CitiMeasure - using citizen measurements to create smart, sustainable, and inclusive cities

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Authors (Partner)	Eurocities		
Responsible Author	Mohammad Gharesifard	Email	Mohammad.gharesifard@eurocities.eu
Partner	Eurocities		
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Acronyms

BZK	Ministry of the Interior and Kingdom Relations of Netherlands
DIY	Do it Yourself
NGO	Non-Governmental Organization
QR	Quick Response
Scivil	Flemish Citizen Science network
UK	United Kingdom

1 Executive Summary

This report presents the case studies of the CitiMeasure pilots. The main aim is to share the lessons learned from each pilot in a narrative way. To do so, these case studies focus on the impact of the pilots as well as the experience of the teams implementing them. The current report can also serve as inspiration for how to communicate about the project's impact.

2 Introduction

2.1 ABOUT CITIMEASURE

Citizen measurement (or citizen science) initiatives contribute to a sustainable transition in European cities. By using an array of tools and instruments, citizens can play a role in the measurement and monitoring indicators on air quality, temperature, soil moisture, biodiversity, or risk management, among other environmental areas. Citizen measurement initiatives also can foster communications and interactions among stakeholders and contribute to the democratisation of science and policy. The CitiMeasure project (2021-2023) aims to bring together the experiences and expertise of European cities, organisations and networks in implementing citizen science initiatives (in the form of guidelines, toolbox, web-platform, Apps, etc.). The project builds upon the lessons learned from the Dutch City Deal Working Groups, a network of stakeholders working on the broader area of smart cities, including citizen measurement initiatives. The City Deals are an instrument of the Dutch Ministry of Interior Affairs and Kingdom Relations. One of these City Deals is the City Deal 'A smart city'.

CitiMeasure builds upon these experiences and will use those to develop and pilot three 'instruments', namely:

1. An instrument that allows the outputs of different city measurement initiatives to be compared.
2. An instrument that safeguards the digital inclusivity of city measurement initiatives (maximising the opportunities for participation of interested individuals and communities).
3. An instrument that connects information to behaviour and policy change.

A 4th (Strategy and Oversight) working group focuses on providing strategic direction and ensuring cohesion of activities across the three Instrument Sub-Groups and the project in general. CitiMeasure will also raise awareness of the importance of citizen measurement initiatives and capitalise on the results and tools of similar citizen science projects by creating an online European Knowledge Centre with a repository of good practices.

2.2 PURPOSE OF THIS REPORT

This report aims to capture and present case studies of each pilot, as well as the impact produced and reflection about the whole process as a narrative.

2.3 STRUCTURE OF THE REPORT

This report is structured as follows: Section 3 presents the pilot case studies with this section structured per pilot case and provides a story about the impact and rationale of each pilot; The report is concluded in Section 4, with some remarks and elaboration of next steps.

3 CitiMeasure pilot case studies

Deliverable 1.9 included a detailed explanation of the implementation of the CitiMeasure pilots. These case studies, however, focus on the stories and impact behind the implementation process. To extract more information about the pilots, Eurocities' communications specialist interviewed the contact at each pilot. The case studies thus provide a narrative about the pilots, which focuses on the pilots' rationale and the initiatives' impacts.

3.1 SMARTWATERLAND – THE CITY OF ROESELARE

Residents of Roeselare, a city in Belgium, have been experiencing abnormal droughts and intense rainfall in recent years, leading to catastrophic floods. To avoid rainfall consequences, the council involves students in collecting precipitation data via a fine-mesh network of pluviometers and uses it for managing water in the city in a more innovative way.

Students build the pluviometer in their science class, where "they also learn about geographics, climate change or data," says Jasmin Wellens, Project leader in innovation and digitalisation at the City of Roeselare. "Then, they take these pluviometers home and gather the rain data which they can see in the dashboard on their laptops," she adds. That's how 12 and 13 year old students learn how much rain has fallen, and how to measure the temperature.

Figure 1: Students around the prototype of a pluviometer in Roeselare

"When they have mathematics, for example, they use just the data from a book, but when they can use their own data, it's much more fun," says Wellens. That data is also used in statistics lessons, but its implementation can go beyond that. Agriculture is one of the most significant economic sectors in Roeselare. Still, Wellens explains that "we are suffering from climate change because in summer we have very long dry periods while in the winter sometimes we have floods." That's why it's essential

"to have more insights into this water rainfall to make more evidence-based policy decisions" and better planning, she concludes.

