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Wearables & droneS fOr CIty Socio-Environmental Observations and Behavioral ChangE

Deliverable

D5.7 - Definition & planning of pilots.R2

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List of definitions & abbreviations

Abbreviation	Description
API	Application Programming Interface
AQ	Air Quality
BK	Bee Keeper
CO	Confidential
CS	Citizen Science
D	Deliverable
MS	Milestone
MVE	Micro-Volunteering Engine
QB	Queen Bee
WB	Worker Bee
WSN	Wearable Sensor Node

Executive Summary

This deliverable describes the pilot plan. It is the main output of Task 5.3. This is the second version of the previously issued deliverable D5.6 [1] that was delivered right after M17 (February 2024) and evolves here into D5.7 (update in month M27 – December 2023).

This document includes the following parts:

- ***Requirements for conducting the pilots*.** Pilot plan organization, pilot site description, personnel involved, pilot methodology, technologies to be tested, potential users, pilot sample, schedule, and test result collection.
- ***Ethical and legal requirements*** including data use consents, data privacy, and good governance guidelines regarding the sharing and use of data between citizens and municipalities (check WP6).
- ***An engagement and cooperation plan*** will be established in each pilot before implementation and framework deployment.
- **Descriptions of the *relevant on boarding materials*,** like training materials, questionnaires or interview guidelines and templates required, adapted to the collectives and language of each pilot (part of Task 5.4 in Grant Agreement).
- ***Trial evaluation plans for phase 2 of each pilot.*** Detailed planning and Key Performance Indicators (KPIs) specification for the evaluation framework and the associated technical components.

This document plays a key role in WP5 since it contains the *plans for execution and evaluation of the pilots* that will validate the SOCIO-BEE platform resulting from T5.1, through 2 evaluation cycles. This version of the deliverable concentrates on the planning and organization of iteration 2 comprising the period January to June 2024.

Finally, the SOCIO-BEE project is not a project for bees. We use the beehive metaphor to depict our engagement strategy. You may find details on the beehive metaphor in section 2.1 of this document.

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1 Introduction

1.1 Purpose of the document

The purpose of this document is to describe the pilot plan for iteration 2 in SOCIO-BEE, being the main output of Task 5.3. This is the second version of the deliverable that is scheduled for M27 – December 2024. This document includes the following parts:

- **Recommendations**: some improvements and lessons learned were described in deliverable "D5.12 - Evaluation of pilots and behaviour change assessment - 1st release" [2]. In this deliverable, we have considered those recommendations dealing with the evaluation process, particularly with regards to the questionnaires used, so that an improved version is used in iteration 2.
- **Guidelines of coordination per use case**: including aspects such as the within consortium and pilot-specific coordination structure (personnel involved); overall planning of iteration 2; the methodology for pilot execution (pre and pilot execution sub-phase); engagement and cooperation plan; communication and training being prepared; the technology being made ready and tested; ethical and legal requirements to be met; how support will be arranged through a Help Desk and how sensors are planned to be distributed in pilots. This follows the same structure already described in deliverable D5.6.
- **Specification of pilots' experimentation:** detailing pilot per pilot, their requirements, associated stakeholder map, the at least 2 new campaigns co-designed per pilot, the pilot execution plan and community building plan to organize the task and community engagement and cooperation activities to be organized.
- **Evaluation approach and organization**: detailing the objectives the evaluation of iteration 2, the approach followed and, dimension and constructs to be considered, the qualitative and quantitative techniques to be used to collect results (questionnaires, interview guidelines and so on). Key Performance Indicators (KPIs) specification for the evaluation framework and the associated technical components.

This document plays a key role in WP5 since it contains the plans for execution and evaluation of the pilots' iteration 2 that will validate the SOCIO-BEE platform resulting from T5.1. This version of the deliverable concentrates on the planning and organization of iteration 2 comprising the period January 2024 to June 2024.

1.2 Relationship with other deliverables

This deliverable is based on the following previously issued deliverables:

Table 1. Relationship of D5.7 with other deliverables.

