PROCEEDINGS OF SCIENCE

Exploring the potential of citizen science: science transformation through citizen involvement in health, conservation and energy research

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The project STEP CHANGE (Science Transformation in EuroPe through Citizens involvement in HeAlth, coNservation and enerGy rEsearch), funded by Horizon 2020 and launched in March 2021, is implementing five citizen science initiatives (CSIs) in the fields of health, energy and environment. The CSIs will tackle the issues of wildlife conservation in Slovenia, non-alcoholic fatty liver disease in the UK, energy communities in Germany, infectious disease outbreak preparedness in Italy, and off-grid renewable energy in agriculture in Uganda. The project will bring novelty in citizen science research while contributing to broader science aspects. The overall objective of STEP CHANGE is to explore the potential of citizen science and to formulate recommendations and instruments for better cementing this approach within research and innovation institutions as well as changing researchers' mindsets on the value of CS. The project, which aims to make science more socially robust, inclusive, and democratic, will ensure that research institutes make the most of what citizen science has to offer, whilst also identifying, analysing, and limiting the associated risks. Our presentation includes main features of the project, and provides an overview of the multifaceted methodology STEP CHANGE makes use of to foster alignment of CSIs with local contexts, nurture mutual learning, and encourage self-reflection through the means of participatory evaluation exercises. Hence, the presentation provides details about the CSIs but also about the horizontal activities of the project (scoping exercise, mutual learning and training activities, participatory evaluation, and stocktaking process), which have been designed to increase the relevance, inclusiveness and sustainability of the initiatives. In this respect, we also focus on the three levels of participation of the CSIs (core team members, citizen scientists and other stakeholders), to explain the mechanisms put in place to boost the level of engagement.

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Citizen science addresses the transformation processes affecting science in complex settings, leading to greater openness to society in terms of research content and actors involved. This paper describes the development of five citizen science initiatives (CSIs), addressing transformation processes in the context of the Step-Change project. The main aim of the project is to explore the potential of citizen science while providing instruments and formulating recommendations for better cementing this approach within research and innovation organisations. The project is funded under the H2020 programme and draws on the expertise of 11 partners from seven European countries and Uganda, i.e. the University of Primorska (Slovenia, coordinator), Oxford University Hospitals NHS Foundation Trust (UK), Women Engage for a Common Future (Germany), University of Rome Tor Vergata (Italy), Science for Change (Spain), Knowledge & Innovation (Italy), Aarhus University (Denmark), Centre for Social Innovation (Austria), European Citizen Science Association (Germany), European Science Engagement Association (Austria), and Action for Rural Women's Empowerment (Uganda).

Step-Change is implementing CSIs in the fields of health, energy and environment. The project addresses the issues of wildlife conservation in Slovenia, non-alcoholic fatty liver disease in the UK, energy communities in Germany, infectious disease outbreak preparedness in Italy, and off-grid renewable energy in agriculture in Uganda.

In Slovenia, the University of Primorska is developing an experimental data collection campaign as a tool for the involvement of non-professional citizens in wildlife data collection. The campaign, which will target beginners such as outdoor enthusiasts, camera trappers and photographers, invites hunters and non-hunters to collect data about wildlife presence via an app for mobile devices. The app was designed in autumn 2021 and tested on a sample of hunters and wildlife researchers. A co-designing process was initiated involving, among others, a quiz for wildlife identification, which was piloted and integrated into the app. A protocol for data collection was developed in close cooperation with the Hunters Association of Slovenia, which provided extensive advice about data collection, in particular through camera trapping. The ultimate goal of the CSI is to harness the potential of citizen science with the aim of both supporting evidence-based policymaking and raising awareness on biodiversity and conservation issues.

In the UK, the NIHR Oxford BRC is coordinating a translational research experiment in the metabolic endocrinology field, which is being carried out based on a citizen science

approach. The main objective of the CSI is to develop a better understanding of the diurnal variation of hepatic lipid metabolism in overweight patients in different types of conditions, before and after a lifestyle intervention, comprising a weight loss program. Data collected in this field will be integrated with other qualitative information related to daily life, wellbeing and lifestyles of the participants. This will allow comparing the bio-medical measurements with patient daily experiences and with other forms of socio-cultural stress patients are exposed to. In this framework, the Step-Change project will contribute, with the support of citizen scientists, to develop new screening tools and novel interventions with the ultimate aim of improving patient care.

Neighbourhood electricity sharing mechanisms is the main focus of the CSI coordinated by Women Engage for a Common Future, in Germany. The initiative will in fact assess the potential benefits and the main setbacks of neighbourhood electricity sharing by developing three case studies in three diverse energy communities. Data on energy consumption and production will be collected continuously for one year, and the households involved will receive a monthly report about their consumption as well as have real-time access to their data. Moreover, living labs will be developed in each of the communities which are part of the initiative. By directly engaging citizens as scientists, the CSI will shed light on both the potential and barriers of these energy sharing mechanisms. The initiative will tackle this issue in an energy citizenship perspective, namely focusing on three different dimensions: energy consumptions, energy-related lifestyles, and energy culture.

In Italy, Step-Change is investigating how citizen science or similar approaches have been carried out with a specific focus on the Covid-19 pandemic. Building on these analyses, a taxonomy of existing and potential citizen science interventions will be developed, tailored to different types of diseases and epidemiological behaviours. Selected relevant initiatives will be further analysed, and on-site visits to the places where the initiatives have been implemented will take place to gather more information and data. Based on the results collected and the development of the taxonomy, the CSI, which is coordinated by the University of Tor Vergata, will co-design a citizen science strategy for infectious disease preparedness in Italy. The strategy will aim at raising awareness on the role of citizen science as a relevant tool to be incorporated into institutional and scientific practices for a better management of infectious disease outbreaks.

