Citizen Science for Multi-Risk Applications and Behavioural Change

Insights from the I-CHANGE Project

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Take-Home Messages

To achieve the maximum benefits, citizen science activities must be rooted in both scientific (evidence from measurements and observations of the environment) and local knowledge (history of the target area), empowering citizens with the possibility to make a difference.

Technological and non-technological tools offer a powerful possibility for engaging citizens by offering practical means to sense the environment, learn and increase personal awareness, and challenge friends to have an impact. All of this contributes to generating a willing community and providing a long-term perspective to any activity while generating innovative and resourceful data.

Citizens are volunteers, fuelled by motivation and rewarded by the difference their actions can make. Challenges, whether individual or collective, are a great way to motivate participants and support the long-term efficiency of citizen science.

I-CHANGE
CITIZEN ACTIONS ON CLIMATE CHANGE AND ENVIRONMENT

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I-CHANGE

Citizen Actions on Climate Change and Environment

I-CHANGE is an Innovation Action project which started in November 2021 and ends in April 2025. It aims to demonstrate how behavioural change of individuals is possible through citizen science initiatives and citizen tailored Information and Communication Technologies (ICT) solutions. I-CHANGE collected environmental and socio-economic data using novel, user-friendly tools such as sensors, monitoring devices, simplified models, and data resources across eight Living Labs. These labs span diverse morphological and geo-climatic conditions, thereby addressing various environmental hazards. The eight I-CHANGE Living Labs are placed in Amsterdam (The Netherlands), Barcelona (Spain), Bologna (Italy), Dublin (Ireland), Genoa (Italy), Hasselt (Belgium), Jerusalem (Israel) and Ouagadougou (Burkina Faso). The promotion of a co-designed learning approach improved citizen knowledge of climate change related to harmful impacts, and helped citizens understand how a behavioural and consumption shift towards sustainable patterns can make a difference.

The usability and interoperability of the collected data has been improved through a dedicated Environmental Impact Hub.

The I-CHANGE Concept and Approach to Citizen Science

Strict regulations establish the global standard for meteorological data collection and quality assurance, requiring official data providers to adhere to protocols for accurate information dissemination. Challenges arise in complex terrains, like urban areas and mountains, where standard installation protocols for weather stations are often not met, leading to insufficient environmental assessments. Citizen science can help bridge this data gap through extensive monitoring capabilities, but the lack of protocols can result in inconsistencies, limited long-term sampling and scientific rigor. **This raises scepticism about adopting citizen science data among institutions. At the present stage, support from research institutions is essential to validate and improve citizen science data quality, but a more structured approach is needed for its long-term integration into monitoring systems.**

The I-CHANGE project encourages behavioural change among communities and single citizens for adaptation and mitigation of climate change by empowering individuals through a thorough understanding of their options. To promote a genuine and long-lasting transition towards more sustainable patterns, I-CHANGE places the people and civil society at the centre of environmental protection and climate action towards resilience. **I-CHANGE's approach to citizen science combines the expertise of the local community with the evidence-based knowledge produced by practical activities** that include not just technology tools like sensors and applications but also serious games and participatory learning[1]. **Universities, in collaboration with local stakeholders, have become advocates for environmental and climate education**. Thanks to successful transdisciplinary expertise, the citizen science initiatives deployed in the I-CHANGE Living Labs serve as a collective testbed to deliver methodology and inspire good practices through the project lifetime and beyond. Their spirit is **to foster a shared evidence-based understanding of various elements of climate change, allowing citizens to challenge themselves or their communities to be more resilient**. Through the adoption and use of tools, the dissemination of knowledge, and the capacity to link these activities with the appropriate stakeholders of each Living Lab, citizen science initiatives in I-CHANGE have been successful.

Multiple Living Labs, One Methodology

In extreme synthesis, citizen science activities can be classified by their scope to (i) increase awareness of climate extremes and promote adaptation, (ii) promote the identification of mitigation strategies, and (iii) identify sustainable behaviours among consumers. To maximize their impact, all activities insisting on a specific territory must cope with the needs and predispositions of the local population to realize them. The distribution of the project's Living Labs around EU and non-EU countries and the different areas of action that the project tackled in each of them is a source of granularity and disconnection for the fulfilment of citizen science initiatives. The citizen science experiments and campaigns conducted in the I-CHANGE Living Labs can indeed be classified into three different groups: (1) activities related to the **observation of extreme weather phenomena and early warning systems** (temperature, precipitation); (2) campaigns and activities related to **mitigating environmental impact, such as air pollution;** (3) campaigns aimed