#	Title	Dissemination Level	Due Date	Relationship to D5.7
D2.9 [3]	SOCIO-BEE toolkit - final release	CO	M27	Detail of all the engagement tools to be used for recruitment, onboarding, experiments' execution, and evaluation.
D3.3 [4]	Report on use case definition, user requirements and technical compliance to legislation - 2nd release	CO	M24	This document presents the process and the results for extracting the SOCIO-BEE platform's requirements and use cases, the users' requirements and the general SOCIO-BEE system's technical and legal requirements

D3.5 [5]	Technical Specifications & System Architecture - 2nd release	CO	M24	A more detailed information regarding the overall architecture of the system along with all technical specifications are included in this deliverable.
D4.2 [6]	Citizen engagement services layer tool suite - 2nd release	CO	M25	This deliverable provides info regarding the functionality and modules of the Citizen engagement services layer tool suite.
D5.2 [7]	SOCIO-BEE integrated platform - 2nd release	CO	M26	Details about integration of the SOCIO-BEE platform and its validation are encountered here.
D5.5 [14]	Virtual Testing environment for enabling large scale testing - 2nd release	CO	M26	This deliverable contains a drone user guide for pilot cities implementing a drone campaign.
D5.6 [1]	Definition and planning of pilots - 1st release	PU	M17	This deliverable describes the pilot plan and is an output of Task 5.3 for iteration 1.
D5.12 [2]	Evaluation of pilots and behaviour change assessment - 1st release	PU	M23	This deliverable describes the results of the evaluation of the pilots and is an output of Task 5.6.

1.3 Deliverable Structure

The structure of this deliverables is as follows. Chapter 1 includes the guidelines for the coordination of the pilots. It includes details such as the pilots' coordination structure, the overall pilots' planning, the methodology for pilot execution, the engagement and cooperation community building strategy, a summary of the training materials, the technology to be tested or ethical and legal requirements.

Chapter 2 includes specification of the pilots' experimentations planned. Concretely, for each pilot site, it includes their high-level requirements, the stakeholders' map of the pilot, the two campaigns co-designed, the pilot execution plan or the community building plan.

Chapter 3 deals with the evaluation methodology that will be applied before, during and after pilots' iteration 2. It includes, the objectives, evaluation approach, evaluation dimensions and constructs, qualitative and quantitative measures, and the assessment strategy, i.e. how to calculate the impact achieved by pilots' iteration 2 and a comparison with how impact was previously managed in iteration 1.

Finally, chapter 4 concludes the deliverable and proposes future work foreseen in the frame of Task 5.3.

1.4 Summary of changes with regards to D5.6

The following chapters have the same structure as D5.6 [1] previously had; however, this deliverable D5.7 presents the new planning for the second iteration of the SOCIO-BEE project. The new dates are introduced, proposing a pre-pilot sub-phase from January to March 2024 (M28-M30) followed by a pilot execution sub-phase from April to June 2024 (M31-M33).

This document also introduces the new campaigns that the three Pilots (i.e., Maroussi, Zaragoza and Ancona) are going to run in their respective cities. The new approaches and the new locations based on their previous knowledge gained during

the first iteration, along with the improvements in the technological tools (e.g., app, sensor) are going to continue feeding our KPIs. Another approach regarding the campaigns involves the introduction of drones equipped with sensors.

Incorporating feedback from D5.12, several identified improvements have also been integrated into this deliverable, enhancing the overall understanding of our project. It is important to note that iteration 1 missed a crucial aspect, not measuring behaviour change in a thorough manner. To address this, new questions have been incorporated into our evaluation questionnaires. This strategic addition aims to provide a more comprehensive understanding of the project's impact on individuals' behaviours and ensures that future analyses encompass this important dimension. In addition, we have modified some of the questions in the questionnaires based on feedback from the pilots. They suggested that certain questions could be enhanced or shortened to improve the quality of data feeding that is feeding some of our KPIs.

