УДК 37.091.3:004(497-15)=111
001.814-027.562(497-15)=111
37.091.3:02(497.11)=111
001.814-027.562:02(497.11)=111

doi: 10.5937/cit2547022D
Оригинални научни рад

Citizen-Enhanced Open Science in the Balkans: Lessons of the CeOS_SE project and the case of Serbia

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Abstract
Citizen Science (CS) is increasingly recognised as an essential pillar within the Open Science (OS) ecosystem, enabling citizen participation in research while enhancing transparency, accountability and public trust in science. The European Open Science Cloud (EOSC) and UNESCO's Recommendation on Open Science position see CS as central to democratising knowledge and advancing the Sustainable Development Goals (SDGs). However, implementing CS frameworks in the Western Balkans faces region-specific challenges, including underdeveloped infrastructure, capacity gaps, and socio-cultural barriers shaped by the region's post-socialist history. The Citizen-Enhanced Open Science in Southeastern Europe Higher Education Knowledge Hubs (CeOS_SE) project (2022–2024), financed under Erasmus+, aimed to bridge these gaps by fostering CS practices in the Western Balkans, focusing on the role of libraries and higher education institutions (HEIs) as facilitators of participatory research. The project prioritised capacity-building, policy alignment, and institutional integration of CS practices within OS frameworks. This paper relies on the findings from the *Roadmap on CeOS in the Balkans, focusing on Section 5.5.3 (Survey Analysis: Citizen Science), enriched with an analysis of global and regional CS frameworks and policies. Special emphasis is placed on Serbia's pioneering initiatives, including the first accredited CS training for librarians, which operationalizes the vision of libraries as community hubs for citizen science. By examining survey data and local practices, this paper offers actionable insights for policymakers, librarians, researchers, and regional stakeholders seeking to embed CS within OS ecosystems sustainably. Findings reveal high interest in CS across the Western Balkans but highlight the need for structured training, stable funding, and alignment with European frameworks to overcome implementation barriers. The paper concludes with recommendations for sustaining CS practices post-CeOS_SE, including policy integration, funding mechanisms, and regional collaboration, to advance participatory, inclusive, and Open Science in the Western Balkans.*

Keywords: Citizen Science, Open Science, Western Balkans, Serbia, Libraries, Community Engagement, Policy, CeOS_SE, EOSC, Librarian Trainings

Introduction

The global research landscape is undergoing a transformation driven by demands for transparency, accountability, and inclusivity in the scientific process[1]. Open Science (OS) has emerged in response to these demands, promoting the sharing of research processes, data, and results to

[1] This paper relies on the findings from the *Survey Analysis: Citizen Science* presented in Section 5.5.3 of the handbook: Nataša Dakić and Aleksandra Trtovac, *Roadmap on CeOS in the Balkans*, (Belgrade: University Library "Svetozar Marković", 2023), accessed July 2, 2025, https://phaidrabg.bg.ac.rs/open/o:31472.

enhance reproducibility, public trust, and societal relevance[2]. While OS policies are increasingly adopted across Europe, countries like Serbia are taking concrete steps to align with these frameworks, demonstrating commitment to open and participatory research practices.[3]

Within the OS ecosystem, Citizen Science (CS) is increasingly recognised as a practical expression of OS principles, actively engaging citizens in various stages of the research process — from data collection to co-design, analysis, and dissemination — and fostering scientific literacy and community participation.[4] CS aligns with the principles of epistemic democracy by recognising citizens as co-creators of knowledge rather than passive recipients, thereby promoting inclusivity and societal relevance in scientific practice.[5]

Global frameworks such as the European Open Science Cloud (EOSC) and UNESCO's Recommendation on Open Science explicitly recognise CS as a critical pillar for achieving the Sustainable Development Goals (SDGs) by harnessing collective intelligence to address complex societal challenges.[6] The European Citizen Science Association (ECSA) operationalises this vision by outlining principles that emphasise active citizen participation, data quality, open practices, and the co-creation of knowledge, ensuring that CS initiatives benefit both scientific communities and a society.[7]

Effectively embedding CS within OS frameworks requires supportive policies, sustainable funding, and institutional capacities that facilitate ethical practices and meaningful citizen participation.[8] Libraries and higher education institutions (HEIs), as trusted community hubs, are well-positioned to foster CS by providing resources, facilitating partnerships, and supporting capacity-building initiatives that bridge the gap between science and society.[9] When supported by structured training and institutional strategies, librarians and HEI staff can act as facilitators of participatory research, advancing open and inclusive scientific practices.

