TIME4CS

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

D4.3: Final version of the description of TIME4CS training programs

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List of Abbreviations

CS	Citizen Science
CS-ICP	Institutional Contact Point for Citizen Science
D	Deliverable
EC	European Commission
ECTS	European Credit Transfer and Accumulation System
IA	Intervention Area
GA	Grounding Action
MOOC	Massive Open Online Course
OS	Open Science
PES	Public Engagement in Science
RPOs	Research Performing Organisations
RRI	Responsible Research and Innovation
STEM	Science, Technology, Engineering, and Mathematics
WP	Work Package
WP1	Titled: Citizen science state of the art and overcoming challenges
WP2	Titled: Roadmap framework leading to institutional changes
WP4	Titled: Building capacities within institutions to engage and support citizen science activities

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Executive Summary

This deliverable entitled 'D4.3: Description of TIME4CS Training Programs: Final Version' was created as part of the TIME4CS project. The project is supported by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 101006201.

Objective: This deliverable presents the culmination of task 4.1 which focused on developing comprehensive training program content for the TIME4CS project. The primary aim was to create a robust curriculum that integrates citizen science (CS) into the framework of research performing organisations (RPOs).

Methodology

Mapping of existing resources: Over 65 CS training programs and resources were identified and analysed. This analysis facilitated the extraction of key elements such as target audiences, types of training, assessments, content, skills, and infrastructures.

Best practices analysis: An in-depth examination of best practices was conducted to define essential concepts, capabilities, and infrastructures in CS. This included an assessment of the support required for institutional changes related to CS.

Piloting and expert feedback: The development process involved extensive piloting at four implementing institutions and Aarhus University. These sessions provided practical insights and real-world applications, crucial for refining the programs. Additionally, expert insights and feedback played a significant role in shaping the final content and structure.

Outcomes

Comprehensive curriculum: The final version of the TIME4CS training programs represents a diverse and meticulously crafted curriculum, addressing key aspects of CS. It encompasses modules on methodologies, strategic approaches, policy planning, evaluation frameworks, ethics, and institutional support.

Interactive learning: A distinctive feature of the TIME4CS training programs is its interactive nature, offering practical, hands-on experiences for participants to apply theoretical knowledge in real-world scenarios.

Adaptability and relevance: The curriculum's design ensures its applicability across various academic and research contexts, meeting the diverse needs of researchers, educators, managers, administrators, students, and practitioners in CS.

Impact: The TIME4CS training programs are poised to significantly contribute to the integration of CS into RPOs. By providing a well-rounded educational tool that combines theoretical foundations with practical applications, these programs are set to enhance the skills and capabilities of individuals engaged in CS, fostering a more inclusive and innovative research environment. The iterative and collaborative approach taken in developing these programs ensures their relevance and effectiveness in the evolving landscape of citizen science.

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1. Introduction

The principal aim of Work Package 4 (WP4: Building capacities within institutions to engage and support citizen science activities) in the TIME4CS project is to enhance the capability of research performing organisations (RPOs) to employ responsible research and innovation (RRI), primarily through citizen science (CS) and public engagement in science (PES). To effectively develop and implement CS and PES training (hereafter jointly referred to as CS), Task 4.1 mapped existing CS courses, extracting vital information regarding key concepts (including content, audience, training type, and assessment), capabilities (including skills trained and learning objectives), and infrastructures (including training format, publisher, and opportunities for knowledge exchange) within the identified training resources.

Moreover, crucial concepts, skills, and infrastructures were identified from activities in WP1 (Citizen science state of the art and overcoming challenges) and WP2 (Roadmap framework leading to institutional changes), uncovering deficiencies in existing training. These were then incorporated into the creation of the TIME4CS training programs. The programs are structured with adaptable "plug-and-play" modules to facilitate the grounding actions (GAs) outlined in WP1[1]. Presently, these programs are available as a Massive Open Online Course on the EU-citizen.science platform, ensuring their long-term sustainability and broad reach beyond the project's lifespan. This definitive version of the deliverable offers a comprehensive overview and detailed explanation of the components of the TIME4CS training programs.

Integrating CS within RPOs necessitates a collaborative effort, involving not just researchers employing CS methods (a bottom-up approach) but also the management and support functions within RPOs (a top-down approach). These dual strategies correspond to the two theoretical frameworks that TIME4CS utilizes for institutional change: the social and organizational approaches, respectively. The social approach demands a substantial commitment from individuals to alter their behaviours, perspectives, and mindsets, while the organizational approach targets changes in organizational structures like norms, procedures, and protocols.

Acknowledging these approaches and their respective stakeholders highlights the need for capacity building for both researchers and management/other staff. Therefore, the TIME4CS training programs are designed to cater to diverse audiences, focusing on the GAs and strategies necessary to incorporate CS practices within RPOs.

This deliverable marks the conclusive version of the TIME4CS training programs' description. The key difference from the second version lies in subtle modifications to the training programs, informed by feedback from Implementers who tested early versions, as well as input from Front-Runners, experts responsible for running existing CS training programs, and participants in four additional workshops. These

[1] Mondardini, M.R., & Roffler, U. (2021). D1.2 Best practices repository of TIME4CS front-runners. TIME4CS H2020 project. Zenodo (30 June). https://zenodo.org/doi/10.5281/zenodo.5017361

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workshops, conducted at Aarhus University in autumn 2023, each focused on testing one of the four final training programs, providing valuable insights for refinement.

1.1 Insights from the literature

Numerous papers and reports exist that touch upon the subject of citizen science (CS) and training in various capacities. While many simply acknowledge the training of volunteers in their CS projects, others delve deeper, discussing volunteer training methods for specific projects[2], the benefits such training offers to researchers[3], CS training connected to learning or formal education[4], or training aimed at ensuring data quality and reliability, especially in contributory CS projects[5,6]. These publications primarily concentrate on the CS projects themselves or learning associated with them, rather than focusing on the aspects of integration of CS within RPOs. Furthermore, as shown in analyses D1.2 (*Best practices repository of TIME4CS front-runners*[7]) and D1.3 (*Lessons learned repository of TIME4CS*[8]), this kind of training has little impact on the institutional acceptance of CS.

Although there is a scarcity of literature on CS training programs specifically designed to facilitate institutional change, there are suggestions emphasizing the importance of increasing awareness among researchers to

[2] Lasky, M., Parsons, A., Schuttler, S., Mash, A., Larson, L., Norton, B., Pease, B., Boone, H., Gatens, L., & Kays, R. (2021). Candid Critters: Challenges and Solutions in a Large-Scale Citizen Science Camera Trap Project. Citizen Science: Theory and Practice, 6(1), 4. https://doi.org/10.5334/cstp.343

[3] Thornhill, I., Loiselle, S., Lind, K., & Ophof, D. (2016). The Citizen Science Opportunity for Researchers and Agencies. BioScience, 66(9), 720–721. https://doi.org/10.1093/biosci/biw089

[4] Citizen Science in Higher Education, Special Collection (2021). Citizen Science: Theory and Practice. https://theoryandpractice.citizenscienceassociation.org/collections/citizen-science-in-higher-education

[5] Katrak-Adefowora, R., Blickley, J. L., & Zellmer, A. J. (2020). Just-in-Time Training Improves Accuracy of Citizen Scientist Wildlife Identifications from Camera Trap Photos. Citizen Science: Theory and Practice, 5(1), 8. https://doi.org/10.5334/cstp.219

[6] Ratnieks, F. L. W., Schrell, F., Sheppard, R. C., Brown, E., Bristow, O. E., & Garbuzov, M. (2016). Data reliability in citizen science: Learning curve and the effects of training method, volunteer background and experience on identification accuracy of insects visiting ivy flowers. Methods in Ecology and Evolution, 7(10), 1226–1235. https://doi.org/10.1111/2041-210X.12581

[7] Mondardini, R., & Roffler, U. (2021). D1.2: Best practices repository of TIME4CS front-runners. TIME4CS H2020 project. Zenodo (30 June). https://doi.org/10.5281/zenodo.5017361

[8] Herrera, A., & Hacklay, M. (2022). D1.3: Lessons learnt repository of TIME4CS. TIME4CS H2020 project. Zenodo (31 March). https://doi.org/10.5281/zenodo.6402090

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integrate CS more effectively into RPOs[9,10]. Additionally, outputs from the European Commission (EC)[11] and other EC-funded projects[12,13] have highlighted the need for institutional changes to implement RRI in RPOs, including aspects of training. There is also a wealth of resources and trainings available on Open Science (OS)[14], but these seldom address CS in a comprehensive way.

[9] Ayris, P., Román, A., Maes, K., & Labastida, I. (2018). Open Science and its role in universities: A roadmap for cultural change. League of European Research Universities (LERU). https://www.leru.org/publications/open-science-and-its-role-in-universities-a-roadmap-for-cultural-change

[10] Wyler, D., Grey, F., Maes, K., & Fröhlich, J. (2016). Citizen science at universities: Trends, guidelines and recommendations. League of European Research Universities (LERU). https://www.leru.org/publications/citizen-science-at-universities-trends-guidelines-and-recommendations

[11] European Commission, Directorate-General for Research and Innovation, Delaney, N., Iagher, R., & Tornasi, Z. (2020). Institutional changes towards responsible research and innovation: achievements in Horizon 2020 and recommendations on the way forward. Publications Office. https://data.europa.eu/doi/10.2777/682661

[12] d'Andrea, L., & Alfonsi, A. (2021). Deliverable 3.3 Guidance document on RRI-oriented grounding actions. GRACE - Grounding RRI Actions to Achieve Institutional Changes in European Research Funding and Performing Organisations, Zenodo (30 November). https://zenodo.org/doi/10.5281/zenodo.5817730

[13] Tokalić, R., Buljan, I., Mejlgaard, N., Carrió, M., Lang, A., Revuelta, G., & Marušić, A. (2021). Responsible research and innovation training programs: Implementation and evaluation of the HEIRRI project. Forensic Sciences Research, 6(4), 320–330. https://doi.org/10.1080/20961790.2021.1970319

[14] Swiatek, C., McCaffrey, C., Meyer, T., Svenbro, A., Wojciechowska, A., Clavel, K., Brinken, H., & Egerton, F. (2020). Open science training methods and practices across European research libraries: Survey analysis. LIBER Publications. Zenodo (22 June). https://zenodo.org/doi/10.5281/zenodo.3903141

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2. Mapping citizen science training across Europe

The EU-citizen.science platform served as the foundational resource for mapping CS training across Europe. This was made possible by the dedicated efforts of the platform's team, who not only compiled but also encouraged contributions of CS training resources from the CS community. Furthermore, additional training courses were discovered through case studies in WP1, as many universities do not feature their courses on the EU-citizen.science platform. Metadata for these identified trainings were collected, encompassing general information, key concepts, capabilities, and infrastructures (as shown in Table 1). This facilitated a thorough gap analysis, comparing these trainings with the identified needs (Section 3.3, Gaps in Existing Training Modules). A comprehensive list of the CS training resources identified can be accessed on Zenodo[15].

Table 1 – Metadata collected for identified citizen science trainings in Europe

Essential key themes	Metadata	Metadata description
General training course information	Title	Course title
	Year	Year first run/published
	Author(s)	Name(s) of training creators
	Language(s)	Which language(s) the course is available in
	Accessibility	Is the training course open to all, restricted, paid for?
	Time required	How long (approx.) is required to complete the course?

[15] Kragh, G., & Nielsen, K.H. (2022). TIME4CS WP4 Mapping of citizen science training resources. TIME4CS H2020 project. Zenodo (15 July). https://doi.org/10.5281/zenodo.6840274

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Essential key themes	Metadata	Metadata description
Concepts covered	Content description	Brief description of the course content
	Audiences (number of resources targeting listed audience)	CS Project Leaders & Initiators (34) Researchers & Academics (31) Community Members & Citizens (22) Civil Society Orgs & NGOs (22) Educators (20) Students (12) All Audiences (11) Librarians (5) Policy & Decision Makers (5) Government employees (2) Journalists (1)
	Training type (number of resources of a certain type)	MOOC (39) Static resource (Guide, Handbook, Toolkit) (26) Webinar (4) Onsite training (3) University course (2)
	Assessment	What type of assessment of trainees is conducted, if any?

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Essential key themes	Metadata	Metadata description
Capabilities covered **(skills trained)**	Content themes (number of resources dealing with theme)	Introduction to CS (40) Engagement (40) Best practices (27) Communication (26) Project management (23) Data quality and standards (18) Research design and methods (17) Regulations and ethics (16) CS stories (14) Evaluation of citizen science (14) Link with formal education (13) Co-creation (10) Empowerment (10) Impact (10) Project sustainability (6) Reflections on science (6) Event planning (4) Transferability (3) Funding (1)
	Learning goals	Description of learning goals of training
Infrastructures covered	Training format (number of resources with certain format)	Online/onsite (69/3) Website (69) Course (44) Text (Guide, Handbook, Toolkit) (26) Video (13)
	Publisher	Who published the resource
	URL	Link to website
	Knowledge exchange opportunities	Any knowledge exchange possible in relation to the training?

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3. Key concepts, capabilities, and infrastructures for CS training

The survey of existing courses facilitated the identification of critical concepts, skills, and infrastructures, delineating the current best practices in CS training and resources. When examined alongside the knowledge generated by the TIME4CS consortium about optimal practices for integrating CS into RPOs, and considering Implementers' roadmaps, this information provides insights into the institutional support achievable through the implementation of training programs. Furthermore, it enables the recognition of discrepancies between existing best training practices and the requirements for effective institutional change.

3.1 Key concepts, capabilities, and infrastructures in identified CS training materials

The scope and representation of key concepts, capabilities, and infrastructures in the CS training materials identified are broad, yet their presence in these materials varies, as detailed in Table 1.

3.1.1 Key concepts

Audiences: Most identified trainings cater to CS Project leaders & initiators (34 instances) and Researchers & academics (31). Training aimed at Community members & citizens (22), Civil society organisations & NGOs (22), and Educators (20) were also notable. Newly emerging target groups include Policy & decision makers (5), Librarians (5), and Journalists (1). As the CS community recognizes these other vital stakeholders, a shift towards more specialized training resources, beyond basic CS introductions, is anticipated.

Training type: The term "training type" here encompasses various formats of educational content specifically designed for training, excluding scientific articles, reports, and other non-training materials. Training resources counted here as "courses" were generally listed as MOOCs (Massive Open Online Courses) and included an assessment component, often one or more self-assessment quizzes, often had the option for participants to gain some sort of recognition, such as a badge or certificate, on completion, and were offered for free. Most courses (38) were online, ranging from 1 to 40 hours over 10 weeks. Only three courses were onsite (two university courses and one by an NGO). More RPOs were found offering CS-related courses in WP1 case studies, but due to limited information, they were not included in the final list. Additionally, many resources (26) were written guides, handbooks, or toolkits. Recorded webinars were less common (4), though more may exist on CS association websites and YouTube[16].

Assessment: Formal assessments were uncommon in identified courses, except in most online courses which included quizzes or reflective questions. Some platforms offer badges or certificates, usually conditional on achieving a minimum quiz score. The two onsite university courses had formal exams with ECTS credits, and

[16] See, for example, the YouTube Channels of the Citizen Science Association and the Australian Citizen Science Association YouTube Channel: www.youtube.com/@CitizenScienceAssociation and www.youtube.com/@CitSciOz

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one other onsite course offered 1 ECTS upon completion. Guides, handbooks, and toolkits sometimes included reflective questions, but formal assessments were not typical in these resources.

3.1.2 Key capabilities (content and skills)

Content themes/skills trained: The identified training resources encompass a diverse range of themes and target various aspects of CS. These themes are categorizable into five primary topics:

1. About CS: This includes an Introduction to CS, Best Practices, and CS Stories.
2. CS project design and management: This encompasses project management, co-creation, engagement, communication, regulations and ethics, funding, and event planning.
3. CS as research methodology: Covering data quality and standards, research design and methods, and reflections on science.
4. CS in education: Focusing on the link with formal education.
5. Outcomes of CS projects: Encompassing project sustainability, evaluation of CS, impact, empowerment, and transferability.

These five main topics primarily concentrate on CS as a field or on specific projects, rather than on the integration of CS into organizations and the institutional support needed for successful CS projects. Nonetheless, the subjects covered in the identified training align well with the needs of the target audiences.

Learning goals: Where specified, these align with the content themes, aiming to foster a comprehensive understanding of CS, particularly in terms of project management, scientific aspects, and the outcomes of CS projects.

3.1.3 Key knowledge infrastructures

Online provision: A diverse array of organizations and entities have developed and published the training resources, including NGOs, government bodies, consortia funded by the European Commission, CS associations, and universities. Given that the majority of these resources are online, a range of hosting platforms facilitate access and learning. These include well-known MOOC providers, institutional websites, project-specific sites, and independent web platforms.

Knowledge exchange opportunities: Knowledge exchange can significantly enhance learning experiences. However, most identified training resources, being accessible online continuously, do not typically incorporate this element. Some MOOC platforms offer participant forums, although the extent of their use remains unclear. In contrast, onsite courses, which allow direct interaction among participants, provide more tangible opportunities for knowledge exchange.

3.2 Required institutional support for CS training

The examination of key concepts, skills, and infrastructures in existing training programs (section 3.1) highlights the need for comprehensive institutional support for diverse training resources. These observations have been juxtaposed with the data on institutional integration from various RPOs (WP1) and

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the anticipated institutional changes by Implementers (WP2). The subsequent sections will discuss the conclusions drawn from this comparative analysis.

The TIME4CS project has yielded valuable insights regarding the necessary institutional support for implementing and integrating CS within RPOs.

In WP1, an extensive study was conducted on the institutional integration of CS in Front-Runners (FRs) and 38 RPOs globally. The *D1.2: Best Practices Repository of TIME4CS Front-Runners* [17], based on the analysis of FRs, outlined several recommended Grounding Actions (GAs) for each Intervention Area (IA) and numerous best practices implemented by FR institutions. These preliminary findings were further elaborated and validated through analysis of the TIME4CS case study repository to understand the various routes to CS-related institutional integration (*D1.1: Collection of Case Studies of institutional adoption of CS*)[18]. Additionally, the *D1.3 Lessons Learned Repository of TIME4CS*[19] utilized Fuzzy-set Qualitative Comparative Analysis of survey data from 38 RPOs to highlight effective strategies, such as developing CS projects across multiple disciplines, promoting CS champions, and establishing institutional plans, strategies, or policies.

WP2 has led to the creation of a roadmap framework to ensure CS-related institutional change among Implementers. The *D2.1: Compilation of Roadmaps and Grounding Actions for the Implementers*[20] details tailored roadmaps for the four TIME4CS Implementers, reflecting their unique institutional needs, challenges, and barriers to change. These varied roadmaps underscore the differences in existing institutional support for CS among the Implementers, and consequently, the diverse requirements for institutional support in CS training. As the Implementers have developed GAs focusing on training, awareness-raising, identifying CS contact points, formulating CS policies/guidelines, and participating in CS networks (see Figure 1), it becomes crucial that training resources encompass a wide range of applications in terms of audiences, topics, activities, and assessments.

