DOI: https://doi.org/10.24818/cike2024.62
UDC: 027.7:[001.81+001.92]

THE ROLE OF ACADEMIC LIBRARIES IN PROMOTING PARTICIPATORY SCIENCE

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Abstract: This paper provides an understanding of the ways in which participatory science and citizen science can benefit libraries and how libraries can effectively implement these initiatives. Based on literature review, methods and practices for implementing citizen science by other libraries are highlighted, including the promotion of civic and research interests that contribute to general scientific progress. The paper outlines reasons why libraries should communicate and encourage active involvement in citizen science projects and what are the benefits of citizen science initiatives for the organisers. Ways of how resources and facilities of academic libraries can be leverage in Open Science are highlighted. The paper elaborates on the six steps recommended by the Open Science Meets Citizen Science Guide that academic libraries should follow while engaging in participatory science. Competences of librarians to initiate participatory science activities are outlined. Professional and material benefits of participants in Open Science and recognition of their contribution to participatory science are also highlighted.

Keywords: participatory science; citizen science; open science; benefits for libraries; libraries as Hubs for Innovation in Participatory Science; librarians' competences

JEL Classification: D83; I23; L86

1 Introduction

Changes in research are having a major impact on academia worldwide, and academic libraries are directly affected by these changes. In this context, academic libraries are called upon to adapt their services to meet the new demands of research development and to actively participate in innovative research initiatives such as Open Science and Participatory/Citizen Science. Through these initiatives, academic libraries can make more effective use of academic resources, enhance interaction with the community and facilitate closer collaboration between researchers, students and citizens, thus becoming dynamic collaborative hubs where knowledge is co-created and shared transparently with wider communities.

Open Science is one of the political priorities of the European Union and is structured into eight pillars. One of these pillars is participatory or citizen science, which promotes the idea that citizens can and should actively contribute to the creation of scientific content. Academic libraries play an important role in facilitating communication and supporting participatory science initiatives, thus helping open up access to research and involve general public in scientific projects.

2 Conceptual aspects

The term 'citizen science' was first used in the UK and the US in the mid-1990s by authors Alan Irwin and Rick Bonney. Alan Irwin is best known for his book Citizen Science: A Study of People, Expertise, and Sustainable Development (1995), while Rick Bonney used the term in the context of bird monitoring projects at the Cornell Lab of Ornithology. According to Irwin, participatory science is a model of scientific practice that actively involves citizens in the research process. He introduced the term to describe an approach in which scientists and citizens work together in an open and interactive way to develop scientific knowledge. Rick Bonney referred to the voluntary involvement of the public in scientific projects and science communication. The concepts and terms used in the literature and press to characterize civic researchers and civic science were criticized by Fiona Clark and Deborah Illman (USA) in 2001 - they stated that these terms are "ambiguous, perhaps even contradictory". In 2009 Jonathan Silvertown, UK, an ecologist and professor known for his contributions to citizen science and plant ecology, defined citizen scientists as volunteers who collect and/or process data as part of scientific research. Bruce Lewenstein, USA, in 2004 defined the term highlighting three key elements: lay participation in data collection, data use and data interpretation according to scientific protocols; lay involvement in policy decisions with technical or scientific components; and participation of scientists in democratic and political processes.

In 2013, the European Commission's Green Paper on Citizen Science described that "Citizen science refers to the involvement of citizens in scientific research activities when citizens actively contribute to science with their intellectual effort or with their tools and resources", and in 2015, the European Association for Citizen Science published the Ten Principles of Citizen Science, which summarizes the principles that underpin good practice in citizen science.

In the Republic of Moldova, Nelly Turcan, Ph.D., lecturer at the Department of Communication and Information Theory of the State University of Moldova (USM), is a leading figure in the field of Open Science. She is recognized for her outstanding contributions in involving academic libraries in the promotion and dissemination of Open Access scholarly publications. In 2019, Nelly Turcan promoted the concept of Participatory Science in scholarly publications in Moldova, emphasizing that "Participatory Science effectively transfers scientific activities to a wider community and provides grounds for increased interaction between science and society".

3 The role of academic libraries in promoting Participatory Science

Libraries around the world are already actively involved in participatory/citizen science projects, leveraging their extensive resources and networks to engage and mobilize communities in scientific research. Through their collaboration in these projects, libraries have not only helped to advance scientific research, but have become active centers of innovation, demonstrating how they can enrich community education and support public engagement in participatory science. Already having experience in promoting and implementing Open Science in Universities, academic libraries in Moldova can capitalize on their expertise in assisting researchers, including in managing data generated from participatory/citizen science projects. Academic libraries in Moldova are an ideal framework for supporting and promoting participatory or citizen science, as they can provide various resources and facilities, including:

- Open and accessible library spaces create a safe environment for meetings, collaboration and events related to participatory research. In addition, university libraries have valuable

information resources at their disposal, including collections of books and periodicals in various fields, access to databases and digital tools.

