From Data to Development: Citizen Science in Urban and Regional Transformation

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Citizen Science (CS), community engagement in data collection and analysis for research projects in societal issues, is increasingly employed in the implementation and support of innovative public policies. CS provides the academic community with new data by enabling citizens to participate actively in scientific research, thereby establishing a foundation for collaboration between volunteers and academia (Bonney et al., 2009). Specifically, CS projects not only make science more engaging for the public but also help participants gain a deeper understanding of scientific concepts. These projects typically aim to produce new knowledge and tangible scientific outputs, a characteristic that distinguishes CS from other forms of science education and public engagement, which tend to focus primarily on the dissemination of finalized research results (Reynolds et al., 2021). Additionally, for the proper evaluation of this method, the EU has developed a platform of tools for measuring the costs and benefits of CS. The impacts of the CS are assessed within the framework of five sectors, namely, Society, Governance, Economy, Environment and Science.

In general, CS can be adapted and applied in different disciplines. The rapid growth of CS initiatives worldwide offers significant opportunities, like fostering cohesion within the CS community and establishing a shared global purpose, while simultaneously promoting the continued creativity of CS activities. Therefore, the European Citizen Science Association (ECSA) set out the ten basic principles as a base for good practice in CS (Robinson et al., 2018).

This study examines how CS initiatives contribute substantially to contemporary regional development and urban planning practices, fostering collaborative governance at the regional level. Integrating CS into local development strategies not only improves the quality of planning outcomes but also empowers communities to actively shape their urban and regional environments. This method highlights the potential of participatory science to bridge the gap between local knowledge and formal planning processes, offering a different approach for sustainable regional development. Despite its potential, the integration of CS into urban and regional planning encounters structural barriers like data quality assurance and consistency, digital divide, and need for sustained funding. Addressing these challenges requires clear communication and standardized protocols that ensure CS projects proper implementation (Beck & Mitkiewicz, 2025).

This paper synthesizes literature and case studies – projects to underline the impact of CS initiatives on regional development and urban planning. By aligning participatory research with regional policy objectives, CS can become a very significant urban planning method for resilient, sustainable and socially inclusive development strategies (Franco & Cappa, 2021).

In addition, CS can be a powerful tool. This method is excellent for scientific discovery and public awareness, especially in issues related to environmental sciences and biodiversity. However, it is not always the most suitable approach for every research subject and should not be regarded always as a low-cost procedure as it requires resources, time and continuous support (Tweddle et al., 2012).

Furthermore, CS offers significant innovative potential for science, society and policy. It can contribute to achieving environmental and conservation goals in three main ways, knowledge generation in basic or applied science and society-related problems, learning opportunities like acquiring new skills and environmental literacy and civic participation by empowering citizens for more active involvement and more social responsibility for significant local issues and beyond (Turrini et al., 2018). Similarly, according to Angelakis et al., (2025), CS aims to improve knowledge production and data collection, the active participation of citizens in social issues and the understanding of serious issues of modern society, such as environmental pollution or climate crisis. Specifically, citizen engagement develops emotional, and social skills and enhances their sense of belonging to the community, promoting social justice (Ivanjko et al., 2023).

The evolution of smart cities and technological advancement contributed to the emergence of CS as a powerful tool for shaping sustainable regional development and urban planning (Beck & Mitkiewicz, 2025). CS fosters collaboration between public and private sector actors, empowering citizens to contribute to the sustainable development of cities. This process reinforces trust-based relationships between public institutions and citizens, thereby enhancing social cohesion (Franco & Cappa, 2021).

In recent years, it has increasingly been believed that a liveable city does not only consist of good infrastructure and sustainable energy supply, but also citizen input and feedback. Citizen design Science is a new strategy, particularly innovative, for urban planning that aims to integrate citizens' ideas and aspirations into the city design process (Mueller et al., 2018). In the context of regional development, this method strengthens communities to identify local gaps and needs, monitor resources, and participate in decision-making processes, supporting social cohesion. Through participation in the project, community members developed skills in organizing and communication, empowering them to engage in policymaking and decision processes at both local and state levels to tackle environmental injustices in their communities (Bonney et al., 2016).

Furthermore, as for urban planning, CS projects can foster data-driven planning about land-use, urban sustainability and social-ecological resilience (Newman et al., 2017). Specifically, by engaging local communities in data collection and monitoring, CS initiatives like air and water quality monitoring or road traffic monitoring can help create adaptive and sustainable urban environments, thus they provide important insights into environmental, social, and infrastructural challenges that are often overlooked by traditional top-down approaches. Particularly, the core socioeconomic

impacts of CS projects are fostering community empowerment, engagement, and educational opportunities (Beck & Mitkiewicz, 2025).

As a result, CS makes a significant contribution to urban resilience by acting as a bridge between local data collection, community empowerment, and adaptive governance. Future developments should prioritize the active involvement of citizens in more analytical roles, rather than instrumental ones like data collection, in CS projects and explore CS in social urbanism for transforming vulnerable communities (Beck & Mitkiewicz, 2025).

In conclusion, CS is an innovative method of participatory research that actively involves volunteer citizens in scientific investigations aimed at generating new knowledge or understanding. This type of science is a dynamic research methodology that offers significant benefits for both individuals and the academic community, ultimately contributing to the cultivation of a closer relationship between science and society. In the context of urban planning and policy, CS initiatives have the potential to enhance data-driven planning, urban sustainability, urban resilience, healthier cities, and social equity.

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