2 Guidelines for coordination of the use cases

The SOCIO-BEE pilots will be planned, executed, and evaluated by partners of WP5, namely, CERTH, VUB, UNIPD, ECSA, ZKF, ZGZ, MRSI, ANCONA, UNIVPM, ID2M and HOPU. “WP5 - Pilots, Integration Testing & Evaluation”. WP5 is divided into 6 tasks which tackle pilots’ preparation (T5.1 to 5.3), execution (T5.4 & T5.5.) and evaluation (T5.6). Pilots planning and definition of the pilot evaluation strategy is the core mission of T5.3, which is reported in this document. This section provides the guidelines for the upcoming execution and evaluation of the pilot, dealing with the following aspects:

- Coordination structure – who will participate in the piloting and what their responsibilities will be.
- Overall pilot’s second iteration planning.
- Methodology for pilot execution.
- Engagement and cooperation plan for community building.
- Communication and training materials.
- Technology to be tested: SOCIO-BEE platform.
- Ethical and legal requirements.
- Help Desk: problem resolving approach and support mechanism.
- Sensors’ distribution.

2.1 The BeeHive metaphor in SOCIO-BEE

The BeeHive metaphor was already described in D5.6[1], hence, if already fully aware you may skip it. We have kept it to ensure this document is self-sufficient.

Through an example taken from nature, SOCIO-BEE builds on the metaphor of bee colonies to develop effective behavioural and engagement strategies with a wide range of stakeholders, namely, Queen Bees, drone Bees, working Bees, and bears, and to co-create through Citizen Hives long-lasting solutions against urban air pollution supported by emerging new technologies such as drones or wearables.

Figure 1 shows the roles that different members of a hive may play within SOCIO-BEE and what functionalities the underlying SOCIO-BEE platform offers them to manage and partake in CS campaigns:

- **Beekeeper**. S/he is responsible for setting up a new hive. S/he adds members to that hive. S/he creates a new campaign based on SOCIO-BEE toolkit element for onboarding and engagement, i.e., campaign template.

- **Queen Bee**. S/he firstly configures CS campaigns (area, measurements' type, frequency and period, research questions to address and so on). Secondly, it launches, manages, and monitors the evolution of the campaign and measurements being taken by fellow Worker Bees. S/he also takes part in interim publication of results for the hive and its stakeholders. Finally, s/he closes the campaign and pushes wide dissemination and communication of its results, reflecting in workshops with other hive stakeholders, namely, bear, beekeeper, and hive members.
- **Worker Bees**: they are notified about new campaigns where they can partake. Through a mobile app and a wearable AQ sensing device, whenever available they get recommended possible cells to pollinize. They recurrently gather new measurements during a campaign's timespan. They can also capture audio/video through the BEE Mate module, an additional component of SOCIO-BEE platform, whilst 90'' long air quality measurements are taken with the AQ wearable devices. They regularly check how the pollination in the campaign is ongoing and access heat maps informing about air quality evolution in space and time. They are informed about the end of campaigns and provide feedback of their experience through the mobile app. They take part in a post-pilot reflection workshop.
- **Drone Bees**: they receive generic information about the AQ CS campaigns arranged by a council. They spread the results of campaigns published in an easily graspable manner to enhance understanding of the effects of air pollution and remediation actions. They are invited to attend a reflection workshop to have a say regarding possible actions to be taken by the public administration.

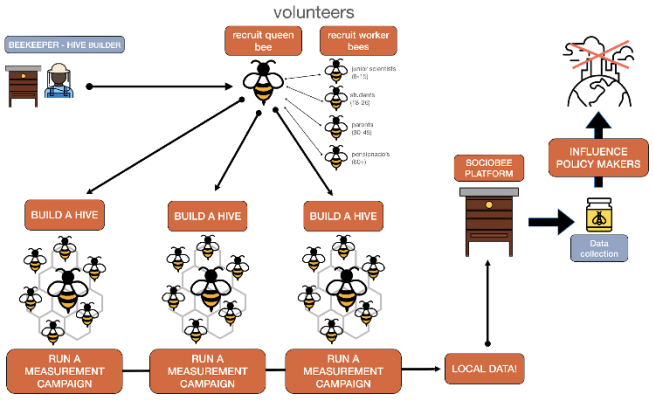


Figure 1. Bee metaphor employed by SOCIO-BEE.

