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CITIZEN SCIENCE AS A CONTEMPORARY RESEARCH PRACTICE: KEY CHALLENGES AND WAYS TO OVERCOME THEM

ABSTRACT. *Citizen science is becoming increasingly important as a component of open science and a mechanism for university-society engagement; however, researchers' perspectives on the primary obstacles to its development and potential ways to overcome them remain insufficiently explored. The aim of the study is to identify the key challenges and barriers to the development of citizen science and to analyze the solutions proposed by researchers. The research methods included an international online survey of 100 citizen science researchers and practitioners from 31 countries, alongside a thematic analysis of respondents' open-ended answers. The analysis enabled the ranking of the following major issues: difficulties in engaging a broad audience, lack of funding, insufficient skills within the academic community, low public awareness, inadequate regulatory frameworks and technical and organizational challenges, data quality concerns, and institutional and administrative barriers. The analysis of open-ended responses complemented the identified challenges with systematized proposals for overcoming them. It has been established that overcoming the main barriers to the development of citizen science requires a comprehensive combination of financial, institutional, educational, organizational, communication and partnership mechanisms.*

KEYWORDS: *citizen science; open science; institutional support; public engagement.*

INTRODUCTION. Citizen science is an element of open science and a crucial aspect of universities' fulfillment of their third mission. Universities worldwide implement citizen science projects in diverse contexts ranging from situations where national strategies exist and citizen science is integrated into institutional development plans to isolated initiatives or even a lack of familiarity with the term "citizen science", despite the practice being employed. A well-known challenge in citizen science is ensuring data quality (Balazs et al., 2021; Burgess et al., 2017; Williamson et al., 2016). However, an increasing number of publications address other factors influencing the spread of citizen science, such as local community motivation, the use of inclusive tools and project communication, trust and mutual support among participants, and the social significance of the research (Abernethy et al., 2025). Gray et al. (Gray et al., 2012) highlight the issue of resource constraints, as well as the importance of designing projects that reflect the nature of scientific inquiry, fostering dialogue with experts, and developing critical thinking skills among the public.

An assessment of certain obstacles and potential success factors for citizen science projects is provided by Lee et al. (Lee et al., 2020). They include having a clear vision of project goals and expected outcomes, understanding citizen motivations and ensuring effective communication between professional scientists and citizen researchers. A study of citizen scientists conducted by Shinbrot et al. (Shinbrot et al., 2023) showed that learning motivation and values fostered participation, whereas time constraints limited involvement in citizen science projects. At the same time, the successful development of citizen science depends not only on citizens' willingness to participate but also on the capacity of researchers and scientific institutions to create appropriate conditions for such engagement.

Despite the growing prevalence of citizen science, the question of how researchers directly involved in citizen science assess the main obstacles to its development and which practical mechanisms for overcoming them they consider most appropriate, remains insufficiently studied. In particular, the relationship between the identified barriers and the solutions requires further examination across areas such as research

organization, institutional support, funding, professional development, communication, partnerships and participant engagement.

The aim of this study is to identify the primary obstacles to the development of citizen science based on the assessments of researchers directly involved in citizen science projects and to analyze the strategies they propose for overcoming these challenges.

METHODS. To collect empirical data, an international online survey was conducted among researchers and practitioners involved in citizen science. Information about the survey was disseminated through professional networks and relevant organizations, notably the European Citizen Science Association (ECSA) and the Australian Citizen Science Association (ACSA). Individual researchers who received invitations voluntarily shared information about the survey with their professional contacts and communities. One recruitment channel involved targeted expert selection based on a Google Scholar search for academic publications in the field of citizen science. Priority was given to authors of empirical studies and accounts of practical experience in implementing citizen science projects, as such individuals were likely to have direct experience organizing or participating in relevant initiatives. Following the selection of publications, personalized email invitations to participate in the survey were sent out. Contact details for potential participants were obtained from open sources, specifically the contact information provided in the academic publications.

The survey was conducted under conditions of confidentiality and did not involve the collection of direct personal data. Participation was voluntary, and the results were analyzed and presented in aggregated form. A total of 100 respondents from 31 countries (including 21 European Union member states) participated, providing broad international coverage. Data collection was carried out using an online questionnaire comprising both closed-ended and open-ended questions. In addition to fixed response options, most questions allowed respondents to provide their own answers. Open-ended responses were processed using thematic analysis. Substantively relevant responses were summarized, grouped by theme, and structured according to key approaches for addressing the identified challenges in citizen science. Responses that lacked specific proposals for addressing the issues, were overly general or vague, or did not clearly indicate a proposed solution were excluded from the subsequent thematic analysis of open-ended responses.