- The connections libraries have with the academic and research communities facilitate collaboration between students, teachers and citizens interested in participatory/citizen science projects.
- Organizing events - by organizing workshops and training sessions, libraries can educate and mobilize communities in citizen science.

The main role of academic libraries in this context is to be intermediaries between researchers, students and the general public. In order to fulfil this role, they need to take on the following responsibilities: creating support centres to facilitate interaction between academia and society; effectively managing the data collected in research; providing advice for the development of data management plans; organizing workshops, webinars and courses aimed at developing volunteers' digital skills and data management; creating platforms dedicated to sharing resources and knowledge between partners from different disciplines; developing the digital infrastructures needed to maintain continuous communication between researchers and the community involved, etc.

To engage effectively in participatory or citizen science initiatives, academic libraries can be guided by the **six steps recommended by the Open Science Meets Citizen Science Guide**. These steps provide a structured framework to help libraries develop and implement strategies to support and promote participatory science. By following these recommendations, libraries can facilitate community engagement in research by supporting access to resources, forming partnerships, and organizing events and workshops that connect citizens with the scientific process:

1. The first step university libraries should take is to **provide mentoring** for Open Science and Participatory Science. As science libraries, there are opportunities to bring our Open Science expertise into the realm of citizen science and help improve traditional research methodologies. Ideally, university libraries should be involved from the very beginning of a participatory/citizen science project, however, it is never too late to add value. Even if a project is already underway, their expertise can be used to optimize and modernize the research process.
2. The second step that can be taken is **Designing Engagement.** If a researcher or a group of researchers have already started their participatory/citizen science project before librarians are involved, they may not be able to influence the Designing Engagement, but understanding the different levels of engagement is still relevant. Citizen science is an extremely diverse field, and the ways in which volunteers can be involved in projects can vary considerably from project to project. Potential ways in which librarians and volunteers can be involved in citizen science include:
   - Input into the formulation of research questions;
   - Contributions to the design of the research project and protocol;
   - Collecting new data, for example from the environment or about themselves;
   - Processing the collected data, e.g. annotating images / videos, transcribing text;
   - Analyzing and interpreting the data, e.g. performing statistical analysis and arguing the results;
   - All (extreme citizen science) or some of the above
3. The third step is **compliance with ethical principles**. It is important to respect rigorous ethical principles and to ensure transparency in the use and sharing of data. University libraries, with their

expertise in information and data management, can contribute to meeting these standards. Ensuring the recognition of volunteer contributions, the protection of privacy and the accessible publication of results are important aspects that need to be taken into account to maintain the integrity and quality of participatory research.

4. Next step like **Data Collection - Open Hardware**. Open data sharing is important for citizen science projects. Volunteers contributing to data collection should have access to the data. The final dataset should be published in a data repository, such as Zenodo, and updated with new data as it becomes available. At the same time, be careful about the personal data included, such as geolocation data or information about volunteers.
5. The fifth step is **Data analysis.** Research volunteers can also contribute to the data analysis. It is recommended that you share all the software code used for this analysis along with the dataset. If the citizen science project attracts dedicated and competent volunteers, they may be willing to conduct additional analysis. In this context, access to the software code becomes even more important.
6. And the last and most important step is **Publishing the results**. As in the case of code and data sharing, when research is based on voluntary contributions, it is imperative that those contributors can also have access to the published results and therefore they should be published with open access. Beyond that, there is a second aspect you should think about: volunteers may have put considerable effort into making a research project possible. Frequently, volunteers are only mentioned in publications that emerge from citizen science projects, but you should consider whether volunteers might be eligible for authorship, especially when they have been heavily involved in many different aspects of the project.

4 The benefits of university libraries in promoting and organizing Participatory Science activities

Involving librarians in participatory science activities brings multiple benefits to them, contributing to their professional development and broadening their skills. By working with researchers and the community, librarians improve their knowledge of scientific methods and become facilitators of research processes. Such involvement also gives them the opportunity to build interdisciplinary networks and strengthen their role in promoting education and innovation. Moreover, active participation in citizen science projects enables librarians to contribute directly to the creation and dissemination of knowledge, adding value to the institutions in which they work.

The authors, Dolores Mumelaš and Alisa Martek, counselors of the National and University Library of Zagreb, Croatia, categorized the benefits of participatory/citizen science for libraries into two categories: external benefits and internal benefits. External benefits refer to the library's impact on the wider community, including partnerships with other organizations, attracting new users, and creating visibility in the media. Internal benefits, on the other hand, focus on improving the library's internal processes and capabilities, such as collection development, capitalizing on staff expertise and personal development.