2.2 Pilots' coordination structure

Figure 2 shows the coordination structure devised for the planning, execution, monitoring, and assessment of pilots in SOCIO-BEE. The top layer of the diagram indicates which WPs and tasks will realise the technical implementation needs for the piloting (WP4, T5.1 and T5.4), plus the tasks T3.2 and T5.3 where the specification and planning of the pilots are made ready. Indeed, the following sections of this document cover the outcomes of *"T5.3. Pilots' requirements, planning and KPIs definitions"*. The second layer from the top in Figure 2 indicates who will be responsible for the cross-pilots coordination (CERTH) and who will be responsible at each specific pilot site. The following subsections of this chapter indicate the support process that will be prepared for SOCIO-BEE (as outcome of T5.3) whilst T5.5 (led by CERTH) and T5.6 (led by HKU), due according to the Grant Agreement in M35 (August 2024), will be responsible for reporting the operation and monitoring, and, the evaluation and interpretation, respectively, of pilots' iteration 2.

Hence, Figure 2 shows the distribution of responsibilities among consortium partners during the piloting process. Thus, CERTH is the coordinator of the cross-pilot coordination and overall pilot iteration 1 and iteration 2 operation and monitoring. The support provided to piloting sites will be coordinated by DEUSTO with the technical support of CERTH, HYP, AUTH, DEUSTO and BETTAIR, whilst citizen science support and community building activities will be supported by HKU, VUB, ECSA and DEUSTO. Pilot coordination organizations, also termed as *pilot owners*, are those where pilots will be deployed, namely ANCONA, MRSI and ZGZ, respectively. Technical partners and other consortium partners will also support pilot site coordinators in legal (VUB), governance (CERTH), technical (HYP, AUTH, DEUSTO, BETTAIR, HOPU and UNIPD) and sustainability aspects (UNIVPM).

2.3 Overall pilots' iteration 2 planning

Piloting is necessary to validate whether the SOCIO-BEE approach and supporting assets in terms of toolkit items and software tools will change the "*behaviour of citizens towards Air Pollution, making them more aware, better informed and reactive*". This is crucial for this second iteration since we aim to measure the behaviour change of those taking part in the experiments. In other words, in SOCIO-BEE we want to meet the following *evaluation objectives*:

1. Increase citizenry awareness of air pollution and possible reaction actions.
2. Demonstrate effectiveness of SOCIO-BEE engagement methodology, toolkit, and tools to realise CS experiments for pollution understanding monitoring and remediation.
3. Achieve an inclusive empowerment of CS Hives with instruments to measure, analyse and understand impact of air pollution.
4. Validate whether Citizen Science enables more open and sustainable decision-making processes or not, still complying with data privacy aspects.
5. Explore the potential of repeatability, scalability, and sustainability of SOCIO-BEE approach.
6. Gain some data evidence for policy making in the form of a set of recommendations gathered in a White Book

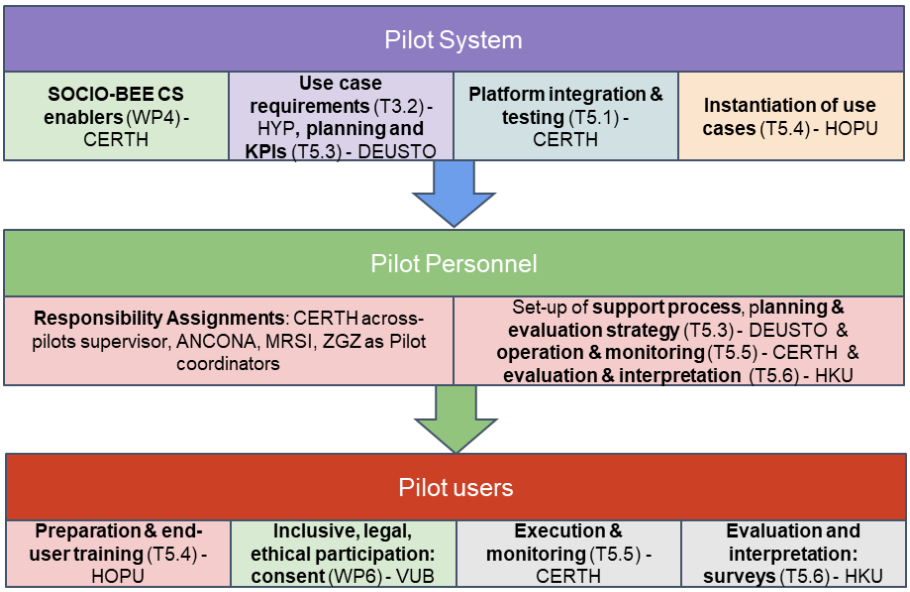


Figure 2. SOCIO-BEE pilots' coordination structure.