In the Western Balkans, the integration of CS within OS frameworks presents both opportunities and challenges shaped by the region's post-socialist legacy, economic transitions, and infrastructural disparities that influence perceptions of volunteering and trust in institutions. Aligning regional efforts with European frameworks while simultaneously addressing local needs is essential to ensuring that CS initiatives contribute meaningfully to societal development.[10]

The Citizen-Enhanced Open Science in South-East Europe (CeOS_SE) project, implemented between 2022 and 2024 across Croatia, Bulgaria, Greece, Cyprus, and Serbia with Erasmus+ funding, exemplifies how CS can be systematically embedded within OS frameworks in the Western Balkans. The project emphasised the role of libraries and HEIs as facilitators of

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[2] Rick Bonney et al., "Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education," In *A CAISE Inquiry Group Report* (Washington, DC: CAISE, 2009), accessed July 5, 2025, https://files.eric.ed.gov/fulltext/ED519688.pdf.

[3] Ministry of Education, Science and Technological Development, Republic of Serbia, *Open Science Platform 2.0* (Belgrade: MESTD, 2024).

[4] Darlene Cavalier and Eric B. Kennedy, eds., *The Rightful Place of Science: Citizen Science* (Tempe, AZ: Consortium for Science, Policy, and Outcomes, Arizona State University, 2016), accessed July 5, 2025, https://www.researchgate.net/publication/305489010_The_Rightful_Place_of_Science_Citizen_Science.

[5] Muki Haklay et al., "What Is Citizen Science? The Challenges of Definition", in *The Science of Citizen Science*, ed. Katrin Vohland et al. (Cham: Springer, 2021), https://doi.org/10.1007/978-3-030-58278-4_2.

[6] UNESCO, *Recommendation on Open Science* (Paris: UNESCO, 2021), accessed July 7, 2025, https://unesdoc.unesco.org/ark:/48223/pf0000379949?posInSet=3&queryId=4e9e5e25-46d0-428c-86ae-4191da67426c.

[7] European Citizen Science Association (ECSA), "Ten Principles of Citizen Science," ECSA, 2015, accessed July 7, 2025, https://www.ecsa.ngo/10-principles/.

[8] Susanne Hecker et al., eds., *Citizen Science: Innovation in Open Science, Society and Policy* (London: UCL Press, 2018), accessed July 7, 2025, https://discovery.ucl.ac.uk/id/eprint/10058422/1/Citizen-Science.pdf.

[9] Ignat, Tiberius, Darlene Cavalier and Caren Nickerson, "Citizen Science and Libraries: Waltzing towards a Collaboration," *Communications of the Association of Austrian Librarians* 72, no. 2 (2019): 328–36, https://doi.org/10.31263/voebm.v72i2.3047.

[10] Dakić and Trtovac, *Roadmap on CeOS in the Balkans*

participatory research, conducting policy mapping, capacity-building workshops, and pilot CS initiatives aligned with European standards. Serbia, in particular, has emerged as a regional leader in CS implementation through pioneering initiatives, including the first accredited CS training for librarians, dedicated funding for CS projects, and the integration of CS within national OS policies.

This paper examines the implementation and outcomes of the CeOS_SE project, focusing on survey findings from the Western Balkans (Section 5.5.3 of the *Roadmap on CeOS in the Balkans*), situating them within the broader context of global CS and OS frameworks. It provides a comprehensive analysis of the region's readiness, barriers, and best practices for embedding CS within OS ecosystems and offers recommendations for sustaining CS practices post-CeOS_SE through policy integration, funding mechanisms, capacity-building, and regional collaboration.

In doing so, this paper contributes to the ongoing discourse on CS and OS in the global South and post-socialist regions, offering insights for policymakers, librarians, researchers and practitioners seeking to advance participatory science and societal engagement in research. It underscores the transformative potential of CS in addressing local and regional challenges while aligning with European and global OS policies, fostering a research culture that is inclusive, collaborative, and responsive to societal needs.

Survey methodology and findings

Methodology

The present study utilises a mixed-methods approach, combining quantitative survey analysis with qualitative insights from workshops and policy document analysis to capture both quantitative trends and qualitative insights on CS perceptions. This methodology aligns with the principles of participatory research evaluation within CS contexts, ensuring that findings capture both institutional readiness and perceptions regarding CS implementation in the Western Balkans.[11]

The primary data source is the CeOS_SE regional survey conducted in 2023, aligned with the *Roadmap on CeOS in the Balkans,* complemented by policy analysis of national frameworks in Serbia and qualitative feedback from workshops and capacity-building events.