at analysing **the sustainability of behaviour and consumption patterns related to waste management and sustainable energy production**. Ultimately, the citizen science initiatives developed within I-CHANGE have followed a similar structure, despite advocating for different objectives. Each activity foresaw: (i) an **initial co-design stage** where the scope of the activity was proposed to the community and the realization discussed; (ii) a **selection of the tools** to be adopted for the scope; (iii) the **activity realization and data collection**; (iv) a **contextualization of the obtained results** and (v) a **discussion of the outcomes** and potential implications for themselves and the environment. This structure framed a common workflow for the implementation of citizen science activities inspired by I-CHANGE, as depicted in **Figure 1**. Tailoring this framework to the requirements of each Living Lab, a set of lessons learned have been extrapolated from the initiatives.

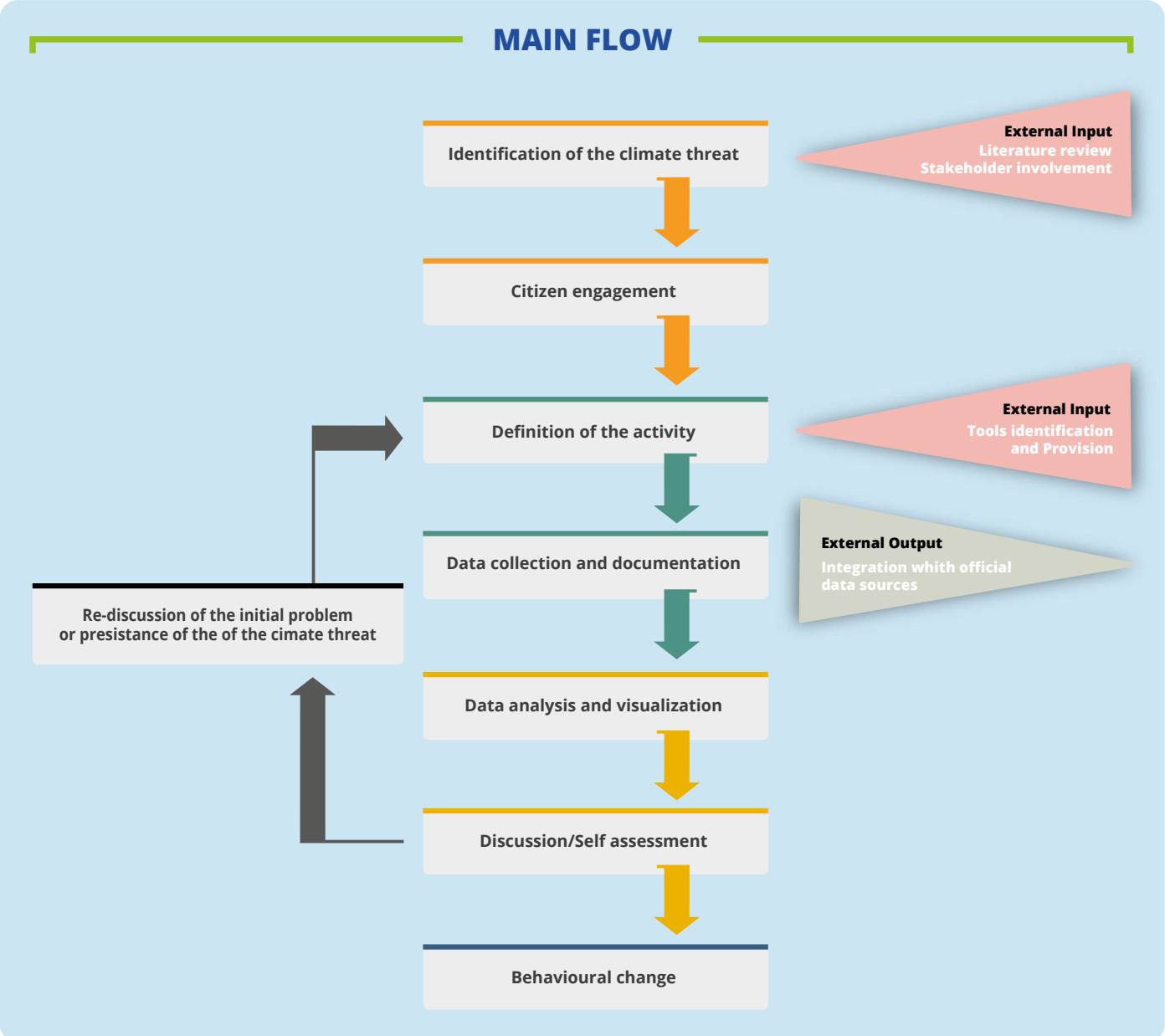

Figure 1: *Workflow for citizen science activities within the I-CHANGE project.*

Recommendation from Citizen Science Activities within I-CHANGE

Owed to the experience gathered from many citizen science initiatives designed and implemented in each of the I-CHANGE Living Labs, **key lessons learned** have been extrapolated, emphasizing the **usage of sensors** to gain a deeper understanding of processes and phenomena responsible for climate change **as well as behavioural change-promoting actions**:

- **Easy tool, easy activity:** the winning strategy for sensing the city is the adoption of ready-to-use sensors, that can provide real-time visualization of the collected data in an enjoyable, yet meaningful, way. This aspect was particularly evidenced when citizens were using MeteoTrackers[2] to perform the monitoring. The reason is twofold, and it is linked to the functioning mechanism of the sensor: (i) the sensor must stay connected to the personal smartphone, continuously sending the measurements directly to it. Real-time data are likely to be repeatedly seen even by a distracted user by the simple process of using the smartphone for any common reason; (ii) the sensor operates while moving, so it needs active travel to perform the measurements. Once again, it is more likely that a user is affected and reacts to the monitoring if the monitoring itself is active, i.e., it requires daily management of the sensor. This procedure is different from traditional environmental monitoring devices that are set in a fixed place to measure continuously and independently from user operations, thus decreasing the level of attention to the collected data.
- **More is more:** splitting a citizen science activity into multiple events helps to achieve a greater goal and constantly refreshes the participants' enthusiasm. It works best when a measurement campaign is divided into several consecutive stages performed in different sessions (e.g., choosing a problem, designing a solution, collecting data with the sensor, and analysing the results), to finally reach a goal. This makes it possible to combine theoretical knowledge (lectures, workshops), easing the transition from raising awareness of a known problem to experiencing it in everyday life and reacting to it. This process has proved particularly productive when initiatives are carried out with schools, where climate resilience programs can benefit from active participation from the students.
- **Repetita iuvant:** repeating an activity with different working groups is a simple way to increase participation. This is especially the case when your supporting tools require a maximum number of users. Data collected also becomes comparable among different groups, providing a contact point between them and adding value to the discussion.
- **Multi-risk assessment:** tackling multiple climate threats with a single activity stimulates discussion and behavioural change. The complexity of daily human activities is such that everyone is likely to be affected by multiple climate and environmental risks. **To gain an effective behavioural change and start decreasing the environmental footprint, solutions must be effective and efficient for multiple everyday problems at the same time**. The most explored example within the project of integrated problems is linking mobility with air quality. Developing sustainable mobility roots through everyday life scenarios (serious games) or by collecting evidence of spatial air pollutant distribution (air quality monitoring) can provide solutions to both problems. Another example is offered by waste management and flooding risks: with correct and sustainable waste management, the risk of obstruction of drainage channels effectively decreases, with co-benefits for the preservation of the ecosystem and human health.
- **Challenging spirit:** structuring the citizen science activities in a competitive, yet fun, initiative increased the impact of the achieved results. The promotion of behavioural change passing through the idea of challenging themselves or a community to achieve a result has been effective. A virtuous example is given by the carbon footprint calculator

(ChallengeYeti App): a project application designed to engage people with various challenges to be tackled singularly or involving a community, aimed at reducing the personal environmental footprint. The board game "Our Climate Story" is another good example where small communities compete to find more sustainable solutions for everyday problems.

A Compelling Example of a Transnational Citizen-Science Activity: the I-CHANGE Day

The I-CHANGE Day was a joint initiative of the I-CHANGE Living Labs that took place on June 5th, 2024, to favour behavioural change through common citizen science activities that enabled participants to collaborate with international peers who performed the same activity at the same time in the other Living Labs of the project. The climate and environmental issues addressed by the I-CHANGE Day were air pollution and thermal comfort. Through the use of the Smart Citizen Kits[3], participants were able to collect air pollutant concentrations in selected hot spots within each city and compare the level of air pollution within their city and with the other Living Labs, thanks to a real-time sharing of the measurements. Through a dedicated cycling and/or walking experience, citizens collected data on air temperature and humidity with the MeteoTrackers along a selected route across critical neighbourhoods and popular areas of the cities. This last monitoring activity was linked to an evaluation of personal thermal comfort perception in multiple stops along the cycling/walking route for a self-assessment compared to monitoring data.