To achieve those objectives, the project is being **evaluated across two iterations** (the first iteration accomplished already), divided into two evaluation stages, where:

- *Exploration stage*: performed in iteration 1, explored the potential of first release of SOCIO-BEE (methodology, toolkit, platform) to foster assembly of citizen science hives which through experimentation campaigns on Air Quality promote pro-environmental behaviour change and support decision-making.
- *Consolidation stage*: performed to assess impact from piloting in the upcoming iteration 2, tackles scalability and replicability of SOCIO-BEE, still trying to scale up behaviour change and climate literacy.

From a practical point of view, SOCIO-BEE will execute Citizen Science (CS) campaigns that will be run by citizens' hives. Concretely, it is planned that each pilot organizes at least two CS campaigns in iteration 2, as it was previously done in iteration 1.

The SOCIO-BEE platform developed and the WP2's engagement toolkit assessed during iteration 1, had hives promoted from the consortium, particularly pilot owners, whilst hives will be created more spontaneously for iteration 2. Consequently, two types of hives are considered whilst piloting (see Figure 3 for an illustration of the phases):

- *Artificial hive* (in iteration 1): small-scale, controlled experiments created and led by Beekeepers selected and appointed by pilot owners.
- *Organic hive* (in iteration 2): large-scale, open experiments led by citizen scientists, which may emerge as result of communication campaigns launched by the project.

The iteration 2 is divided into 2 sub-phases, following the same structure as iteration 1. The first sub-phase (a.k.a., the *pre-pilot sub-phase*) will be used to make sure that the upgraded SOCIO-BEE platform v2 (i.e., wearable sensors, campaign blueprints and engagement toolkit, AcadeMe's back end and front-end, including mobile and web apps), bearing in mind changes performed in WP4 due to feedback received in D5.12[2], is fully tested and mostly bug-free. In this first sub-phase for iteration 2, again, a controlled and selected reduced group of *alpha testers* will report about their experience using the upgraded for iteration 2 SOCIO-BEE platform and toolkit. Their feedback, gathered through different means, will be used for several purposes:

- To apply any necessary corrective actions to ensure a smooth execution of the second pilot phase.
- To make sure that all CS enabling tools and toolkit to be tested are properly instrumented with execution logs and questionnaires so that the right details about them can be collected to be used by Task 5.5 and 5.6.

Additionally, project-wide and pilot's campaign specific KPIs will be refined, based on Grant Agreement (GA) declaration, and new ones are to be defined during this first subphase. Importantly, besides the technical viability of the CS enabling platform adopting the Bee metaphor being tested, it is paramount to ensure that ethical approvals of the project assessment plans at the different pilots' sites are obtained before the launch of the first sub-phase.

The second sub-phase (the *pilot execution sub-phase*) of iteration 2 will correspond to the launching of the Pilots Iteration 2 itself. A wider open set of *beta testers* (i.e., communities of practice composed by citizens assembling CS hives associated to the different pilot sites) will access to the SOCIO-BEE platform and toolkit v2 published in SOCIO-BEE's GitHub organization and deployed as external release of Pilots Iteration II. One single deployment of AcadeMe will be shared by all pilot sites during iteration 2.