The survey instrument contained 49 questions:

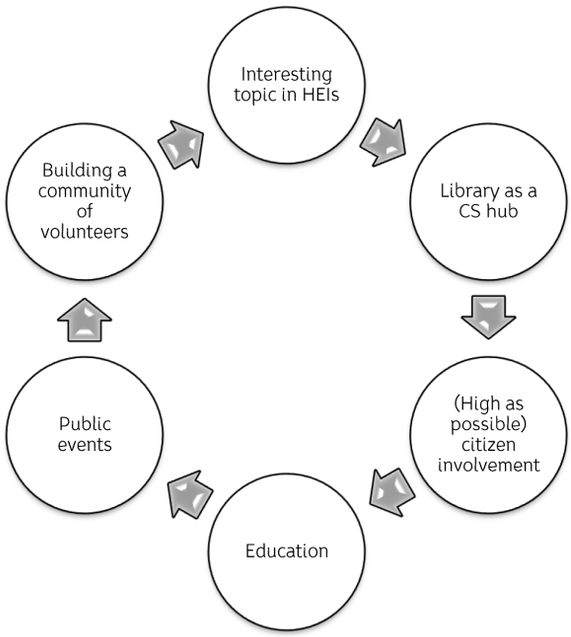
- 11 on general institutional characteristics;
- 12 on OS practices and readiness;
- 26 on CS activities, perceptions, barriers, and training needs.

Question types included multiple-choice, Likert scales (e.g., "1 = strongly disagree, 5 = strongly agree"), and open-ended qualitative questions to capture nuanced perspectives.

By examining the responses to these three sets of questions, University Library "Svetozar Marković" (UNILIB) conducted a comprehensive analysis of the state of Open and Citizen Science within the Balkan region.

The findings and insights obtained from this research formed the basis for developing a roadmap that outlines potential strategies and recommendations for further advancing Open and Citizen Science practices in the region. Graph 1 illustrates the key components identified as necessary for achieving success in CS initiatives, providing a visual anchor for the roadmap discussed in subsequent sections.

[11] John W. Creswell and Vicki L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. (Thousand Oaks, CA: Sage, 2018).



Graph 1: Conceptual framework of lessons learned

Sampling and participants

The survey reached 99 institutions across Serbia, Croatia, Bosnia and Herzegovina, Montenegro, North Macedonia, Bulgaria, Greece and Cyprus. Serbia contributed 55% of the total responses due to strong national project coordination and already established OS networks.

Participants included:

- Academic librarians (79.8%),
- Public librarians (5.1%),
- National library representatives (4%),
- University administrators and researchers (11.1%).

The high proportion of academic librarians reflects the focus on HEIs in the survey design. Also, the gender distribution was 78.8% female, 19.2% male, and 2% preferred not to respond, with a majority (74.8%) aged between 40–65 years, indicating an experienced cohort capable of assessing institutional CS capacities.

Data collection

The survey was administered online via the Google Forms platform, with follow-up reminders sent to ensure comprehensive participation. Workshops and webinars accompanying the survey facilitated clarification and contextual discussion of CS concepts, supporting informed responses.

- Additionally, qualitative data were collected through:
- Notes from capacity-building events in Serbia, Croatia, and Bulgaria;
- Focus groups conducted with librarians in Serbia during the accredited CS training pilot;

Stakeholder interviews with policymakers, including representatives from the Ministry of Education, Science, and Technological Development in Serbia.

Data analysis

Quantitative data were analysed using descriptive statistics to establish frequencies, means, and comparative trends across countries and institution types. Cross-tabulation explored relationships between variables such as institutional type and CS activity levels. Qualitative data were analysed using thematic analysis[12] to identify recurring themes around benefits, barriers and perceptions of CS within OS frameworks.

