TIME4CS

SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Topic Area: Research & Methodology

TIME4CS Training Program 1

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

TIME4CS Intervention Area: Research

Training Program 1

Training Module 1.1: Research design and methodologies

- Training Module 1.1.1: Citizen science methodologies
- Training Module 1.1.2: Assessing the suitability of citizen science for your research
- Training Module 1.1.3: Interactive session: Employing a decision framework to determine whether your ideas are suitable for citizen science

Training Module 1.2: Open science practices

- Training Module 1.2.1: Data management and open science practices in citizen science projects
- Training Module 1.2.2: Public engagement and volunteer management
- Training Module 1.2.3: Interactive session: Navigating data management, volunteer management, and communication in citizen science projects

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TIME4CS Intervention Area: Research

Training Program 1: Learning outcomes

- Gain an understanding of Citizen Science (CS) methodologies within the broader context of Open Science (OS)
- Acquire the skills to conceptualize and implement new research initiatives using CS approaches or integrate CS methodologies into existing research projects
- Utilize structured decision frameworks to evaluate the appropriateness of CS for specific research projects or ideas
- Master the principles of data management and public outreach in line with OS standards, using tools like the Data Charter for Citizen Science
- Learn best practices for data management, including understanding FAIR (Findable, Accessible, Interoperable and Reusable) data principles and employing effective data hygiene, standards, and formats
- Acquire skills in volunteer management and understand the motivations and journeys of volunteers in CS
- Develop strategies for effective communication and public outreach, crucial for the success and impact of CS projects.
- Through interactive sessions, learn to formulate action plans or pitches for CS projects, integrating learned concepts in data management, volunteer management, and communication

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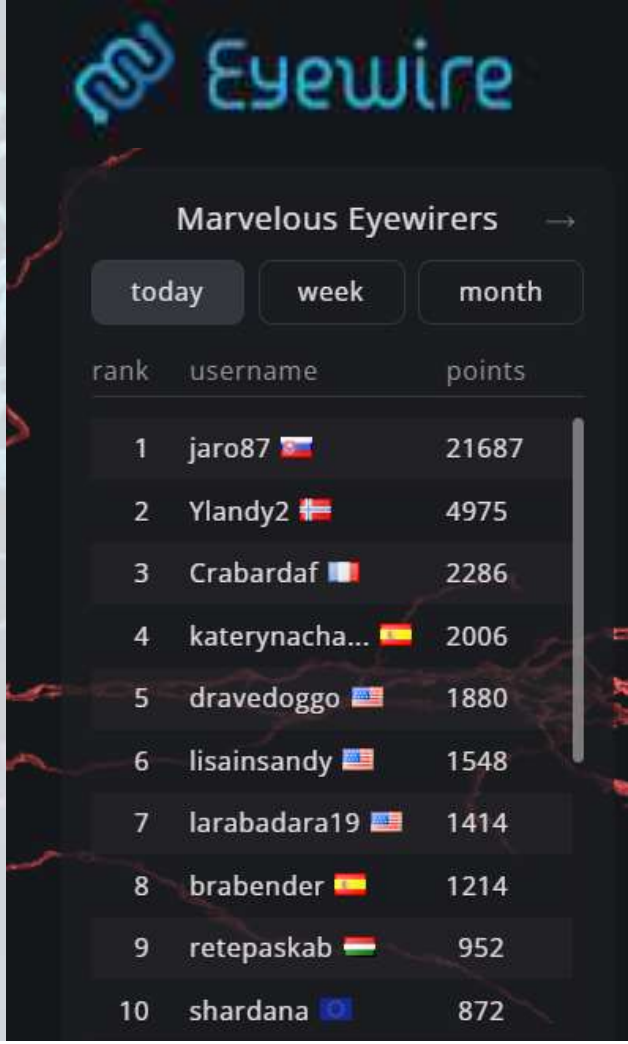
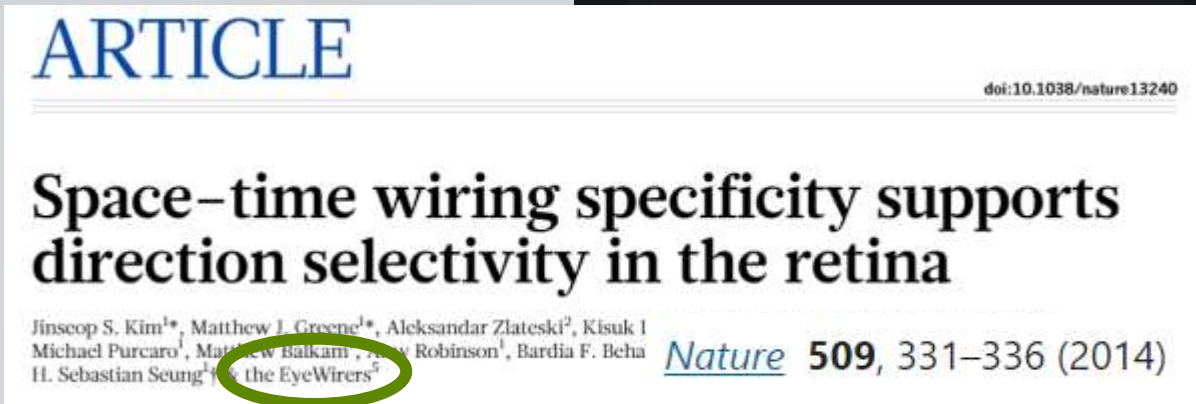
TIME4CS Eyewire – example

Mapping eye neurons

Launched 2012 >225.000 players >150 countries

- **Build a community** – Know your community partners
  - Make it fun. Engage with your volunteers. Be social!
- **Sustain and Improve** – Communicate effectively
  - Use social media, blog posts, emails; images have bigger impact
- **Sustain and Improve** – Build flexibility into your project
  - Continue improving your project; take suggestions from volunteers!




ARTICLE

doi:10.1038/nature13240

Space–time wiring specificity supports direction selectivity in the retina

Jinseop S. Kim[1]*, Matthew J. Greene[1]*, Aleksandar Zlateski[2], Kisuk Lee[1], Michael Purcaro[1], Matthew Balkam[1], Andrew Robinson[1], Bardia F. Behabadi[1], H. Sebastian Seung[1]† & the EyeWirers[3]

Nature 509, 331–336 (2014)

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Eyewire.org

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Citizen science research design and methods

Training module 1.1

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Citizen science methodologies

Training Module 1.1.1

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TIME4CS Many types of citizen science - examples

- Make computer power available for projects
- Solve tasks online
- Play games with research content online
- Crowdfunding for science
- Participate in public debates -> influence decisions
- Participate in prioritization re. research
- Hacker/maker spaces (Do-It-Yourself (DIY) labs)
- Helping archives
- Helping with fieldwork
- Community science

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Citizen science – the term emerges

Amateur contributions to science

Audubon Society (1989) &
Rick Bonney (1996)

- Citizens collecting and analysing rain samples
- Birdwatchers submitting sightings
- *Participants are instruments*

Biodiversity monitoring

Democratisation of science

Alan Irwin (1995)

- Democratic, participatory science
- Science to address needs and concerns of citizens
- Citizens could develop process of producing reliable knowledge themselves
- *Participants can influence and transform science*

Activist science

Participatory action research

Community-based natural resource management

Public and Patient Involvement (PPI)

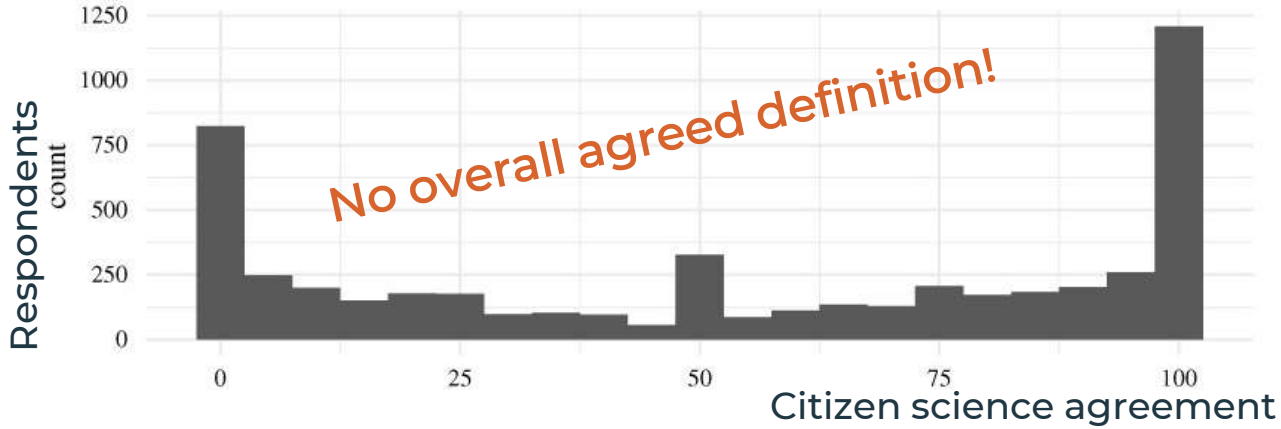
CS now

What is citizen science today?

"Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists or scientific institutions"

(Oxford English Dictionary)

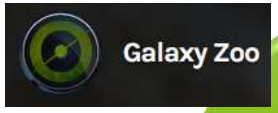
- Public participation in scientific research
- Crowdsourcing and crowdfunding
- Distributed (hybrid) intelligence
- Community science
- Action (or activist) science



Contours of Citizen Science (Haklay et al. 2021)

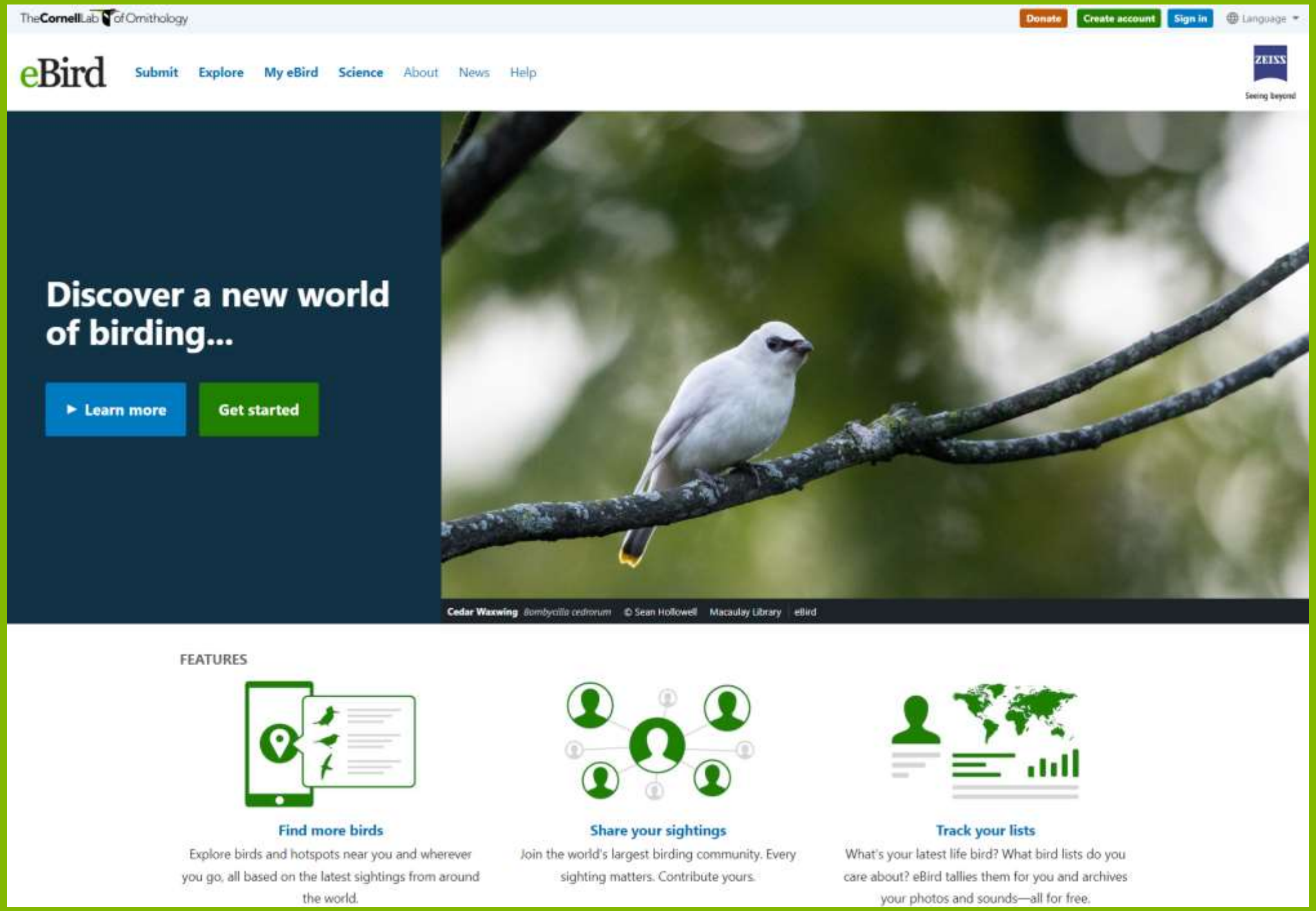
- Wide range of activities
- Within a wide range of scientific fields