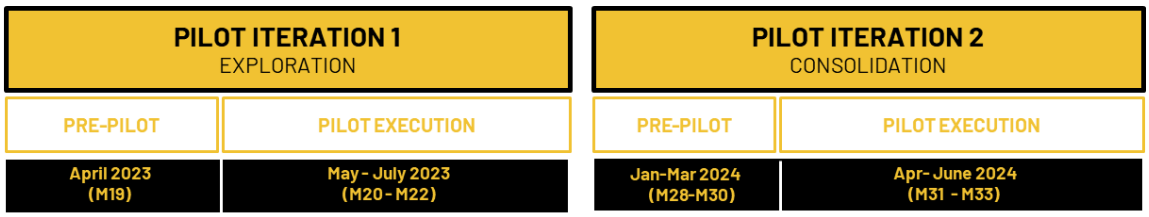


Figure 3. SOCIO-BEE pilots' evaluation across two iterations.

2.4 Methodology for pilot execution

The pilot execution, as earlier outlined, will be divided into two subphases, namely, pre-pilot and pilot execution subphases, respectively. Figure 4 shows the suggested types of actions that are envisaged to be taken within the two subphases, by pilot participants. The following two sub-sections describe one by one the candidate action types that should be executed during the whole pilot iteration 2's timespan, from January to June 2024.

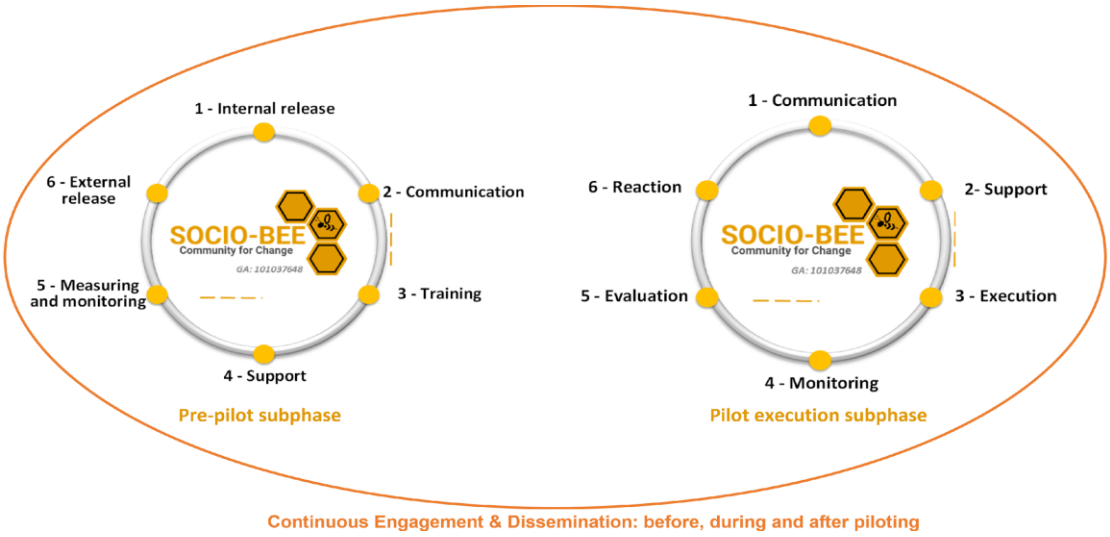


Figure 4. Action types executed within iteration 2's sub-phases.

The following two sub-sections describe the different steps in which the execution of pilots' iteration 2's sub-phases will be divided. It also includes a generic planning (indication of candidate dates) for Pilots Iteration II, comprising months M28 (January 2024) to M33 (June 2024).

2.4.1 Pre-pilot execution sub-phase

The following types of activities will be carried out during the pre-pilot execution sub-phase (review Figure 4's left-hand side):

- *Internal release*: the SOCIO-BEE platform and toolkit (new version details published at D2.9 - SOCIO-BEE toolkit final release [8] due in December 2023) are made available in v2 for pilot owners and alpha testers. In some pilots, co-designed campaigns will be refined and grounded so that they can be realised by the beginning of pilot execution sub-phase.
- *Communication*: SOCIO-BEE public administrations in collaboration with task forces members identify and select an internal group of potential alpha-testers (between 5 to 10 users per pilot site). For that purpose, the public

administration may announce the SOCIO-BEE platform, methodology and approach, internally. Participants from past iteration 1 will be mostly recruited.