Results: Citizen Science in the Balkans

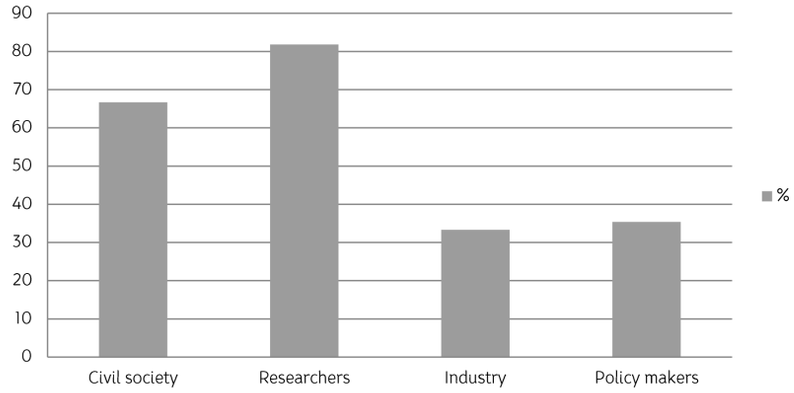
Institutional readiness

The survey revealed high interest in CS but limited structured institutional readiness:
- Only 23.2% of institutions had formally included CS in their strategic plans.
- 63.6% expressed willingness to engage in CS but cited lack of capacity as a barrier.
- Libraries with prior OS experience were more likely to engage in CS initiatives.

Domains of Citizen Science activity

Although CS remains underdeveloped in libraries across the Balkans, 15% of respondents reported that their institutions organise participatory science activities, primarily including:
- Training sessions and lectures,
- Environmental preservation initiatives,
- Research activities with citizens, schools and pupils,
- Collaborations with local universities, national libraries and cultural institutions,
- Engagement in OpenAIRE projects,
- Community engagement initiatives.

Respondents recognised the potential of citizen science, identifying researchers (81.8%) and civil society organisations (66.7%) as the primary potential partners in citizen science activities (Graph 2).



Graph 2: Potential partners in CS activities

Conversely, 72.7% of libraries do not offer services to researchers and the broader scientific community engaged in CS and 76.8% lack support or training activities for researchers, students,

[12] Virginia Braun and Victoria Clarke, "Using Thematic Analysis in Psychology," *Qualitative Research in Psychology* 3, no. 2 (2006): 77–101.

or citizens interested in participating in CS initiatives. According to the survey responses, Cyprus presents the most favourable conditions for CS activities, whereas Bosnia and Herzegovina demonstrates the least favourable circumstances.

A significant majority of respondents reported the absence of citizen science strategies at various levels: 80% at the national level, 86% at the university level, and 90% at the library level. However, the situation is changing. For example, in Serbia, the Center for the Promotion of Science, under the Ministry of Science, has so far announced two public calls for funding citizen science projects (in 2023 and 2024) and granted funds to a total of 17 projects. These calls aim to strengthen the connection between researchers and citizens to address social challenges and achieve common goals; recognize and encourage active citizen participation in scientific research; inspire innovative approaches in research; and highlight the social impact of citizen science in contributing to the Sustainable Development Goals.[13]

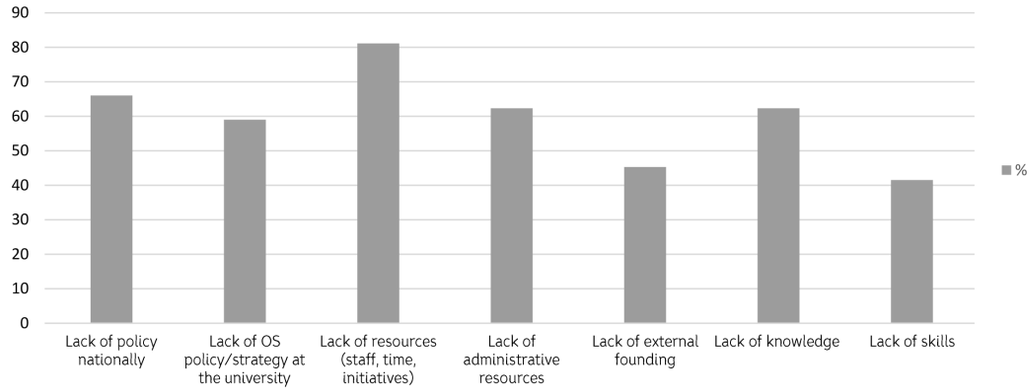
However, the main conclusion remains that across the region, citizen science initiatives are still fragmented and uncoordinated, although examples of individual projects highlight opportunities for systematic integration within institutional and national strategies.

Barriers to implementing Citizen Science

While many respondents perceive minimal obstacles to introducing CS policies, with 47% at the national level, 42% at the university level and 41% at the library level indicating openness to policy adoption, localised challenges persist, particularly in Bulgaria, Greece, Serbia and Cyprus.