Wide range of fields



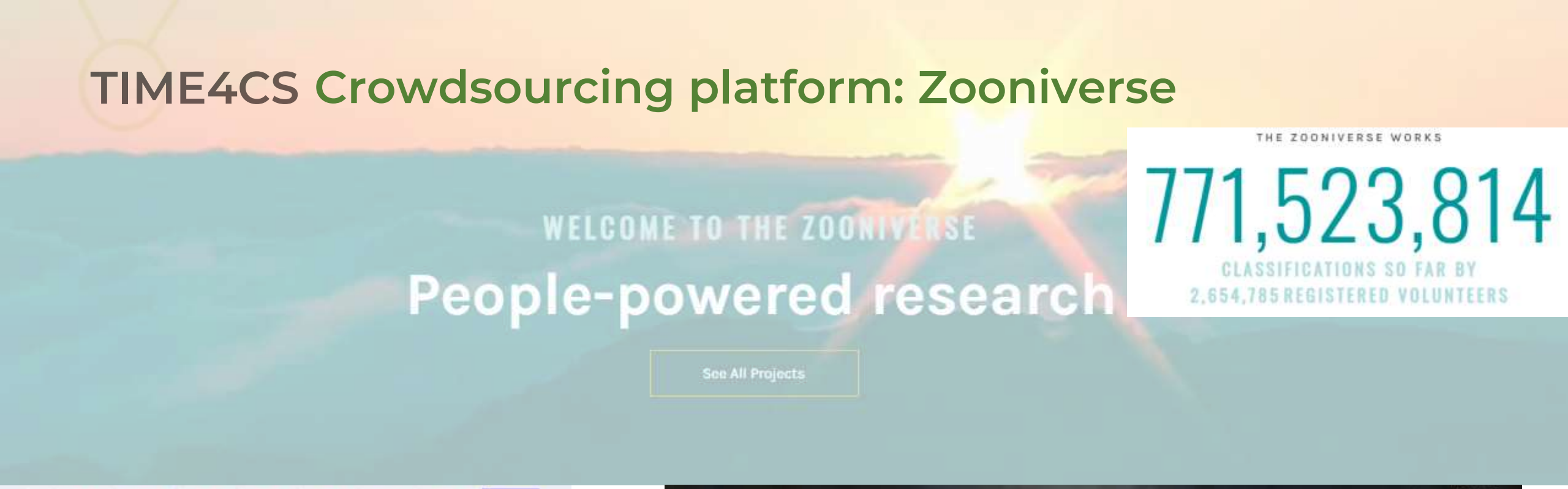
CCCBLAB
CULTURAL RESEARCH AND INNOVATION

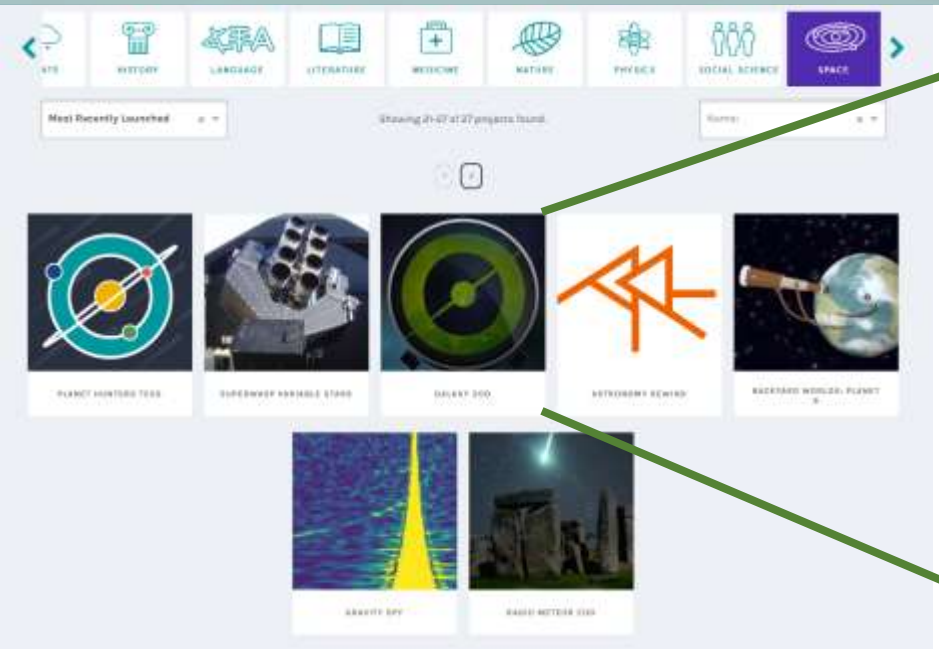
Ecology
"SDG monitoring"
Health
Citizen science
Astronomy
Archaeo-logy
Social science
Meteoro-logy
Physics

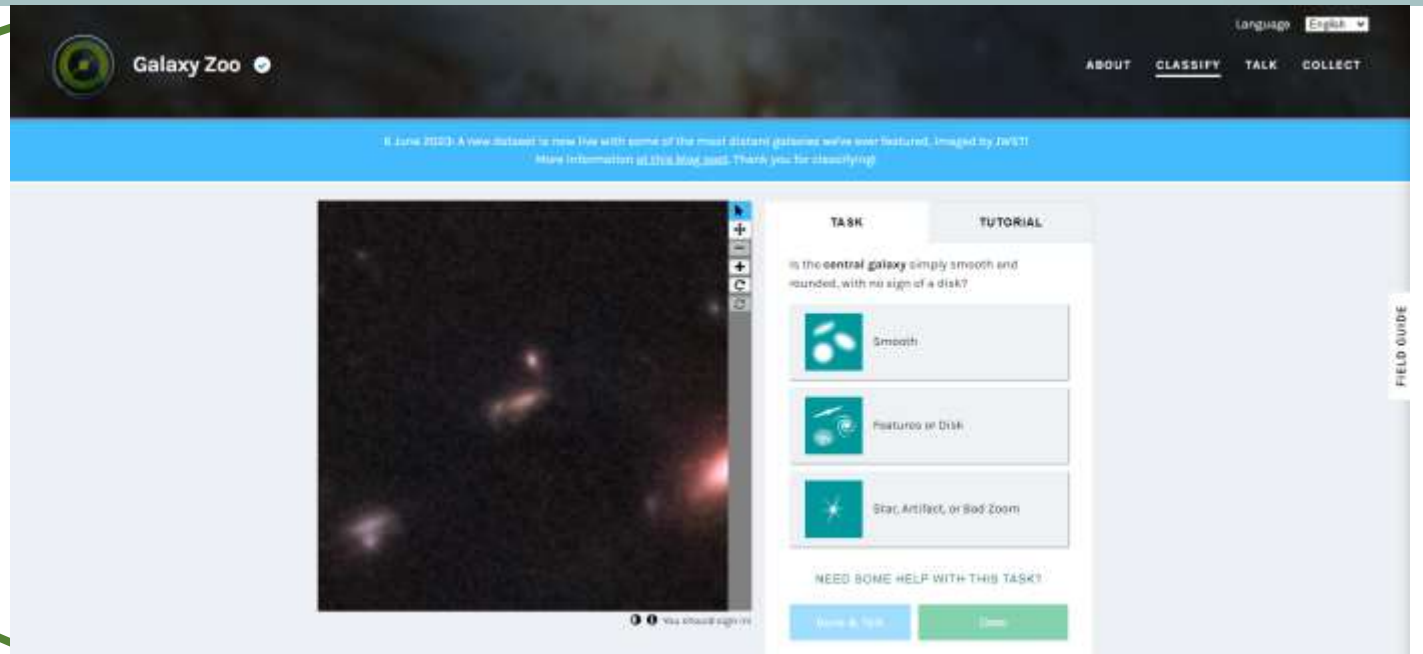


- **Worldwide**
- 100s of partner groups
- 100 million obs / year
- 20% growth year on year
- Birds are ecological indicators
- **Scope Your Problem** – Engage stakeholders (both government and NGOs)
- **Build a Community** – Know your community partners (participate in bird meetings & festivals)
- **Sustain & Improve** – Adapt to cycles of participation (evaluate and adapt)

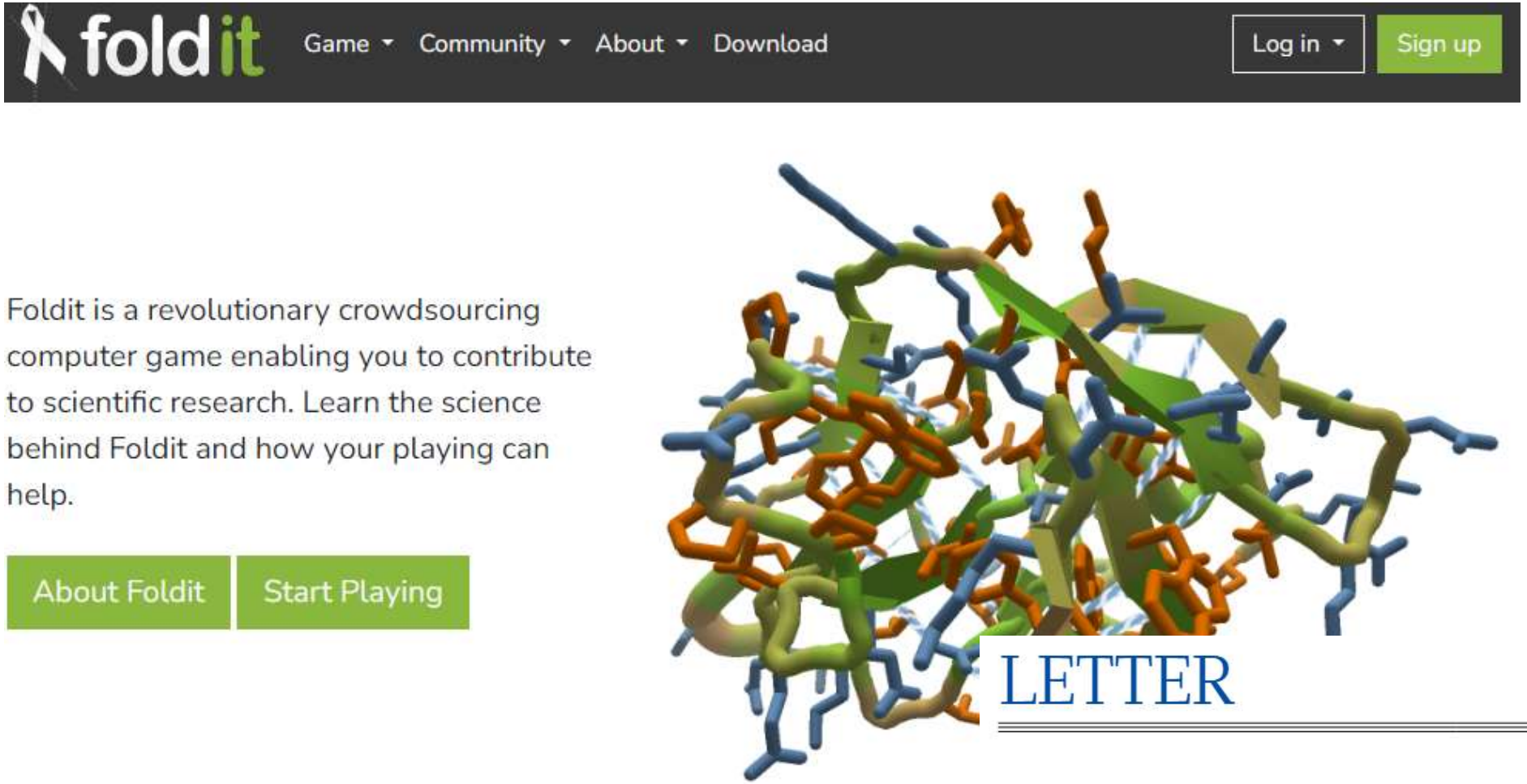
TIME4CS Crowdsourcing platform: Zooniverse