Finally, the Step-Change project will generate knowledge about the impact of renewable energy technology for productive use in rural Uganda via a citizen science approach.

Citizen scientists selected from farmers of six agricultural cooperatives and interested communities will participate in the CSI. The initiative, coordinated by the Action for Rural Women's Empowerment in Uganda, explores to what extent the adoption of renewable energy in agricultural production can be a useful way of responding to the increasing energy demand of the sector as well as a vehicle to promote social and environmental sustainability. Building on lessons learnt, the CSI will collect evidence on the potential of up-scaling these experiences to the whole region while providing an estimation of the up-scaling potential at the national level.

In all CSIs, diverse groups of citizens and stakeholders will be mobilized and recruited. This will not only increase the relevance of the project to a diverse set of social groups, including disadvantaged ones, but also provide the opportunity to integrate their needs, potential and priorities in an inclusive and intersectional perspective [1]. The CSIs will result in novel means of social inclusion by engaging in their research a variety of stakeholders and citizens of different ages, genders, income, and nationalities. Since the very beginning of the Step-Change project, CSIs have been encouraged to understand the social realities and contextual conditions of the areas they are located in. In citizen science, in fact, real inclusion is more likely to occur if issues are framed around participants' values, focusing on local conditions and tangible concerns. More specifically, measures fostering the inclusion of both men and women have been included, as well as strategies to engage with low-income families and migrant status people who are traditionally underrepresented in science.

In order to go beyond a purely contributory vision of citizen science, the project has planned a series of targeted activities to ensure a wide-ranging participation of citizens in all phases of the implementation of the CSIs, including the very first ones, such as the design phase. Four types of horizontal, cross-cutting activities have been designed in the project, e.g. a scoping exercise, a mutual learning and training activity, a stocktaking process, and an evaluation exercise. The CSIs have been supported through a scoping exercise that has prepared their implementation. This exercise has been designed to ensure that the synergy between each CSI and the territory in which it takes place is well established. This activity is linked with the need of fostering societal anchorage of the initiatives, thus increasing their relevance, significance, feasibility, and sustainability from the onset. To maximise its impact, Step-Change is making use of a multifaceted methodology not only fostering alignment with local contexts and boosting the participation of citizens throughout the whole timeline of implementation of the

initiatives, but also by nurturing mutual learning and encouraging self-reflection [2]. A set of support actions, mainly consisting of citizen science training activities, has also been planned to facilitate transdisciplinary work. Within this framework, different training formats targeting the CSI core teams have been arranged, and capacity building of citizen scientists and extended participants is fostered.

In the final months of the project, a stocktaking exercise will be conducted with the aim of ensuring long-term support to citizen science, as well as to encourage a better institutional anchorage of this practice in the broader scientific community. Building on the outcomes of the project, this work will also produce a model of Research and Innovation socialisation through citizen science to be addressed to researchers, citizens, businesses and policymakers, consisting of both analytical and operational components. A Citizen Science Navigator will be created to support interested researchers in the development of citizen science initiatives. The Navigator will feature conceptual, methodological and practical aspects of citizen science, and will build on the results of Step-Change as well as on tools developed in the frame of other citizen science projects.

Finally, the evaluation component of the project applies a participatory and developmental approach to map the most valuable dimensions of the research conducted within the CSIs, and identify indicators, taking into account the diverse perspectives of the involved stakeholders, and at the same time provide occasions for self-reflection and feedback on the design and implementation of the CSIs [3]. The developmental approach, used for evaluating complex social interventions with a high level of uncertainty, is a participatory, reflexive and non-judgmental process that contributes to the work of the CSI implementing teams with proactive support [4]. It is focused on the social processes underlying the CSIs and on the identification and anticipation of potential risks affecting them, rather than on simply mapping the gap between a set of established objectives and the ex-post project outcomes. In this process, the evaluation of the CSIs in itself is designed and implemented as a CSI, which can be considered as an additional, cross-cutting citizen science experiment within the Step-Change project [5].

The citizen science approach adopted in the Step-Change project may be part of a broader process of change in science and can play an important role in engaging citizens in science, thus mitigating the decreasing trust in science and the tensions stemming from the reorganisation of science and the transformations of the science and society relationship.

References

[1] European Citizen Science Association, *Ten Principles of Citizen Science,* (2015). https://doi.org/10.17605/OSF.IO/XPR2N

[2] P. Klaassen, L.Verwoerd, F. Kupper, & B. Regeer, Reflexive monitoring in action as a methodology for learning and enacting Responsible Research and Innovation, in *Assessment of Responsible Innovation: Methods and Practices*, eds. E. Yaghmaei & I. van de Poel, Routledge, London (2020).

[3] B. Kieslinger, T. Schaefer, F. Heigl, & D. Dörler, *Evaluating citizen science—towards an open framework*, UCL Press (2018).

[4] M. Q. Patton, *Developmental Evaluation. Applying Complexity Concepts to Enhance Innovation and Use*. Guilford Press, New York (2010).

[5] D. Byrne, Evaluating complex social interventions in a complex world, *Evaluation* **19**, 3 (2013) 217-228.