3.2.1 Target audiences for training programs

Many RPOs could offer CS training to researchers and students across several disciplines. Promoting cross-disciplinary interest in CS is a key route to its institutional integration. Especially in multi-faculty RPOs,

[17] Mondardini, R., & Roffler, U. (2021). D1.2: Best practices repository of TIME4CS front-runners. TIME4CS H2020 project. Zenodo (30 June). https://doi.org/10.5281/zenodo.5017361

[18] Herrera, A., & Haklay, M. (2022). D1.1: Collection of Case Studies of institutional adoption of CS. TIME4CS H2020 project. Zenodo (8 March). https://zenodo.org/doi/10.5281/zenodo.5807507

[19] Herrera, A., & Hacklay, M. (2022). D1.3: Lessons learnt repository of TIME4CS. TIME4CS H2020 project. Zenodo (31 March). https://doi.org/10.5281/zenodo.6402090

[20] Vilarchao, E., Brandstetter-Kunc, A., & Ipolyi, I. (2022). D2.1: Compilation of roadmaps and Grounding Actions for the Implementers – Second Version. TIME4CS H2020 project. Zenodo (30 December). https://doi.org/10.5281/zenodo.5743298

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targeting participants from all faculties is vital since CS projects thrive on multi-disciplinary collaboration. While many CS projects originate in natural or technical sciences, the potential for CS extends to all academic fields. Therefore, training programs, even if discipline-specific, should encompass a broad range of academic areas.

Additionally, CS training should extend to other RPO staff, including public information officers, librarians, and research support workers, as well as management. Current training programs are predominantly researcher-focused, given their role in initiating CS projects. However, for comprehensive institutional integration of CS, training should also address non-researcher roles.

Identifying and training potential CS champions within the RPO is also key. Targeted training should include researchers, staff, and management with existing interests in CS, Open Science (OS), or RRI. Additionally, training aimed at developing or promoting institutional CS plans should also include managers at all levels.

3.2.2 Training types and formats

A variety of training types and formats have been identified, each tailored to specific support topics. General CS introductions for researchers or students might be best served through courses or seminars. In contrast, topics like policy development or champion promotion may require specialized formats like workshops or masterclasses.

Train-the-trainer programs deserve special focus due to their potential for creating ripple effects within an organization, helping to institutionalize envisaged changes. The train-the-trainer concept refers to a training methodology where experienced individuals or skilled trainers conduct training sessions for others who will then become trainers themselves. The primary goal of this approach is to build the capacity and experience of a group of trainers who can then train others within their organisation or community, thus extending the reach of the original training. Such programs, even when not explicitly designed as train-the-trainer, can be adapted by including exercises for participants to develop further training modules within the RPO.

Assessments in training serve dual purposes: skill evaluation and participant motivation for applying skills towards institutional change. Formal recognition, like ECTS credits, has been found important for institutional change, so a focus on formal training acknowledgment is essential. Assessments should align with the specific learning goals of the training and can be structured formally or designed for specific ad hoc objectives.

3.2.3 Training content and skills (learning goals)

A range of skills and aligned learning goals are pertinent to institutional changes for CS. Existing training resources mainly cover CS project design and processes. Yet, tasks specific to institutional changes, such as CS policy and guideline development, receive less attention. For instance, only one training resource addresses fundraising for CS, and policymaking is not covered at all. These tasks are vital for specific pathways to CS-related institutional integration and are integral to the Implementers' roadmap framework in TIME4CS (for more information on gaps identified, see 3.3).

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3.2.4 Knowledge Infrastructures

Current CS training programs offer a rich infrastructure that can inspire the development of new CS training programs targeted at RPOs. This includes a variety of online courses (often MOOCs), syllabi, learning goals, guides, and handbooks.

Knowledge exchange is a critical component, particularly for RPOs focusing on train-the-trainer concepts. Most existing programs do not facilitate knowledge exchange, except through online forums for participant interaction. Enhancing opportunities for knowledge exchange during and after training could be a valuable addition to future training programs.

3.3 Gaps in existing training modules

The analysis has highlighted certain gaps in current training modules related to the institutional change as envisioned by the TIME4CS consortium. These gaps, alongside established best practices, have shaped the development of the training programs outlined in section 4, TIME4CS Training Programs.

3.3.1 Narrow target audiences in training programs

In the pursuit of integrating CS into RPOs, the importance of training not just scientific staff and students, but also communication, outreach, policy staff, and management, is paramount. These groups are seldom the primary focus in publicly available training resources. This apparent gap in training for non-research RPO staff may be attributed to such trainings being internal and not publicly shared, as suggested by findings from WP1 case studies. Three RPOs reported having internal CS training for staff, with others in development.

Regarding student training, twelve case study RPOs indicated the presence of CS training, either as standalone courses or integrated into other programs. However, these are underrepresented on the EU-citizen.science portal, with only two courses listed.

While many existing programs target external audiences like communities, educators, and policymakers, these groups have not been a primary focus in the TIME4CS analysis of institutional change. However, recognizing their potential as external stakeholders, community and stakeholder analysis will be incorporated into the upcoming training courses.

3.3.2 Need for additional skills

Current training often focuses on skills necessary for designing and conducting CS projects, overlooking other RPO facets. Institutional integration of CS also requires strategic planning and support structures. TIME4CS Implementers have highlighted the importance of developing guidelines, policies, and support infrastructures as key GAs. Each Implementer has adapted these GAs to their unique institutional contexts by selecting relevant GAs for implementation within their organizations, as illustrated in Figure 1.

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Furthermore, skills for planning fundraising activities beyond individual projects, e.g., for support structures, are crucial. These organizational skills and resources should be included in training aimed at comprehensive institutional change in CS.

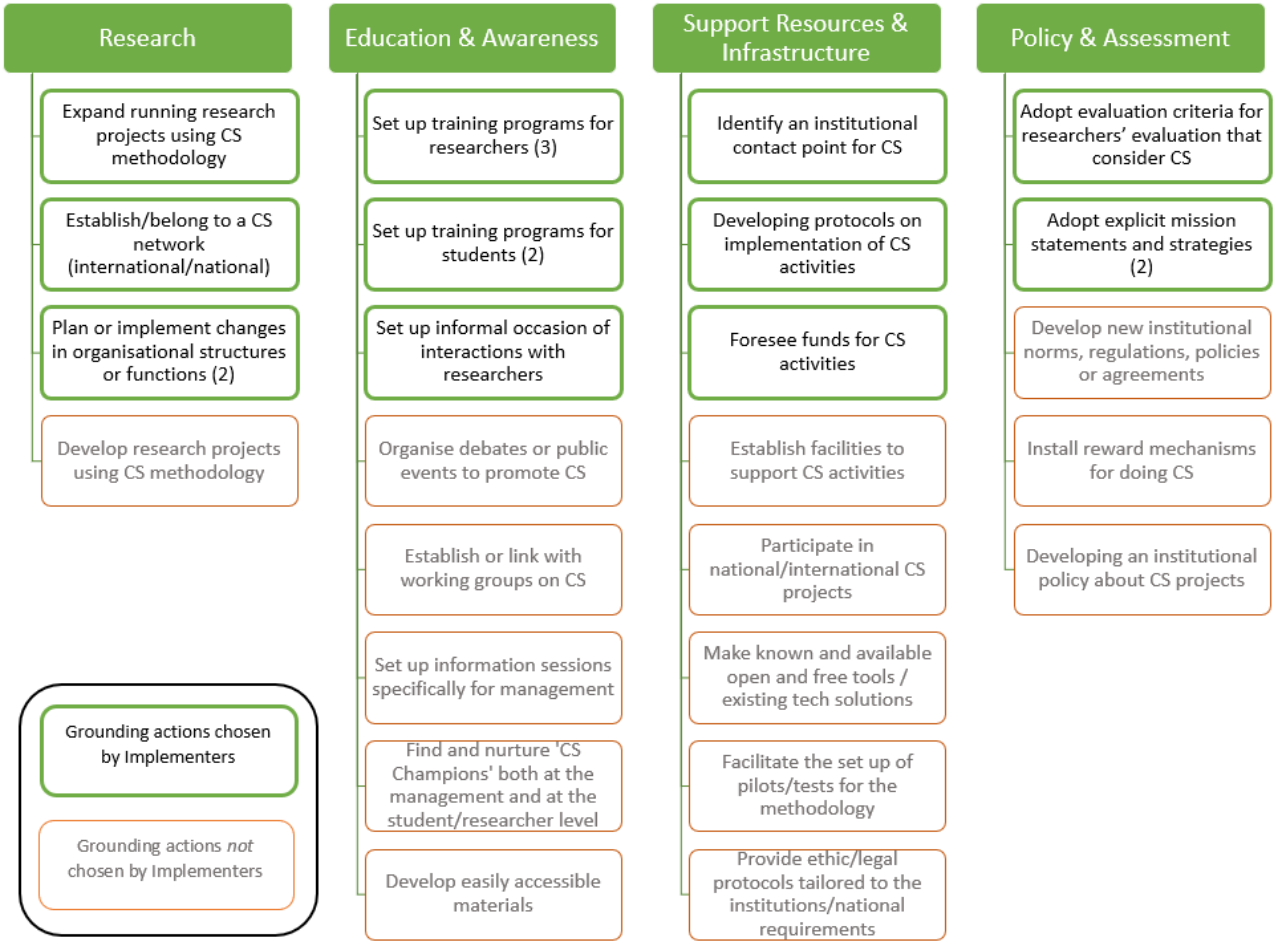

Figure 1. Overview of the GAs selected by Implementers in green boxes and the number of Implementers choosing a GA in parentheses. Non-chosen GAs in orange boxes.

3.3.3 Overlooking infrastructure development

No training programs currently address the creation or maintenance of infrastructures needed for CS training. While many provide online resources, they rarely encourage the development of additional infrastructures for training or learning purposes. Addressing this requires skills in educational, communicative, or technical domains.

Furthermore, infrastructures facilitating knowledge exchange within RPOs, especially post-training, are often overlooked. Institutional change can hinge on cascading effects like train-the-trainer programs or knowledge exchange infrastructures.

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The need for an institutional CS contact point, a GA in TIME4CS, is also not addressed in existing programs. This gap could be filled by programs specifically designed to establish such contact points and training for staff members operating them.

3.4 The need for additional citizen science training programs

The need for new CS training programs in RPOs becomes evident when considering the gaps and requirements identified in the above sections. These new training programs are essential for several reasons:

- Broadening the audience reach: Existing training resources primarily focus on researchers and students, overlooking other crucial staff members like communication officers, outreach staff, policy makers, and management. The new training programs should aim to include these additional audience groups, as their involvement is pivotal for the successful institutional integration of CS.
- Addressing cross-disciplinary involvement: Since the development of CS projects often benefits from multi-disciplinary collaboration, training programs need to cater to a wide range of academic disciplines. This not only encourages cross-disciplinary interest but also ensures that the potential of CS is fully realized across various fields of study.
- Filling skills gaps: Current training programs mainly concentrate on the skills needed for the design and execution of CS projects. However, for comprehensive institutional integration, skills related to strategic planning, policy development, fundraising, and support infrastructure are equally important. New training programs should cover these organizational skills to facilitate broad institutional changes related to CS.
- Infrastructure development: A notable gap in current training is the lack of focus on developing and maintaining infrastructures necessary for CS training. Future programs should emphasize the creation and enhancement of infrastructures, including those for educational, communicative, or technical resources. This also includes fostering environments conducive to knowledge exchange within the RPOs.
- Incorporating knowledge exchange: Existing training seldom addresses the facilitation of knowledge exchange, especially post-training. New programs should include components that encourage ongoing learning and sharing of experiences, which are crucial for sustaining institutional change.
- Establishing institutional contact points: The absence of training focused on establishing and managing institutional CS contact points is a significant oversight. New programs should aim to fill this gap, providing strategies and skills for setting up these contact points and training for staff members who will manage them.
- Tailoring to institutional needs: As different RPOs have varied levels of existing support for CS, training programs must be tailored to reflect these differences. This customization is vital for addressing specific institutional demands and barriers to change.

In summary, the development of new CS training programs in RPOs is not just a matter of expanding the existing curriculum but involves a strategic overhaul to encompass broader audience groups, diverse skills, infrastructure development, and tailored approaches to meet specific institutional needs and goals. These

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programs are crucial in shaping the future of CS within RPOs, enabling them to adapt to and effectively integrate CS into their institutional structures and cultures.

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4. Developing the TIME4CS training programs

The design and development of the TIME4CS training programs underwent three iterations with two sets of workshops to support the ongoing enhancement of the programs. The iterative process offered numerous advantages that significantly enhanced the overall quality and effectiveness of the training, including:

- The opportunity for continuous improvement. With each iteration, the training materials and content were refined based on feedback and insights gained from workshop participants. This iterative cycle results in more polished and effective training programs.
- Allowing for adaptation to learner needs. By gathering feedback from participants, trainers, or stakeholders after each iteration, training developers were able to make necessary adjustments to better cater to the specific preferences and requirements of the learners. This ensured that the training would remain relevant and engaging for its intended audience.
- Identifying and correcting errors. As the training programs evolved, it became easier to identify and rectify errors, inconsistencies, or gaps in the materials. Addressing issues promptly led to a more reliable and error-free training program.
- Ensuring that the training programs align closely with its intended learning objectives. Fine-tuning the content over multiple iterations helped ensure that the training effectively addresses the desired outcomes and goals.
- Promotion of enhanced engagement. Feedback loops allowed for the incorporation of interactive elements that improved the overall learning experience. These elements included activities, case studies, and assessments that have made the training more interactive and enjoyable.
- Flexibility and agility, allowing training developers to adapt to shifting circumstances, emerging needs, or advancements in the field. This adaptability ensures that the training programs remain responsive to evolving challenges and technologies. The modular structure of the training programs developed progressively throughout the three iterations detailed below.
- Involving various audiences ensured that their perspectives and expertise were being considered. We engaged with different stakeholders at the four workshops held by the implementing institutions and the four workshops held at Aarhus University, such as researchers, managers, librarians, graduate students, administrative personnel, etc. This stakeholder involvement led to training programs that align more closely with various organisational goals and priorities.
- Incremental testing of training materials and activities. Smaller sections or modules could be tested and refined before finalizing the entire program. This reduced the risk of encountering major issues later in the development process.
- Quality assurance with multiple iterations provided opportunities for rigorous quality checks, ensuring accuracy, consistency, and reliability in the training programs.

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Ultimately, the iterative process resulted in training programs that are not only adaptable and sustainable over the long term but also capable of meeting the changing needs of learners and the organizations they serve.

4.1 Developing and implementing the first two versions of the training programs

The TIME4CS training programs have undergone two releases, with the first one becoming accessible through the TIME4CS Zenodo community on July 26, 2022, and the second version on January 26, 2023[21]. Each version comprised four training programs, one for each of the four IAs. Right from the start, these training programs followed a modular structure, with each program consisting of up to four self-contained modules. These modules typically encompassed 2-3 GAs and were designed to be utilized either as components of complete training programs or independently, depending on the specific needs and demands of the implementing institution.

The first version of the training programs underwent an internal assessment process that involved peer review and mutual learning. This evaluation drew from the conclusions derived in the analysis of institutional adoption of CS based on case studies within the TIME4CS case study repository[22]. According to this analysis, several factors contribute to the successful institutional integration of CS. Each of these factors were incorporated into the second version of the TIME4CS training programs to enhance the readiness and effectiveness of research institutions in adopting CS:

- **Interdisciplinary CS projects:** The second version of the training programs emphasized the importance of interdisciplinary CS projects. Participants are encouraged to explore and develop CS initiatives that span several disciplines, fostering collaboration between researchers from different fields. Case studies and examples are used to illustrate the benefits of interdisciplinary projects, and practical guidance was provided on how to initiate and manage such projects.
- **Multiple CS champions:** The second version of the training programs recognized the significance of having multiple CS champions within an institution. Participants are introduced to the concept of CS champions and the roles they can play in advocating for CS at different levels. Strategies for

[21] Nielsen, K.H., & Kragh, G. (2022). D4.1: First version of the Description of TIME4CS training programs. TIME4CS H2020 project. Zenodo (26 July). https://doi.org/10.5281/zenodo.6906330; Nielsen, K.H., & Kragh, G. (2023). D4.2: Second version of the Description of TIME4CS training programs. TIME4CS H2020 project. Zenodo (26 January). https://doi.org/10.5281/zenodo.7560973

[22] Herrera, A., & Haklay, M. (2022). D1.1: Collection of Case Studies of institutional adoption of CS. TIME4CS H2020 project. Zenodo (8 March). https://zenodo.org/doi/10.5281/zenodo.5807507; Herrera, A., & Hacklay, M. (2022). D1.3: Lessons learnt repository of TIME4CS. TIME4CS H2020 project. Zenodo (31 March). https://doi.org/10.5281/zenodo.6402090

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identifying and nurturing CS champions within an organization are discussed, enabling participants to take practical steps to promote CS within their institutions.

- **Senior management involvement:** The second version of the programs highlighted the role of senior management as CS champions who can influence decision-making processes and organizational structures. Participants learn about the importance of senior-level support for CS initiatives and are provided with strategies for engaging senior management in CS efforts. Practical exercises and case studies would showcase successful examples of senior management involvement.
- **Institutional plans:** The second version of the training programs stressed the value of having institutional plans that incorporate CS and public engagement. Participants were guided in developing and aligning institutional strategies and policies with CS objectives. They learned how to integrate CS into existing institutional plans or create dedicated CS plans, ensuring that CS becomes an integral part of the institution's mission and activities.
- **Funded coordinator:** While the role of a funded coordinator was found to be less influential in supporting institutional integration, the second version of the training programs acknowledged its potential significance in certain contexts. Participants were educated about the coordinator's role in facilitating CS activities and managing resources. They were encouraged to assess their institution's specific needs and determine whether appointing a funded coordinator would be beneficial.

In addition, the work conducted in WP1 and the obstacles identified during this phase played a crucial role in shaping the second version of the TIME4CS training programs[23]. The insights gained from WP1, particularly the development of institutional roadmaps for the Implementers as well as additional GAs, served as valuable input for refining the content and scope of the initial version of the training programs. These roadmaps provided a comprehensive overview of the institutional landscape and the challenges faced by research institutions in adopting CS.

The second version of the training programs leveraged these insights to ensure their relevance and effectiveness in the following way:

- **Engaging stakeholders**: The second version of the training programs emphasized the importance of involving all stakeholders from the project's inception and maintaining regular engagement. Participants learned about strategies for effective stakeholder engagement to overcome resistance and build support for CS initiatives.
- **Involving research support staff:** Recognizing the role of research project managers and support staff, the second version of the training programs encouraged their active participation in CS projects. Participants gained insights into how research support staff can facilitate CS implementation.

[23] Vilarchao, E., Brandstetter-Kunc, A., & Ipolyi, I. (2022). D2.1: Compilation of roadmaps and Grounding Actions for the Implementers – Second Version. TIME4CS H2020 project. Zenodo (30 December). https://doi.org/10.5281/zenodo.5743298

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- **Awareness-raising within the RPO:** A comprehensive awareness-raising process was advocated within the second version of the training programs. Participants were equipped with tools and techniques to raise awareness about the benefits and potential of CS, both internally and externally.
- **Focus on students and early-career researchers:** To overcome barriers related to limited time and interest among senior researchers, the second version of programs directed attention towards students and early-career researchers. Training initiatives would then be designed to engage this group effectively.

By incorporating these WP1 and WP2 recommendations, the second version of the training programs aimed to equip participants with practical strategies and solutions to address the identified obstacles and promote successful CS integration within their research institutions. The training programs thus evolved to offer tailored guidance and support, aligning with the specific needs and challenges faced by Implementers and their respective organizations.

The second version of the training programmes served as the basis for creating a train-the-trainer workshop conducted for all Implementers and other consortium partners. This workshop took place during the TIME4CS General Assembly, which brought together project partners in Brussels on 13 December 2022. Another train-the-trainer workshop was specifically designed for the UniSR core team as part of their site visit. Although these workshops were not originally included in the project's initial description, they were requested by the Implementers to allow them to effectively utilise the training materials for conducting their own training sessions within their respective institutions. In addition to the train-the-trainer workshop held in Brussels, four additional workshops were carefully planned and conducted at the four implementing institutions during the spring of 2023, as a crucial part of WP4 and reported on in Deliverable 4.4 (*Report on all workshops*) available on Zenodo[24]. These workshops underwent evaluation using the Target Evaluation method, a framework developed within the context of WP5: Evaluation and Impact Assessment[25].