TIME4CS Gamification of research tasks - Foldit




LETTER

https://doi.org/10.1038/s41586-019-1274-4

De novo protein design by citizen scientists

Brian Koepnick[1,2], Jeff Flatten[3], Tamir Husain[3], Alex Ford[1,2], Daniel-Adriano Silva[1,2], Matthew J. Bick[1,2], Aaron Bauer[3], [illegible], Yojiro Ishida[6], Alexander Boykov[11], Roger D. Estep[11], Susan Kleinfelter[11], Toke Nørgård-Solano[11], Linda Wei[11], Foldit Players[16], Gaetano T. Montelione[4,6], Frank DiMaio[1,2], Zoran Popović[3], Firas Khatib[7], Seth Cooper[8] & David Baker[1,2,9]*

NATURE | VOL 570 | 20 JUNE 2019

TIME4CS

Involving school children

TIME4CS Masseeksperimentet (The Mass Experiment)

Plast-forurening i Danmark

Masseeksperiment 2019 i runde tal

Skoler fra **92** ud af 98 kommuner var med

57.000 elever var med

3.548 indsamlinger i alt

I alt indsamlet **374.082** stykker plast

355 km strækning blev kortlagt

I alt **112.018** cigaretskodder

I gennemsnit blev der fundet **105** stykker plast per indsamling

Rekorden for én enkelt indsamling var **3.322** stykker plast

2.560 besøg af Hovedet i Havets karavane

332 sild blev dissekeret

8

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nature › scientific reports › articles › article

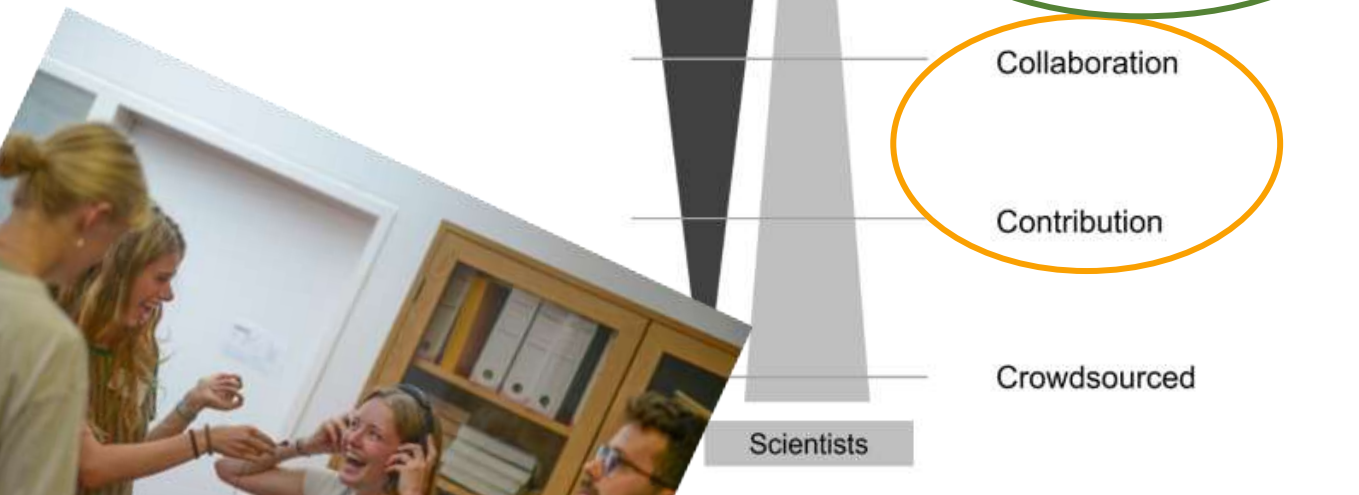
Article | Open Access | Published: 20 October 2020

A nationwide assessment of plastic pollution in the Danish realm using citizen science

Kristian Syberg, Annemette Palmqvist, Farhan R. Khan, Jakob Strand, Jes Vollertsen, Lauge Peter

TIME4CS Give Youth a Voice

- 3½ year project
- Mental health, communication & data with and for youth
- 1775 young people involved (14-22 years old)
  - Unique youth perspective
  - Young peer-to-peer dialogues
- 2 tiers of involvement



agram showing how typology determines the level of engagement for both citizens and scientists.

https://givdeungeordet.dk

Covid lockdown coping mechanisms

Make your bed

You have to communicate more actively than before

Create your own spaces

Create daily structure, e.g. clear separation of 'work space' and 'free time space'

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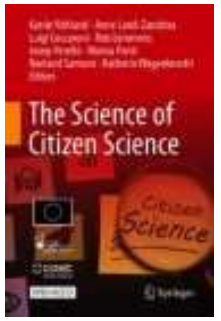
research and innovation programme under grant agreer

TIME4CS Co-creation, participatory, and community-based approaches



Contributory citizen science
(Majority of early online citizen science projects)

Co-creation & participatory approaches
(Citizen social sciences, AR, science shops)

Scientist as project designer

Participatory technology or strategy

Citizens as data gatherers

Citizens' & CSOs' real-world problems

Scientist as co-designer and facilitator

Shared, open, and reflexive research process

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TIME4CS Citizen science methodologies by levels of participation

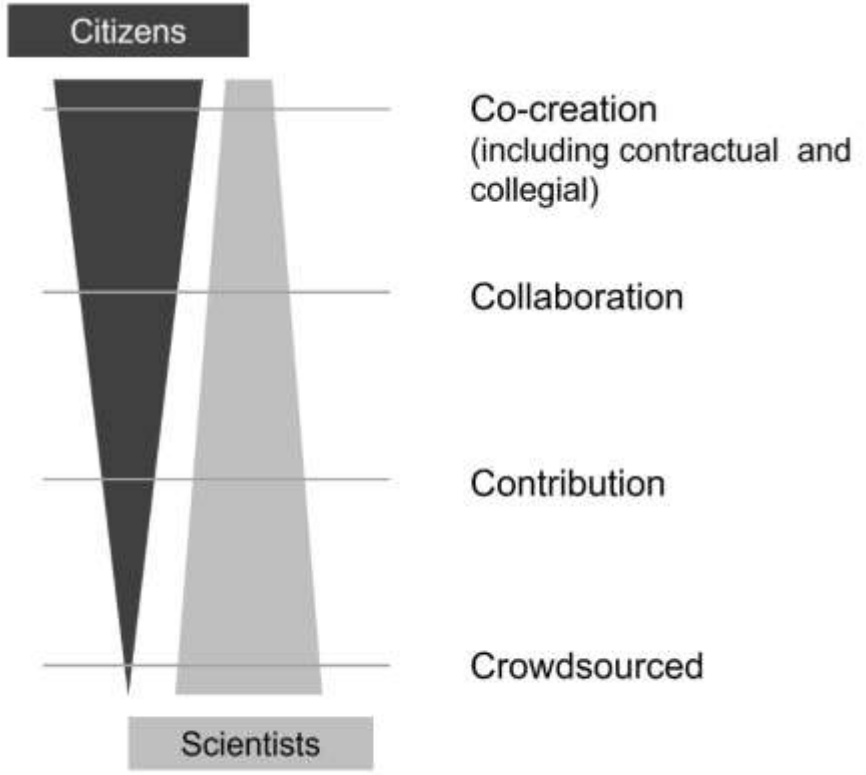


Figure 1: Diagram showing how typology determines the level of engagement for both citizens and scientists.

Level 4 'Extreme Citizen Science'

- Collaborative science – problem definition, data collection and analysis

Level 3 'Participatory science'

- Participation in problem definition and data collection

Level 2 'Distributed Intelligence'

- Citizens as basic interpreters
- Volunteered thinking

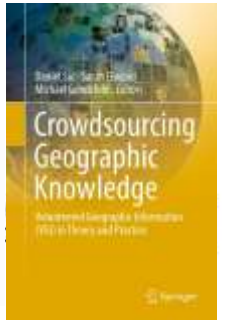
Level 1 'Crowdsourcing'

- Citizens as sensors
- Volunteered computing

Citizen Science and Volunteered Geographic Information: Overview and Typology of Participation

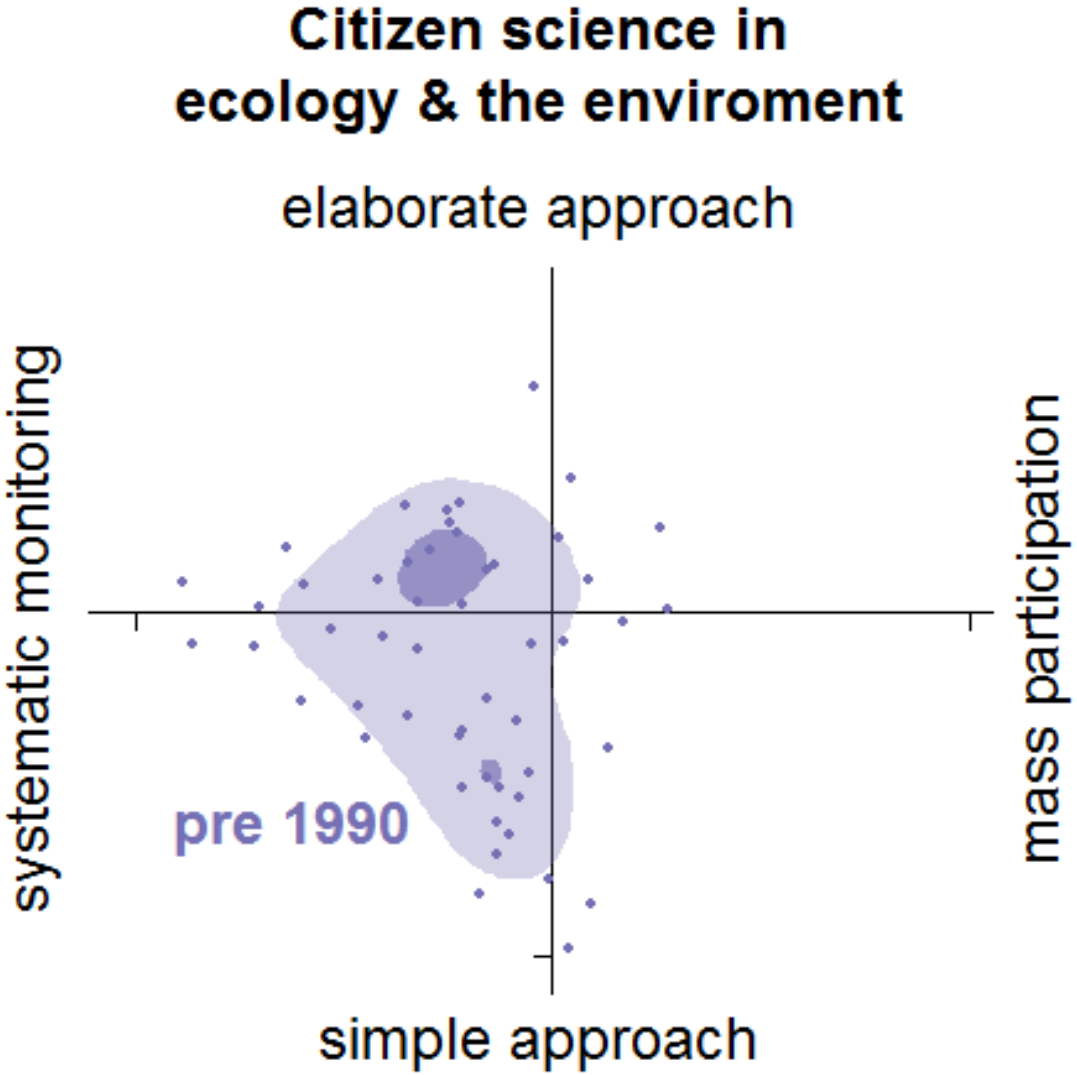
Muki Haklay

Chapter | First Online: 01 January 2012



TIME4CS CS project types change over time

- CS methods are not static but continuously evolve
- Clear trend pre-1990 to 2014: from systematic and elaborate to mass participation and simple