The most commonly reported barriers (Graph 3) include:

1. Lack of national policy (66%): without a clear framework, CS initiatives struggle to gain traction;
2. Absence of university-level policies (50.9%): limits CS integration into academic environments;
3. Insufficient resources (81.1%): staff and time constraints hinder CS initiatives;
4. Limited administrative support (62.3%): inadequate infrastructure and systemic support impede CS efforts;
5. Knowledge gaps (62.3%): insufficient understanding of CS requires targeted education;
6. Skills deficiencies (41.5%): lack of competencies necessitates capacity-building for effective CS participation.



Graph 3: Barriers to implementing CS policies

[13] More at: Centar za promociju nauke. „Javni poziv za finansiranje projekata građanskih naučnih istraživanja (GNI) 2024." Centar za promociju nauke, accessed July 8, 2025, https://www.cpn.edu.rs/javnipoziv_gni_2024/?script=cir.

These findings illustrate that while openness to CS exists, policy gaps, resource limitations and capacity deficits must be addressed to foster sustainable CS environments.

Barriers within libraries

The survey examined the extent to which libraries are involved in CS advocacy and the challenges they face in this area. The findings point to several recurring barriers, ranging from resource limitations to organisational and policy-related constraints.

The survey identified library-specific challenges:

- 87% of libraries have no librarians engaged in CS advocacy,
- despite this, 86% do not perceive barriers to such engagement,
- librarians in Greece, Bulgaria, and Serbia reported more challenges.

Barriers can be categorised as:

- Resource constraints: staff shortages, competing responsibilities;
- Knowledge and skills gaps: limited CS awareness and technical skills;
- Policy barriers: lack of clear policies, data privacy concerns;
- Organisational constraints: overextended staff roles without adequate support.

Existing CS projects despite barriers

Despite these barriers, 16.2% of respondents reported CS projects at the national and university levels, particularly in Greece, Serbia, Croatia, and North Macedonia. Examples include:

- Faculty of Biology monitoring projects,
- Local environmental and air quality initiatives,
- The Erasmus+-funded CeOS_SE project,
- Nautica CBC,
- Plant phenology observations,
- University Library Belgrade projects,
- The Bridge Project,
- AMELib volunteer initiatives for accessible digital book production.

These projects demonstrate grassroots and institutional engagement even in the absence of formal policies.

Library competencies and areas for improvement

Respondents provided feedback on library competencies related to CS, revealing both strengths and areas requiring development:

- Strengths:
  - Event organisation (69% positive)
  - Workshop facilitation (65% positive)
  - Project coordination (54% positive)
- Areas for Improvement:
  - Publishing FAIR (Findable, Accessible, Interoperable, Reusable) data (68% negative)
  - GDPR (General Data Protection Regulation) compliance (70% negative)
  - Teaching, evaluation, communication, and research data management skills (mixed feedback)

Respondents identified several actions to strengthen libraries' capacity to support CS initiatives, including:

- Increasing and promoting workshops
- Hosting expert-led lectures

- Launching CS-focused community activities
- Offering accredited CS training for librarians
- Engaging citizens through surveys and embedded research activities
- Strengthening collaborations with universities and scientific institutions
- Providing targeted professional education and technical training.

Perspectives on CS engagement

The survey captured attitudes towards CS engagement:
- 44.4% of respondents indicated that libraries are open to local community CS initiatives.
- 28.3% expressed uncertainty regarding CS promotion at universities.
- 27.3% were unsure about initiating CS activities within their local communities.

Regional variations were noted, with respondents in Bulgaria, Greece, and Croatia perceiving community collaboration as easier, while those in Serbia and Montenegro favoured university partnerships for CS activities.

Support for library involvement in CS was high, with 63.6% agreeing and 32.3% strongly agreeing that libraries should engage in CS projects (Graph 4). Only 4% disagreed, all from four libraries in Serbia.

Graph 4: Involving academic libraries in CS projects and activities

Regarding potential CS partners, 71.7% of respondents identified opportunities outside HEIs, with high recognition of public libraries (71.6%), citizens' associations (71.6%), research funders (51.4%), school libraries (47.3%) and NGOs (45.9%) as potential collaborators. Furthermore, 85.9% of respondents felt that libraries should increase their involvement in CS projects and activities, with 67.7% believing that library founders support such engagement. Regional differences emerged regarding perceived support from library founders, with lower perceived support in Bosnia and Herzegovina (57.1% negative), Bulgaria (54.5% negative) and Serbia (34.5% negative).