The preparation for the four workshops highlighted the significant advantage of the modular structure embedded within the training programs. This modular approach proved invaluable, particularly because the four implementing institutions had distinct goals and specific requirements for their respective workshops. This diversity in aims and demands was effectively addressed by leveraging the modular design of the training programs. The iterative development process, as previously discussed, played a crucial role in this adaptability. By breaking down the training into modular components, it became feasible to select and tailor the modules to align with the unique needs of each institution. This adaptability allowed for a bespoke approach in workshop design, ensuring that the content was precisely aligned with the objectives of the implementing institutions.

[24] Kragh, G., & Nielsen, K.H. (2023). D4.4 Report on all Workshops. TIME4CS H2020 project. Zenodo (30 June). https://doi.org/10.5281/zenodo.8083037

[25] Schaefer, T., Fabian, C.M., & Kieslinger, B. (2022). D5.2: Interim Evaluation and Impact Assessment Report (1.0). TIME4CS H2020 project. Zenodo (27 December). https://doi.org/10.5281/zenodo.7486206

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The development of the four workshops was a collaborative effort that involved ongoing dialogue with the Implementers (for more information, see Appendices 9.1 Appendix I). For each of the implementing institutions, the process began with a needs assessment, where the project partners identified the specific training needs and objectives. This phase typically involved exchange of emails and online meetings to understand the unique requirements and challenges faced by each partner institution. Based on the needs assessment, the project partners identified key topics and areas of focus for the training sessions. These topics were chosen to address the most pressing issues and to align with the IAs and GAs of the TIME4CS project.

Content for the training sessions was developed on the basis of modules included in the second version of the TIME4CS programs. While the core content of the training programs was standardized to meet project objectives, flexibility was built into the training design to allow the Frontrunners and Implementers to adapt and customize sessions to the specific institutional contexts. Often, additional material had to be developed to meet the demands of the Implementers. Draft versions of the workshop programs were shared with the project partners for review and feedback. This iterative process allowed for refinements and improvements based on the collective expertise of the partners.

4.1.5 Key takeaways from the training programs for Implementers

The lessons from the training sessions at the four implementing institutions highlighted the importance of iterative development and collaboration in creating effective training programs for CS integration across the four IAs. This approach seems to hold great promise in achieving successful institutional adoption of citizen science. Here are the key takeaways:

- **Iterative development:** The iterative process of designing and refining the training programs was crucial in ensuring their relevance and effectiveness. The ongoing dialogue and feedback loops with TIME4CS partners allowed for continuous improvement based on real-world needs and experiences.
- **Tailored workshops or programs:** Customization of training workshops to meet the specific needs of each implementing institution was vital. This approach ensured that the content, focus, and objectives of the workshops aligned with the unique challenges and goals of each partner.
- **Audience segmentation:** Recognizing the diversity of the audience within each institution, including researchers, managers, and support staff, led to the creation of targeted workshops. Tailoring content to the different stakeholders improved engagement and relevance.
- **Practical focus:** The training programs placed a strong emphasis on practical, hands-on learning. Participants benefited from interactive sessions that encouraged them to apply CS concepts directly to their research projects and institutions.
- **Incorporating external expertise:** In some instances, bringing in external experts, such as grant specialists, enriched the training content and provided valuable insights into funding opportunities and proposal development.

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- **Communication and outreach:** Workshops addressing science communication and outreach highlighted the importance of effectively communicating CS initiatives to a broader audience, fostering engagement and support.
- **Research assessment:** The inclusion of sessions on research impact evaluation and assessment criteria allowed participants to better understand how CS projects can be evaluated and recognized within institutional frameworks.
- **Networking and collaboration:** The training programs facilitated networking and collaboration among participants. Sharing experiences and ideas with peers from other institutions encouraged a sense of community and the exchange of best practices.
- **Alignment with institutional goals:** Ensuring that the training programs aligned with the strategic goals and policies of the implementing institutions was crucial for long-term integration of CS into research practices.
- **Adaptability:** The modular structure of the training programs allowed institutions to adapt and use specific modules that best suited their needs, providing flexibility in implementation.

Overall, the training sessions demonstrated the significance of tailored, practical, and collaborative approaches in equipping institutions and their stakeholders with the knowledge and skills to engage in CS endeavours. The iterative development process played a pivotal role in refining the training content to meet the evolving needs and challenges faced by each partner institution.

4.2 Developing and implementing the third and final version of the training programs

The third and final iteration of the training programs was crafted using insights gleaned from the workshops conducted at the implementing institutions, as detailed in the preceding section. To validate the revisions and gather feedback, we piloted this final version in a series of four workshops at Aarhus University during autumn 2023. Furthermore, we consulted four seasoned experts, known for their extensive experience in conducting CS courses and training programs for a diverse range of audiences in RPOs, to refine the final version of the training programs.

4.2.1 Workshops held at Aarhus University (October-November 2023)

The refined version of the four training programs, elaborated in section 5, was the foundation for a series of workshops conducted at Aarhus University in October-November 2023[26]. These workshops primarily aimed to validate the programs and apply final refinements. A particular area of interest was the effectiveness of the interactive sessions, which were more comprehensively developed from the second iteration of the training programs. Additionally, we sought to assess the efficacy of the modular structure of the training

[26] The full programs are available online: https://projects.au.dk/citsci/upcoming-events/citizen-science-workshops-2023

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programs in facilitating targeted training for each of the Integrating Activities (IAs): Research, Education & Awareness, Support Resources & Infrastructure, and Policy & Assessment.

Participants were recruited through the Aarhus University CS Network, the university's Open Forum (coordinating OS activities), and our professional contacts and networks. The workshops saw attendance ranging from 8 to 16 participants. We carried out a target evaluation similar to those conducted following the initial workshops at the implementing institutions. Furthermore, we gathered participant feedback using post-it notes. Overall, the evaluations affirmed the effectiveness of the training programs, particularly underscoring the importance of customization and interactive elements in enhancing the educational impact of the training.

Workshop on IA Research (2 October 2023)

The first workshop provided a comprehensive overview of CS research design and methods, emphasising the practical applications and interactive learning aspects. It began with an exploration of various research activities that utilise CS, highlighting significant achievements in data collection, processing, and community science projects. A key focus was on evaluating the suitability of CS for specific research projects or organisations, with participants employing a decision framework tailored to this purpose.

The training also delved into open science practices within CS projects. The presentations encompassed the definition of research problems, how to create research protocols, and develop open data management plans, aligning with OS standards in publication and public outreach. The module on public engagement and volunteer management provided practical strategies for effective communication and volunteer retention.

The participants particularly enjoyed the interactive sessions, which seemed to have significantly enhanced their learning experience. In these sessions, participants actively engaged in discussions about the suitability of their project ideas for CS, drawing from their own experiences and ideas. These discussions were enriched by the creation of concise pitches for their CS project concepts, fostering a deeper understanding and practical application of the concepts. The interactive sessions stood out for their emphasis on collaborative learning. Participants brainstormed and shared best practices in data management, volunteer coordination, and communication. These sessions not only facilitated an understanding of the challenges in these areas but also led to the collaborative creation of a resource encapsulating key best practices, emphasising the value of interactive learning in the training.

Workshop on IA Education & Awareness (27 October 2023)

This second workshop offered an in-depth exploration of training and awareness strategies in CS, with a strong emphasis on practical applications through interactive sessions. It commenced by presenting examples of impactful learning experiences and guiding participants in crafting interactive and collaborative training sessions for researchers and various other staff within the RPO as well as project volunteers.

A key focus was on developing effective training sessions tailored to different RPO groups. This included audience assessment, stakeholder analysis, and the train-the-trainer concept, along with introducing fundamental components of training design. Participants were encouraged to use these concepts to devise

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comprehensive CS training programmes, adaptable for either internal stakeholders within their RPOs or for external audiences such as project volunteers.

The training also delved into engaging schools and communities in CS projects. Emphasis was placed on adapting activities to suit school children, aligning them with their comprehension levels and the core research objectives, as well as crafting purposeful communication and engagement strategies for diverse audiences to further CS projects.

Interactive sessions were instrumental in augmenting learning outcomes. During these sessions, participants took part in hands-on activities, including the creation of their training programs and the development of narratives or communication strategies tailored to CS. Feedback from participants highlighted the value of implementing learned concepts in a practical setting, which deepened their understanding of effective training and engagement tactics. This practical approach was particularly appreciated, as it equipped them with the skills necessary to translate these strategies into effective, real-world CS initiatives, ensuring impactful training, meaningful engagement, and lasting results.

Workshop on IA Support Resources & Infrastructure (7 November 2023)

This third workshop focused on empowering CS initiatives through resources, funding, proposals, ethics, infrastructure, and institutional support. It included comprehensive insights into how RPOS can enhance CS at an institutional level, covering aspects such as funding avenues, organisational structures, and the creation of CS hubs or Institutional Contact Points of CS (CS-ICPs). The significance of the EU-citizen.science platform as a key online resource was also highlighted.

Crucial to the training were interactive sessions, designed to significantly enhance learning outcomes. In one session, participants actively developed their own research proposals for CS projects, selecting appropriate funding calls and brainstorming ideas. The workshop culminated in a hands-on session where participants planned and designed a CS institutional contact point for Aarhus University. This session empowered them to create a tailored roadmap, aligning with the unique needs and goals of their departments, thus bolstering support for CS initiatives.

Participants reported gaining valuable skills in developing effective research proposals for CS, strategically aligned with funding opportunities and institutional goals. They also highlighted practical insights into setting up and managing institutional support structures for these initiatives.

Workshop on IA Policy & Assessment (27 November 2023)

The fourth and final workshop provided a comprehensive understanding of strategy, evaluation, and impact in CS, with a significant emphasis on interactive sessions. It covered the development of effective strategies and policies to support and integrate CS within RPOs, using real-world examples of successful strategies and policies. Participants explored broader assessment models for CS, expanding traditional scientific research reward systems, and learned how to effectively evaluate and reward citizen science contributions.

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Key to the training were the interactive sessions. In one, participants collaboratively designed assessment criteria for CS projects, focusing on scientific, societal, and participant impacts. This session utilised the "Measuring Impact for Citizen Science" (MICS)[27] domains and indicator clusters, allowing participants to develop a multifaceted assessment approach. Another interactive session involved designing a systematic evaluation framework for CS initiatives, introducing participants to various evaluation tools and their application.

Participants expressed that they learned how to strategically integrate CS into RPOs and effectively evaluate its impact, gaining practical skills in designing comprehensive assessment criteria and evaluation frameworks. One participant noted, "This workshop showed me how to align CS projects with broader research goals and ethical practices, and the interactive sessions really brought these concepts to life."

4.3 Expert insights and feedback on the TIME4CS training programs

The concluding phase of the validation process involved gathering insights and feedback from experts specializing in CS training for diverse audiences. We sought their perspectives and reflections on the initial iteration of the final version of the TIME4CS training programs, aiming to integrate their input into the final refinements of the programs. This phase comprised three interviews with experts and written feedback from an additional expert.

Interview with expert from University of Southern Denmark, Denmark

Affiliated with the Citizen Science Knowledge Center at the University of Southern Denmark, the interviewee, who has experience in designing training programs for a diverse range of participants including researchers and students, shared his insights on the TIME4CS training programs.

The programs were received positively, being characterized as both stimulating and trustworthy, which suggests they are well-suited for practical use. The chosen target groups within the RPO were deemed appropriate, reflecting a broad stakeholder engagement. The content was considered comprehensive and aligned well with the goal of driving institutional change.

Regarding the format, the interviewee noted that the TIME4CS training programs adopt a thorough approach, incorporating case studies and interactive elements extensively. Nonetheless, an improvement was suggested for more structured guidance in terms of tailoring content to specific contexts and enhancing post-training support. A significant aspect of the training is its emphasis on collaboration with teachers and forming partnerships with schools, highlighting the necessity of demonstrating clear benefits to these key stakeholders.

In terms of content, the training was acknowledged as solid, but certain areas were pinpointed for potential further development. These areas included strategic leadership, development of employability and

[27] From the EC-funded MICS project: https://mics.tools

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transferable skills, and strategies to motivate time-constrained researchers. Another aspect that could have a bigger focus is the management of volunteer engagement and whether this should be a responsibility of the RPOs.

From a training program evaluation perspective, there was a suggestion for more conventional, critical assessments. This would entail giving participants greater opportunities to provide in-depth feedback and recommendations for refinement. The implementation of follow-up evaluations, possibly in the form of focus groups, was proposed as an effective method to gain a deeper understanding of the training's effectiveness and areas needing enhancement.

Interview with expert from University of Calgary, Canada

The researcher and instructor in Patient and Community Engagement Research from University of Calgary has extensive experience working with other researchers as well as the public and patients in research projects. Evaluating the TIME4CS training programs, she was positive about the amount covered in the modules and felt that the audiences identified were right for the content. She added that it might be beneficial to also target the Education sector, especially in relation to the module on involving schools.

In relation to the format, her main comments were around usability, emphasising how important it is to provide an overview of content and additional resources so learners can quickly find relevant content again and can deep dive into additional resources. These aspects are best considered in the TIME4CS online course[28] which provides both.

With a background in health research, the interviewee's comments in relation to content centered around importance of covering relational aspects and equity, diversity and inclusion aspects. These topics are particularly important within health research but are also relevant in all other types of CS projects, which highlights the importance of our 6. Equity, Diversity, and Inclusion Considerations section in this deliverable.

An additional aspect mentioned that would have been good to cover is financial aspects related to volunteers or project participants such as the possibility of refunding transport or parking costs, paying for food at events, or paying participants for their time. It is important that institutions and finance departments are set up to allow for these types of costs. Additionally, library access could be needed for some volunteers, especially if they were involved in project design or writing publications.

Interview with expert from University College London, United Kingdom

The interviewee, affiliated with University College London, has extensive experience in developing and running CS projects and CS training programs for a variety of stakeholders, including other researchers and RPO staff, students, CS practitioners, policy-makers, funders, industry and NGOs.

[28] https://moodle.eu-citizen.science/course/view.php?id=40

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The TIME4CS training programs were evaluated positively, as covering the main important topic areas for the targeted audiences, and as filling a gap in the currently available CS trainings. The interviewee highlighted that local culture, both within RPOs and in local contexts of CS collaborations, could be emphasised more in the training programs.

In relation to audiences, it was suggested to break down the 'Researchers' audience category to 'Researchers' and 'Principal Investigators / Senior Researchers / Project Managers', as these two types of researchers would need to focus on different aspects of CS, and thus would need different content of trainings. It was also suggested to add 'Funders' and 'Training providers' as target audiences where relevant, where 'Training providers' include RPO staff or external training providers who run trainings for researchers and other RPO staff. Further specific audience-related suggestions have been integrated in the training program descriptions below.

In terms of format, the interviewee suggested that interactive sessions could be more or better guided, for example by using templates for participants to complete, or by posing more specific activities such as 'Create a 2-hour session for RPO staff'. This could still be done by individuals using the TIME4CS training programs where they could pose specific activities depending on their organisational context. Further specific format-related suggestions have been integrated in the training program descriptions below.

Regarding content, the session about engagement with schools needs to highlight the ethical and GDPR-related issues, as engaging under-18s in research carries ethical responsibilities that need to be considered from the start (these aspects are currently covered in Training Program 3). Also, it would be good to highlight the need to carefully link the CS project to existing curriculum to make it relevant to the pupils' learning and easy for teachers to use. The final session on assessment could also include more links to specific researcher assessment principles, for example the DORA principles[29] and the CoARA initiative[30], as well as discussions around assessment specifically pitting public engagement (e.g. thousands of people reached) against scientific publications (if more focus on public engagement perhaps less publications).

In relation to evaluating the training program, an online form could be offered when users complete the TIME4CS online course. However, as the online course is mainly a training material resource for training providers, this may not be relevant.

Feedback from expert from Hanze University of Applied Sciences, the Netherlands

Written feedback was obtained from a researcher at Hanze University of Applied Sciences, working with participatory methods and training in the health realm. Her overall comments to the TIME4CS training program were that it was comprehensive and impressive.

[29] The DORA principles: https://sfdora.org

[30] CoARA initiative: https://coara.eu

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Regarding audiences, she noted that the training programs may be relevant for other audiences such as health care professionals, government and municipality staff, or patient associations, which we agree with. As the TIME4CS project was not directly targeting these audiences, they are not written in as target audiences, though they could benefit from completing the training programs, or part thereof.

Regarding the format, the expert noted that the TIME4CS training programs contained a "really good mix of items" that should not be changed.

In relation to the content, one suggested addition would be a reflection or interactive activity on learners' own unconscious biases, for example in relation to equality, language and inclusivity in research, either in the Research or Education and Awareness-raising modules. The informant very much liked the focus on evaluation and impact assessment, as that is often a down-prioritised area of CS projects.

5. TIME4CS training programs

The TIME4CS training programs are designed to facilitate the adoption of CS within RPOs across the four IAs: 1) Research, 2) Education & Awareness, 3) Support Resources & Infrastructure, and 4) Policy & Assessment. The modular structure of the training programs allows for the composition of various training modules, each targeting several specific GAs pertinent to the IAs. This modular approach was validated through training sessions held at the Implementers' locations in spring 2023 and workshops conducted at Aarhus University in autumn 2023 (see section 4.2). These experiences confirmed the training programs' adaptability to different institutional needs by selecting appropriate training modules. Based on the lessons learned, we have simplified the training programs presented in this third deliverable and included more fully developed interactive sessions.

The training modules have been numbered consecutively to avoid confusion and grouped together in pairs. Each pair includes an interactive component, which can be executed in small groups or individually. These interactive sessions are designed to produce tangible outcomes, which can then be evaluated by the course coordinators or by the course participants themselves in peer2peer sessions.

Each training program comprises two pairs of training modules. Although this may vary depending on the duration of the interactive components, the training programs have been designed to last approximately two hours, including time for two interactive sessions. Due to their modularity the training programs are versatile, having been developed for both online and onsite delivery. To enhance accessibility and reach, the slides to accompany all four training programs have been made available both on the Zenodo TIME4CS Community[31]

[31] https://zenodo.org/communities/time4cs

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and on the EU-citizen.science platform as part of our online course, "Supporting Sustainable Institutional Changes to Promote Citizen Science"[32], ensuring wider dissemination and utility.

In addition to the four training programs, a series of 10 webinars has been conducted to complement them. These webinars serve as an additional resource, reinforcing the concepts and practices outlined in the TIME4CS training programs. All webinar recordings and associated slides are accessible on the TIME4CS website and on EU-citizen.science providing further learning opportunities and support for those engaging with the training programs.

5.1 Intervention Area: Research

To facilitate the integration of CS within RPOs, researchers, students, and administrative staff need to recognize CS as a continually evolving research methodology that can add significant value to their work. Researchers ought to be prepared and confident in launching new projects using CS methodologies or in incorporating these methods into existing projects. Equally important is the need for administrative staff to fully understand CS, enabling them to provide optimal support to researchers.

Furthermore, all parties should be aware of the potential social and environmental impacts that CS can bring. CS offers unique opportunities, including access to extensive networks and potential funding sources, which are important for researchers to be aware of. The GAs in the TIME4CS IA: Research are specifically designed to highlight and capitalize on these opportunities, aiming to integrate CS more deeply into research practices and institutional policies.