TIME4CS Summary

- Many types of citizen science
  - From making computer power available, solving tasks & playing games online
  - To participation in debates and prioritization of research
  - And participation in the field and community science
- Citizen science is an umbrella term for many different approaches to involving the public in research processes

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Assessing the suitability of citizen science for your research project

Training Module 1.1.2

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TIME4CS Reasons for choosing citizen science (or not)

CS advantageous when…

- Training required not too technical
- Public involvement serves goals
- You want to promote STEM learning
- You need data across large areas or over long time
- You need many eyes on the ground
- You need to analyse large amounts of data or images
- Tasks can be completed online

CS *not* advantageous when…

- Training or equipment is highly technical
- Other goals to engage the public are more suited to your organization's goals
- Sampling needs to occur infrequently
- Data collection is in remote /inaccessible areas
- Risks for participants are identified

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TIME4CS Defining project aims

Work out what you are trying to achieve

Science as co-creation

- What do you want to study?
- What is the problem, question or issue you are trying to resolve?
- Do you want or need to reach a certain number of volunteers?
- Promote student learning?
- Involve a particular group of people?
- What data will you collect, and how will it help you achieve your goal(s)?
- How will you display your results to clearly show the connection to your aims?
- How will you evaluate your project against your stated aims?

- Make a timeline for your project

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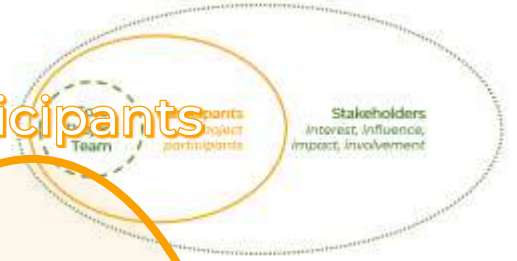
TIME4CS Stakeholder Analysis example: Timing/Stakeholders

Stakeholder mapping for Citizen Science project implementation



Participants

Participants

Participants

Participants

Stakeholders – *any change agents?*

Place your stakeholders according to when you need to involve them

External collaborators – *break this down further, who are they?*

Director / Board

Research Library Staff

Heads of Department

Early Career Researchers

Researchers

Funding Officers

Timing

Planning – Design – Coordination – Outreach – Execution – Evaluation – Follow-up

Participants

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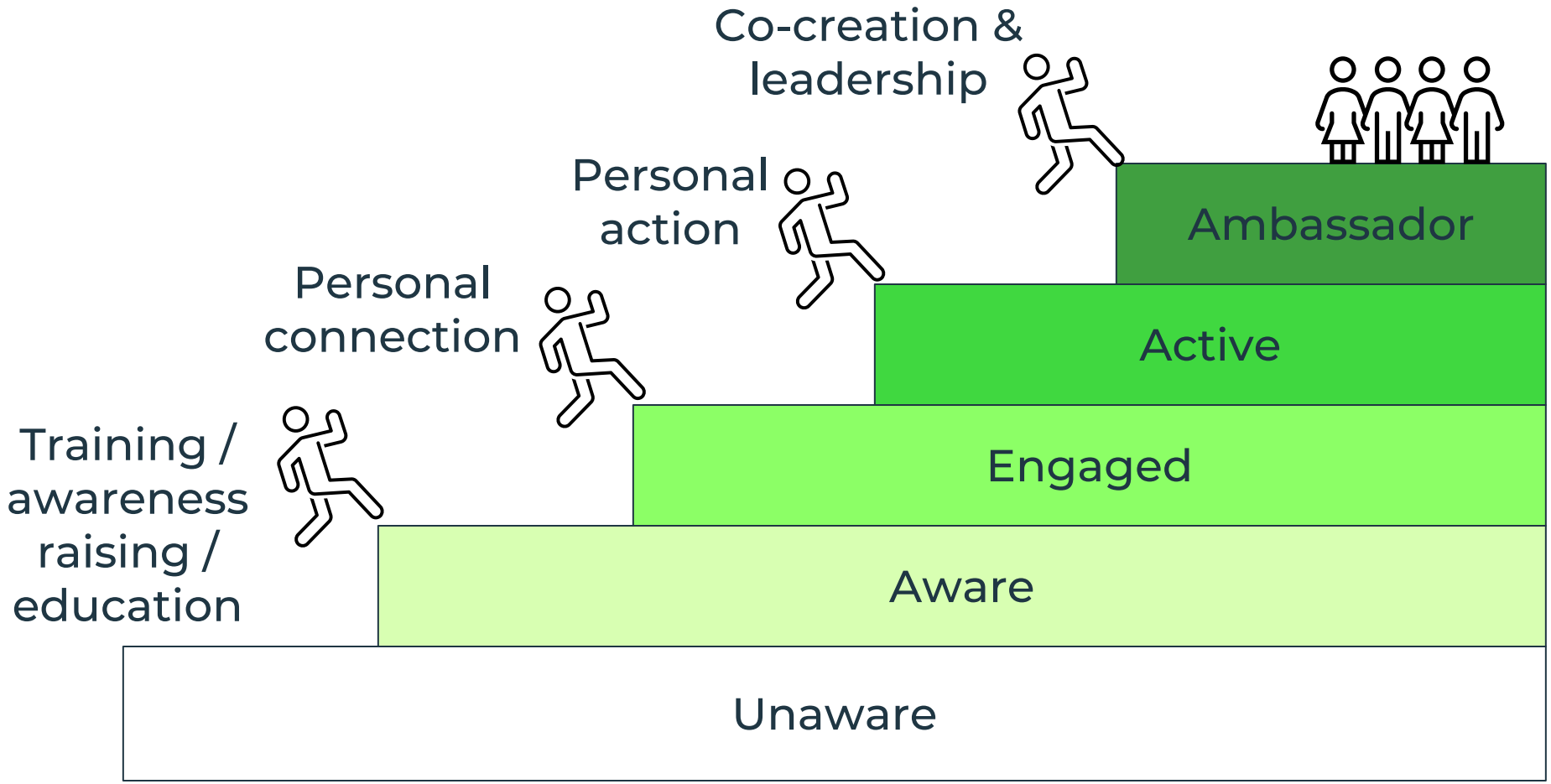
TIME4CS Ladder of Participation for both participants AND researchers!



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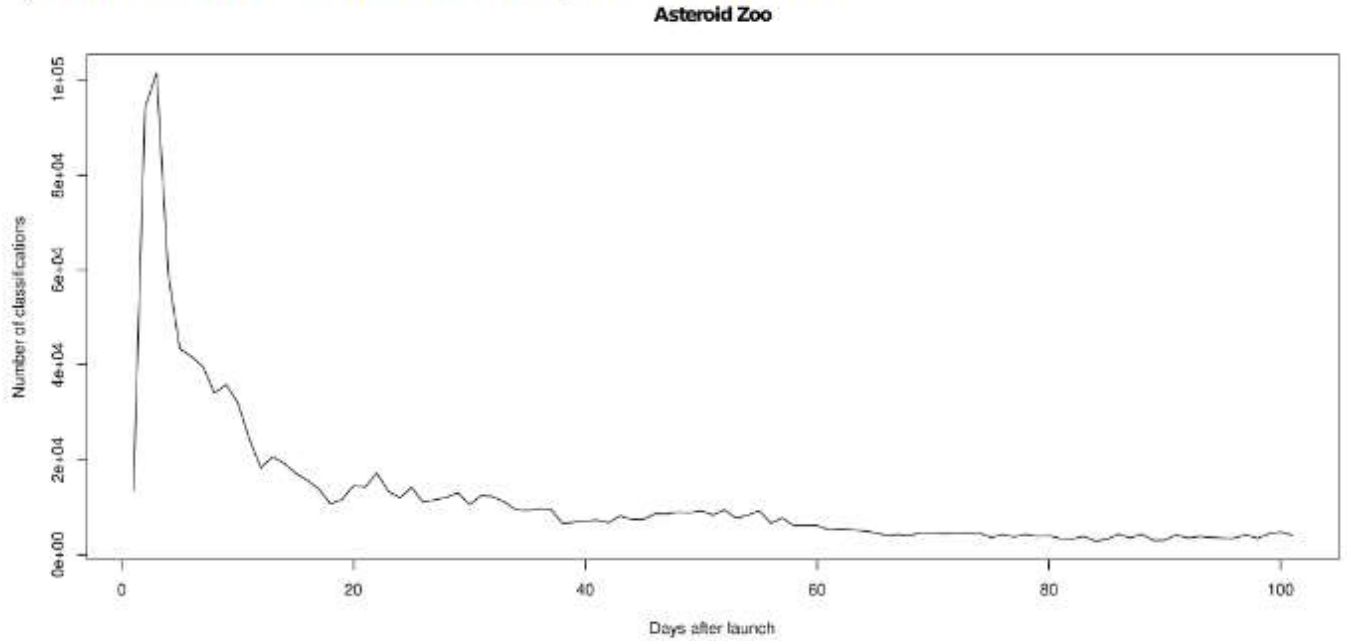
a) Number of classifications a day on Asteroid Zoo.



Asteroid Zoo

Spiers, H., Swanson, A., Fortson, L., Simmons, B., Trouille, L., Blickhan, S. and Lintott, C. (2019). Everyone counts? Design considerations in online citizen science *JCOM* 18(01), A04. https://doi.org/10.22323/2.18010204