Reflections from stakeholders

Interviews with policymakers and librarians emphasised several key points:
- Citizen science fosters trust between citizens and institutions by creating spaces for direct collaboration and shared ownership of research outcomes.
- Libraries' roles are expanding from traditional information providers to active facilitators of community science, positioning them as essential intermediaries between researchers and citizens.
- Funding stability is critical for sustaining citizen science initiatives, with stakeholders noting that ad-hoc or project-based funding limits long-term planning and impact.

- Regional collaboration opportunities exist with neighbouring countries facing similar environmental and societal challenges, opening pathways for cross-border citizen science initiatives.

These reflections underscore the transformative potential of citizen science in the region while highlighting the systemic challenges that need to be addressed. Building trust, securing stable funding and leveraging the evolving role of libraries can significantly enhance the sustainability and impact of citizen science initiatives. Furthermore, fostering regional collaborations can amplify efforts to address shared societal challenges, positioning citizen science as a practical tool for advancing both scientific research and community resilience across the Western Balkans.

Case study: Serbia

National policy context

Serbia has emerged as a regional leader in Citizen Science (CS) integration within Open Science (OS) frameworks, establishing a supportive policy environment that aligns with European Commission guidelines and the European Open Science Cloud (EOSC). The adoption of Serbia's *Open Science Platform* in 2018 and *Open Science Platform 2.0* in 2024 marked a formal commitment to transparency and inclusivity in research, emphasising open access, open data, and public engagement in science.[14]

The *Law on Science and Research* further embedded OS principles into Serbia's research system, explicitly referencing the importance of public involvement and the use of open research infrastructures to enhance societal trust and research impact.[15] The Ministry has allocated annual funding lines supporting OS and CS initiatives, since 2023, demonstrating long-term commitment to institutionalising CS.[16]

Institutional milestones and actors

Key milestones in Serbia include:

- University of Belgrade's endorsement of the Berlin Declaration.
- Establishment of national OA repositories.
- Promotion of OS principles through various events (Annual *Open Science Week*, *Days of Open Science* etc.)
- Integration of OS principles within research funding frameworks.

Additionally, the Center for the Promotion of Science (CPN), under the Ministry of Science, Technological Development, and Innovation, has successfully conducted two public calls for funding citizen science projects. These calls, funded by the Ministry and aligned with national OS priorities, have provided structured financial support for pilot citizen science initiatives across Serbia, enabling libraries, universities, and community organisations to engage citizens directly in scientific research. This has further strengthened Serbia's position as a regional leader in integrating CS within OS frameworks while demonstrating practical pathways for citizen participation in addressing local challenges.[17]

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[14] Ministry of Education, Science and Technological Development, Republic of Serbia, *Open Science Platform*, accessed July 20, 2025, http://www.open.ac.rs/index.php/politika.

[15] Republika Srbija, Ministarstvo za nauku, inovacije i tehnološki razvoj. *Zakon o nauci i istraživanjima* (Beograd: Službeni glasnik Republike Srbije, 2020).

[16] Dakić and Trtovac, *Roadmap on CeOS in the Balkans*.

[17] More at: Centar za promociju nauke. „Javni poziv za finansiranje projekata građanskih naučnih istraživanja (GNI) 2024." Centar za promociju nauke, accessed July 8, 2025, https://www.cpn.edu.rs/javnipoziv_gni_2024/?script=cir.

Two key institutions have driven Serbia's CS agenda:

- Center for the Promotion of Science: A pivotal actor in popularising CS through public science events, workshops, and the publication of CS guides for practitioners and librarians.
- University Library "Svetozar Marković": Leaders in OS and CS training, advancing Serbia's efforts to position libraries as CS hubs.

Through their active engagement and strategic initiatives, these institutions have successfully positioned citizen science as a visible and valued component of Serbia's research landscape, fostering collaboration among citizens, researchers, and policymakers while building a sustainable ecosystem for future CS development.

Accredited librarian training: the first in the region

In 2023, Serbia launched the region's first accredited Citizen Science (CS) seminar for librarians, titled Citizen Science: Libraries as a Link Between Civil Society and Science. The first of many training sessions was held in Novi Sad on March 8th 2023, attracting over 200 librarians from academic, public, and school libraries across Serbia. The curriculum included:

- Principles and types of CS
- Designing and managing CS projects
- Data collection and ethical considerations
- Tools for engaging diverse community groups
- Alignment with EOSC and Horizon Europe standards

This training has been integrated into Serbia's professional development portfolio for librarians, enabling them to take proactive roles as CS facilitators and community science educators. To date, over 500 librarians have gained knowledge and skills in CS through this seminar.