5.1.1 Training Program 1 overview: Citizen science research design and methodologies

Training Program 1 aims to provide researchers, graduate students, and research-support staff with a comprehensive understanding of CS research design and methodologies within the scope of Open Science (OS). Designed as a two-hour course, the training program equips participants to conceptualize, design, and manage research projects by integrating CS and OS methodologies, emphasizing the role of CS in the wider OS movement. With six modules, including two interactive sessions, this program addresses data management, volunteer engagement, and public outreach, preparing participants to tackle challenges and craft solutions within CS projects. Upon completion, participants will be able to develop CS projects, apply decision frameworks, and ensure their research aligns with OS standards, effectively managing data and volunteers for successful public engagement. The program's interactive components encourage the practical application of concepts, fostering collaborative learning and the creation of action plans for CS initiatives.

Grounding Actions covered

- Develop research projects using CS and/or OS methodology

[32] https://moodle.eu-citizen.science/course/view.php?id=40

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- Expand running research projects using CS and/or OS methodology
- Plan or implement changes in organisational structures or functions
- Establish/belong to a CS network
- Establish or link with working groups on CS

Intended audience(s)

- Researchers across all career stages
- Graduate students
- Research-support staff in RPOs or NGOs

Learning outcomes

These learning goals are designed to equip participants with a comprehensive skill set to effectively implement and manage CS projects, contributing to the advancement of research through public participation and open science methodologies.

Upon completion of this course, participants will be able to:

- **Understand the fundamentals of CS:** Gain a foundational understanding of CS methodologies and their role within the broader context of Open Science (OS)
- **Develop and expand research projects with CS methodologies:** Acquire the skills to conceptualize and implement new research initiatives using CS approaches or integrate CS methodologies into existing research projects
- **Apply decision frameworks to assess CS suitability:** Utilize structured decision frameworks to evaluate the appropriateness of CS for specific research projects or ideas
- **Ensure compatibility with OS standards:** Master the principles of data management and public outreach in line with OS standards, using tools like the Data Charter for Citizen Science
- **Manage data effectively in CS projects:** Learn best practices for data management, including understanding FAIR data principles and employing effective data hygiene, standards, and formats
- **Engage and manage volunteers in CS projects:** Acquire skills in volunteer management, including recruiting, retaining, and effectively communicating with volunteers, and understand the motivations and journeys of volunteers in CS
- **Communicate and conduct public outreach:** Develop strategies for effective communication and public outreach, crucial for the success and impact of CS projects
- **Create action plans for 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

Main division - topics

- **Welcome and introduction to the course:** Introduction to the course from the course tutor. Overview of the content and the learning outcomes.

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- **Training Module 1.1: Citizen science research design and methods**
    - **Training Module 1.1.1: Citizen science methodologies** offers examples of research activities that make use of citizen science methodology and provides an overview of the achievements in data collection, data processing, curriculum-based projects, and community science.
    - **Training Module 1.1.2: Assessing the suitability of citizen science for your research project** involves participants in posing and addressing questions aimed at helping them determine the suitability of citizen science for specific project ideas or for their organization. The module also introduces a decision framework for the selection and application of citizen science.
    - **Training Module 1.1.3: Interactive session: Employing a decision framework to determine whether your ideas are suitable for citizen science** encourages participants, drawing from their own CS project ideas or their experiences, to engage in discussions regarding the opportunities and challenges that researchers, participants, and other stakeholders may encounter when employing CS methodologies. This discussion is supported by a handout outlining the levels of participation in CS and a decision framework for selecting and implementing CS approaches. Additionally, participants will craft concise 2-minute pitches for their CS project concepts.
- **Training Module 1.2: Open science practices in citizen science projects**
    - **Training Module 1.2.1: Open data management and open access** enables participants to define their research problem, create an appropriate research protocol, develop an open data management plan, set up a timeline, and establish a budget. The module emphasizes alignment with OS standards concerning publication, data management, and public outreach.
    - **Training Module 1.2.2: Public engagement and volunteer management** offers guidance on various community engagement techniques, including strategies for recruiting and retaining volunteers for citizen science projects. The module also covers effective communication with stakeholders and the public.
    - **Training Module 1.2.3: Interactive session: Navigating data management, volunteer management, and communication** encourages participants to brainstorm and share best practices related to data management, volunteer coordination, and communication within CS projects. Participants will identify and discuss key terms representing these best practices within the three categories: data management, volunteer coordination, and communication. Furthermore, they will engage in a conversation regarding the challenges encountered by both organizers and participants of CS projects in these domains. As an outcome, participants will collaboratively create a slide featuring essential keywords that encapsulate the discussed best practices.

Welcome and introduction

The training program begins with an introductory session led by the instructor or facilitator. During this introduction, the instructor provides an overview of the content and outlines the expected learning

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outcomes for participants. Additionally, the session includes a teaser or story related to citizen science, designed to engage and captivate the participants' interest in the subject matter.

What?	How?	Why?
Introduction from the course tutor	A one-minute presentation, introducing the course to the learner. Introduction of who made the course, and what is covered in it.	Welcome the student, and provide assurance about the credibility of the course
Course overview	Overview of the course structure and learning objectives, explaining the elements that will appear in each module and section	Familiarity with the structure of the course and the reason to engage in it
What citizen science may accomplish	Provide an example of a citizen science research project with real benefits for researchers and participants using this list of Case Studies | CitizenScience.gov (maybe examples from different disciplines so that the participants can choose)	Make the course interesting and worth exploring

5.1.2 Training Module 1.1: Research design and methods

Training module 1.1 introduces participants to various citizen science methodologies and helps them determine the right fit for their research projects. The module covers examples from data collection initiatives like eBird to data processing platforms like Galaxy Zoo, demonstrating citizen science's versatility. It includes a decision framework to aid researchers in assessing whether citizen science suits their project goals, considering the motivations and participation levels of potential volunteers. An interactive component enables participants to apply this framework to their ideas, fostering a deep understanding of citizen science integration into research. The module culminates with reflections on these insights, solidifying the participants' capacity to implement citizen science methodologies effectively.

Training Module 1.1.1: Citizen science methodologies

Training module 1.1.1 educates participants on the diverse methodologies within citizen science, using terminology and real-world examples to illustrate these concepts. By exploring case studies like eBird for data collection and Galaxy Zoo for data processing, the module showcases the impact and breadth of citizen science projects. It culminates by providing an overview of various citizen science approaches, including crowdsourcing, curriculum-based projects, and community science, to equip participants with the knowledge to apply these methods in their work.

What?	How?	Why?
Introduction to CS	Explaining how we are going to cover the topic of citizen science research methodologies through examples of different types of citizen science projects	Explaining to the learner why it is worth following the course

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What?	How?	Why?
Example one - eBird (data collection)	The story of eBird and how it became the world's largest biodiversity-related science projects, with more than 100 million bird sightings contributed annually by eBirders around the world and an average participation growth rate of approximately 20% year on year	Demonstration of what can be achieved with crowdsourcing of data collection
Example two – Galaxy Zoo and Zooniverse (data processing)	The story of Galaxy Zoo and how it has mobilised volunteers to perform millions of classifications of galaxies and resulted in over 450 publications	Demonstration of what can be achieved with crowdsourcing of data processing
Example three - FoldIt (data processing through gamification)	The story of FoldIt and how players have contributed to advanced research on human health, cutting-edge bioengineering, and the inner workings of biology	Demonstration of what can be achieved with curriculum-based citizen science projects
Example four - the Give Youth a Voice project and the Mass Experiment in Denmark	The story of two projects in Denmark – one about mental health and young people and one about plastic pollution involving 57.000 school children	Demonstration of what can be achieved with citizen science projects that involve young people/school children
Overview of citizen science methodologies and what they accomplish: crowdsourcing (data collection and/or data processing), curriculum-based projects, and community science	Bringing the stories together and elaborating on key terms for citizen science methodology: crowdsourcing and volunteered thinking/computing (data collection and/or data processing), curriculum-based citizen science (formal and informal science education), and community science	Helping participants to organise information about individual examples and enabling them to use relevant terminology

Training Module 1.1.2: Assessing the suitability of citizen science for your research

Training module 1.1.2 guides participants through a decision-making process to assess the suitability of CS methods for their research project or ideas. It includes stakeholder analysis and understanding volunteer motivations to ensure a well-aligned approach to project design and execution. The module also introduces a structured decision framework that assists participants in making informed choices about incorporating citizen science methodologies into their projects.

What?	How?	Why?
Reasons for choosing CS as research methodology	Going over reasons for choosing (and not choosing) CS as a research methodology	Demonstrating that there are many reasons for choosing CS

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What?	How?	Why?
Defining the aim of the project	The need for well-defined aim, incl. questions to assist participants in defining their project's aim	Assisting participants in defining project aims
Stakeholder analysis	The motivation for doing a stakeholder analysis	Enabling participants to perform a stakeholder analysis taking into account the timing of the project
Ladder of participation	Defining the ladder of participation for both volunteers and researchers	Encouraging participants to think about different level of participation and why it's important for both volunteer and researchers
The examples of Asteroid Zoo and Supernova Hunters	What Supernova Hunters did to regularly enhance the number of classifications	Enabling participants to design project based on understanding of volunteers' motivation
Volunteer motivations	Different types of motivation for different types of CS projects	Giving participants insight into project characteristics and the different kinds of motivation that drive volunteers
Choosing and using CS	Presenting a decision framework for determining whether CS is a suited methodology or not	Enabling participants to use the decision framework

Training Module 1.1.3: Interactive session: Employing a decision framework to determine whether your ideas are suitable for citizen science

In this hands-on session, participants will employ a decision-making framework to determine if their project ideas align with the principles and practices of CS. This session aims to cultivate engagement, critical evaluation, and collective strategizing. By its conclusion, participants should have a clear understanding of how to integrate their projects within the citizen science framework.

What?	How?	Why?
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.	Engaging in group discussions allows participants to share diverse perspectives and ideas, enriching their understanding of the practical applications of citizen science.
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.	Systematically applying the decision framework to specific projects helps participants critically analyze the suitability of citizen science for their research objectives.

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What?	How?	Why?
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.	This phase encourages participants to think creatively and realistically about the benefits and hurdles of incorporating citizen science, fostering a balanced perspective.
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.	Presenting assessments and receiving feedback cultivates a collaborative learning environment and enhances participants' ability to articulate and refine their project ideas.
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.	Reflecting on the session's activities solidifies learning and allows participants to internalize the decision-making process for future application in their research projects.

5.1.3 Training Module 1.2: Open science practices

Training module 1.2 equips participants to align their citizen science endeavours with the best practices of open science. It begins with an examination of how to integrate open science standards in publication, data management, and public outreach, utilizing the Data Charter for Citizen Science. Participants will explore the benefits of open science across multiple domains, understand the principles of FAIR data, and learn to apply the 5-star open data system to their projects. The module also tackles important considerations of privacy, ethics, data hygiene, and standards. An interactive session brings the module together, where participants will apply their knowledge to manage data, handle volunteer management, and implement effective communication strategies.

Training Module 1.2.1: Data management and open science practices in citizen science projects

Training module 1.2.1 instructs participants on aligning their citizen science projects with OS standards. It delves into the Data Charter for Citizen Science, covering essential elements like FAIR data principles, privacy, ethics, and data hygiene, to ensure responsible and effective data practices. The module also introduces the 5-star open data concept, guiding participants through the application of open data and OS principles to enhance the integrity and impact of their research.

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What?	How?	Why?
The benefits of open science	Going over an array of benefits across five domains	Explaining to the learner why it is worth following the course
Components of open science	Using UNESCO's open science chart to give insight into the many aspects of OS	Demonstrating that there are many reasons for integrating OS and CS
What is FAIR data?	FAIR data principles and why they are important to CS	Demonstrating that there are many reasons for implementing the FAIR data standards in citizen science projects
The 5-star open data and the open attitude	Introducing the 5-star open data ladder and the open attitude	Enabling participants to place their data management plan on the 5-star open data ladder
The Data Charter for Citizen Science: Privacy and ethics	Introducing the Data Charter for Citizen Science and issues pertaining to privacy and ethics	Enabling participants to incorporate reflections about privacy and ethics into their project planning
The Data Charter for Citizen Science: Data hygiene, standards, and formats	The Data Charter for Citizen Science on data hygiene, standards, and formats	Enabling participants to incorporate relevant standards and formats into their data management plan
The Data Charter for Citizen Science: Data management	Overview of data protocols, metadata management, data standards, and data evaluation	Enabling participants to learn from best practices in data management

Training Module 1.2.2: Public engagement and volunteer management

Training module 1.2.2 equips participants with strategies for effective community engagement and volunteer coordination in citizen science projects. It covers the volunteer lifecycle—from recruitment to retention—and provides tools and insights for managing volunteer motivations, experiences, and communications. Additionally, this module emphasizes the importance of public outreach, offering guidance on how to communicate and engage with various stakeholders to maximize the impact of citizen science initiatives.

What?	How?	Why?
Volunteer management	Introducing the notion of volunteer management and the volunteer literature	Demonstrating that there is already a lot of knowledge about how to engage with volunteers
The volunteer's journey	The stages of volunteer's journey and ways to maximise volunteers' experience	Demonstrating that the volunteer experience has many stages with different concerns
The motivations of volunteers	Types of motivations; demography and attributes of volunteers; recruitment techniques or awareness of opportunities	Enabling participants to describe their (potential) volunteers and plan the recruitment process

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What?	How?	Why?
Checklist for project organisers and managers	Key recommendations for project organisers based on the volunteer's journey	Enabling participants to use the checklist for project organisers
Volunteer management	Best practices for onboarding, communication, retention, and acknowledgment	Enabling participants to plan ahead for retention and sustained participation
Communication and public outreach	Issues and tools for communication and public outreach in relation to citizen science projects	Encouraging participants to design and initiate outreach activities in relation to their project (before, during, after)

Training Module 1.2.3: Interactive session: Navigating data management, volunteer management, and communication in citizen science projects

This interactive session aims to consolidate participants' understanding of three core aspects of CS: data management, volunteer management, and communication/public outreach. They will brainstorm, discuss, and share thought on each of the three topics (alternatively choosing just one topic to focus on), creating a flip chart (onsite) or Miro boards (online) to capture the essence of each topic. The expected outcome is for each participant to leave with a well-considered judgment on how to effectively manage data, coordinate volunteers, and communicate in the context of their CS endeavours.

What?	How?	Why?
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).	Focusing on distinct topics helps in organizing thoughts and ensures thorough coverage of key areas in citizen science.
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.	This phase stimulates critical thinking and allows participants to actively engage with the material, reinforcing their understanding.
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.	Visual representation aids in consolidating and synthesizing the learned concepts in a creative and memorable manner.

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What?	How?	Why?
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.	Presenting their work fosters communication skills and confidence, while receiving feedback provides opportunities for refinement and deeper insight.
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.	This final reflective discussion allows participants to internalize their learning and consider practical applications in their future projects.

5.2 Intervention Area: Education & Awareness

The TIME4CS IA related to education and awareness include actions that raise awareness of CS amongst researchers, students, managers and other RPO staff, as well as members of the public (incl. local communities and associations). This includes general information about CS for members of the organisation but also activities – courses, seminars, workshops, master classes, open days, and much more – that involves larger and more diverse audiences. This holistic approach involves not only providing general information about CS within the organisation but also engaging in a diverse array of activities. By involving larger and more diverse audiences through these activities, the TIME4CS project aims to create a robust and inclusive institutional ecosystem for CS.

5.2.1 Training Program 2 overview: Educational and awareness-building efforts in the field of citizen science

Training program 2 is a comprehensive course that motivates participants to create CS training and awareness programs for various audiences within RPOs. Targeting researchers, educational staff, and outreach personnel at all career levels, it covers the development of CS programs, management of volunteers and their training, and the integration of CS into STEM education. The program also emphasizes the importance of public engagement, providing strategies for effective communication and outreach. With six detailed sections, including interactive sessions on designing CS training and engagement initiatives, participants will leave equipped to foster a culture of citizen science within and beyond their organizations. The course culminates with the application of learned concepts through the creation of communication plans and school project implementations, ensuring that participants can enact meaningful CS educational and outreach activities.

Grounding Actions covered

- Set up training programs for researchers and volunteers
- Set up training programs for students

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- Set up information sessions specifically for management
- Set up informal occasions of interactions with researchers
- Find and nurture CS champions
- Develop easily accessible materials
- Organise debates or public events to promote CS

Intended audience(s)

- Researchers at all career stages
- Research-support, educational and outreach staff at research performing organisations (RPOs)
- Training providers for RPOs
- Volunteer managers and facilitators

Learning outcomes

By the end of this course, the learner should be able to:

- **Understand the significance:** Gain a deep understanding of the importance of citizen science training and awareness in promoting responsible and inclusive research and innovation practices
- **Employ effective strategies:** Learn strategies for conducting impactful training sessions and awareness-raising activities tailored to researchers, volunteers, and other stakeholders within RPOs
- **Assess stakeholders and audiences:** Develop the skills to conduct audience assessments and stakeholder analyses to tailor training experiences for specific groups and contexts
- **Use train-the-trainer methodologies:** Explore the train-the-trainer concept and its application in disseminating citizen science knowledge within RPOs
- **Design training programs based in the logic model:** Apply the fundamental components of the logic model to design training sessions that align with objectives, target audiences, and chosen training methods
- **Engage schools and communities:** Understand the challenges and opportunities of involving school children and communities in citizen science projects
- **Design effective communication and engagement:** Craft purposeful communication and engagement strategies tailored to larger and diverse audiences, advancing citizen science projects and building enduring connections with stakeholders beyond RPOs

Main division - topics

- **Welcome and introduction to the course:** Introduction to the course from the course tutor. Overview of the content and the learning outcomes.
- **Training Module 2.1: Training and raising awareness about citizen science**
    - **Training Module 2.1.1: Strategies for training and raising awareness among researchers, volunteers, and other stakeholders** offers examples of impactful learning experiences and awareness-raising activities tailored for RPOs. It also highlights the differentiation between “inreach” and “outreach” strategies. The module guides participants in designing citizen

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science training sessions or informal engagements that foster interaction and collaboration among researchers, volunteers, and various RPO staff, including research-support personnel, outreach officers, research librarians, and management staff.

- **Training Module 2.1.2: Setting up training sessions for researchers and others** focuses on the development of training sessions and engaging learning experiences tailored to researchers and various RPO groups. It underscores the importance of crafting effective training sessions and meaningful educational encounters for specific audiences and stakeholders. Participants will be introduced to audience assessment, stakeholder analysis, and the train-the-trainer concept. The module also explores learning opportunities for volunteers and introduces the fundamental components of the logic model for training design.
- **Training Module 2.1.3: Interactive session: Design your own training program** encourages participants to leverage the logic model framework to craft a comprehensive CS training program. Participants have the flexibility to design this program for either internal stakeholders within their RPOs or for external audiences, depending on their specific goals and needs. During this session, participants will explore the various elements of CS training, such as defining objectives, identifying target audiences, selecting appropriate training methods, and assessing outcomes. They will gain hands-on experience in developing a structured training plan that aligns with their chosen context, whether it be within the RPO or for external outreach. This practical exercise not only enhances participants' understanding of CS training but also equips them with the skills to design effective training sessions tailored to their unique requirements. It empowers them to engage and educate a wide range of stakeholders, contributing to the successful implementation of citizen science initiatives.