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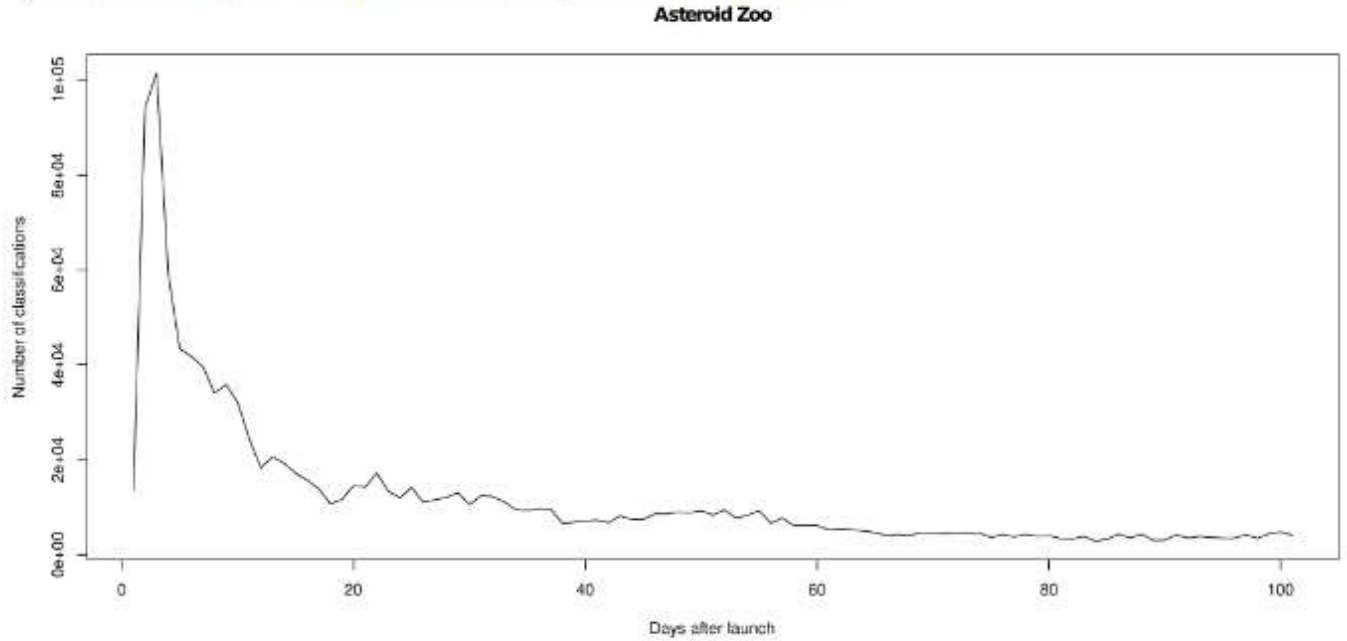
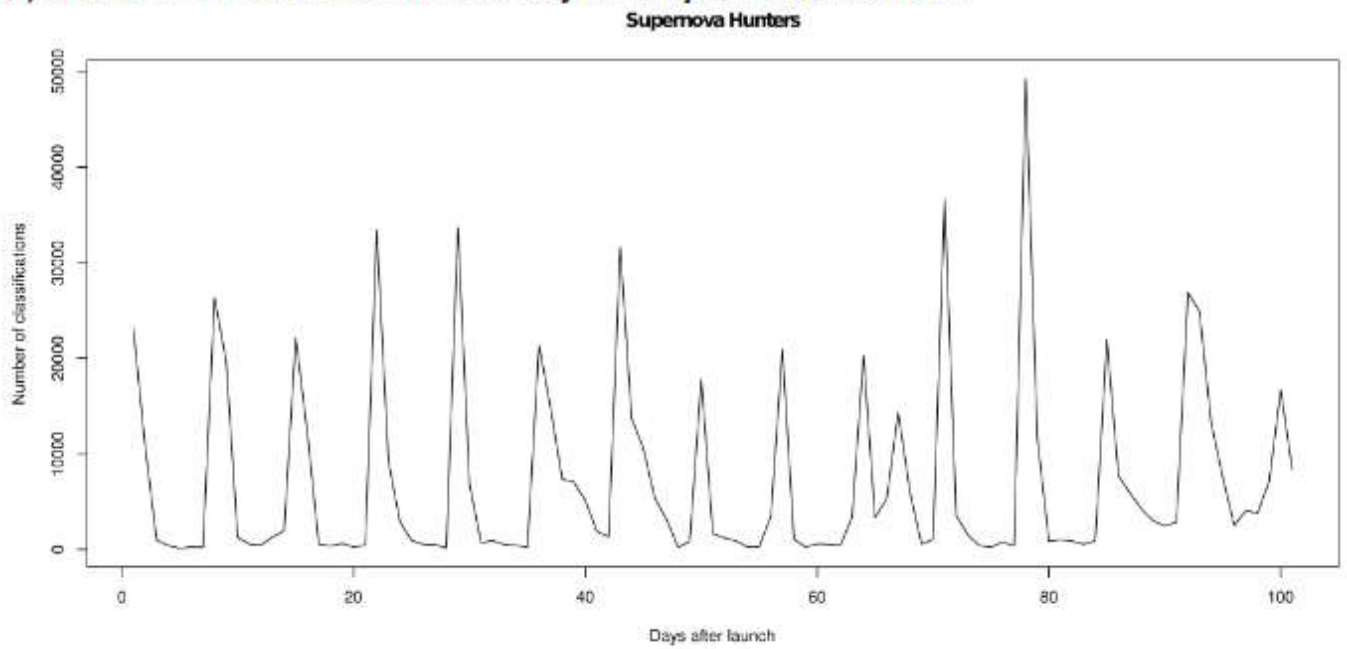


b) Number of classifications a day on Supernova Hunters.



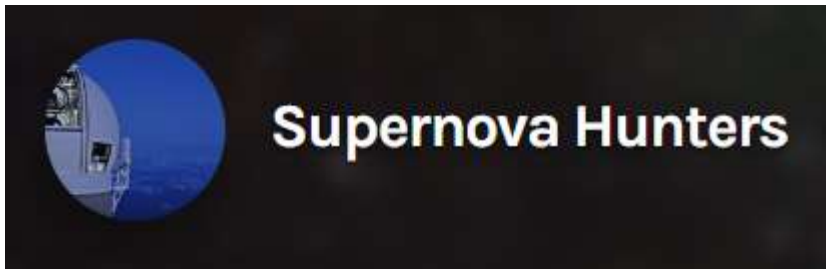


Figure 4 : *Supernova Hunters has a distinctive classification curve.* A typical Zooniverse project has a classification curve displaying a peak of activity after launch that rapidly declines a), however there are exceptions to this observation, the most striking of which is the classification curve of the *Supernova Hunters*

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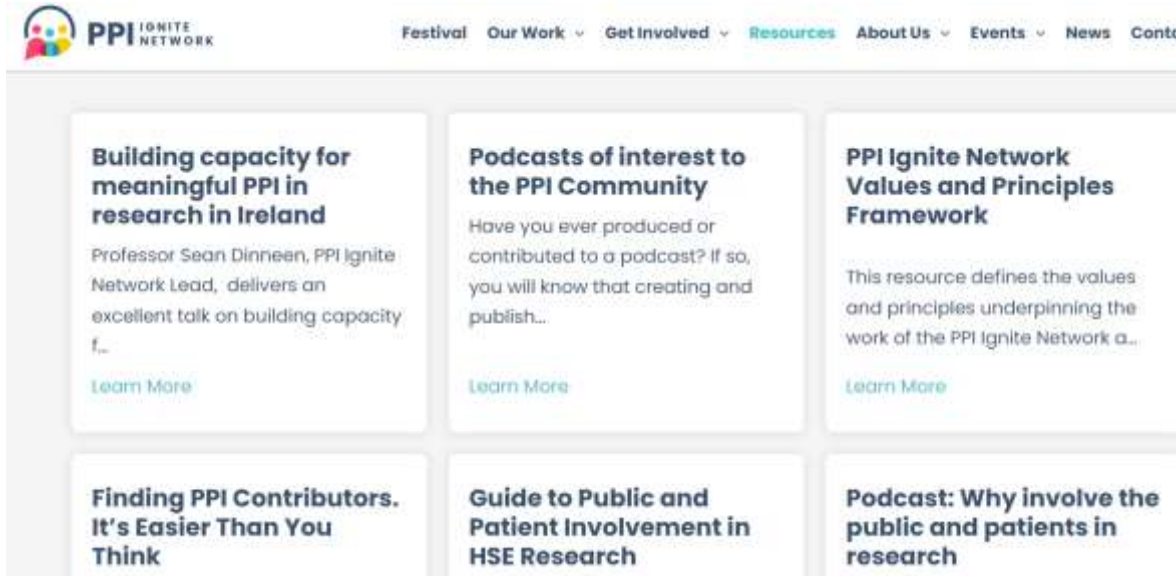
Spiers, H., Swanson, A., Fortson, L., Simmons, B., Trouille, L., Blickhan, S. and Lintott, C. (2019). Everyone counts? Design considerations in online citizen science *JCOM* 18(01), A04. https://doi.org/10.22323/2.18010204

TIME4CS Public & Patient Involvement (PPI)

TABLE 1 | Characteristics of citizen science projects in prevention.

Project characteristics	*n*	%
Aims of citizen science projects		
Identify problems	29	40%
Generate or prioritize solutions	21	29%
Develop or deliver intervention	21	29%
Monitor and/or evaluate interventions	20	27%
Community empowerment or capacity building	15	21%
Access novel data	11	15%
Influence health knowledge, attitudes, or behaviors	5	7%
Scale		
Small (<50 participants)	43	61%
Medium (50 to 299 participants)	11	16%
Large (> 300 participants)	16	23%

Marks et al. 2022: [A Scoping Review of Citizen Science Approaches in Chronic Disease Prevention]