RESULTS AND DISCUSSION. To identify the main barriers to the development of citizen science, respondents were asked to evaluate the issues they considered the greatest obstacles to its development and practical implementation. Among the options provided in response to the question “In your opinion, what is the biggest problem/challenge in citizen science?”, respondents most frequently selected difficulties in engaging a broad audience (27 responses) and a lack of sufficient funding (21 responses). Other significant problems or obstacles included insufficient pedagogical and methodological skills among scientists for implementing citizen science projects (15 responses) and the public’s low level of awareness of citizen science (11 responses). A roughly equal number of responses cited technical and organizational difficulties (7 responses), inadequate regulatory frameworks (6 responses), and the low quality of data collected by citizens (6 responses). Additionally, an “Institutional and administrative barriers” category was identified, encompassing responses regarding insufficient support for citizen science from university administrations, a lack of necessary infrastructure and administrative hurdles to project implementation. The remaining responses fell into the “Other” category (3 responses) and concerned excessive bureaucracy and complex research approval procedures, as well as the reluctance of some academic staff to involve citizens in scientific research.

Overall, respondents more frequently linked the challenges of implementing citizen science projects to issues of participant engagement, communication and competence than to the technical aspects of research organization. While data quality – specifically, the quality of data collected by citizens is a common concern in the academic literature on citizen science, respondents did not identify it as a key obstacle

to the field's development. An analysis of open-ended responses revealed that some respondents view institutional policies and practices as barriers to the advancement of citizen science. Respondents also identified the scientific community's lack of preparedness for working with the public as a significant obstacle.

To gain deeper insight into the challenges and barriers associated with implementing citizen science, survey participants were asked an open-ended question "How do you think these problems can be solved?". The proposed solutions and measures were systematized, consolidated and grouped into nine thematic areas as presented in Table 1.

Table 1. Thematic summary of proposed ways to overcome the challenges of citizen science

No	Key areas for overcoming problems	Proposed measures
1	Recognition and regulatory framework for citizen science	• Development and review of legal and regulatory frameworks for citizen science. • Implementation of citizen science policies at transnational, national, local and institutional levels. • Systematic integration of citizen science into educational contexts.
2	Institutional support for citizen science by universities	• Recognition of the need for leadership in citizen science and the establishment of participation in citizen science projects as standard practice. • Establishment of dedicated institutional infrastructure for citizen science, such as centers, offices and services. • Allocation of resources and time for academic staff to implement citizen science projects, rather than treating them solely as an additional workload. • Integration of citizen science into university curricula and its incorporation into students' research projects. • Reduction of administrative bureaucracy.
3	Financial support for citizen science	• Expansion and diversification of funding sources (government grants, private funding, corporate sponsorship, donations and partnership funding). • Targeted and specialized funding for citizen science. • Increasing the number of available funding opportunities and ensuring access to funding for a wide range of researchers. • Funding for human and organizational resources (coordinator positions, additional staff, participant engagement specialists, etc.), as well as resources for working with participants and technical support. • Funding for communication and public engagement.
4	Communication and popularization of citizen science among the public	• Enhancing the prestige and status of citizen science. • Conducting information and promotional campaigns. • Use of mass media and social networks. • Informing and engaging the public through lectures, presentations and other educational activities. • Identifying effective ways to communicate with target groups. • Raising awareness among local government representatives and non-governmental organizations of the potential and societal value of citizen science.
5	Planning and organization of citizen science projects	• Enhancing the prestige and status of citizen science. • Conducting information and promotional campaigns. • Use of mass media and social networks. • Informing and engaging the public through lectures, presentations and other educational activities. • Identifying effective ways to communicate with target groups. • Raising awareness among local government representatives and non-governmental organizations of the potential and societal value of citizen science.
6	Improving data quality and reliability	• Providing high-quality recommendations to citizens. • Data collection in collaboration with professional scientists, with quality oversight provided by them. • Development of standard data collection protocols. • Engagement of citizens in higher education.

End of Table 1

No	Key areas for overcoming problems	Proposed measures
7	Professional development of the academic community	• Creating opportunities for learning and professional development in citizen science methodology, instructional design, community engagement strategies and practical project organization. • Enhancing professional skills through participation in specialized training events, educational campaigns, summer schools, workshops, etc. • Developing methodological and communication competencies.
8	Motivating and incentivizing academic staff to participate in citizen science projects	• Raising awareness of citizen science as an effective method for obtaining research data. • Implementing effective mechanisms to encourage participation in citizen science projects. • Ensuring sufficient time and human resources for the implementation of citizen science projects. • Creating mutual benefits through partnerships between citizen researchers and professional scientists.
9	Partnership and cooperation	• Collaboration with civil society organizations and engagement of government institutions in citizen science practices. • Engaging community opinion leaders in the implementation of citizen science projects. • International cooperation and exchange of best practices in the field of citizen science.

The respondents' answers indicate a need to establish a systemic regulatory and policy environment for the development of citizen science. Overall, the approaches proposed by researchers to overcome barriers to citizen science entail its multi-level institutionalization, encompassing regulatory frameworks, policy formulation at various governance levels and the systemic integration of citizen science into the educational process. Respondents view the university not merely as a venue where individual researchers carry out citizen science projects, but as an institution responsible for creating the conditions necessary for its systemic development. In the view of those surveyed, the institutionalization of citizen science within universities should involve its formal recognition, the creation of specialized infrastructure, the provision of necessary resources and time to academic staff, its integration into the educational process and the streamlining of administrative procedures.