- **Training Module 2.2: Engaging schools and communities**
  - **Training Module 2.2.1: Involving schools in citizen science engagement** focuses on the crucial task of involving school children in citizen science (CS) projects. It highlights the need for project managers to skilfully adapt and differentiate CS activities to align with the abilities and comprehension levels of children. Simultaneously, the module underscores the importance of maintaining a strong connection between these activities and the core research objectives.
  - **Training Module 2.2.2: Effective communication and engagement** is dedicated to the art of crafting purposeful communication and engagement strategies tailored to larger and diverse audiences with the goal of advancing CS projects and cultivating enduring connections with stakeholders beyond the RPO. The module emphasizes the significance of building sustained and meaningful relationships with stakeholders beyond the RPO, whether they are local communities, policymakers, or partner organizations. Participants will gain insights into strategies for fostering collaboration, trust, and mutual understanding, which are essential for the long-term success and impact of CS projects.
  - **Training Module 2.2.3: Interactive session: Crafting narratives and communication strategies in citizen science** will delve into the transformative power of storytelling and

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strategic communication within the realm of CS. The session introduces two intriguing task options, distribute comprehensive handouts with clear instructions and illustrative examples, and equip participants with the necessary tools, whether it be large sheets of paper and markers for physical collaboration or digital drawing tools for online engagement. Whether the participants choose to craft captivating narratives for their CS projects or explore communication strategies, they will have the opportunity to present their work to peers and receive valuable feedback, fostering a deeper understanding of the importance of clarity, engagement potential, and comprehensiveness in narratives and communication strategies. Ultimately, they will be inspired to integrate these storytelling and communication elements into their real-world CS initiatives, ensuring meaningful engagement and enduring impact.

Welcome and introduction

The training program begins with an introductory session led by the instructor or facilitator. During this introduction, the instructor provides an overview of the content and outlines the expected learning outcomes for participants.

What?	How?	Why?
Introduction from the course facilitator	Introducing the course to the learner. Introduction of who made the course, and what is covered in it	Welcome the participants, and provide assurance about the credibility of the course
Course overview	Overview of the course structure and learning goals - explaining the elements that will appear in each section	Familiarity with the structure of the course and the reason to learn in

5.2.2 Training Module 2.1: Training and raising awareness about citizen science

Training module 2.1 centres on the development and execution of CS training and awareness within RPOs. It equips participants to conduct impactful inreach and outreach activities, distinguishing between internal training programs and external public engagement efforts. The module showcases exemplary CS educational initiatives, like the Citizen Science Talent Program at the University of Southern Denmark and the MOOC from UCL's Extreme Citizen Science Group, demonstrating the range of training formats available. It emphasizes the train-the-trainers methodology, preparing participants to both learn and teach CS concepts effectively. The interactive session uses the logic model to guide participants through designing their own CS training, fostering a practical understanding of planning, executing, and evaluating educational programs.

Training Module 2.1.1: Strategies for training and raising awareness among researchers, volunteers, and other stakeholders

Training module 2.1.1 focuses on developing effective citizen science training and awareness programs within RPOs. It guides participants through the nuances of inreach (internal training and learning) versus

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outreach (public engagement) activities, using examples from diverse programs like the Citizen Science Talent Program and online courses from the UCL's Extreme Citizen Science Group. The module emphasizes the importance of understanding different audience needs and tailors its content to ensure participants can design impactful training sessions and public events that effectively promote citizen science.

What?	How?	Why?
Overview of inreach and outreach activities	Explaining the difference between in- and outreach in terms of target groups and formats	Providing the participants with an overview, which is useful for the following examples
Example one: Citizen Science Talent Program (Master's level course offered by the University of Southern Denmark)	Describing an on-site Master's level course for students (including group projects on citizen science)	Demonstration of what can be achieved with a course specifically designed for university students and involving researchers as supervisors
Example two: Citizen Science and Scientific Crowdsourcing: An Introduction (MOOC offered by UCL's Extreme Citizen Science Group)	Describing one of the many available online courses for researchers and others that would like to know (more) about citizen science	Demonstration of what can be achieved with in introduction course on citizen science
Example three: The EU-Citizen.Science Training Platform with one example (Storytelling for citizen science)	Describing the scope of the EU-Citizen.Science Training Platform and providing one example of a free 2,5-hour course designed to introduce storytelling and give practical tools to shape narratives to communicate about and engage with citizen science	Demonstration of free training resources already available and one example, which is also relevant to the topic of this training program
Example four: Open Citizen Day held at the Steno Museum in Aarhus, Denmark	Describing an open-day activity designed to promote a variety of citizen science projects to the general public	Demonstrating the potential of outreach awareness-raising activities outside the RPO
Overview of what can be accomplished by inreach and outreach activities	Bringing the stories together and elaborating on some key terms for citizen science education and awareness such as inreach program and initiatives (curriculum-based courses, capacity-building trainings, informal mutual learning events) and public outreach activities (open days, festivals, happenings, science cafes)	Enabling the participants to think about pros and cons of inreach and outreach activities

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Training Module 2.1.2 Setting up training sessions for researchers and others in the RPO

Training module 2.1.2 is designed to impart the essentials of creating CS training and development programs within RPOs. It emphasizes the train-the-trainers methodology, equipping participants with the skills to design and conduct training sessions for various stakeholders, including researchers, volunteers, students, and administrative staff. The module covers stakeholder analysis, training content development for different audiences, and best practices for volunteer training, ultimately enabling participants to comprehensively plan and execute effective CS training sessions within their organisations.

What?	How?	Why?
Things to consider before setting up training sessions for researchers and others	Thinking about the who, when and what for training of staff (audiences, stakeholders, and content) + the train-the-trainer concept	Explaining to participants that there are many groups and resources to consider in preparation for training
Stakeholder analysis	Describing the basic model of stakeholder analysis going beyond the core team to consider audiences and stakeholders	Enabling the participants to situate their (planned) training in the organisational framework of the RPO and to perform stakeholder analysis to inform their training designs
What researchers need to know about CS	Describing the content of existing training courses aimed at researchers	Inspiring participants to design their own training programs for researchers
What students need to know about CS	Describing the content of existing training courses aimed at students	Inspiring participants to design their own training programs for students
What other RPO staff need to know about CS	Describing the content of existing training courses aimed at administrative staff, e.g., research-support, educational and outreach staff	Inspiring participants to design their own training programs for administrative staff
Train-the-trainer (TTT)	Describing the TTT concept and things to consider when leading a TTT workshop	Demonstrating the value and practice of TTT
Setting up training sessions for volunteers (participants)	Explaining the various steps from including the participants in the stakeholder analysis to planning of training and taking into consideration different learning styles	Enabling participants to get an overview of the process involved in setting up training for volunteers
Levels of training for volunteers from onboarding to task training and other in-project learning opportunities	Providing an overview of different levels of trainings for volunteers: recruitment (onboarding) – task training – expanded learning and development opportunities	Enabling participants to get an overview of the various training and learning opportunities for volunteers

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What?	How?	Why?
The logic model used to design volunteer training	Introducing the logic model in the context of volunteer training	Allowing the participants to become familiar with the logic model applied to volunteer training (to be used in the interactive session)

Training Modules 2.1.3: Interactive session: Design your own training inside or outside your RPO

In this interactive session, training module 2.1.3, participants will utilize the logic model to design a CS training program, either for internal stakeholders within their RPOs or for external audiences. Participants will have a clear, logic model-based plan for a CS training program. They will gain hands-on experience in applying a structured approach to training design. The session fosters collaboration, critical thinking, and practical application of theoretical knowledge in CS training development.

Program	Task
Introduction	Briefly introduce the logic model as a tool for planning and evaluating CS training programs. Explain the session's objective: to create a structured plan for a CS training session.
Group formation	Divide participants into small groups or set them up to work individually. Provide each group or individual with a template of the logic model and necessary materials (pens, paper, or digital tools).
Designing the training	Participants use the logic model to develop their CS training plan. This involves identifying inputs (resources needed), activities (what will be done), outputs (immediate results), outcomes (short and long-term goals), and impacts (broader changes or benefits). Encourage creativity and practicality, considering factors like audience, content, resources, and desired outcomes.
Sharing and feedback	Each group or individual presents their logic model-based training plan. Encourage peer-to-peer feedback, focusing on the feasibility, clarity, and potential impact of each plan.
Evaluation and conclusion	Conclude the session by highlighting the importance of structured planning in effective training program design. If time allows, the facilitator can provide brief, overarching feedback, emphasizing key takeaways.

5.2.3 Training Module 2.2: Citizen science in educational settings and outreach activities

Training module 2.2 equips participants with the knowledge to effectively integrate CS into school curricula and public outreach. It guides them through the development of communication strategies, leveraging storytelling and various tools to engage with stakeholders and the broader community, while also emphasizing collaboration with schools for educational CS projects. By incorporating elements such as curriculum alignment and problem-based learning, participants learn to create educational experiences that enhance scientific literacy and foster environmental awareness. The program culminates with an interactive

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session where participants create detailed communication plans, ensuring they can convey their projects' objectives compellingly and foster enduring community connections.

Training Module 2.2.1: Collaborating with schools for effective citizen science engagement

Training module 2.2.1 focuses on integrating CS projects into school curricula, addressing the unique challenges and opportunities of working with students. It emphasizes the need for adapting activities to suit students' abilities and ensuring that these activities align with educational goals and contribute to the overarching research objectives. The module provides examples of successful school-based projects, such as the Mass Experiments in Denmark, and discusses design principles for curriculum-based citizen science, including problem-based learning and teacher collaboration, highlighting the diverse learning outcomes achievable through such engagements.

What?	How?	Why?
Why is it important to learn about collaboration with schools in CS?	Engaging in CS within school settings can yield scientific results, and schools, educators, and students can experience valuable advantages by participating	Explaining to the participants why it is important to consider schools in CS projects
Example of a successful school-based project: The Mass Experiments in Denmark	Describing the idea behind the Mass Experiment in Denmark and the 2023 experiments on microfauna	Demonstrating that citizen science can successfully be integrated into schools and curricula
The impact of CS projects in schools such the Mass Experiments	Describing the benefit of integrating CS into schools in terms of scientific and educational impact: authentic science experience, scientific literacy, inquiry-based learning	Demonstrating that CS holds great promise for school collaboration
Collaborating with schools for effective citizen science engagement	Outlining four basic values of CS in schools: Enhanced learning and understanding of science, Community engagement and civic responsibility, Scientific literacy, informed decisions, and STEM careers, and Environmental awareness and sustainable practices	Encouraging the participants to reflect over important values involved in engaging with schools to do citizen science
Two other examples of CS projects in schools: The LETS Study Leysin and ReGAME	Introducing two other CS projects in school settings: the teacher-initiated LETS Study Leysin and the Research-Enabling Game-Based Education (ReGAME)	Demonstrating that there are various ways to integrate CS in schools
Guiding design principles for CS in schools	Introducing three basic design principles for CS in schools: Curriculum alignment, Problem-based learning (PBL) design, and Collaboration with teachers (teachers are important gatekeepers, team leaders, and data quality filters)	Allowing participants to understand three important design principles for CS in schools

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What?	How?	Why?
Developing materials for education and learning opportunities in CS	Addressing three relevant socio-cognitive contexts for educational material: The science context, the context of participation, and the project-specific context	Encouraging reflection on relevant contexts for educational and learning material
Recognizing the diversity of learning outcomes	Explaining that participants can acquire a range of skills and knowledge from scientific understanding and skills to collaboration, empowerment, and advocacy	Enabling participants to recognize the diversity of learning outcomes from CS in schools

Training Module 2.2.2: Communication and engagement in citizen science

Training module 2.2.2 equips participants with strategies for designing and executing communication and engagement activities in CS projects. It underscores the importance of such activities in enhancing data quality, motivating participants, and raising public awareness about CS. The module delves into the creation of effective communication plans, including identifying project aims, engagement levels, and target audiences, and utilizing diverse tactics like digital storytelling and gamification. Participants are taught how to design compelling stories to clearly convey project objectives and processes, fostering a strong sense of community and stakeholder connection.

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What?	How?	Why?
What makes communication and engagement with participants in CS crucial?	Elaborating on three potential outcomes of communication and engagement in CS projects: Enhanced data quality and reliability, Motivation and retention, and Public awareness and impact	Explaining the key take-aways to the participants: Effective communication and engagement ensures common understanding of goals, methods, and process, while also building a sense of community
Building blocks of a communication plan	Describing the six building blocks of a CS communication plan: Determine project aims, Define the level of engagement, Specify the target audience, Understand audience motivations, Engage in various ways, and Evaluate and improve the materials	Allowing participants to contemplate the six building clocks in a communication plan
Tactics and tools for communicating with participants, stakeholders, and the public	Introducing tactics and tools for communication: Existing networks, Fun and enjoyable experiences, Social media, Digital storytelling, Gamification, and Project ambassadors	Enabling participants to contemplate different tactics and tools for communication
Elements of a good story	Using storytelling (incl. Digital storytelling) to explain expectations, purpose, and skills in a project. Elements of a good story: Structure, character, setting, authenticity, accessible language, and message	Enabling participants to use basic storytelling techniques to communicate their project

Training Module 2.2.3 Interactive session: Crafting narratives and communication strategies in citizen science

This interactive session offers participants the choice between two tasks focused on enhancing communication in CS: crafting a compelling story for a project or selecting and diving into communication tactics and tools. Participants will be encouraged to develop a structured story or a detailed communication strategy that can be applied to enhance engagement in their CS projects. They will gain insights into the narrative and visual representation of their project's story or the practical use of communication tools to engage diverse audiences effectively.

What?	How?
Introduction	Present the two task options and distribute handouts with instructions and examples. Provide participants with large sheets of paper for their work and markers or other drawing tools (online if necessary).
Task selection and planning	Divide participants into small groups or set them up to work individually. Participants choose one of the two tasks: developing a story or selecting communication tactics. They brainstorm key elements or tactics/tools they wish to focus on.

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What?	How?
Task execution	For the storytelling task, participants sketch out the narrative of their chosen citizen science project, focusing on structure, characters, setting, and message. For the communication strategies task, participants list and elaborate on selected tactics and tools, considering how they would apply to a specific citizen science initiative.
Sharing and feedback	Participants briefly present their stories or communication plans, highlighting the rationale behind their choices. Peers provide feedback, focusing on the clarity, engagement potential, and comprehensiveness of the narratives or communication strategies.
Conclusion	Summarize the importance of storytelling and strategic communication in citizen science. Encourage participants to incorporate these elements into their actual citizen science projects.

5.3 Intervention Area: Support Resources & Infrastructure

Support resources and infrastructure for CS encompass the vital components necessary to facilitate and enhance citizen science initiatives. These resources include but are not limited to funding opportunities, organizational structures, knowledge sharing platforms, communication tools, and governance frameworks. Establishing robust support resources and infrastructure is crucial for ensuring the success, sustainability, and ethical compliance of citizen science projects. Participants in training programs focused on citizen science benefit from understanding these elements, as they empower them to navigate the complexities of citizen science effectively and align their initiatives with real-world funding opportunities, ethical standards, and institutional needs.

5.3.1 Training Program 3 overview: Navigating institutional support, funding, and ethical considerations

Training program 3 serves as an invaluable resource, offering insights into three vital components of the CS journey: the institutional contact points for CS (CS-ICPs), the intricate landscape of CS funding, and the specific ethical and legal requirements related to CS projects. This program is designed to achieve several key objectives. First, it provides participants with a deeper understanding of the pivotal role played by CS-ICPs within RPOs. Through this exploration, participants will have the opportunity to reflect on the necessity of establishing one or more CS-ICPs within their respective organisations. Secondly, training program 3 equips participants with the knowledge and tools needed to navigate the intricate funding ecosystem, spanning organizational, national, and international levels. By the end of this program, participants will be well-positioned to identify targeted funding opportunities for their CS projects and develop innovative project ideas that align with these opportunities. Thirdly, training program 3 introduces participants to the specific ethical and legal requirements that pertain to CS projects.

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Grounding Actions covered

- Identify an institutional contact point for CS
- Establish facilities to support CS activities
- Facilitate the set-up of pilots/tests for the methodology
- Make known and available open and free tools and/or existing tech solutions
- Foresee funds for CS activities
- Establish facilities to support CS activities
- Participate in national or international CS projects
- Provide ethical/legal protocols tailored to the institution/national requirements
- Develop protocols on implementation of CS activities

Intended audience(s)

- Researchers at all career stages, including researchers who are already running CS projects
- Research managers, research-support staff and other administrative staff groups, including staff working with ethics and GDPR, in research performing organisations (RPOs) or non-governmental organisations (NGOs)

Learning outcomes

By the end of this course, the learner will be able to:

- **Understanding the role of institutional support:** Gain an understanding of the critical role that institutional support and infrastructure play in advancing CS initiatives within RPOs.
- **Creating compelling grant proposals:** Acquire insights into strategies for aligning CS research portfolios with funding opportunities and learn the secrets to designing compelling grant proposals.
- **Ethical and legal awareness:** Recognize the ethical and legal considerations inherent in CS projects and their importance in ensuring responsible and compliant research practices.
- **Embracing CS-ICPs:** Comprehend the concept of CS Institutional Contact Points (CS-ICPs) and their significance in providing essential resources and guidance for CS efforts.
- **Designing Tailored CS-ICPs:** Develop practical skills in designing and planning a tailored Institutional Contact Point (CS-ICP) that aligns with the unique needs, goals, and characteristics of their respective organizations, enhancing support for citizen science initiatives.

Main division - topics

- **Welcome and introduction to the course:** Introduction to the course from the course tutor. Overview of the content and the learning outcomes.
- **Training Module 3.1: Empowering citizen science initiatives: Resources, funding, and proposals**
    - **Training Module 3.1.1: Successful institutional promotion of resources and infrastructure to support citizen science** offers illustrations of CS projects within RPOs that bolster citizen science on an institutional level, including aspects such as funding avenues and

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organizational structures. It also introduces the concept of CS Hubs or CS-ICPs. Furthermore, it acquaints participants with the EU-citizen.science platform, serving as an online hub for community-driven knowledge exchange, tools, training, and resources related to CS.

- **Training Module 3.1.2: The funding landscape for citizen science** delves into the various funding entities that actively endorse CS initiatives and elucidates strategies for aligning CS research portfolios with these funding prospects. This module also imparts valuable insights into crafting compelling grant proposals that have a higher likelihood of success, uncovering the secrets to securing funding for CS projects.
- **Training Module 3.1.3: Interactive session: Creating your citizen science research proposal** invites participants to engage in a dynamic 30-minute activity aimed at defining their own research proposals for CS projects. They select a funding call from a list of options, brainstorm project ideas aligned with the call's objectives, outline their proposals, and receive feedback from peers. This hands-on experience equips participants with the skills to strategically align their project concepts with real-world funding opportunities, fostering a deeper understanding of the proposal development process in the context of CS.

- **Training Module 3.2: Ethics, infrastructure, and institutional support for citizen science**
  - **Training Module 3.2.1: Ensuring that citizen science projects adhere to ethical standards and legal requirements** offers participants insights into the crucial ethical and legal aspects of citizen science projects. It outlines the relevance of understanding the support resources and infrastructure needed for ethical and legal compliance in CS projects. Real-world cases such as the Health Data Exploration Project and West Baltimore Mosquito Stoppers, both based in the United States, are used to emphasizing the significance of ethical and legal issues. Existing codes of conduct and ethical principles as well as the concept of ethical and legal governance and the need for institutional review board approval are introduced.
  - **Training Module 3.2.2: Institutional contact points for citizen science** produces insights into establishing institutional contact points or hubs for CS. It explains the coverage of this concept and its relevance in understanding crucial support resources and infrastructure for CS. The module then proceeds to highlight examples of existing CS-ICPs, highlighting their diversity and the absence of a one-size-fits-all model. Participants will also explore the BESPOC model, encompassing elements like an online hub, service desk, communication tools, and knowledge resources, to help them contemplate and design single points of contact tailored to their institutions. Lastly, the module introduces a governance framework from the INCENTIVE project, enabling participants to design their governance structures for CS hubs.
  - **Training Module 3.2.3: Interactive session: Creating your institutional contact point for citizen science (CS-ICP)** is a 30-minute interactive workshop where participants will embark on a journey to plan and design a CS-ICP tailored to their own institution. The session is structured into several engaging activities to facilitate the creation of a comprehensive blueprint for this essential element in citizen science support. The session empowers participants to create a tailored roadmap for establishing an institutional contact point that

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aligns with the unique needs and goals of their respective organisations, ultimately enhancing support for CS initiatives.