Participant feedback highlighted the seminar's practical relevance:

- "I now feel confident to lead small CS projects in our community library."
- "We plan to collaborate with local schools on water quality monitoring."
- "The workshop was very useful and creative. The information provided offers unlimited opportunities for collaboration and for connecting citizens with scientific work through the library, as well as with other forms of human creativity."
- "There is a clear need to popularise the concept of Citizen Science among the heads of research organisations and cultural institutions, as key figures for promoting its broader implementation and effective operationalisation."

By equipping librarians with accredited CS knowledge and practical skills, Serbia is building a sustainable foundation for libraries to become active hubs of citizen participation in science across the region.

Project case studies

In recent years, several successful citizen science (CS) projects have been organised in Serbia, demonstrating the practical value and impact of citizen participation in research. These initiatives highlight how localised engagement can directly contribute to achieving national research objectives while fostering community ownership of environmental monitoring and scientific data collection. By actively involving citizens, these projects not only generate valuable datasets but also strengthen public awareness and stewardship of local environmental and societal challenges.

The following projects illustrate the practical benefits of citizen science in Serbia:

- Obtectus Finders.[18] This project engages citizens in monitoring agricultural pests (*Callosobruchus maculatus*) in Serbia's rural regions, directly addressing food security and sustainable agriculture challenges while empowering local communities to contribute to national agricultural monitoring efforts.
- Monitoring Megachile sculpturalis.[19] This project involves citizens in tracking the spread of the invasive sculptured resin bee (Megachile sculpturalis), which affects local pollinator dynamics and biodiversity, thereby enabling the early detection and management of invasive species through community participation.

Together, these projects demonstrate how citizen science can serve as a practical tool for addressing local challenges while contributing to Serbia's broader research and environmental goals, offering a replicable model for regional and national strategies.

Lessons learned

The experiences of the CeOS_SE project, combined with Serbia's pioneering initiatives, reveal several key lessons about effectively embedding citizen science within the regional Open Science landscape and leveraging libraries as engines for participatory research:

- Libraries as community hubs for CS. Libraries are effective, trusted spaces for CS, providing infrastructure, credibility, and community networks that facilitate participation. Librarians, when trained, can design, manage, and evaluate CS projects, contributing to the social fabric of their communities.
- Importance of structured training. Structured, accredited training, as demonstrated in Serbia, equips librarians with confidence and skills to facilitate CS, overcoming barriers related to uncertainty or lack of expertise.
- Policy support enables sustainability. Embedding CS within national policies and research strategies, combined with dedicated funding streams, ensures CS activities are not isolated but part of systemic scientific practice.
- Addressing cultural barriers. In post-socialist contexts, historical perceptions of mandatory volunteering can hinder citizen participation. Framing CS as empowering, voluntary, and impactful is key to fostering engagement.
- Data quality and ethics. Effective CS requires clear data management protocols, validation processes, and ethical guidelines to ensure trustworthiness and respect for participants' contributions.

Recommendations

Building on these lessons, the following recommendations are proposed to support policy-makers, libraries, and regional stakeholders in advancing citizen science within Open Science frameworks across the Western Balkans. These actions aim to institutionalise citizen science, secure its sustainability, and maximise its societal and scientific impact.

1. Institutionalise CS in strategies: Integrate CS explicitly within library and HEI policies and national research strategies.
2. Secure dedicated funding: Establish stable funding mechanisms at national and regional levels to support CS projects and capacity-building initiatives.

[18] More at: Serbian Evolutionary Society. "Obtectus Finders: Citizen Science Project", accessed July 3, 2025, https://www.opasuljise.rs/en/.

[19] More at: Ćetković, Aleksandar et al. "Monitoring the Spread of Sculptured Resin Bee (Megachile sculpturalis) in Serbia." Centre for Bee Research, Faculty of Biology, University of Belgrade, accessed July 8, 2025, https://srbee.bio.bg.ac.rs/english

3. Expand accredited training: Scale Serbia's accredited CS librarian training to other Balkan countries through collaborations with library associations and ministries.
4. Develop multilingual resources: Create CS materials in regional languages to ensure accessibility for diverse communities.
5. Foster regional cooperation: Build regional CS networks for joint projects addressing cross-border environmental and societal challenges.
6. Align with European frameworks: Ensure CS initiatives align with EOSC and Horizon Europe, enabling integration into broader research ecosystems.
7. Monitor and evaluate: Establish monitoring frameworks for CS projects to track participation, data quality, and societal impact.