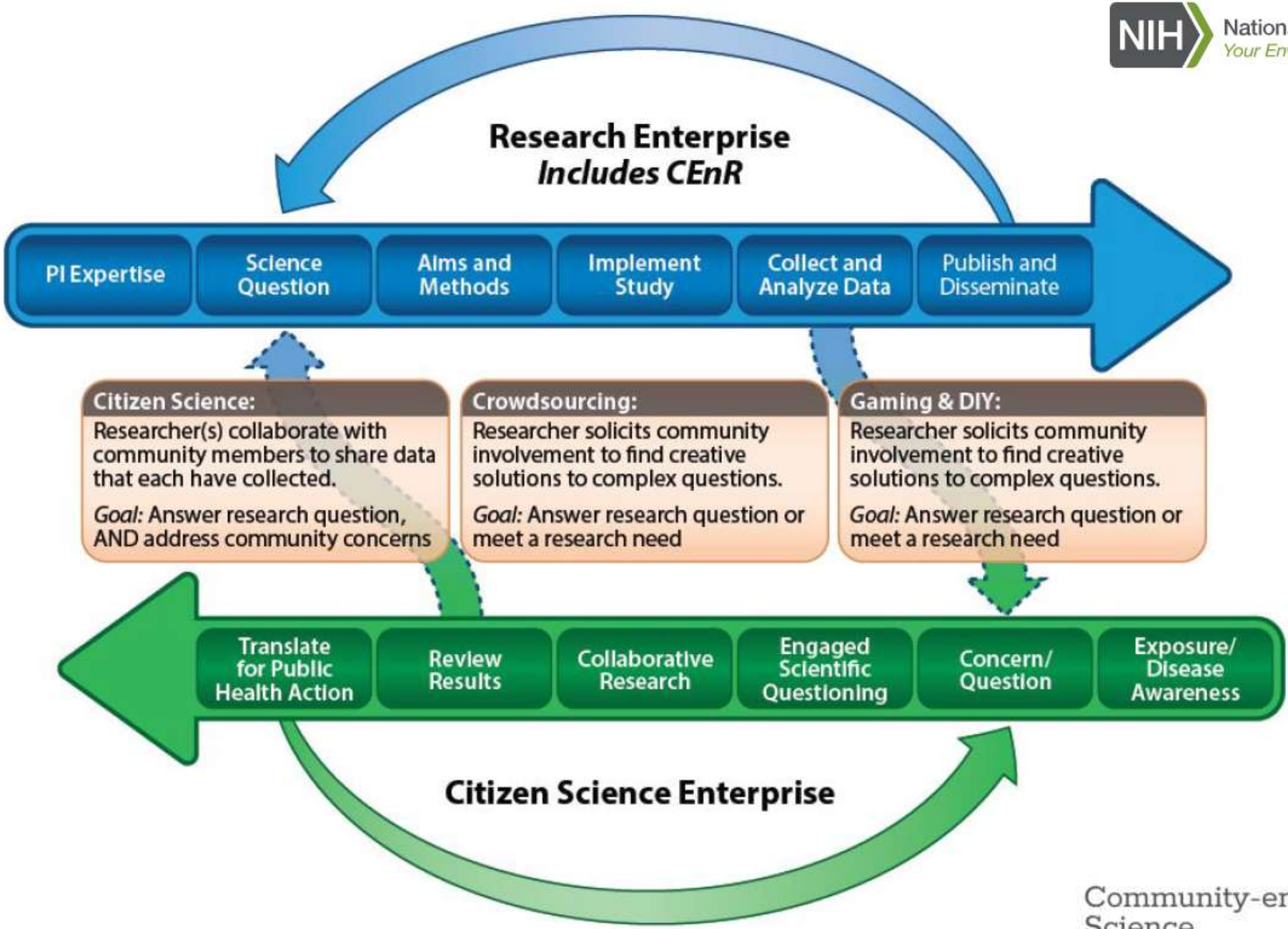


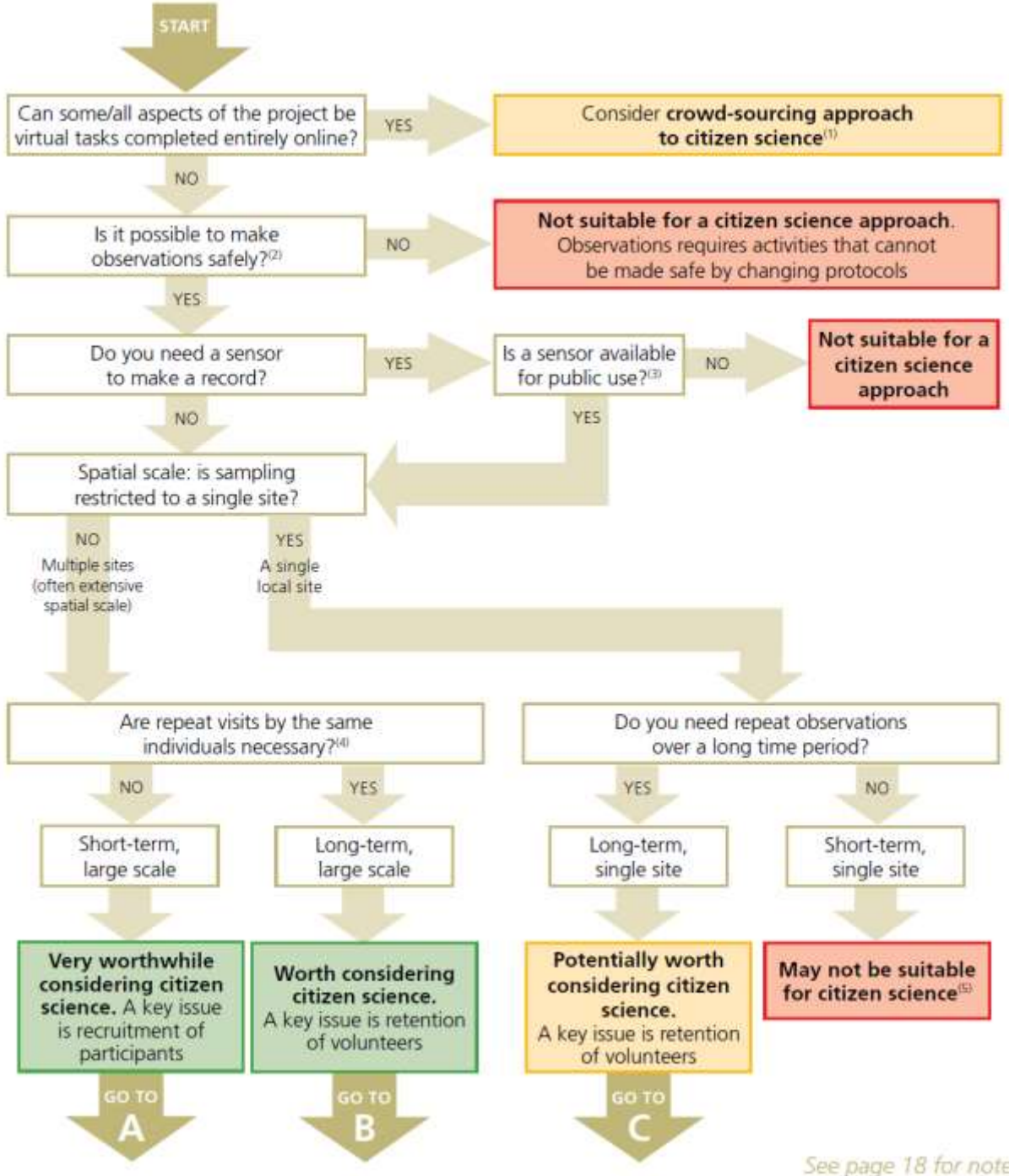
TIME4CS Volunteers' motivations

Environmental monitoring projects

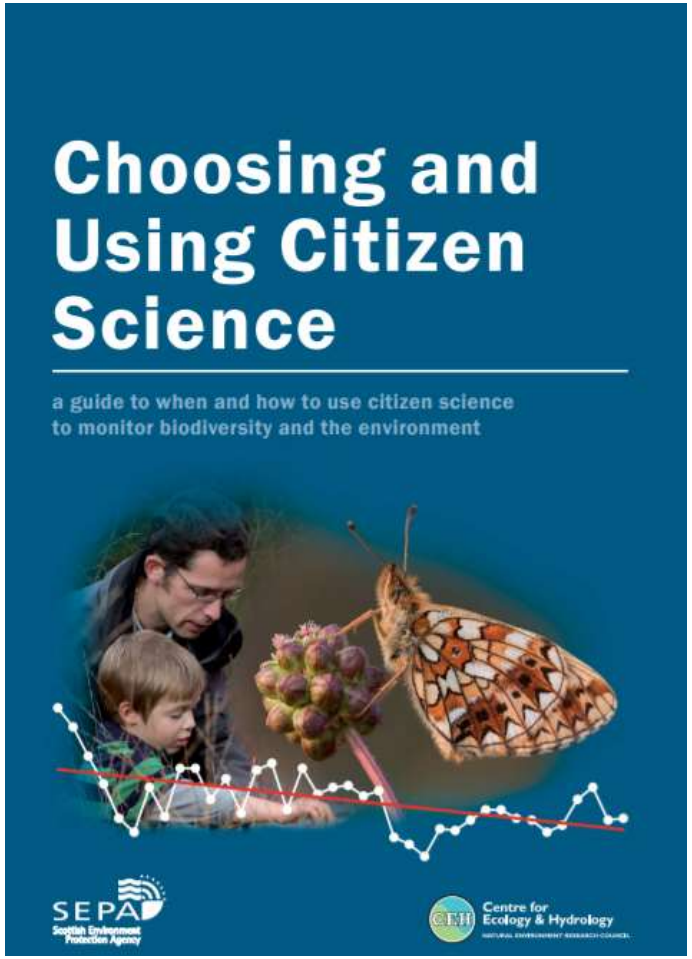
Motivational function	Specific motivation	Sources
Values	Interest in wildlife Concern for the environment, wildlife or conservation	Weston et al. 2006, Davies et al. 2011, Hobbs and White 2012, Johnson et al. 2014, Wright et al. 2015, Geoghegan et al. 2016, Martin et al. 2016
	Contribution to science and data collection	Davies et al. 2011, Hobbs and White 2012, Wright et al. 2015, Geoghegan et al. 2016, Martin et al. 2016
Understanding	Desire to learn and exchange knowledge	Bell et al. 2008, Thiel et al. 2014, Martin et al. 2016
Recreation / Enhancement	Opportunity to spend time in nature or outdoors	Bell et al. 2008, Johnson et al. 2014, Wright et al. 2015
	Gaining public recognition for their efforts	Thiel et al. 2014
Social	Social interactions	Bell et al. 2008
	Collectivism	Rotman et al. 2012

National Institute of Environmental Health Sciences
Your Environment. Your Health.





CS is a method like any other scientific method
– only use when appropriate!



Pocock et al. 2014: https://www.ceh.ac.uk/citizen-science-best-practice-guide

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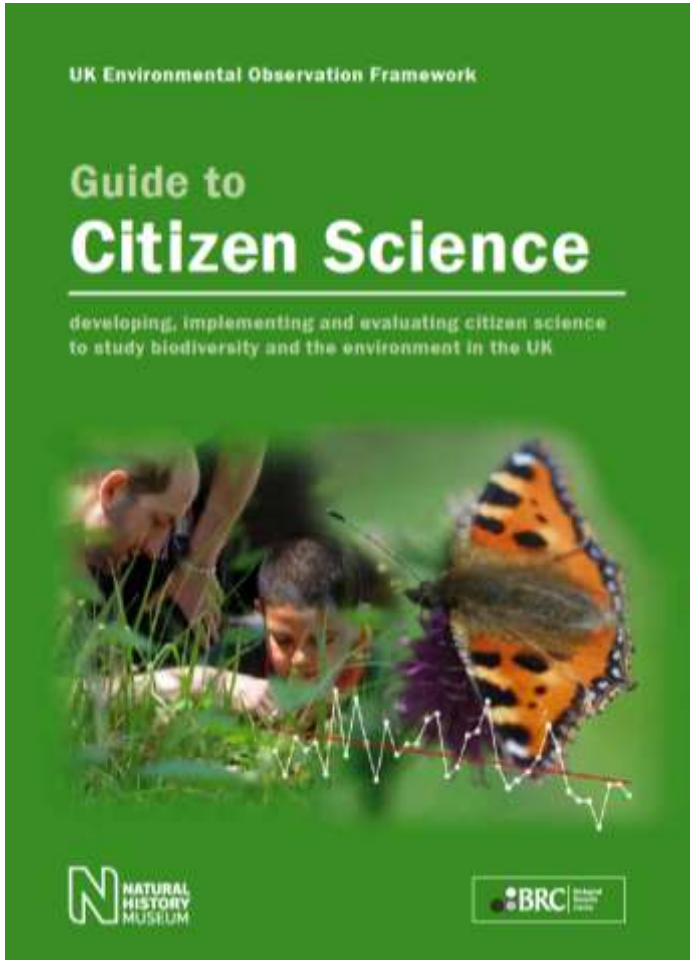
TIME4CS Setting up for success

CS is a method like any other scientific method
– only use when appropriate!



Pocock et al. 2014: https://www.ceh.ac.uk/citizen-science-best-practice-guide

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Employing a decision framework to determine whether your ideas are suitable for citizen science

Training Module 1.1.3:
Interactive session

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TIME4CS Interactive session: Using a decision framework to decide whether your ideas are right for CS

Program	Task
Group discussion	Participants discuss the various aspects of their projects, such as the research question, target community, expected outcomes, and potential challenges. They are encouraged to share their project ideas or existing projects.
Applying the framework	Each participant or group applies the decision framework to their project idea or existing project. This involves systematically evaluating their project against the criteria outlined in the framework.
Identifying opportunities and challenges	Participants identify the opportunities that CS could bring to their project, such as increased data collection, broader public engagement, and enhanced community relevance. They also discuss potential challenges, including managing volunteer contributions, ensuring data quality, and addressing ethical considerations.
Presentation and feedback	Participants or groups present their assessments in a two-minute pitch, outlining whether CS is suitable for their project and why. Presentations are followed by a feedback session, where peers and/or facilitators provide constructive comments, alternative perspectives, and suggestions for improvement.
Conclusion and reflection	The session concludes with participants reflecting on their learning experience. They consider how the decision framework has influenced their understanding of the applicability of CS to their research.

