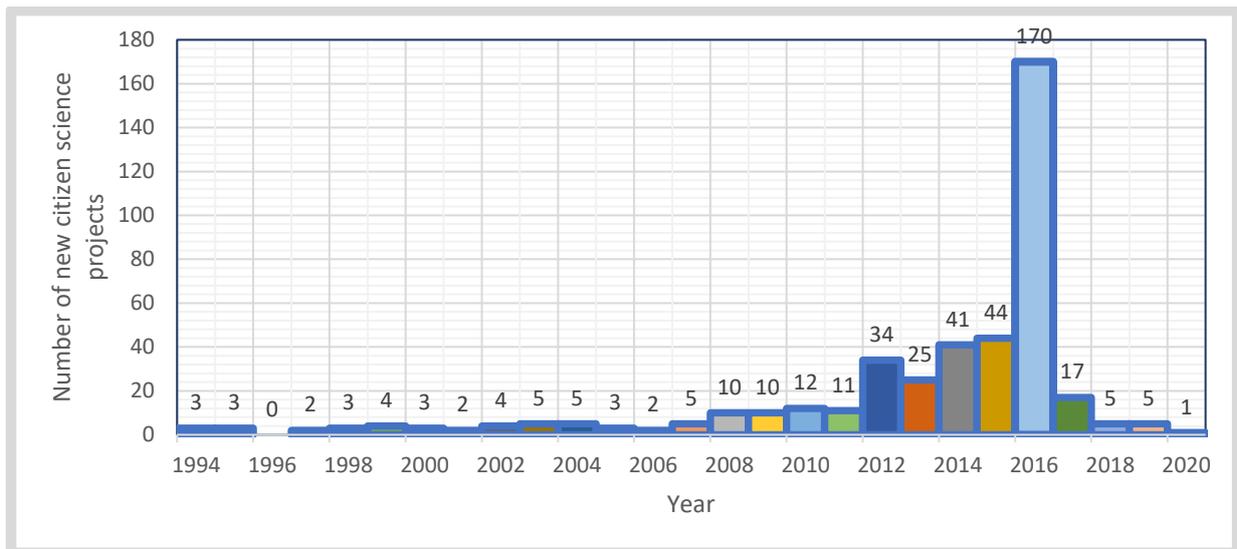[28] https://www.citizenscience.org/wp-content/uploads/2019/11/CSA-Strategic-Plan-2019.pdf

Figure 1: Growth of citizen science projects in US since 1994. [29]

Europe

Central inventory platform

EU-Citizen.science[30] is the central platform for sharing projects, resources tools and training. It was established with just under €2 million of funding by the European Commission Horizon 2020 programme, as part of the 'Science with and for Society' workstream. It is managed by the EU-Citizen Science consortium, consisting of 14 partners and nine third parties from across 14 European member states, as well as other project supporters.

Government support

In 2012, the European Commission initiated a consortium project called 'Socientize'. This was critical in increasing the recognition of citizen science projects. Socientize developed the 'Green and White Papers on Citizen Science' for Europe.

The Green Paper[31] mapped and analysed citizen science projects, and identified ongoing initiatives and programmes focused on 'researchers' outside academia. The report drafted new policy options addressing key areas to improve.

The White Paper[32] proposed actions for policy makers and science funders, citizen science mediators/facilitators, and for citizen science practitioners. The White Paper recommendations provided the basis for the establishment of the European Citizen Science Association and other science engagement initiatives directed by the European Commission.

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[29] The drastic increase in the number of new projects in 2016 could be related to the Crowdsourcing and Citizen Science Act of 2016 established by the government.
[30] https://eu-citizen.science/
[31] https://ciencia-ciudadana.es/wp-content/uploads/2018/09/GreenPaperOnCitizenScience2013.pdf
[32] https://eu-citizen.science/resource/8

One such programme is the 'Science with and for Society' (SWAFS) programme. The SWAFS Work Programme 2018–2020[33] was developed to support the evolution of citizen science at national and EU levels.

European Citizen Science Association

The European Citizen Science Association (ECSA) has more than 200 individual and organisation members from over 28 countries. The ECSA grew from an informal network into a non-governmental organisation with a board of directors and secretariat. The ECSA published a strategy in 2015 and have subsequently published three policy briefs.[34]

Germany

Central inventory platform

Bürger schaffen Wissen[35] ('Citizens Create Knowledge') is managed by Museum für Naturkunde Berlin in cooperation with the science communication agency Wissenschaft im Dialog, and funded by the German Ministry of Education and Research.

Government support

The 'Citizens Create Knowledge' (GEWISS)[36] capacity-building programme was funded by the German Federal Ministry of Education and Research to strength citizen science in Germany.[37] Its main purpose was to give an overview of citizen science projects, to further develop the landscape of citizen science, and to increase its visibility within the German public and discourse. The programme engaged more than 1200 citizen science practitioners and interest groups from over 380 organisations.

There are a range of different funding sources of citizen science in Germany, including Richtlinie zur Förderung von bürgerwissenschaftlichen Vorhaben (Citizen Science) by the German Federal Ministry of Education and Research (BMBF), providing €200,000 to €600,000 per project.

Austria

Central inventory platforms

The online platform Österreich forscht,[38] founded in 2014, is an independent, bottom-up initiative managed by early-career researchers at the University of Natural Resources and Life Sciences (BOKU) Vienna.

Government support

The Austrian Centre for Citizen Science[39] was established at the Austrian Agency for International Cooperation in Education and Research (OeAD) in 2015 by Federal Ministry of Education, Science and Research (formerly BMWFW). It acts as a 'service point' for citizen

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[33] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-swfs_en.pdf

[34] https://ecsa.citizen-science.net/documents/

[35] https://www.buergerschaffenwissen.de/

[36] https://www.buergerschaffenwissen.de/ueber-uns/gewiss-bausteinprogramm

[37] The information on Germany may not be exhaustive because of the unavailability of all documents in English.

[38] https://www.citizen-science.at/en/

[39] https://zentrumfuercitizenscience.at/de/ueber-uns/

science, connecting interested people with research institutions. They also administer a citizen science award.

Citizen Science Network Austria

The Österreich forscht platform (see above) led to the formation of Citizen Science Network Austria (CSNA).[40] The first Austrian citizen science conference was held in 2015 and is currently an annual event. The platform has grown to include 40 different citizen science project partners from over 30 different institutions. As a bottom-up initiative, the partners meet annually to decide their agenda for the coming year in a democratic way.

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[40] https://www.citizen-science.at/en/network

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