To achieve these objectives, Roeselare city council has worked with several partners in this initiative. One of them, the University of Applied Sciences, developed the package of the digital preview meter, and with a private company, created packages for teachers so that they can just open a book and have all the information on how to build the pluviometer, but also how to explain it in the classroom.

This initiative made the Flemish government award "The Smart in the City" prize to the citizen science project Smartwaterland. Wellens would like to invest the grant in transforming the pilot into a bigger experiment by trying it out in different schools in the city, "or maybe even in other cities in the region," she says.

Smartwaterland was the first citizen science project coordinated by the city council in collaboration with other partners. Through the CitiMeasure pilot, the city aimed to boost the project's potential in two key areas: communication and impact evaluation.

The city aimed to strengthen the project's communication efforts to raise awareness about data, targeting the young and old population, agriculture and other businesses, and internal employees. In addition, there was a need for a tailor-made impact assessment that matches the specific aims and ambitions of citizen science projects. A selection of recommendations included in the CitiMeasure Behaviour & Policy guidelines was used to draft a communication plan and define key indicators and impact domains of the initiative.

3.2 TRAINING WORKSHOPS - THE CITY OF BARCELONA

Citizen science projects can shape urban lives, or even save them. One excellent example is Mosquito Alert, the app that gathers efforts to detect and control the expansion of the tiger mosquito, the yellow fever mosquito and other invasive mosquito species. The initiative investigates and controls disease-carrying mosquitoes among the population.

Other projects can shape policies, like CoAct, which creates research groups that will develop locally embedded strategies to address those issues on a scientific and real political level. It includes citizens social science as a research approach to achieve thematic and local integration, ensuring citizens participate as equal stakeholders, and a focus on bottom-up collaboration for socially robust knowledge production.

The CoAct's approach enabled the provision of socially robust scientific knowledge to promote social change. Research design, data collection, and interpretation for evidence-informed policy and collective action were based on a constant and open dialogue, both with citizens and in the public sphere.

Barcelona (Spain) has one of the liveliest ecosystems encouraging citizen participation in Europe. With the support of the local Citizen Science Office, citizen science projects such as Mosquito Alert and CoAct have flourished in the past years.

Due to its experience, Citimeasure counted on the city's help to shape the CitiMeasure Behaviour & Policy and Digital Inclusion guidelines through feedback and participatory sessions, and contribute to their dissemination. CoAct and Mosquito Alert participated in presenting their challenges and successes in influencing policies in an in-person seminar.

Figure 2: Participants in the seminar in Barcelona on November 17

The interactive session included hands-on exercises to encourage participants to share real experiences and engage in conversations with peers and other actors that they may not discuss with on a regular basis (e.g., the city council staff). The seminar, organised at the Centre de Vida Comunitaria de Trinitat Vella, built upon two previous meetings and events for knowledge exchange with the local citizen science community.

CitiMeasure provided a unique opportunity for representatives of European cities, academia, and (non-)governmental organisations to come together, discuss and identify how citizen science initiatives can change actors' behaviour and enhance their policy impact.

The CitiMeasure Behaviour & Policy Guidelines aim to advance the understanding of policy and behavioural change aspects of citizen science. The result is 65 recommendations under ten overarching categories on how to trigger behaviour change and how to improve policy impacts of citizen science.

This publication is primarily developed to guide those interested in identifying, understanding, and enhancing policy and behavioural changes resulting from citizen science initiatives. It thus targets those initiating citizen science projects or those who aim to study or improve current practices in existing citizen science initiatives. The guidelines include challenges and applications of citizen science and recommendations for cities and citizen science initiatives on how to foster policy and behaviour change using citizen science.

Nevertheless, these guidelines do not result from a systematic and holistic literature review and are not meant to be used as a step-by-step guideline. Rather, they are intended to be taken as a source of inspiration and best practices. Adopting each recommendation should be considered in relation to the context in which an initiative or project will operate and closely linked to its aims.