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Open science practices in citizen science projects

Training Module 1.2

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SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Open data management and open access

Training Module 1.2.1

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TIME4CS The benefits of open science

Open science offers an array of benefits across five domains

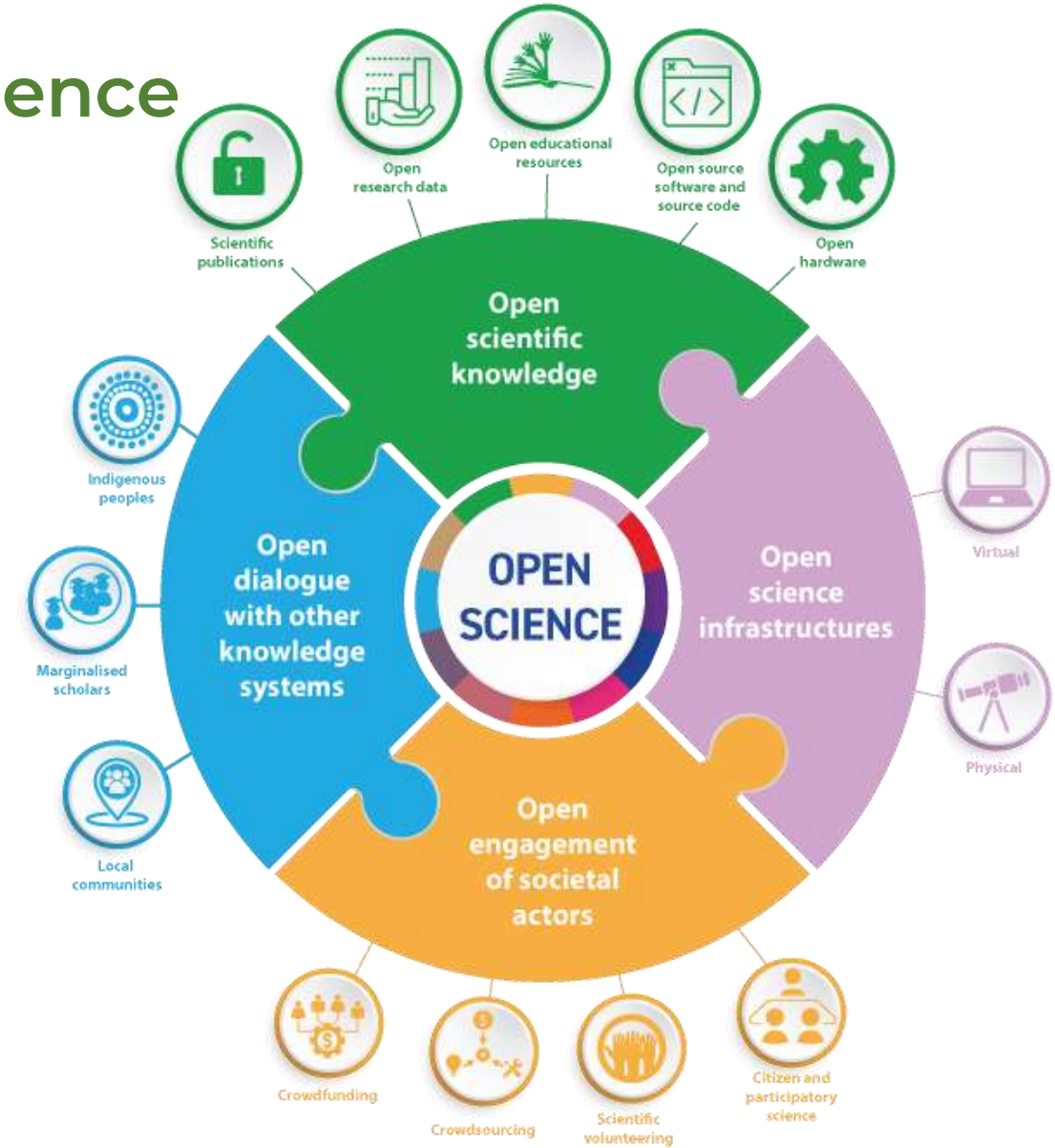
- **Supporting the growth of the knowledge economy/society**
  - Reciprocity between research, innovation, civil society, and governance
- **Improving the integrity, reliability, and transparency of research**
  - Enhanced credibility and legitimacy for scientific research
- **Generating social and public benefit**
  - Social needs articulated by the public inform greater share of research
- **Strengthening scientific literacy and education**
  - A rigorous and inquisitive approach and better informed decisions
- **Improving public policy and democracy**
  - Flow of knowledge from science into policy-making and deliberation

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

TIME4CS Components of open science

Citizen science as open science

- **Engagement with societal actors and stakeholders**
  - Enhanced dialogue between scientists, policymakers and practitioners, entrepreneurs and community members (knowledge holders)
- **Access to infrastructures of scientific knowledge production and dissemination**
  - Shared repositories for data and code, publication platforms, open labs, etc.



UNESCO Recommendation on Open Science, 2021

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TIME4CS What is FAIR Data? Why is FAIR Data important to citizen science?

FAIR = Findable, Accessible, Interoperable, Reuseable

- **Enhanced findability, accessibility, and learning opportunities**
  - Enables diverse participation and fosters inclusivity and learning
- **Increased engagement, collaboration, and innovation**
  - Facilitates effective collaboration leading to innovative solutions and the development of new research projects
- **Improved data quality and validation**
  - Allows broader scrutiny for error identification and correction, and enables validation through replication and reanalysis
- **Public value and impact**
  - Promotes the broader dissemination of research, informing decision-making and enabling advocacy for community changes

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Guide to Data Charter for Citizen Science

v1.0

A basic set of principles to support open and interoperable citizen-science data

Flanders
State of the Art

SCivil
Citizen Science Vlaanderen

2021

Note

obtaining '5-star open data'

Globally, there is a growing trend towards publishing '5-star open data', also known as 'Linked Open Data' (LOD).
This involves structuring and defining data in such a way that you can easily link it digitally (within the boundaries of privacy and security regulations) and in which data exchange becomes easier. Sir Tim Berners-Lee, the inventor of the world wide web, translated this so-called interoperability into a graduated scale (see Figure 2).
The higher you are on the scale, the easier it is for others to reuse your project data.

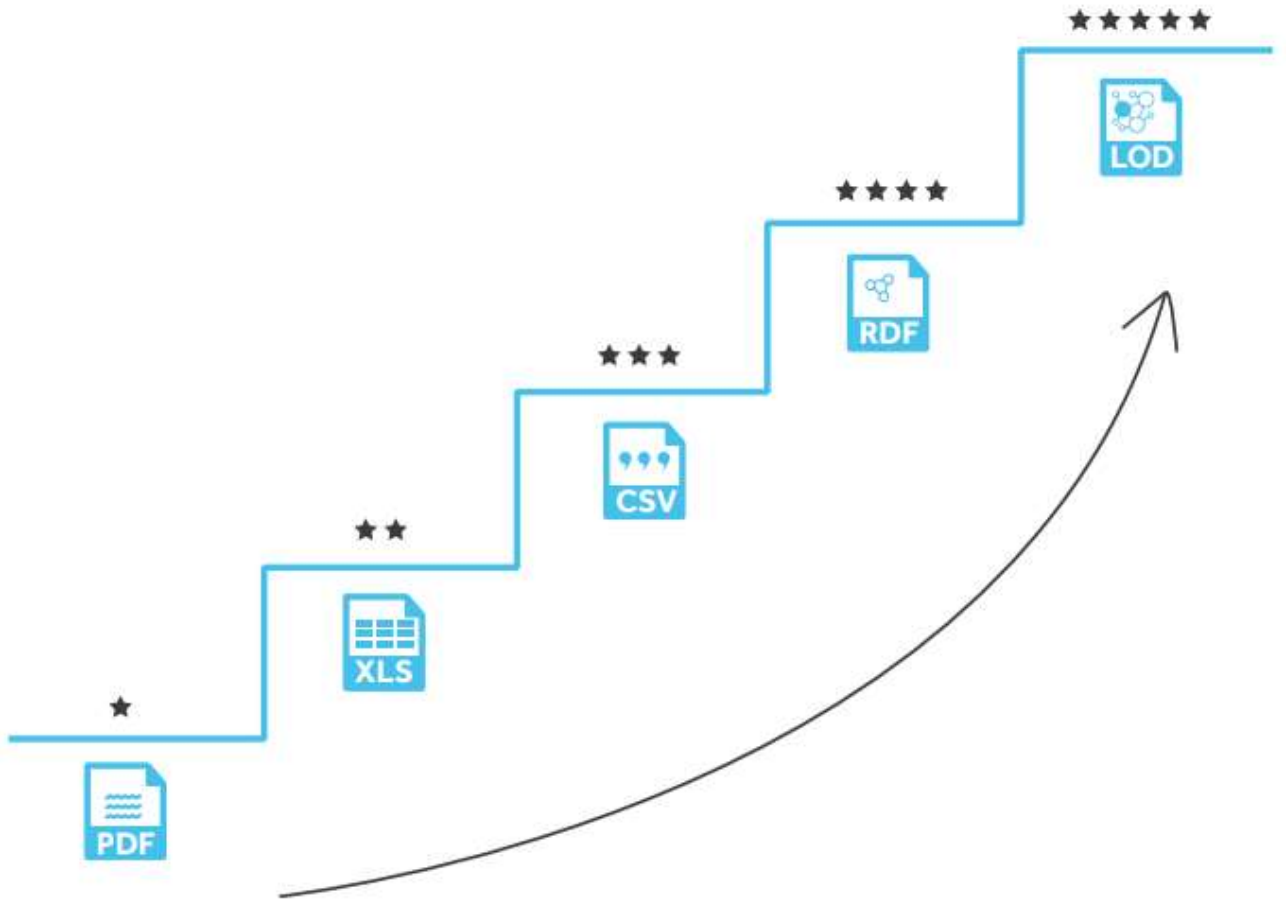

Figure 2
'5-Star Open Data'.

Sterken M., Capiau R., Members of the Scivil data management working group. 2021. Data Charter for Citizen Science: A basic set of principles to support open and interoperable citizen-science data. Scivil, 2021.

TIME4CS Introducing the open attitude

Data Charter for Citizen Science

How to make your citizen science “stuff” available on the web (whatever format) under an open license

- **Aim to publish your data openly on the web, or give a clear and well-founded reason if this is not possible**
- **Publish your data under an open licence that you choose from a short, recommended list**
  - For example, the Creative Commons license or the Open Data Commons
- **Publish your research results and findings where possible in Open Access Journals**
  - Where possible, also publish the software you develop under open licences
- **Actively seek for open data – and seek advice from support services**
  - For example, the library or open science officers

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TIME4CS Privacy and ethics challenges

Data Charter for Citizen Science

How to maintain adherence to privacy and ethics standards in citizen science projects

- **Informed content and transparent communication**
  - Prioritize obtaining clear and informed consent from participants, ensuring they are fully aware of the project's goals, risks, and their rights
  - Maintain open and transparent communication about project goals, data usage, and results, forstering trust and collaboration
- **Data protection measures**
  - Implement robust data protection measures such as encryption and anonymization to safeguard sensitive information (GPDR compliance)
- **Diversity and inclusivity**
  - Promote diversity and inclusivity in project participation, making it accessible and equitable to different demographics, and considering diverse needs and perspectives in project design and implementation

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TIME4CS Data hygiene in citizen science

Data Charter for Citizen Science

How to ensure the cleanliness, accuracy, and quality of citizen-science data within a database or information system

- **Data validation and regular data audits and cleaning**
  - Apply rigorous data validation techniques to ensure the accuracy and consistency of the collected data
  - Identify and rectify errors, duplicates, and inconsistencies to maintain data integrity and prevent the propagation of incorrect information
- **Maintain data security and privacy**
  - Employ robust security measures and privacy protocols to protect data from unauthorized access, loss, or corruption
- **Standardize data collection and management**
  - Develop and adhere to standardized protocols for data collection, entry, and management, ensuring uniformity and consistency in data handling, facilitating easier analysis, and interpretation of citizen-contributed data

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TIME4CS Data management in citizen science

Data Charter for Citizen Science

How to secure the coherence, reliability, and enhanced usability of the collected data

- **Clear, consistent and standardized data protocols**
  - Establish and communicate clear data collection, processing, and management protocols, ensuring standardized guidelines and procedures
  - Adopt and enforce data standardization norms and formats to ensure uniformity and consistency across datasets, facilitating seamless integration, analysis, and interpretation of the collected data
- **Metadata management and the linking of datasets, if possible**
  - Emphasize the creation and management of comprehensive metadata to provide detailed descriptions of the data, offering context and enhancing the understandability, discoverability, and usability of the datasets
  - Facilitate the integration and linking of datasets across different projects, promoting interoperability and collaboration

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TIME4CS Data management in citizen science

A decision-framework approach to data management providing a structure to evaluate alternatives systematically

- **Define data management objectives**
  - Ensure data management objectives align with the overall goals of the citizen science project: specifying the type, quality, and format of data to be collected, managed, and analyzed
- **Establish data standards and protocols**
  - Define the acceptable formats, quality criteria, and metadata requirements, enabling uniformity and enhancing the usability and interoperability of the collected data
- **Evaluate and optimize data management practices**
  - Monitor compliance with the established standards and protocols, addressing any discrepancies, and adapting practices as needed to accommodate evolving project needs and technological advancements

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TIME4CS

SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

Public engagement and volunteer management

Training Module 1.2.2

The TIME4CS project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101006201

TIME4CS Volunteer management

What is volunteer management? Why is it important to citizen science?