Welcome and introduction

The training program begins with an introductory session led by the instructor or facilitator. During this introduction, the instructor provides an overview of the content and outlines the expected learning outcomes for participants.

What?	How?	Why?
Introduction from the facilitator	Introducing the course to the learner. Introduction of who made the course, and what is covered in it.	Welcome the partipants, and provide assurance about the credibility of the course
Course overview	Overview of the course structure - explaining the elements that will appear in each section	Familiarity with the structure of the course and the reason to learn about support resources and infrastructure for citizen science projects

5.3.2 Training Module 3.1: Empowering citizen science initiatives: Resources, funding, and proposals

Training Module 3.1.1: Successful institutional promotion of resources and infrastructure to support citizen science

Training module 3.1.1 offers illustrations of CS projects within RPOs that bolster citizen science on an institutional level, including aspects such as funding avenues and organizational structures. It also introduces the concept of CS Hubs or CS-ICPs (Institutional Contact Points). Furthermore, it acquaints participants with the EU-citizen.science platform, serving as an online hub for community-driven knowledge exchange, tools, training, and resources related to CS.

What?	How?	Why?
Introduction to the notion of CS-ICPs	Different areas of CS are presented, with special attention to how CS-ICPs may help researchers in relation to CS projects	Explaining to the participants why CS-ICPs may be useful for various CS projects
Example of successful integration of CS-ICPs in RPOs	The story of A Healthier Southern Denmark and how it has enabled citizens to take part in making decisions about the prioritisation of research funding	Demonstration of what can be achieved if the CS-ICP (CS Knowledge Center at the University of Southern Denmark) supports citizen science initiatives

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What?	How?	Why?
Example of successful integration of CS-ICPs in RPOs	Citizen Science Zürich is developing a set of tools that make it easier for scientists and citizens to engage with CS projects. Special case: Project Wencker (crowdsourcing of transcriptions)	Demonstration of what can be achieved at a CS-ICP in terms of tools development and research support
Expanding on the idea of CS-ICPs	Bridging the stories together and elaborating on key responsibilities of citizen science "single points of contact" (LERU 2016): Recognition of success criteria specifically relevant to citizen science; allocation of funding (or support for the development of funding proposals) for community management, platform development, and other non-research functions characteristic of citizen science; support ethical approval and legal assistance of citizen science projects	Helping participants to organise information about the two examples and enabling them to develop broad thinking about hubs and institutional points of contact (ICPs)
Leveraging resources provided by the EU-citizen.science platform	Showcasing training sessions and MOOCs as an example of non-institutional support	Providing participants with insights from existing resources and infrastructures such as the EU-citizen.science platform

Training Module 3.1.2: The funding landscape for citizen science

Training module 3.1.2 delves into the various funding entities that actively endorse CS initiatives and elucidates strategies for aligning CS research portfolios with these funding prospects. This module also imparts valuable insights into crafting compelling grant proposals that have a higher likelihood of success, uncovering the secrets to securing funding for CS projects. It introduces participants to funding opportunities and strategies for citizen science proposals. Participants should be able to foresee funds for citizen science activities and develop ideas for targeted funding of citizen science projects.

What?	How?	Why?
Introduction to databases such as Research Professional	Guidance for using Research Professional (or similar database) to discover information about available funding opportunities.	Giving the participants insights on how to use existing resources to identify potential funding sources.
Examples of funding programs that support citizen science and the reasons why	HorizonEurope, Sparkling Science 2.0, Earthwatch Research Funding, project-initiated seed funding (IMPETUS), …	Demonstrating that there are several funding opportunities for citizen science projects, each with a different scope and different eligibility and evaluation criteria

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What?	How?	Why?
Secrets to writing a winning grant	Tips of the trade: Do extensive research of the available grants and noting differences in the types of project financed by various funding bodies; pitching your proposal; the write stuff; communicating your idea effectively; what not to do	Providing participants with tips on how to avoid application pitfalls

Training Module 3.1.3: Interactive session: Creating your citizen science research proposal

Training module 3.1.3 encourages participants to create their own research proposals for CS projects. During this activity, they choose a funding call from a provided list, brainstorm project ideas that align with the call's objectives, outline their proposals, and obtain feedback from fellow participants. This hands-on exercise equips attendees with the abilities to match their project concepts with actual funding possibilities, thereby enhancing their comprehension of the proposal development process within the CS context.

What?	How?	Why?
Funding call selection	Participants choose from a curated list of actual or hypothetical funding calls from various sources, such as government agencies, foundations, and research institutions. Each funding call has a specific focus and criteria.	This session allows participants to gain practical experience in navigating the complex landscape of funding opportunities, enabling them to select the most relevant calls based on their project ideas.
Project brainstorming and proposal outline	Participants individually or in small groups select one of the funding calls and start brainstorming project ideas that align with the call's objectives and requirements. Participants outline their research proposals based on the chosen funding call. They could include key sections such as project objectives, research methods, anticipated impacts, and budget estimates.	Participants have the chance to transform their project concepts into concrete proposals, developing essential skills in project design, alignment with call objectives, and proposal structuring.
Peer discussion	Participants exchange their project ideas within their groups or with a partner. They provide feedback, suggestions, and ask critical questions to refine each other's proposals.	Through peer interactions, participants benefit from diverse perspectives and constructive feedback, refining their proposals and enhancing their problem-solving abilities.
Presentation and feedback	Each participant or group presents a brief overview of their research proposal to the larger group. Presentations should include the research questions, methodologies, target audiences, and expected outcomes. Participants should further emphasize how their project aligns with the chosen funding call.	Presenting proposals to the larger group fosters communication skills and offers valuable exposure, while feedback from peers sharpens proposal quality.

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What?	How?	Why?
Feedback and reflection	The facilitator encourages participants to reflect on the feedback they received and how it might improve their proposals.	Reflection on received feedback prompts participants to improve their proposals and encourages a growth mindset.

5.3.3 Training Module 3.2: Ethics, infrastructure, and institutional support for citizen science

Training Module 3.2.1: Ensuring that citizen science projects adhere to ethical standards and legal requirements

Training module 3.2.1 offers participants insights into the crucial ethical and legal aspects of citizen science projects. It outlines the relevance of understanding the support resources and infrastructure needed for ethical and legal compliance in CS projects. Real-world cases such as the Health Data Exploration Project and West Baltimore Mosquito Stoppers, both based in the United States, are used to emphasizing the significance of ethical and legal issues. Existing codes of conduct and ethical principles as well as the concept of ethical and legal governance and the need for institutional review board approval are introduced.

What?	How?	Why?
Examples of CS projects that includes an ethical dimension	Introduction to two projects about personal data donation (Microsetta Initiative and the Personal Genome Project) and the West Baltimore Mosquito Stoppers project.	Demonstration of how ethical issues such as informed consent, privacy, and equity may inform CS projects
Six out of the Ten Principles of Citizen Science from ESCA, which include ethical dimensions	Going over six principles in the Ten Principles for Citizen Science framework produced by ECSA that involved ethical issues: Principle 3, 5, and 7-10.	Showing that ECSA's ten principles already include ethical aspects.
Encompassing adherence to ethical standards and compliance with laws	Elaboration on the rational approach to ethical conduct and legal compliance: How to foster accountability, transparency, and risk management within organisations or projects to ensure responsible behavior and mitigate legal risks	Enabling participants to contemplate ethical and legal standards, accountability and compliance, and transparency and risk management
Integrating ethical considerations into all aspects of citizen science projects	Presenting elements of an ethical infrastructure for citizen science: Institutional frameworks and Open Science and Responsible Research and Innovation	Allowing participants to consider various aspects of ethical and legal compliance

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Training Module 3.2.2: Institutional contact points for citizen science

Training module 3.2.2 produces insights into establishing institutional contact points or hubs for CS. It explains the coverage of this concept and its relevance in understanding crucial support resources and infrastructure for CS. The module then proceeds to highlight examples of existing CS-ICPs, highlighting their diversity and the absence of a one-size-fits-all model. Participants will also explore the BESPOC model, encompassing elements like an online hub, service desk, communication tools, and knowledge resources, to help them contemplate and design single points of contact tailored to their institutions. Lastly, the module introduces a governance framework from the INCENTIVE project, enabling participants to design their governance structures for CS hubs.

What?	How?	Why?
Examples of citizen science hubs or CS-ICPs	Describing types of citizen hubs or institutional contact points, for example libraries, research centres, and others. Three different examples are given to illustrate: Citizen Science Knowledge Center - University of Southern Denmark, Citizen Science Center Zurich, and Aarhus University Citizen Science	Demonstrating that citizen science hubs already exist and showing that there is no one-size-fits-all
The role of the CS-ICP in an institution	Describing the CS-ICP as a vital link between research and the wider community, ensuring that CS projects align with the organisation's goals, values, and ethical standards while facilitating their successful implementation and impact	Allowing the participants to consider these functions of the CS-ICP: 1) Coordination and support, 2) ethical and legal compliance, and 3) quality assurance and promotion
Designing and customizing the CS-ICP for an institution	How to design on ICP with regard to impact, outreach and sustainability: 1) Assessment and needs analysis, 2) Role definition and structure, and 3) Training and integration	Enabling participants to design and customize the CS-ICP for their institution
Designing a governance framework for CS-ICPs	Presenting the governance framework designed by the INCENTIVE project	Enabling participants to design a governance framework

Training Module 3.2.3: Interactive session: Creating your institutional contact point for citizen science (CS-ICP)

Training module 3.2.3 is a 30-minute interactive workshop where participants will embark on a journey to plan and design a CS-ICP tailored to their own institution. The session is structured into several engaging activities to facilitate the creation of a comprehensive blueprint for this essential element in citizen science support. The session empowers participants to create a tailored roadmap for establishing an institutional contact point that aligns with the unique needs and goals of their respective organisations, ultimately enhancing support for CS initiatives.

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What?	How?	Why?
Needs assessment	Participants will reflect on the unique needs and characteristics of their institutions, sharing insights and potential benefits of an institutional contact point for citizen science (CS-ICP). They must do a collective brainstorm to identify specific challenges and opportunities.	Allowing participants to understand the specific needs and benefits of CS-ICP within their institutions, fostering a collective brainstorming process to identify challenges and opportunities unique to their context.
Designing the contact point	Participants may use a template or worksheet provided to design these components of an institutional contact point: Online hub/portal, Service desk, Communication tools and platform, Knowledge and expertise (best practices, protocols, evaluation forms, etc.), Partnership frameworks. This part of the program ends with group discussions for idea exchange and feedback.	Participants learn how to design essential components of a CS-ICP, including an online hub, service desk, communication tools, knowledge resources, and partnership frameworks. Group discussions enable idea exchange and valuable feedback, ensuring the development of effective CS-ICPs.
Governance framework	Based on an example governance framework (e.g., the INCENTIVE project's framework), participants will consider how to adapt and implement governance at their institution and for the specific CS-ICP. The governance framework should include a tailored roadmap for establishing a CS-ICP that aligns with the unique needs and goals of their respective organisations.	Based on a sample governance framework (e.g., the INCENTIVE project's model), participants explore how to adapt and implement governance tailored to their institutions and CS-ICP. This framework helps create a roadmap for establishing CS-ICPs aligned with their organization's specific needs and objectives.
Sharing and feedback	Participants will briefly present their draft institutional contact point designs to the group. Peers provide feedback, suggestions, and insights.	Participants present their draft institutional contact point designs to the group, facilitating peer feedback, suggestions, and insights, ensuring the refinement of their CS-ICP plans through collective expertise.

5.4 Intervention Area: Policy & Assessment

Recognizing the critical role of citizen science as a legitimate research methodology, RPOs face the imperative need to adapt their institutional norms, policies, regulations, and agreements. Currently, the academic landscape often lacks explicit acknowledgment of citizen science within its framework. To enable researchers to actively participate in CS projects, it is essential for RPOs to establish clear regulations, policies, and agreements tailored to this unique research approach.

Moreover, RPOs should introduce reward mechanisms that incentivise researchers to engage in CS initiatives. Integrating citizen science into the evaluation criteria for researchers becomes vital, allowing for the measurement of their impact in such projects. By doing so, RPOs promote a culture that encourages

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researchers to actively interact with the public and communities, enhancing their roles as active contributors to society.

Incorporating CS into evaluation criteria serves as evidence of the RPO's commitment to inclusivity and community engagement. Developing explicit mission statements that prioritise citizen science reinforces the organisation's dedication to these principles. These mission statements guide RPOs in aligning their strategies with the core values and objectives of citizen science, ensuring the seamless integration of this approach into their research programmes.

Tailored strategies for citizen science are essential for RPOs, enabling effective resource allocation, promoting collaboration, and facilitating the integration of citizen science into their broader research agendas. Ultimately, these initiatives empower RPOs to harness the full potential of citizen science as a recognised and celebrated research methodology, fostering a culture of engagement, collaboration, and societal impact.

5.4.1 Training Program 4 overview: Strategic planning, evaluation, and responsible research integration

The aim of training program 4 is to embed CS in existing strategies and policies of the RPO and to envisage new ones. By the completion of the course, the participants will have a better understanding of strategy- and policymaking processes. TC4 will specifically address new institutional norms, regulations, policies, or agreements, including reward mechanisms for CS implementation. It will provide an overview of the reward system of science, including the diversity of reward mechanisms and assessment criteria for researchers, research projects, and RPOs. Based on analysis of existing reward mechanisms in their own RPO, the participants will develop a portfolio of assessment criteria relevant to CS. The final aim of TC4 is to connect CS to the wider aims of RRI which draws on more established agendas and processes. Several Horizon2020 projects such as RRI Tools and Res-AGorA have already built resources and tools for incorporating RRI in policy and institutions.

GAs covered

- Develop new institutional norms, regulations, policies or agreements
- Install reward mechanisms for doing CS
- Adopt evaluation criteria for researchers' evaluation that take into account CS
- Adopt explicit mission statements and strategies

Intended audience(s)

- Researchers at all career stages, including researchers who are already running citizen science projects and senior researchers
- Research-support staff and other administrative staff groups in research performing organisations (RPOs) or non-governmental organisations (NGOs)
- Managers in RPOs or NGOs

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Learning outcomes

By the end of this course, the learner will be able to:

- **Recognize the importance of strategic approaches and policies for CS:** Understand the significance of developing strategic approaches and policies for CS within RPOs.
- **Explore successful strategies and policies in CS:** Explore real-world examples of successful CS strategies and policies implemented by various institutions.
- **Understand the role of strategic planning in CS integration:** Acquire knowledge of the fundamental concepts of strategic planning and its role in seamlessly integrating citizen science into RPOs.
- **Investigate broader assessment models in CS:** Gain a comprehensive understanding of how to effectively evaluate and reward CS contributions, enhancing the recognition and promotion of CS within research institutions.
- **Align citizen science with RRI:** Establish a connection between CS and RRI principles and processes.
- **Learn from successful projects bridging CS and RRI:** Examine real-world examples of projects that successfully bridge CS and RRI, identifying valuable lessons for citizen science initiatives.

Main division - topics

- **Welcome and introduction to the course:** Introduction to the course from the course tutor. Overview of the content and the learning outcomes.
- **Training Module 4.1: Strategy, evaluation, and impact for citizen science**
    - **Training Module 4.1.1: Strategic approaches to citizen science in RPOs: Policies and planning** focuses on the development of effective strategies and policies to support and integrate citizen science within RPOs. Participants will explore real-world examples of successful citizen science strategies and policies implemented by various institutions. Additionally, the module introduces the concept of strategic planning within RPOs to facilitate the seamless integration of CS methodologies. Through this training, participants will gain insights into the importance of strategic thinking, policy formulation, and planning to harness the full potential of citizen science as a recognized research methodology within their organisations.
    - **Training Module 4.1.2: Evaluating citizen science: Expanding assessment criteria for research rewards** delves into the assessment criteria for CS, expanding on traditional reward systems for scientific research. The session will explore broader assessment models and engage in discussions regarding additional or supplementary criteria specific to CS projects. By the end of this training, participants will have a comprehensive understanding of how to effectively evaluate and reward CS contributions, enhancing their ability to recognise and promote the value of CS within research institutions.
    - **Training Module 4.1.3: Interactive session: Assessing citizen science impact: Collaborative criteria design** provides participants with the opportunity to work collaboratively on either their own CS project or the hypothetical “Pollinator Paradise” project provided in the handout. The main objective is to collectively brainstorm and design assessment criteria for

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the chosen CS project, focusing on scientific, societal, and participant impacts. To guide their efforts, participants can refer to the Measuring Impact for Citizen Science (MICS) domains and indicator clusters outlined in the handout. Each group will create a flip chart sheet presenting their assessment criteria, providing a clear explanation of the criteria and the rationale behind them. This activity fosters a deeper understanding of the multifaceted assessment process in CS, ensuring that projects are evaluated comprehensively and effectively.

- **Training Module 4.2: Systematic evaluation approaches and alignment with society**
  - **Training Module 4.2.1: Designing a systematic evaluation framework for citizen science** delves into the methodological aspects of constructing a robust evaluation framework for CS initiatives. Participants will be introduced to the logic model of evaluation and its application in the context of CS assessments, providing a foundational understanding of methodological approaches to assessment. The session will also explore various tools commonly used for evaluation, such as surveys, interviews, embedded assessment, participatory observation, and self-reflection processes, shedding light on their strengths and limitations. Participants will gain insights into the systematic development of an evaluation framework for CS projects, guided by methodological principles. This training equips participants with the knowledge and tools needed to comprehensively evaluate CS endeavors, ensuring their effectiveness and impact.
  - **Training Module 4.2.2: Aligning citizen science with Responsible Research and Innovation (RRI)** establishes a crucial connection between CS and the RRI agenda. Participants will gain insights into how to align the mission statements, strategies, and evaluation frameworks of CS initiatives with the principles and processes of RRI. The session will commence with an introduction explaining the significance of bridging CS and RRI. It will then highlight real-world examples of projects that have successfully connected the two domains. Participants will explore the convergences and divergences between CS and RRI, with a focus on the valuable lessons CS can glean from RRI approaches. Additionally, the session will delve into strategies for incorporating RRI, and by extension, CS, into higher education institutions (HEIs) and RPOs. This training equips participants with the knowledge and tools needed to enhance the ethical and responsible dimensions of their CS endeavours, fostering alignment with RRI principles and practices.
  - **Training Module 4.2.3: Interactive session: Defining relevant Responsible Research and Innovation (RRI) indicators for citizen science** engages the participants in group discussions to collectively define relevant RRI indicators tailored specifically to CS projects. The aim is to deepen participants' understanding of responsible and inclusive research and innovation practices within the CS context. This collaborative exercise equips participants with the skills to integrate RRI principles effectively into their citizen science projects.

Overview course plan

Welcome and introduction to the course

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Introduction to the course from the course tutor. Overview of the content and the learning outcomes.