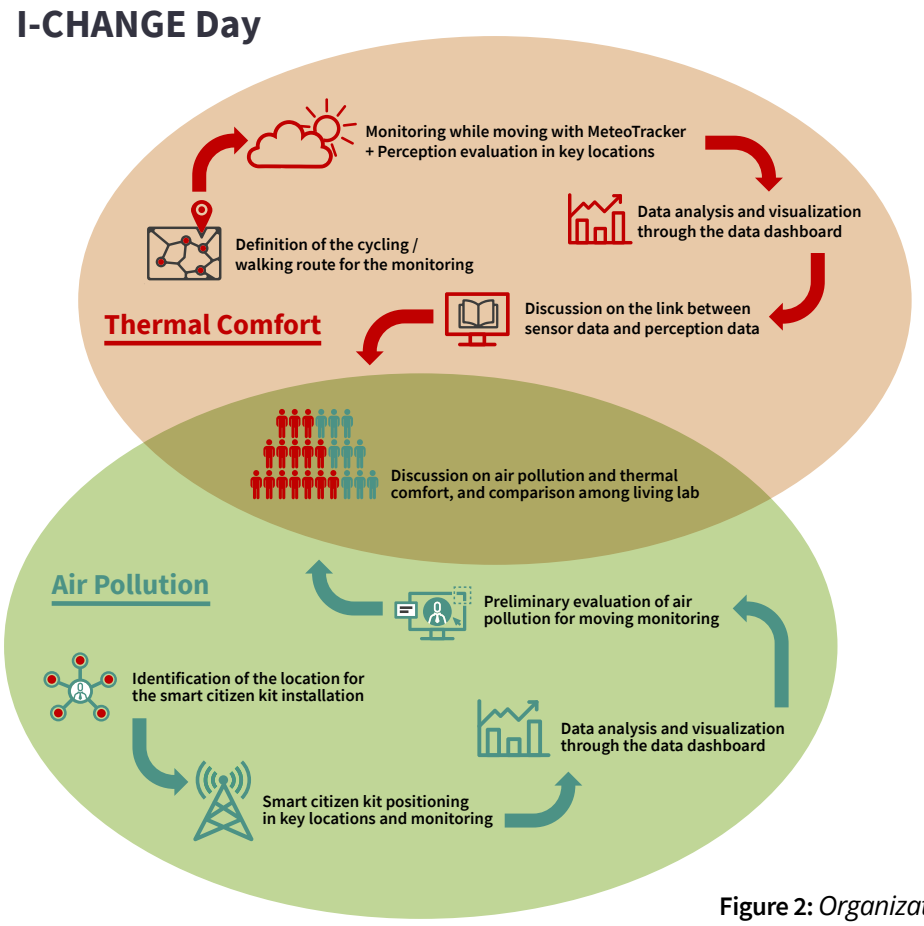

Figure 2: *Organization of the I-CHANGE Day.*

The whole initiative allowed us to collect useful environmental and perception data to identify vulnerable areas and safe routes, promote sustainable behaviours, share and compare evidence across Living Labs, and enhance the visibility of the I-CHANGE project within the communities. The organization of the activity was based on the diagram in **Figure 2.**

The I-CHANGE Day activities attracted over 600 community members across the various Living Labs. Sampling approaches included collaborations with non-governmental organizations, local government, and community organizations to recruit participants, with specific outreach via social media and direct contacts. These efforts helped ensure diverse participation and provided valuable insights into how different demographic groups perceive and engage with climate data.

Read More

The content of this brief is based on the following key project deliverables: D1.4 "Evaluation framework for the analysis of behavioural changes"; D2.2 "Local implementation plans for each partner city"; D2.3 "Framework for monitoring tools for I-CHANGE citizen science activities"; D2.4 "Living Labs experience in near-EU countries"; D3.6 "Citizen science community report"; D4.4 "Implementation and update of an app for carbon and environmental footprint"; D4.5 "Implementation of citizens tailored apps for environmental and weather monitoring"; D4.6 "I-CHANGE dashboard for citizen-oriented data analytics and visualization"; D5.5 "Lectures and workshops materials of Climate Action Training Schools as MOOC"; D5.6 "Production of a printed game-pack available also through the I-CHANGE dashboard"; D6.8 "Policy briefs for different policy levels". **All deliverables are available on the I-CHANGE website https://ichange-project.eu/**

[1] To consult the full list of technological and non-technological tools developed and adopted by I-CHANGE, have a look at the project website (https://ichange-project.eu/) and dashboard (https://citizens4climate.com/).

[2] MeteoTracker (https://meteotracker.com/) is a system for agile and accurate weather data measurements on the move, targeting the professional and amateur (Citizen Science) sectors.

[3] The Smart Citizen Kit (https://smartcitizen.me/) is a set of low-cost, portable and easy-to-use modular hardware components providing measurements of a set of environmental variables.

Acknowledgement and Disclaimer

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