- **Definition of volunteer management**
  - Volunteer management in citizen science refers to the systematic coordination and organization of volunteer contributions, including the recruitment, training, support, and development of volunteers, to optimize their involvement and ensure the effective execution of the project
- **Enhancement of volunteer contribution**
  - Effective volunteer management is crucial as it optimizes the engagement and contributions of volunteers, ensuring their skills and efforts are utilized productively and contribute effectively to the achievement of project goals
- **Sustaining volunteer participation**
  - High levels of volunteer motivation and satisfaction help to ensure the retention of participants and foster a sense of community and belonging

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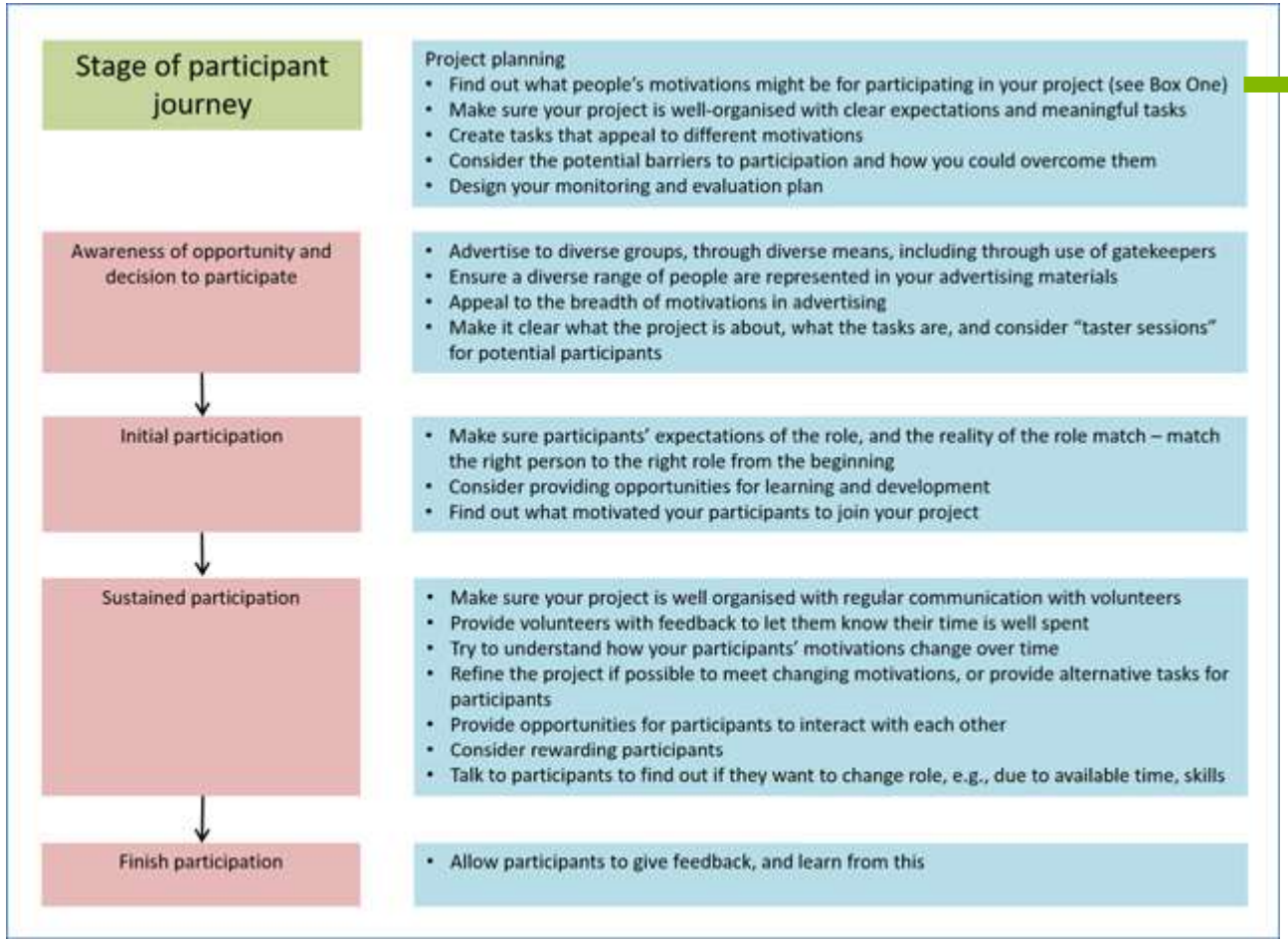
TIME4CS Factors that influence the volunteers' journey



Stage of participant journey	
	Project planning • Find out what people's motivations might be for participating in your project (see Box One) • Make sure your project is well-organised with clear expectations and meaningful tasks • Create tasks that appeal to different motivations • Consider the potential barriers to participation and how you could overcome them • Design your monitoring and evaluation plan
Awareness of opportunity and decision to participate	• Advertise to diverse groups, through diverse means, including through use of gatekeepers • Ensure a diverse range of people are represented in your advertising materials • Appeal to the breadth of motivations in advertising • Make it clear what the project is about, what the tasks are, and consider "taster sessions" for potential participants
Initial participation	• Make sure participants' expectations of the role, and the reality of the role match – match the right person to the right role from the beginning • Consider providing opportunities for learning and development • Find out what motivated your participants to join your project
Sustained participation	• Make sure your project is well organised with regular communication with volunteers • Provide volunteers with feedback to let them know their time is well spent • Try to understand how your participants' motivations change over time • Refine the project if possible to meet changing motivations, or provide alternative tasks for participants • Provide opportunities for participants to interact with each other • Consider rewarding participants • Talk to participants to find out if they want to change role, e.g., due to available time, skills
Finish participation	• Allow participants to give feedback, and learn from this

Intrinsic Motivations (Finkelstien 2009)

- Understanding (Clary and Snyder 1999)
  - Wanting to learn new things (Bell et al. 2008)
  - Wanting to share existing knowledge with others (Bell et al. 2008)
- Values (Clary and Snyder)
  - Helping other people (Raddick et al. 2013)
  - Helping science (Raddick et al. 2013)
  - Helping the environment (Hobbs and White 2012)
  - Help a particular site (Jacobsen et al. 2012)
- Social (Clary and Snyder 1999)
- Enhancement (Clary and Snyder 1999)
- Protective (Clary and Snyder)

Extrinsic Motivations (Finkelstein 2009)

- Career (Clary and Snyder 1999)

West, S and Pateman, R 2016 Recruiting and Retaining Participants in Citizen Science: What Can Be Learned from the Volunteering Literature? *Citizen Science: Theory and Practice*, 1(2): 15, pp.1–10, DOI: https://doi.org/10.5334/cstp.8

TIME4CS

ANALYSIS environmental SCIENTIST | August 2016

The motivations of volunteers in citizen science

Gitte Kragh discusses the motivations that drive volunteers to participate in citizen science.

"Because citizen science projects depend on their volunteers, understanding the motivations of volunteers can enhance recruitment, ensure good retention rates and ultimately make the citizen science project a success."

▼ Table 1. Self-directed and altruistic motives of volunteers in citizen science. Often volunteers have more than one reason for participating in citizen science, and often it is a combination of self-directed and altruistic motives.

Self-directed motives	• Have a personal interest in the topic studied[10,11,12,13,14,15,16] • Desire to learn something new[9,17] • Desire to discover something new[11,18] • Desire to spend time in nature[9,10,12] • Socialising with like-minded people[9]
Altruistic motives	• Desire to volunteer for a cause[10,12,13,15,19] • Wish to contribute to science[11,12,14,15,16] • Feel it is important to help[14]

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TIME4CS Checklist for project organizers

Stage of participant journey	
Project planning	• Find out what people's motivations might be for participating in your project (see Box One) • Make sure your project is well-organised with clear expectations and meaningful tasks • Create tasks that appeal to different motivations • Consider the potential barriers to participation and how you could overcome them • Design your monitoring and evaluation plan
Awareness of opportunity and decision to participate	• Advertise to diverse groups, through diverse means, including through use of gatekeepers • Ensure a diverse range of people are represented in your advertising materials • Appeal to the breadth of motivations in advertising • Make it clear what the project is about, what the tasks are, and consider "taster sessions" for potential participants
Initial participation	• Make sure participants' expectations of the role, and the reality of the role match – match the right person to the right role from the beginning • Consider providing opportunities for learning and development • Find out what motivated your participants to join your project
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Finish participation	• Allow participants to give feedback, and learn from this

TIME4CS

CITIZEN SCIENCE: THEORY AND PRACTICE

TIME4CS Volunteer management in citizen science

How to create an informed and motivated environment conducive to the success of citizen science projects

- **Implement efficient onboarding processes**
  - Develop and implement comprehensive onboarding and training sessions to ensure clarity and understanding of project goals and to equip volunteers with the necessary skills and knowledge, fostering a sense of confidence and preparedness amongst participants
- **Maintain regular communication**
  - Establish consistent communication channels for ongoing engagement, providing regular updates, feedback, and support, to keep volunteers informed, motivated, and valued, thereby sustaining participation and enthusiasm

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TIME4CS Volunteer management in citizen science

How to create an informed and motivated environment conducive to the success of citizen science projects

- **Adopt effective organizational practices and tools**
  - Embrace organizational practices that are structured and efficient to enhance volunteer engagement, such as clearly defined roles, responsibilities, and workflows, enabling volunteers to contribute more effectively and feel a stronger connection to the project
  - Leverage volunteer management software to organize, coordinate, and monitor volunteer activities efficiently
- **Recognize and value contributions**
  - Regularly acknowledge and appreciate volunteer efforts and contributions, fostering a sense of value and accomplishment, which boosts morale, encourages ongoing participation, and aids in volunteer retention

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TIME4CS Communication and engagement

How to foster engagement, build trust and community, and facilitate ongoing learning and improvement

- **Five phases to design a communication plan**
  1. Define projects aims, decide the level of engagement, and set clear communication objectives
  2. Identify target audience (volunteers and others) in terms of their interests, expectations and motivations to participate
  3. Choose appropriate channels and tools to leverage accessible and interactive platforms that best reach the intended audience
  4. Establish regular and transparent communication with consistent updates, sharing progress, and being open about challenges and changes, keeping volunteers informed, engaged, and motivated, enhancing their learning and sense of connection and commitment to the project
  5. Evaluate and adjust strategy, considering feedback and changing circumstances to enhance its impact

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Navigating data management, volunteer management, and communication

Training Module 1.2.3: Interactive session

TIME4CS

SUPPORTING SUSTAINABLE INSTITUTIONAL CHANGES TO PROMOTE CITIZEN SCIENCE IN SCIENCE AND TECHNOLOGY

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TIME4CS Interactive session: Navigating data and volunteer management, and communication

Program	Task
Topic breakdown	The session focuses on three topics: data management, volunteer management, and communication/public outreach. Participants are instructed to dedicate a section of their flip chart (or Miro board) to each topic (alternatively choose one topic to focus on).
Brainstorming and discussion	For each topic, participants brainstorm and discuss key words, concepts, or principles they have learned. They are encouraged to reflect on the content covered in this module, drawing upon specific examples and best practices discussed.
Flip chart (or Miro board) creation	Participants then translate their brainstorming into a visual representation on the flip chart (or Miro board). They are encouraged to be creative, using diagrams, keywords, and bullet points to capture the essence of each topic.
Presentation and feedback	Each group or individual presents their flip chart, explaining their choice of keywords and concepts. This is followed by a feedback session where other participants and/or the facilitator can offer insights or ask questions to deepen the understanding.
Reflection and conclusion	The session concludes with a reflective discussion, allowing participants to share what they found most valuable and how they might apply these concepts in their own CS projects.

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Thank you for your attention !

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