What?	How?	Why?
Introduction from the facilitator	Introducing the training module to the participants. Introduction of who made the training module, and what is covered in it	Welcome the participants, and provide assurance about the credibility of the training module
Training module overview	Overview of the training module structure and learning goals - explaining the elements that will appear in each section	Understanding the training module structure and the motivation for participation

5.4.2 Training Module 4.1: Strategy, evaluation, and impact for citizen science

Training Module 4.1.1: Strategic approaches to citizen science in RPOs

This module is dedicated to empowering participants with the knowledge and skills required to develop successful strategies and policies that promote the integration of CS within their RPOs. Participants will delve into real-world examples of successful CS strategies and policies implemented by various institutions. Furthermore, the module will introduce the principles of strategic planning within RPOs, facilitating the seamless integration of CS methodologies. By the end of this training, participants will possess valuable insights into the significance of strategic thinking, policy formulation, and planning, all of which are essential for fully realizing the potential of CS as a recognized research methodology within their organisations.

What?	How?	Why?
Introduction to the module	Text, explaining how we are going to introduce the topic of citizen science strategies and policies, with two examples of different policy documents that were developed and enacted in two different contexts	Explaining to the learner why this section is relevant to understanding citizen science strategy and policy-making
Example of successful CS strategy implementation in RPO	Telling the story of the NOAA Citizen Science Strategy, which outlines a path for the agency to engage the public in support of key mission areas and aligns with the US Crowdsourcing and Citizen Science Act	Demonstration of an institutional policy that connects citizen science to key mission areas and national policy
Example of development of national CS strategy	Telling the story of the German citizen science strategy, which contains 94 concrete recommendations for action to further develop citizen science in Germany and anchor it permanently in science, society and politics	Demonstration of a national policy that seeks to anchor citizen science permanently in scientific institutions and society

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What?	How?	Why?
Strategic planning in RPOs with particular attention to citizen science (2 min)	Going over the three planning imperatives - leadership, communication, assessment - with special emphasis on linking assessment and planning	Helping participants to develop their thinking about strategic processes in RPOs with special attention to assessment and planning

Training Module 4.1.2: Evaluating citizen science: Expanding assessment criteria for research rewards

Training module 4.1.2 delves into the assessment criteria for CS, extending beyond the conventional reward systems typically associated with scientific research. Throughout the session, participants will explore more expansive assessment models, delving into discussions aimed at identifying additional or supplementary criteria specifically tailored to the unique nature of CS projects. Upon completion of this training module, participants will emerge with a thorough and comprehensive understanding of the intricacies involved in evaluating and rewarding contributions made within the realm of CS. This newfound knowledge and expertise will empower them to effectively recognize, appreciate, and advocate for the substantial value that CS may bring to RPOs. It equips participants with the tools to not only assess but also strategically promote and endorse the importance of CS within their research communities and organisations.

What?	How?	Why?
Introduction to the training module	Providing a link between the previous training module and the need for comprehensive evaluation and assessment related to CS	Explaining to the participants why this section is relevant - to link policy-making and strategy to assessment criteria
Challenges in evaluating CS	Explaining why CS assessments need to be broader than usual assessments in science including diverse objectives and project types, issues around data quality and reliability, and subjective impacts	Demonstrating the need for more comprehensive assessment models
Assessing citizen science to evaluate its quality, impact, and effectiveness	Elaborating scientific, societal, and participant impacts, including data quality, research contribution, environmental and societal benefits, awareness and education, engagement, and empowerment	Giving participants an understanding of the many different quality criteria that are relevant for CS assessment

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What?	How?	Why?
The Citizen Science Impact Assessment Framework (CSIAF)	Explaining the six guiding principles of CSIAF: 1) Acknowledging a variety of purposes of citizen science impact assessment, 2) Non-linear conceptualisation of impact journeys to overcome impact silos, 3) Comprehensive impact assessment methods and information sources, 4) Moving beyond absolute impact, 5) Fostering comparison of impact assessment results across citizen science projects, and 6) Cumulative enhancement of the framework over time	Equipping participants with a set of foundational principles to support thorough and effective evaluation in the realm of CS
MICS: Measuring the impact of CS	Describing the five impact domains included in the MICS framework, including examples of the indicators proposed	

Training Module 4.1.3: Interactive session: Expanding assessment criteria for research rewards

Training module 4.1.2 provides participants with the opportunity to work collaboratively on either their own CS project or the hypothetical "Pollinator Paradise" project provided in the handout. The main objective is to collectively brainstorm and design assessment criteria for the chosen CS project, focusing on scientific, societal, and participant impacts. To guide their efforts, participants can refer to the Measuring Impact for Citizen Science (MICS) domains and indicator clusters outlined in the handout. Each group will create a flip chart sheet presenting their assessment criteria, providing a clear explanation of the criteria and the rationale behind them. This activity fosters a deeper understanding of the multifaceted assessment process in CS, ensuring that projects are evaluated comprehensively and effectively.

What?	How?	Why?
Project selection	In smaller groups, participants choose to work either own CS project or the hypothetical CS project called "Pollinator Paradise". If they opt for the latter option, they will familiarize themselves with the project as outlined in the handout.	Providing participants with a tailored learning experience. This allows them to apply assessment criteria directly to their own projects or gain valuable experience by working with a hypothetical case, ensuring the relevance of the activity to their specific needs.
Brainstorming on assessment criteria	Participants will collaboratively brainstorm and design assessment criteria for the chosen citizen science project. The groups should consider the scientific impact, societal impact, and participant impact. If necessary, refer to the MICS domains and indicator clusters provided in the handout for guidance.	Encouraging participants to consider diverse perspectives and enhancing the quality of assessment criteria. They gain a holistic understanding of the multifaceted nature of CS evaluation, preparing them to evaluate real-world projects effectively.

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What?	How?	Why?
Flip chart creation	Each group creates a flip chart sheet outlining the assessment criteria. The participants are encouraged to be creative in their thinking about the criteria and how they are presented visually.	Fostering creativity and visual communication skills. Encouraging participants to think critically about how to present assessment criteria effectively, a valuable skill in the communication of complex ideas in the academic and professional world.
Presentation and feedback	The groups present their flip chart with their assessment criteria. Presentations should explain the criteria and the reasoning behind them. Feedback is provided from other groups and the facilitator.	Promoting public speaking and presentation skills as well as critical feedback from peers and the facilitator to ensure that participants receive diverse perspectives, helping them refine and improve their assessment criteria.

5.4.3 Training Module 4.2: Systematic evaluation approaches and alignment with society

Training Module 4.2.1: Methodological approaches to developing an evaluation framework for citizen science

This section enables participants to develop an evaluation framework for citizen science in a methodological and systematic way. The participants will get acquainted with the logic model of evaluation and the open framework for evaluating CS, which aims at assessing and evaluating CS projects in a transdisciplinary and bottom-up manner.

What?	How?	Why?
Skills and resources needed for CS assessment	Introducing more challenges for CS evaluation.	Explaining to participants that researchers and their RPOs need to invest and allocate resources for CS assessments, in particular if they are going to be continuous.
Open Framework for Evaluating Citizen Science Activities (OFECSA)	Describing the elements of the Open Framework for Evaluating Citizen Science Activities, including the scientific, volunteer, and the socio-ecological dimensions.	Demonstrating how a simple evaluation model applies to citizen science as a basic introduction to methodological approaches to evaluation.
Tools for evaluation	Describing basic tools of evaluation such as surveys, interviews, embedded assessment, participatory observation, and self-reflection processes.	Providing an overview of simple assessment tools + their pros and cons.

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What?	How?	Why?
The logic model of evaluation applied to citizen science	Introducing the logic model as an overall framework for systematic assessments.	Guiding participants to think methodologically about evaluation and assessment criteria.

Training Module 4.2.2: Aligning citizen science with Responsible Research and Innovation (RRI)

This section establishes a crucial connection between CS and the RRI agenda. Participants will gain insights into how to align the mission statements, strategies, and evaluation frameworks of CS initiatives with the principles and processes of RRI. The session will commence with an introduction explaining the significance of bridging CS and RRI. It will then highlight real-world examples of projects that have successfully connected the two domains. Participants will explore the convergences and divergences between CS and RRI, with a focus on the valuable lessons CS can glean from RRI approaches. Additionally, the session will delve into strategies for incorporating RRI, and by extension, CS, into higher education institutions (HEIs) and RPOs. This training equips participants with the knowledge and tools needed to enhance the ethical and responsible dimensions of their CS endeavours, fostering alignment with RRI principles and practices.

What?	How?	Why?
Fostering democratic, accountable, and responsive R&I.	Portraying RRI as a framework and approach that seeks to ensure that research and innovation activities are conducted in a way that aligns with societal values and needs, and that they contribute to positive societal outcomes.	Explaining the RRI philosophy to the participants.
Analysis of how Citizen Observatories (COs) have adopted RRI principles.	COs are collaborative initiatives that engage members of the public, including volunteers and local communities, in monitoring and collecting data related to various aspects of the environment, society, or public services.	Demonstrating that COs have adopted some RRI principles such as Open Access and Public Participation in Scientific Research, but not others such as ethics and governance.
Overlaps and divergences between CS and RRI.	Explaining overlaps between CS and RRI, but also their divergences, arguing that citizen science could learn lessons from RRI approaches and processes	Enabling participants to consider CS from an RRI perspective and learn from RRI approaches.
Integrating RRI into higher education institutions and citizen science.	Describing how HEIs can help transform the research and innovation system by developing new normative frameworks, plans to foster dialogue and participatory approaches, policies of openness and inclusivity.	Enabling participants to design a strategy for how to incorporate RRI into HEIs (and citizen science).

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What?	How?	Why?
Evaluation dimensions for RRI.	Presenting the seven RRI dimensions (Public engagement, Gender equality, Research ethics, Open science, Sustainability (social, economic, and ecological), Science education and outreach, and Governance) and how they may be evaluated in terms of process (formative evaluation) and outcome (summative evaluation)	Providing participants with conceptual tools for evaluations of RRI and CS.

Training Module 4.2.3: Interactive session: Defining relevant Responsible Research and Innovation indicators for citizen science

Training module 4.2.3 involves participants in collaborative group work and in-depth discussions aimed at collectively formulating pertinent RRI indicators customized for CS projects. The primary goal is to enhance participants' comprehension of responsible and inclusive research and innovation practices, particularly within the unique context of CS. Through this collaborative exercise, participants develop the necessary competencies to integrate RRI principles into their CS initiatives, fostering a culture of ethical and inclusive research and innovation.

What?	How?	Why?
Brainstorming	In small groups, the participants consider the key RRI dimensions outlined in the handout. Each group should brainstorm and compile a list of specific indicators within these dimensions that hold relevance for citizen science projects (such as Pollinator Paradise from the previous interactive session).	Participants gain the opportunity to collaborate and brainstorm in small groups, allowing for the integration of diverse perspectives and insights into the development of RRI indicators.
Sharing and discussion	Each group will present one or two indicators they have generated for a general discussion on their RRI significance and potential impact on citizen science projects.	The sharing of generated indicators allows participants to exchange ideas and insights. It promotes a collaborative learning environment where individuals can learn from one another's perspectives and experiences.
Consolidation and conclusion	In groups, discuss common themes and trends that emerged from the shared indicators. Select a few indicators that seemed particularly important or universally applicable to citizen science.	Selecting a few indicators as particularly important or universally applicable provides participants with actionable takeaways. It empowers them to implement these indicators effectively in their CS projects, aligning them with responsible and inclusive research and innovation practices.

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6. Equality, Diversity and Inclusion Considerations

For anyone using all or parts of the TCs for training programs, it will be important to consider issues relating to equality and participation. An Equality Impact Assessment (EIA) is suggested, as it is designed to help institutions and trainers ensure that their training, courses, and resources are fair and do not present barriers to participation or disadvantage any specific groups from participation. Performing an EIA for a training program will help to ensure that trainers and participants understand the potential effects. This can be done by assessing the trainings' impact on different groups, identifying any adverse impacts and taking action to remove them, and ensuring that decisions behind the trainings are transparent and based on clear reasoning. The table below include issues and mitigation measures for the eight different topics, which form the basis of an EIA, by looking for bias that can occur when there are significant differences (disproportionate difference) between groups of participants in the way the elements of the trainings might potentially impact on them.

Table 2 - Elements of an Equality Impact Assessment (EIA)

Topics	Issues and mitigation
Age	Addressing age-related concerns is crucial to ensure that training materials are accessible and relatable to participants of varying generations, promoting an inclusive learning experience for all age groups. Practical mitigation measures: • Use a clear and readable font style and size in training materials to accommodate older participants. • Provide options for adjusting text size or using screen readers for visually impaired individuals. • Ensure that examples and case studies consider a wide age range and are relatable to participants of different generations.
Disability	Ensuring accessibility is essential to accommodate learners with disabilities, allowing them to fully engage with training content and fostering inclusivity for individuals with diverse needs. Practical mitigation measures: • Develop training materials with accessibility in mind, following guidelines such as WCAG (Web Content Accessibility Guidelines) to make them accessible to learners with disabilities. • Offer alternative formats for content, such as audio versions or transcripts for video materials. • Include closed captions and audio descriptions for multimedia content to support those with visual or hearing impairments.

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Topics	Issues and mitigation
Ethnicity	CS has underrepresentation of people from black and minority backgrounds. Recognizing disparities and promoting inclusiveness in CS projects and CS training is vital to address underrepresentation and create an equitable learning environment that reflects the diversity of potential participants. Practical mitigation measures: • Incorporate case studies and examples that highlight diversity in citizen science projects, showcasing initiatives involving underrepresented communities. • Promote cultural sensitivity by addressing disparities and acknowledging the potential for inclusiveness within citizen science projects.
Religion and belief	Writing training materials in a way that acknowledges differences in religious beliefs helps avoid unintentional bias and promotes respect for diverse faiths, fostering an inclusive atmosphere. Practical mitigation measures: • Use inclusive language and avoid making assumptions about participants' religious beliefs. • Be respectful of religious holidays and observances when scheduling training sessions or assignments, allowing for flexibility when necessary
Gender	Balancing gender representation in examples and role models within training materials is crucial to challenge traditional gender biases and provide equitable opportunities for all genders in CS. Practical mitigation measures: • Ensure that training materials feature a balanced representation of genders in examples, case studies, and role models. • Highlight the contributions and achievements of individuals of all genders in the field of citizen science.
Sexual orientation	Avoiding prejudice based on sexual orientation in training content contributes to a more welcoming and inclusive learning environment that respects the diversity of sexual orientation. Practical mitigation measures: • Promote an inclusive and non-prejudiced learning environment by using language that is respectful and affirming of diverse sexual orientations. • Avoid content that marginalizes or stigmatizes individuals based on their sexual orientation.

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Topics	Issues and mitigation
Intersectionality	Intersectionality is crucial as it acknowledges the complex interplay of multiple dimensions of diversity, ensuring that training programs consider the unique experiences and challenges faced by individuals at the intersections of various identities, fostering true inclusivity. Practical mitigation measures: • Recognize that individuals may belong to multiple marginalized groups simultaneously (e.g., an older person with a disability who identifies as LGBTQ+). • Consider the unique needs and perspectives of intersectional learners in training materials and activities.
Feedback mechanisms	Feedback is important because it allows continuous improvement and responsiveness to learners' needs, ensuring that training programs evolve to provide a better and more equitable learning experience for all participants. Practical mitigation measures: • Establish a feedback mechanism that allows participants to report accessibility issues or content that may be exclusionary. • Actively seek input from participants from diverse backgrounds to ensure the training programs remain inclusive and responsive to their needs.

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7. Conclusion

This document details the outcomes of task 4.1 in the TIME4CS project, focusing on the development of training program content. The task encompassed a thorough mapping of existing CS training programs and resources, analysis of best practices to define essential concepts, skills, and infrastructure, assessment of institutional support for CS-related change, and the creation of comprehensive training programs catering to all four Intervention Areas (IAs) and relevant Grounding Actions (GAs).

Our mapping initiative identified over 65 training programs and resources, the mapping document is available on Zenodo[33]. This analysis extracted vital elements such as target audiences, training types, assessments, content, skills, learning goals, and infrastructures like format, publishers, and knowledge exchange avenues. These resources, continually developed and maintained online, offer Research Performing Organisations (RPOs) versatile tools for incremental institutional change, promoting the broader inclusion of CS across various faculties and disciplines.

The analysis compared existing training resources with insights gained by the TIME4CS consortium on the institutional support needed for implementing and adopting CS in RPOs. It identified overlaps and gaps, such as limited target audiences in training programs, the need for enhanced skills, and the lack of support resources and infrastructures vital for CS research and training.

The development of the TIME4CS training programs underwent a meticulous, iterative process, resulting in a finely tuned final version. This version, shaped by extensive piloting at four implementing institutions and Aarhus University, reflects a blend of real-world application and expert insights. These pilots were critical for fine-tuning the training programs to suit target audience needs. Expert feedback further refined the content and structure, ensuring a curriculum that is both practical and theoretically sound, responding effectively to the dynamic field of CS.

The final version of the TIME4CS training programs, as outlined in this document, offers a diverse and carefully designed curriculum covering key CS aspects. This includes modules on CS methodologies, strategic approaches, policy planning, evaluation frameworks, ethics, and institutional support. The curriculum's success lies in its interactive nature, providing practical, hands-on experiences for participants to apply theoretical knowledge in real-world settings. In essence, the TIME4CS training programs stand as a comprehensive and adaptable educational tool, ready to meet the varied needs of researchers, educators, managers, administrators, students, and practitioners in the multifaceted realm of citizen science.

[33] Kragh, G., & Nielsen, K. H. (2022). TIME4CS WP4 Mapping of citizen science training resources (Version v1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.6840274

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8. Acknowledgements

We express our gratitude to the EU-citizen.science team for providing their training resource list and the accompanying guidance document for the development of training resources on their platform. Our thanks also extend to all of the TIME4CS partners, in particular our collaborators at KTU, Tyndall, CRG, and UniSR for their instrumental role in organizing the four workshops conducted in spring 2023. Additionally, we appreciate the contributions of all workshop participants and the invaluable feedback from numerous individuals, including our expert interviewees, which significantly enhanced the development of the TIME4CS training programs.

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9. Appendices

9.1 Appendix I: Description of training programs designed for all Implementers

This appendix complements the content provided in *D4.4 Report on all Workshops*[34] by offering additional details regarding the customization of the training program and the iterative learning process. These insights were derived from the workshops and have been instrumental in enhancing the development of the TIME4CS training programs described in this deliverable.

9.1.1 Training programs designed for Kaunas University of Technology (13 March 2023)

The TIME4CS partner at Kaunas University of Technology (KTU) identified the need for two distinct training programs: one aimed at management and the other tailored for researchers and stakeholders. In response, the first workshop was conducted at KTU's central office, targeting a specific audience from the management of the social science faculty. The program for this workshop incorporated elements from the training program within the IA of Policy & Assessment.

In contrast, the second workshop was hosted in the campus library amphitheatre as an open event, welcoming a broader audience, including researchers and interested individuals from the community. The program for this event drew from elements of the training program within the IAs of Research and Education & Awareness.

Policy & Assessment workshop

The Policy & Assessment workshop at KTU was a focused event aimed at addressing strategic aspects of CS integration. It started with an introduction to the TIME4CS project and continued with presentations and group discussions. The topics covered included strategic planning, research assessment, societal impact, and communication strategies in the context of CS. Participants engaged in group discussions to explore these themes further.

The workshop aimed to provide participants with examples of strategic CS adoption in other RPOs and insights into how CS can be supported through institutional strategies and policies. It also encouraged discussions on adapting current KTU policies to better support CS. The goals included understanding research assessment criteria related to CS, policy-making, and funding opportunities for citizen science initiatives in national and international contexts.

Throughout the event, participants collaborated to identify CS-related aspects in current KTU policies and proposed adaptations to enhance CS support. The workshop served as a platform for knowledge exchange and the development of strategies to promote CS at KTU.