An analysis of the responses highlights the need to establish a stable and accessible system for the financial support of citizen science. Proposed solutions include diversifying funding sources, introducing targeted and specialized support mechanisms as well as securing funding for human, organizational, and technical resources. Particular emphasis is placed on the need to allocate resources to communication and public engagement efforts, reflecting the nature of citizen science as a research activity grounded in interaction with participants.

It is worth noting that respondents view communication as a key mechanism for expanding public participation and enhancing the societal significance of citizen science. Their responses highlight the importance of proper planning and organizational support for citizen science projects. Proposed measures include meticulous research design, the clear definition of procedures and instructions and the allocation of necessary time, personnel and other resources. This underscores the need to design citizen science initiatives with the specific nature of citizen participation in mind, rather than simply adding citizens to an existing research framework. Respondents also indicated that improving the quality and reliability of citizen science data depends primarily on providing participants with appropriate methodological and scientific guidance.

Effective implementation of citizen science projects requires both the professional development of the academic community and the creation of incentives for academic staff to participate. A crucial aspect identified is the creation of mutual benefits through partnerships between citizen scientists and professional researchers. Overall, fostering partnerships and collaboration in the field of citizen science expands its potential and integration.

CONCLUSIONS. The survey results indicate that engaging a broad audience is one of the major challenges in citizen science; addressing this issue requires a comprehensive approach involving information, communication, partnership and motivational mechanisms. Another barrier is insufficient funding, addressing which requires the creation of a dedicated financial model for citizen science that accounts for its specific organizational, staffing, communication and technical requirements. The researchers surveyed expressed considerable concern about the methodological and communication skills of scientists involved in citizen science projects, highlighting the need for targeted professional development. Respondents view data quality primarily as a result of proper project design and data collection organization, rather than as an inherent limitation of citizen researchers. Increasing public recognition of citizen science and ensuring effective communication to inform and engage the public are of critical importance.

Insufficient support from university administrations, a lack of necessary institutional infrastructure and administrative hurdles were identified as key institutional and administrative barriers. These barriers are essentially cross-cutting, as they can exacerbate other issues, such as resource shortages, limited academic staff participation, project organization difficulties and challenges in public engagement. Improving the quality of project design and organizational support, alongside the use of digital tools, serves as a countermeasure to these organizational and technical challenges. Thus, overcoming existing obstacles to citizen science is linked not only to the creation of specific project support mechanisms but also to the formation of a favorable regulatory, political, financial, educational and communication environment for the systemic development of citizen science.

Prospects for further research include the development of practical recommendations for the development of citizen science for scientists, universities, governments and other stakeholders. Formulating these recommendations would benefit from drawing on findings related to other aspects of the survey, specifically the factors contributing to the success of citizen science projects, effective methods for public engagement, institutional support, the competencies and motivation of academic staff, necessary resources and international cooperation.

Investigating the interrelationships between individual barriers is also of interest, as the study's results indicate that these obstacles do not exist in isolation – for instance, institutional and administrative conditions can influence funding, the time available to researchers, project organization and public engagement. An important direction for further research is the development of a model of institutional support for citizen science at the university level that would combine regulatory, organizational, personnel, communication, and other types of support.

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ГРОМАДЯНСЬКА НАУКА ЯК СУЧАСНА ДОСЛІДНИЦЬКА ПРАКТИКА: ОСНОВНІ ВИКЛИКИ ТА ШЛЯХИ ЇХ ПОДОЛАННЯ

АНОТАЦІЯ. Громадянська наука набуває дедалі більшого значення як складова відкритої науки та механізм взаємодії університетів із суспільством, однак бачення дослідниками основних перешкод для розвитку громадянської науки та можливих шляхів їх подолання висвітлено недостатньо. Мета роботи – визначити основні проблеми і перешкоди розвитку громадянської науки, а також проаналізувати запропоновані дослідниками шляхи їх подолання. Методи дослідження: міжнародне онлайн-опитування 100 дослідників і практиків громадянської науки з 31 країни та тематичний аналіз відкритих відповідей респондентів. Аналіз відповідей респондентів дозволив ранжувати наступні основні проблеми: складнощі із залученням широкої аудиторії, брак фінансування, недостатні навички академічної спільноти, низький рівень обізнаності населення, недостатнє нормативно-правове забезпечення громадянської науки та технічні і організаційні складнощі, якість даних, а також інституційні та адміністративні бар'єри. Аналіз відкритих відповідей доповнив визначені проблеми систематизованими пропозиціями щодо їх подолання. Встановлено, що подолання основних бар'єрів розвитку громадянської науки потребує комплексного поєднання фінансових, інституційних, освітніх, організаційних, комунікаційних і партнерських механізмів.

КЛЮЧОВІ СЛОВА: громадянська наука; відкрита наука; інституційна підтримка; залучення громадськості.