External benefits:

- Developing partnerships
- Recognition as partners in various scientific fields
- Training citizens in participatory/citizen science

- Advocacy
- Attract new library users
- Media recognition

Internal benefits:

- Staff personal and professional development
- Service development
- Building on existing staff skills
- Material benefits

Thanks to their considerable contributions in providing resources and support for learning and research, academic libraries are recognized as collaborative **partners in various scientific fields**, contributing to the development of education in different scientific fields. By supporting this model, libraries put themselves forwards as promoters of inclusion in the knowledge creation process, thus strengthening their role as relevant and innovative institutions in society. This approach encourages the active participation of citizens in research, which not only increases the accessibility of data, but also develops a shared responsibility for scientific subjects. By supporting citizen science, libraries promote the idea that the public can make a significant contribution to the research of scientific content. In addition, the creation of a dedicated function, such as Open Science staff, within the library can become a new library service that will add value to academic libraries.

Involvement in participatory research initiatives enables university libraries to **develop partnerships** both within their internal organizational structure and with external entities. Internally, libraries can establish collaborations between different departments, promoting a multidisciplinary approach to citizen science projects. Trine Kaarsted, who is known for her contributions to the field of citizen science and libraries, and is involved in initiatives aimed at using the existing skills of library staff to support and promote open science research, recommends that academic libraries actively seek partnerships by getting involved in working groups of their university's research projects, networks or consortia of existing projects. Alternatively, they can initiate new collaborations to expand the impact and resources available, which may be other universities, civil society, government entities, the education sector, the private sector, etc. These collaborative efforts contribute to the library's ability to support and enhance citizen science activities, expand its network, and create a more robust ecosystem of shared knowledge and resources.

Oftentimes, citizen science projects engage the community in research, giving libraries an excellent opportunity to **attract new users** who would not normally use library services. In this way, libraries have the opportunity to expand their user base, attracting people interested not only in scientific exploration, but also in various services and resources they offer. The participation of librarians in participatory science initiatives helps to promote the image of libraries and their role in society.

University librarians have a diverse range of skills and competences essential for supporting participatory/citizen science, having already experience of implementing and promoting open access in academia. By integrating these competences into participatory/citizen science initiatives, academic libraries can make a significant contribution to the success of scientific projects, maximizing their impact and effectiveness.

The active participation of librarians in participatory science projects **contributes to the development of their skills**, such as project coordination and management, analyzing and interpreting research data. This involvement gives them the opportunity to get acquainted with new

methods and techniques, thus fostering a deeper understanding of collaborative research and contributing to their professional and personal growth. In addition, the experience gained can add value to library services, strengthening the library's role in the community and in academia.
Involving librarians in participatory projects offers them various material benefits. Participants in these projects have access to state-of-the-art research infrastructure and specialized materials needed to conduct research. In addition, some projects financially compensate participants' contributions and labor, covering travel and other associated costs. Material benefits may also include recognition opportunities such as prizes and diplomas for contributions made. In addition, participants have the opportunity to attend free courses and workshops that support professional development and further knowledge in the field.

5 Conclusions

Academic libraries can redefine participatory science and strengthen their role as centers of innovation and research collaboration, as they can facilitate interaction between researchers, students and communities, supporting and promoting the development of a more inclusive and accessible scientific ecosystem, thus contributing to the advancement of scientific knowledge.
Through academic libraries, participatory science benefits from an ideal setting to develop and contribute to the advancement of scientific knowledge in an inclusive and accessible way. The resources and infrastructure of these libraries, such as open spaces, technical equipment and databases, can support participatory science projects and diverse research activities.
Close connections between libraries and academic communities also facilitate the integration of researchers and students in citizen science projects. By organizing educational events, workshops and training sessions, libraries can mobilize and educate communities in participatory science, thus contributing to democratizing and expanding access to scientific knowledge.
Participatory science projects bring significant benefits to academic libraries. Externally, they become valued partners in the scientific community, strengthening their role and developing new partnerships. Internally, these initiatives stimulate staff professional development, improve services and leverage expertise. By engaging in such projects, libraries extend their user network and assert their importance in supporting research.
Looking to the future: In a context where open and participatory science are increasingly valued, academic libraries are well positioned to continue to play a decisive role in facilitating these initiatives. They have the opportunity to develop and implement innovative strategies to support and extend community engagement in research:

- Academic libraries can embrace emerging technologies such as artificial intelligence and big data to support the analysis of data collected in participatory science projects, facilitating their interpretation and use in innovative ways.
- Academic libraries can become Hubs of Innovation, providing spaces for interdisciplinary collaboration where researchers, students and community members can develop new projects together, stimulating creativity and the exchange of ideas.
- Through educational programs and workshops, libraries can contribute to increasing scientific literacy among the general public, thus encouraging more active involvement in participatory science projects.

- University libraries can create and manage digital platforms to facilitate access to participatory research data and results, ensuring that they are available and accessible to all interested parties.
- By strengthening partnerships and creating new collaborations with research institutions, non-governmental organizations and local communities, libraries can extend collaborative networks, bringing a greater diversity of perspectives and contributions to participatory science projects.
- University libraries can support interdisciplinary projects that integrate different fields of knowledge, promoting a holistic approach to complex problems and encouraging synergy between different scientific disciplines.
- Libraries can play a key role in promoting sustainable practices in research, ensuring that participatory science projects are both innovative and environmentally and socially responsible.

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