3.3   SENSOR2SCHOOL (SENZORY DO ŠKOL) – PRAGUE

As with many other European cities, the capital of the Czech Republic, Prague, is facing air quality problems. But now, residents and students can measure the air quality around them. The civic group Senzorvzduchu, z.s. (in English, 'Air Sensor') develops and gives instructions for installing a DIY air sensor. They also organised community-building workshops for those interested in having further information.

"Understanding and measuring air quality by citizens is crucial because it shows that citizen science initiatives can produce valuable information about local air quality," says Michael Lažan, the founder of Senzorvzduchu, z.s.

"Such information can be used, for example, to improve official air quality models to estimate pollution levels and identify suitable actions to improve air quality. We can also identify hot spots in cities where there is a lack of official stations," he adds. The initiatives often help to raise public awareness of air quality problems, which can lead to more robust public measures to address the issue or changes in personal behaviour, such as switching from driving to walking or cycling.

Thanks to Senzorvzduchu, students from two elementary schools, three high schools and six kindergartens, built their own sensors and monitored the results through an information board with a QR code accessible via a web platform. Senzorvzduchu participated in CitiMeasure to build 50 sensors in schools together with students, discussing with them the possibility of citizen measurements and the importance of air quality.

"While performing workshops in schools and working with groups of children I am particularly proud that students who didn't even think before that building electronic devices by themselves is possible are now capable of connecting them, uploading code and instantly measuring data displayed in real-time on a map," says Lažan. Performing various activities connected to handling the data, he says, writing reports and doing "science" is possible even from a young age. Older students are

brainstorming possible future applications of the ground data with connection to satellite data promising new implications in healthcare, agriculture and a deeper understanding of climate.

Figure 3: Students building a low-cost sensor in a school in Prague.

Indeed, surveys revealed acquired knowledge and changes in students' perception of air quality. After the session, more participants knew where to get information about air quality, how to use the sensor and how to interpret results. Also, more respondents stated air quality as a problem.

By reaching students and young adults it is hoped to achieve long-term effects and a deep understanding of the importance of clean air for human health and the environment. "From our experience," adds Lažan, "this topic is now perceived as highly important by students because of its direct connection to climate change."

The initial aim of Senzorvzduchu was to fill up the blank space of sensors between Germany and Poland on the sensor map. The NGO developed a Twitter alarm bot informing citizens whenever the air pollution levels reach or surpass harmful levels.

"It was also nice to have a reflection on the project from other participants. Together we designed a tool for assessing the project's impact by creating pre-survey and after-survey," explains Lažan. "This helped us better understand the change in perception of the topic by pupils. Outcomes are now directly measured and from the results, we can conclude that our work is important and does make a difference."

The interactions with CitiMeasure provided new perspectives as citizen science initiatives are still relatively recent in the local context. For example, after the discussions with the Comparability working group members, the Sensor2School project plans to focus more on inequalities by comparing data and school surveys in deprived regions in Czechia.

3.4 COMPARABILITY TOOL

Engaging citizens in air quality monitoring is a growing trend. In 2019, the European Environment Agency reported that citizen science projects on air quality produce useful information and raise public awareness. The first Zero Pollution Monitoring and Outlook report[1] seeks to promote citizen science for effective and efficient air pollution management. Yet, a tool to dig deeper into the experiences of the cities and organisations implementing these initiatives was missing.

"CitiAIR is not a simple collection of projects," explains Irene Vivas Lalinde, Project Officer at Citimeasure. "It is an opportunity to showcase the power of the involvement of individuals in the fight for healthier environments." Individuals from cities such as Helsinki (Finland), Rotterdam (Netherlands), Rumia (Poland), Ferrara (Italy) or Bobigny (France) have engaged in air quality measurements to inspire behaviour changes, and design targeted local solutions. The initiatives go from street-scale to European and global scales, for example, Sensor.Community with a network of more than eleven thousand sensors worldwide. Different types of devices are used, including passive tubes to low-cost sensors; and these devices measure various parameters.

In addition, some projects shared the challenges they faced, and lessons learned. For example, citizen science on air quality must provide user-friendly technology and engage participants and authorities to set expectations and provide the most impact. This type of approach should not be dismissed solely based on data quality concerns. However, future implementers must be aware of the costs and technical and practical challenges they propose. "There is plenty of resistance in public authorities to support these approaches based on technical concerns," explains Vivas. "While these are valid concerns, I cannot stop but ask myself: Is not citizen science all about respecting and acknowledging that everybody has knowledge and power? For me, CitiAIR is contributing to the democratisation of science, and most importantly, valuing the contribution of the citizen science community in the quest for cleaner air in our cities."