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Research and Education & Awareness workshop

The focus of the workshop was to address key aspects of CS methodology, project management, and communication and outreach, with an emphasis on their relevance to research. Participants gained insights into the dynamic nature of CS as a continually evolving research methodology that can significantly enhance their work. They also worked together on tasks related to communicating CS initiatives to wider audiences.

One crucial aspect highlighted during the workshop was the need for researchers, students, and administrative staff within KTU to recognize CS's potential value. Researchers were encouraged to be both prepared and confident in launching new projects using CS methodologies or integrating these methods into existing research endeavours. Administrative staff's understanding of CS was deemed equally important, as it empowers them to provide optimal support to researchers.

The workshop's relevance was underscored by the IA Research, which emphasizes the integration of CS within RPOs. In this context, the workshop aimed to equip participants with the knowledge and skills required to fully embrace CS as a valuable research methodology. It aimed to raise awareness about the potential social and environmental impacts of CS and highlight the unique opportunities it offers, including access to extensive networks and potential funding sources. In summary, the event sought to bridge the gap between CS and research practices within RPOs, ensuring that all stakeholders are well-prepared to harness the benefits of CS in their work.

9.1.2 Training programs designed for Tyndall National Institute (28 March 2023)

Tyndall National Institute, University College Cork (Tyndall-UCC), an Implementer in the TIME4CS project, identified the need for a comprehensive training workshop tailored specifically to early-career researchers. The primary focus of this workshop was to provide practical guidance and support for emerging leaders in the field of citizen science (CS) research. It aimed to equip early-career researchers with essential knowledge and skills related to CS integration into their research projects, emphasizing the development and effective communication of impactful CS initiatives.

Overall, this workshop combined elements from all four IAs, offering early-career researchers a well-rounded and practical training experience to enhance their capabilities in the field of CS. It emphasized hands-on learning and skill development to support the success of future CS endeavours led by these emerging CS research leaders.

Integrated workshop

One key objective of the workshop was to educate participants on the process of designing CS funding proposals, with a particular focus on understanding potential funding opportunities at both the national and EU levels. Furthermore, the workshop aimed to provide insights into connecting with individuals who could offer support for research ideas related to CS, fostering collaboration and partnership within the CS community. Participants were empowered by enhancing their understanding of CS, improving their ability to secure funding, and enabling them to effectively integrate CS into their research endeavours.

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Additionally, the workshop had the goal of empowering participants with the necessary tools and knowledge to assess the impact of their CS projects comprehensively. It aimed to facilitate engagement with the international citizen science community and enable participants to communicate their CS initiatives effectively to diverse audiences.

The workshop encouraged active engagement and skill development with four interactive sessions. They were designed to equip participants with practical skills and insights related to CS project development, impact assessment, and effective communication strategies, contributing to their ability to engage with and lead successful CS initiatives. The following were the interactive sessions:

1. **Exploring connections between your research and citizen science methodologies:** In this session, participants deepened their understanding of how citizen science methodologies could be integrated with their research interests. They worked in smaller groups, presenting their research topics and exploring opportunities for adopting CS approaches. Handouts were consulted to understand different levels of citizen participation and research processes. Each group developed at least one CS project idea for later general discussion.
2. **Designing citizen science research for impact:** Participants focused on designing impactful CS projects. They worked in smaller groups, selecting calls like the New European Bauhaus call for citizen engagement activities or Experiment.com crowdfunding. Each group crafted a pitch for a CS proposal by addressing context, significance, and research goals.
3. **Research assessment criteria and processes at Tyndall:** The session enhanced participants' knowledge of research assessment criteria and processes, particularly within the context of CS. Group discussions assessed Tyndall's existing research assessment criteria, considering their alignment with research projects. Participants evaluated criteria for quantitative and qualitative aspects and inclusiveness. They collaboratively defined appropriate research assessment criteria and processes for CS projects, drawing inspiration from the EC-funded project Measuring Impact of Citizen Science (MICS)[34] domains and indicators.
4. **Communicating Citizen Science at Tyndall:** Participants explored communication practices at Tyndall, specifically those related to participatory CS and engaged research. Group discussions identified potential outreach and communication activities that could support CS projects. Participants proposed effective communication strategies aligned with CS principles, leveraging their experiences, and providing communication strategies.

9.1.3 Training programs designed for the Centre for Genomic Regulation (8 May 2023)

The Centre for Genomic Regulation (CRG) expressed the need for two distinct workshops. The first workshop was intended for the entire CRG community and covered aspects of Research and Policy & Assessment. The second workshop, designed specifically for CRG scientific project managers, grants specialists and Principal

[34] MICS project: https://mics.tools

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Investigators, focused on stakeholders in CS and explored funding opportunities, falling under the IA Support Resources & Infrastructures. To enrich the second workshop, CRG grant specialists participated, providing insights into funding opportunities for CS in Spain.

Research and Policy & Assessment workshop

The workshop aimed to achieve several objectives: It started by introducing participants to the TIME4CS project, providing an understanding of its purpose and goals. Next, it delved into the concept of CS, ensuring participants gained a comprehensive understanding of its principles and applications. Interactive sessions encouraged participants to explore how they could incorporate CS methodologies into their own research projects.

The workshop also introduced the MICS framework, guiding participants on effectively utilizing MICS indicators in their citizen science project ideas. Participants learned practical strategies for communication within the context of citizen science initiatives, ensuring they could effectively engage with various stakeholders.

Two hands-on interactive sessions allowed participants to develop communication activities tailored to their specific citizen science project ideas:

1. **Exploring research opportunities with CS**: In this session, participants collaborated in smaller groups to delve into their primary research interests and identify potential opportunities for integrating CS methodologies. Utilizing provided handouts, participants examined various levels of citizen participation and explored how these methods could be incorporated into the research process, including aspects of community-engaged research and citizen science. Each group was tasked with generating at least one CS project idea related to their research interests, with the intention of presenting and discussing these ideas in a collective session at the session's conclusion. This interactive session aimed to stimulate collaborative idea generation and promote the adoption of CS within research endeavours.
2. **Developing a research impact evaluation framework for CS**: This session aimed to deepen participants' knowledge regarding the evaluation of citizen science project impact and equip them with the skills to design and assess such initiatives effectively within the CRG context. Participants collaborated in groups to focus on the creation of a research impact evaluation framework tailored specifically for citizen science projects. The session's objectives encompassed:
    - Reviewing the existing practices for evaluating research impact and communicating scientific findings within CRG.
    - Generating relevant impact indicators for citizen science projects at CRG, drawing inspiration from the MICS domains and indicators.
    - Identifying the desired outcomes associated with citizen science initiatives and exploring effective measurement methods for these outcomes.
    - Engaging in discussions about the necessary inputs and processes required to achieve the identified outcomes.

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Support Resources & Infrastructure workshop

The purpose of this workshop was to provide participants with comprehensive insights into various aspects of support and infrastructure for CS and its relevance to health-related research. Participants first delved into the concept of CS with a specific focus on its applications in health-related research. The workshop also included a session on stakeholder mapping in CS, where the participants learned how to identify and categorize stakeholders who could be influenced by or could influence their research projects. Finally, the workshop addressed the critical aspects of finding funding opportunities for CS projects. Participants gained insights into the international and national funding opportunities, providing participants with valuable information about potential sources of financial support for their projects. Additionally, they explored available support resources at CRG.

Two interactive sessions were held:

1. **Stakeholder analysis:** This session allowed participants to practically apply stakeholder analysis techniques, helping them identify key stakeholders and understand their roles in research projects. They were challenged to compare stakeholders with intended audiences and participants based on an audience mapping of specific groups or individuals in the organisation.
2. **Designing impactful CS proposals:** This session aimed to enhance participants' skills in effectively articulating the value and objectives of their CS proposals, preparing them for future funding opportunities. Participants were divided into smaller groups and tasked with selecting one of the available calls for CS projects, including the IMPETUS call, Experiment.com crowdfunding, Barcelona City Council & la Caixa Foundation call, or another call of their preference, preferably within the domain of CS. Within their respective groups, participants worked collaboratively to develop a pitch for a CS proposal by addressing fundamental questions related to their research projects. These questions encompassed the context of the research (why it mattered), the significance of the research (how much it mattered), and the goals of the research (what they aimed to achieve). Each group then presented their pitch to the larger group, fostering peer learning and constructive feedback.

9.1.4 Training programs designed for Vita-Salute San Raffaele University (19 May 2023)

The Vita-Salute San Raffaele University (Uni-SR) expressed the need for two separate workshops. The first workshop provided researchers with a general introduction to CS and covered CS assessment, with a focus on examples from CS health research. The second workshop was tailored for managers and supporting officers and incorporated elements from IAs Education & Awareness and Policy & Assessment. Additionally, a train-the-trainer session was conducted for the Uni-SR core team, concentrating on CS.

Research and Policy & Assessment workshop

This workshop served as an educational platform for participants to gain a deeper understanding of CS, particularly in the context of health research. It empowered them to explore opportunities, assess impact,

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and apply CS methodologies to their own research projects or research ideas, ultimately contributing to the advancement of knowledge and public engagement in the field of health. The MICS framework was used to provide a structured approach to the assessment of the impact of CS projects.

Two interactive sessions were carried out:

1. **Exploring research opportunities through CS methodologies:** During this interactive session, participants engaged in smaller group discussions to explore the potential integration of CS methodologies into their own research interests. They collectively deliberated on how citizen science could be applied to enhance their projects. To guide these discussions, participants referred to provided handouts that outlined various levels of citizen participation and the research process, including concepts like community-engaged research and various CS practices. Each group was tasked with generating at least one innovative idea for a CS project that would align with their research.
2. **Building an impact assessment framework for CS at UniSR:** The session aimed to equip participants with the tools and knowledge to construct a robust research impact evaluation framework tailored specifically to CS projects at UniSR. Building on the MICS framework, participants worked together to propose impact indicators that would be relevant and applicable to CS projects at UniSR. They then delved into discussions on how these impacts could be effectively measured and assessed, which involved identifying the necessary inputs and processes required to evaluate these impacts accurately.

Education & Awareness and Policy & Assessment workshop

This workshop aimed to introduce participants to the concept of CS, with an emphasis on the importance of effective communication in this field. It addressed the necessary changes that universities should consider for enhancing public engagement and embracing CS initiatives. The workshop also described the transformational change of universities to embrace CS, benefiting from increased research scope, public recognition, and additional resources, while also contributing professional infrastructure, knowledge, ethical guidance, and educational support to CS initiatives. However, university involvement in CS encounters challenges that require careful project planning and support from funders and policymakers to address effectively.

Due to time constraints, just one interactive session was conducted, but with two objectives:

1. Firstly, participants were encouraged to delve into the realm of citizen science methodologies and communication at UniSR. In group discussions, they had the opportunity to explore the levels of citizen participation and research processes in CS, including community-engaged research and citizen science, as outlined in handouts. Their objective was to identify and discuss ways to motivate and facilitate researchers in the utilization of CS methodologies effectively.
2. Alternatively, the session also focused on developing a science communication framework tailored for CS initiatives. Participants engaged in conversations about the existing practices of science communication and outreach at UniSR. Additionally, they explored the potential for implementing

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supplementary communication activities aligned with the six tactics provided. This dual approach aimed to enhance the understanding of CS methodologies and communication strategies within the UniSR community, fostering a more comprehensive engagement with citizen science projects.

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9.2 Appendix II: Supporting resources

The following resources were used or are provided here as additional resources for these training programs.

9.2.1 Intervention Area: Research

- Determining whether CS is right for your project (weighing pros and cons of CS)
  - CH 1: Determine if Citizen Science is Right for Your Project | US Forest Service (usda.gov)
- Planning your CS project
  - Choosing, using, and evaluating CS (Centre for Ecology and Hydrology) (it has a focus on ecology, so needs to be adapted for other disciplines, e.g. health)
  - Project Planning Guide | US Forest Service (usda.gov) (it has a focus on environmental projects, so needs to be adapted for other disciplines, e.g. health)
- Data management in CS projects
  - Data charter and guide for citizen science | Scivil
  - DataONE-PPSR-DataManagementGuide.pdf
  - Data and Metadata Working Group: Resources - Citizen Science Association
- Volunteer management in CS projects
  - Recruiting and Retaining Participants in Citizen Science: What Can Be Learned from the Volunteering Literature? (citizenscienceassociation.org)
- OS basics (incl. CS)
  - OLCreate: ORION_MOOC ORION MOOC for Open Science in the Life Sciences (this course has sections on the topics below)
  - Publishing and open access
  - Research data management (FAIR and Open Data)
  - Science communication and public engagement
- Exemplary CS cases
  - Case stories about successful (and persistent) CS projects (tailored to match the disciplinary background/interests of participants)
- Institutional theory of organisations (intro)
  - Organized patterns of actions (social norms) vs. formal structures
  - External and internal pressures on the organisation
- Training needs in the organisation
  - Training needs and recommendations for Citizen Science participants, facilitators and designers (openrepository.com)
- CS and libraries
  - The Librarian's Guide to Citizen Science
- CS policies and roadmaps
  - Green Paper on Citizen Science (ibercivis.es) and White Paper on Citizen Science for Europe (Ibercivis.es)

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- D2.1: Compilation of roadmaps and Grounding Actions for the Implementers - First Version | Zenodo

9.2.2 Intervention Area: Education & Awareness-raising

- Communication and dissemination in CS
  - Communication and Dissemination in Citizen Science | SpringerLink
  - Scivil Communication Guide.pdf
- Effective course design in university settings / learning through CS
  - Design & Teach a Course - Eberly Center - Carnegie Mellon University (cmu.edu)
  - Learning* through Citizen Science: An Aspirational Vision and Ten Questions to Prompt Reflection on Practice - Citizen Science AssociationBlog |
- Organisational communication
  - Formal vs. Informal communication
  - Internal vs. external communication
  - Communication strategy and evaluation
- Fostering capacities for collaboratives innovation processes involving RPOs and civil society
  - EU-Citizen.Science: Training programs to build capacity for collaborative innovation processes
- Best practices/existing CS courses
  - Examples from TIME4CS repository of existing CS course and training materials (in progress)
- Working with CS communities
  - EU-Citizen.Science: Volunteer engagement, management and care
- Motivation, recruitment and retainment
  - Recruiting and Retaining Participants in Citizen Science: What Can Be Learned from the Volunteering Literature? (citizenscienceassociation.org)
- CS in schools
  - EU-Citizen.Science: Citizen Science in Schools: schools as agents of community well-being through science and research
  - EU-Citizen.Science: Empowerment through co-designed Citizen Science in education
  - EU-Citizen.Science: Enhancing youth learning through Community and Citizen Science: a guide for practitioners
- Manual for CS community building
  - INCENTIVE-D2.3_Manual-for-Citizen-Science-Community-Building-final.pdf (incentive-project.eu)
- Modes and channels of communication; effective communication
  - Public Engagement with Science - Open Science MOOC
  - Science Communication and Public Engagement Course - FutureLearn (requires subscription)

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        - Science Communication (EdX)
    - Citizen science as a means for public engagement
        - Citizen Science as a Means for Increasing Public Engagement in Science: Presumption or Possibility? - Victoria Y. Martin, 2017 (sagepub.com) (requires subscription)
        - Citizen communicators: Changing the conversation about science through citizen communicators | Research and Innovation (europa.eu)
    - Planning, designing and evaluating public engagement with science events and activities
        - PES_guide_10_20r_HR.pdf (mos.org)

9.2.3 Intervention Area: Support Infrastructure & Resources

- Cultural change in RPOs (open science) and recommendations specifically for CS
    - LERU-AP24-Open-Science-full-paper.pdf (p. 59-60)
- Towards CS-ICP: 1) online hub/portal, 2) service desk, 3) communication tool/platform, 4) knowledge and expertise (best practices) + Setting up CS-ICP
    - (13864) Citizen Science 'Single point of contact'. - YouTube
- Exemplary cases
    - Libraries as CS-ICPs
        - Citizen Science | Library Services - UCL – University College London
        - Citizen Science - University of Southern Denmark, SDU
    - Research centres
        - Citizen Science Center Zurich
        - Extreme Citizen Science (ExCiteS) — UCL Department of Geography
    - Others
        - Citizen Science (zentrumfuercitizenscience.at)
        - Citizen Science Hubs Governance Framework and Operating Models (INCENTIVE EU)
- Funding opportunities for CS projects in RPOs and with national and international funding bodies
    - Horizon Europe | European Commission (europa.eu)
    - Sparkling Science 2.0
    - GreenpaperonCitizenScience.pdf (ibercivis.es)
- Writing a winning grant
    - Secrets to writing a winning grant (nature.com)
- Overview of ethics guidelines for CS
    - Ethics Guidelines in Citizen Science (ETH Zürich / CCCS)
    - ECSA's 10 principles of Citizen Science
- Research ethics for CS (working with volunteers and human research subjects)
    - Ethics Working Group: Resources - Citizen Science Association
    - Code of Citizen Science Research Ethics | BTO - British Trust for Ornithology

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- CS ethical framework related to the health sciences
  - Ethics framework for citizen science and public and patient participation in research | BMC Medical Ethics | Full Text (biomedcentral.com)
- GDPR and data protection in citizen science projects
  - Getting it right: implementing data protection in citizen science research (uksg.org)
- Ethics committees, Internal Review Boards and ethics approvals at RPOs
- CS case study (to prepare participants for deliberations)
  - Special Collection: Ethical Issues in Citizen Science

9.2.4 Intervention Area: Policy & Assessment

- Strategic planning in RPOs for CS
  - TIME4CS Reflection tool for institutional changes in citizen science
  - Strategic Planning in Higher Education: A Guide for Leaders
    - Mission, vision and values
    - Collaborators and beneficiaries
    - Environmental scan
    - Goals
    - Strategies and action plans
    - Plan creation
    - Outcomes and achievements
  - Strategic planning: time for a rethink? | Times Higher Education (THE)
- Uptake of CS for policymaking in Europe
  - Critical factors that influence and determine the uptake of CS for policymaking
  - Exploring citizen science strategies and initiatives in Europe (2021)
- Exemplary cases
  - NOAA Citizen Science Strategy
  - Green Paper Citizen Science Strategy 2020 for Germany
  - White Paper Citizen Science Strategy 2030 for Germany
- The reward system of science
  - Scientific recognition: authorship, citations, acknowledgements, prizes
  - Scientific careers and assessment criteria for advancements (research, teaching/outreach, industrial/public sector collaboration, other)
  - Rankings of RPOs: national, regional and international
  - Intended vs. unintended effects
- Reform proposals
  - Transition to open science standards
  - Identifying and removing incentives that discourage cooperation, encourage poor scientific practices, and deter new talent from entering the field

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        - Promoting inclusive metrics of success and impact to dismantle a discriminatory reward system in science
        - Research evaluation needs to change with the times (nature.com)
        - Declaration on Research Assessment (DORA)
        - Coalition for Advancing Research Assessment (CoARA)
    - Co-Creating and Implementing Quality Criteria for Citizen Science (citizenscienceassociation.org)
    - Measuring the Impact of Citizen Science (MICS) EC-funded project
    - RRI goals, processes and tools
        - RRI goals: ethics, societal engagement, gender equality, open access/science and science education
        - RRI processes: diversity & inclusiveness, anticipation & reflexivity, openness & transparency, and responsiveness & adaptation
        - RRI tools: self-reflection and inspiration
        - Home Page - RRI Tools (rri-tools.eu)
    - CS and RRI as overlapping approaches
        - RRI and citizen science, how these approaches overlap – Eusea – European Science Engagement Association
    - How to incorporate RRI and CS in RPOs
        - How to incorporate RRI in higher education institutions - RRI Tools (rri-tools.eu)

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