Conclusion

The CeOS_SE project has demonstrated that citizen science can become a foundational pillar of Open Science in the Western Balkans, with Serbia offering a replicable model of policy alignment, capacity-building, and community engagement. By actively involving citizens in research processes, citizen science fosters transparency, trust, and inclusivity, aligning science with societal needs while enhancing the relevance and impact of research.

Libraries have emerged as accessible, trusted institutions capable of facilitating participatory research, providing both infrastructure and a community hub for citizen engagement. The successful implementation of accredited citizen science training for librarians in Serbia highlights the potential of structured capacity-building to empower librarians as citizen science facilitators and community educators.

However, realising the full potential of citizen science in the region requires moving from fragmented, project-based initiatives to systematic integration within institutional and national research strategies. Policy support, stable funding mechanisms, and cross-sectoral partnerships are essential for sustaining and expanding citizen science practices. Furthermore, addressing cultural barriers, ensuring data quality, and aligning with European frameworks such as EOSC and Horizon Europe will enable the region to integrate citizen science within broader research ecosystems effectively.

By leveraging these lessons and recommendations, the Western Balkans can advance participatory science that empowers citizens, strengthens the societal relevance of research, and contributes to addressing regional and global challenges through science. In doing so, citizen science will not only enrich the Open Science ecosystem but also build resilient, informed, and engaged communities across the region.

In the coming period, in Serbia and all the Western Balkans region, active efforts must also be made to raise researchers' awareness of the role of libraries in citizen science projects, that is, to continuously emphasize the fact that libraries are the vital link between science, scientists, and citizens.

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Подршка грађана отвореној науци на Балкану: искуство из пројекта CeOS_SE и студија случаја у Србији

Сажетак

Грађанска наука све више се препознаје као кључни стуб у оквиру екосистема Отворене науке јер омогућава учешће грађана у истраживању, истовремено јачајући транспарентност, одговорност и поверење јавности у науку. Европски облак отворене науке (EOSC) и Унескова *Препорука о отвореној науци* позиционирају грађанску науку као централни елемент демократизације знања и напретка у остваривању Циљева одрживог развоја (SDGs). Ипак, примена оквира за грађанску науку у региону Западног Балкана суочава се са специфичним изазовима, укључујући недовољно развијену инфраструктуру, недостатке у капацитетима и социјално-културне баријере обликоване постсоцијалистичком историјом региона. Пројекат Подршка грађана принципима отворене науке у високом образовању у земљама Југоисточне Европе (*Citizen-Enhanced Open Science in Southeastern Europe Higher Education Knowledge Hubs - CeOS_SE*, 2022–2024), финансиран у оквиру програма Erasmus+, имао је за циљ да премости ове недостатке подстицањем пракси грађанске науке на Западном Балкану, са фокусом на улогу библиотека и институција високог образовања, као посредника у партиципативним истраживањима. Пројекат је за приоритет имао изградњу капацитета, усклађивање политика и институционалну интеграцију пракси грађанске науке у оквиру отворене науке. Овај рад се ослања на налазе из *Смернице за грађанску науку на Балкану*, са посебним осврtом на одељак 5.5.3 (Анализа анкете: грађанска наука) допуњене анализом глобалних и регионалних оквира и политика у области грађанске науке. Посебан акценат стављен је на пионирске иницијативе у Србији, укључујући прву акредитовану обуку за библиотекаре у области грађанске науке, којом се остварује визија библиотека као заједничких чворишта за грађанску науку. Кроз анализу података из анкете и анализу локалних пракси, рад нуди значајне увиде у тему креаторима политика, библиотекарима, истраживачима и регионалним актерима који настоје да на одржив начин интегришу грађанску науку у екосистем отворене науке. Резултати анкете указују на висок степен интересовања за грађанску науку у региону Западног Балкана, али и на потребу за структурисаним обукама, стабилним финансирањем и усклађивањем са европским оквирима како би се превазишле препреке у примени. Рад на завршетку доноси препоруке за одржавање пракси грађанске науке након завршетка пројекта CeOS_SE, укључујући интеграцију у политике, механизме финансирања и регионалну сарадњу, како би се унапредила партиципативна, инклузивна и отворена наука на Западном Балкану.

Кључне речи: грађанска наука, отворена наука, Западни Балкан, Србија, библиотеке, укључивање заједнице, политика, CeOS_SE, EOSC, обука библиотекара