The projects above, and many more, were added to the comparability tool co-designed by CitiMeasure Comparability working group members. The comparability tool (CitiAIR) captures information about different air quality initiatives and the stories behind them (who is doing them, what exactly they are doing, and how they are doing the measurements).

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[1] Link to the report: https://environment.ec.europa.eu/publications/zero-pollution-monitoring-and-outlook-report_en
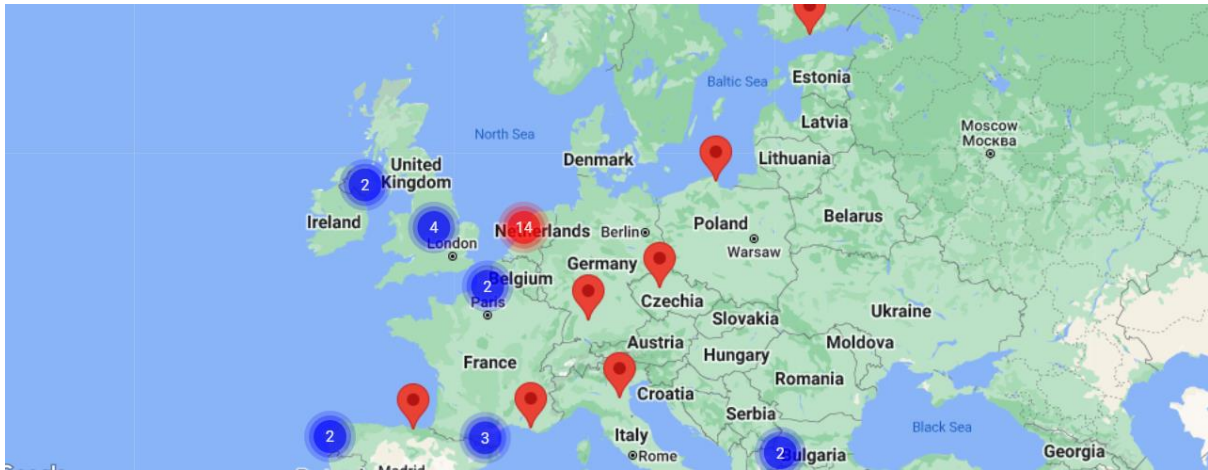
Figure 4: Screenshot of the CitiAIR map

During the co-design process, the online tool was tested internally to make sure that the wording and structure fit the purpose for a wider audience. Then more initiatives were added to both improve the user experience and create a pool of initiatives that can attract people to use the tool in the development or implementation of their own initiative. And finally, the tool was disseminated as an online experience to share valuable information to improve the comparability of air quality initiatives.

The co-design process has resulted in a unique tool to collect technical and descriptive information about air quality initiatives involving citizens. This information can be used to compare different initiatives and also to get inspired when setting up new ones. CitiAIR has been widely tested with various European stakeholders who have provided feedback to improve the user experience.

A total of 38 citizen science initiatives on air quality have been added to the tool by 37 organisations. These initiatives represent twelve European countries (including the UK) that monitor more than 13 parameters using more than 37,000 sensors. This number is expected to grow in 2023 and the CitiMeasure team still aims to add as many initiatives as possible to CitiAIR.

4 Concluding remarks and next steps

This report summarises the impact and the lessons learned by the pilots in a more narrative format. The people involved in the implementation of the Smartwaterland, Sensor2School, Co-ACT and Mosquito Alert projects, among others, are now better equipped to understand and measure competencies for digital inclusion in citizen science or influence behaviour and policy in the cities of Roeselare, Prague and Barcelona. In addition, Eurocities' network has now a tool to showcase the knowledge of citizen science initiatives regarding air quality monitoring.

A webinar will be organised in 2023 to share the lessons learned from the CitiMeasure pilots with a wider audience. The next step for developing the Behaviour & Policy and the Digital Inclusion guidelines will be the visualisation in which the current text format of the guidelines will be transformed into more visual and interactive products. Some of the lessons learnt included in these case studies will be included in the final version of the CitiMeasure instruments.