- *Training*: supporting documentation about the SOCIO-BEE tools, wearables, and toolkit elements, how to tackle scientific approach for air quality pollution analysis materials are made available to the alpha testers. The alpha testers groups should be convened in a training workshop where they will be invited to use the platform, tools, and materials of SOCIO-BEE.
- *Support*: the different support channels are established and presented to the alpha-testers during the training workshop. Technical issues should be reported to consortium members by the different technical mechanisms and support tools specified in section "2.9. Help Desk: problem resolving approach and support mechanism".
- *Measuring & Monitoring*: Variables to be measured in pilot trials will be established. Monitoring of the early testers of the SOCIO-BEE ecosystem is carried out; gathering of evaluation metrics starts. Some of the early testers will be staff from the public administrations or the SOCIO-BEE consortium partners. Possible technical, procedural, or ethical deficiencies are identified and addressed by the SOCIO-BEE support team during January and April 2024.
- *External* Release: Once the support team solves the reported issues (expectantly technical mainly), updated versions (if required) of the platform components, SOCIO-BEE's GitHub platform repository is updated with upgrades versions of the tools and devices. Users from engaged public administrations are free to access all these components in release mode.

In addition to alpha-testers, in this second phase a cross-testing session involving SOCIO-BEE consortium members will be also launched by mid-February presumably through videoconference, to ensure that all the new features added in iteration 2 are fully functional and the new materials also provided for toolkit v2 are also tested. This is to ensure that the full consortium is involved in the testing and refinement of SOCIO-BEE platform, devices, toolkit, and materials, to get them with the highest possible readiness level for iteration 2's pilot-execution sub-phase.

2.4.2 Pilot execution sub-phase

Right after all preparations are in place, beta testers can start with the execution, monitoring, and evaluation of pilots. The pilot-execution sub-phase, according to Figure 4, consists of the following types of activities that will be carried out in an iterative manner in the period M31 (April 2024) to M33 (June 2024):

- *Communication*: an intensive dissemination is carried out across different channels to mark the kick-off of the pilot execution sub-phase. Targeted user groups which might configure the campaign hives for each trial are reminded that the SOCIO-BEE platform and toolkit built and customized for each pilot site are now officially rolled-out urging and incentivizing them to use the SOCIO-BEE ecosystem, through engaging means, e.g. co-design workshops, contests, or rewards. Together with this training, several activities will also be launched in order to ease and promote the use of the ecosystem. Other direct costs of pilots' owners may be applied to produce posters, forms, leaflets, marketing materials and cove costs for arrangement of workshops and public contests, including some minor prizes as incentives.
- *Support*: technical, legal and Citizen Science and Air Quality related support services will be maintained across the execution of the pilots from April to June 2024.
- *Execution*: SOCIO-BEE framework components, namely, AcadeMe mobile and web apps, wearables and toolkit are redeployed, after tuning them because of the pre-pilot sub-phase where v2 of the platform and toolkit are fully tested. Hence, SOCIO-BEE infrastructure, engagement and CS process support materials are ready for wide access

and execution. This activity ensures that the individual deployment per pilot site is kept operative on a 24x7 basis. The deployment of the v2 version of SOCIO-BEE platform (in beta status) must take place before April 2024.

- *Monitoring*: monitoring of the actual pilot users interacting with the SOCIO-BEE ecosystem to realize Citizen Science campaigns which answer different research questions in the domain of Air Quality. The feedback retrieval during the pilot execution serves to sense the user perception of the CS campaigns run, the value they deliver and the overall SOCIO-BEE approach. Monitoring activities will be carried out in period April to June 2024.
- *Evaluation*: actual data about the usage of the tools by the different members of citizen hives is gathered, aggregated, and analysed. Every month usage statistics and KPIs are generated, and feedback analysis carried out. Evaluation activities will be carried out in period April to June 2024.
- *Reaction*: Early conclusions are driven, and corrective actions taken in case the pilot is not progressing as expected, monthly. Based on the monthly evaluations some of the following actions are triggered: new communication actions, launch of contests to incentivize usage or modification of available SOCIO-BEE artefacts to solve issues that may be impeding a bigger adoption.

2.4.3 Pre-requisites for pilot launch

During the pre-pilot execution sub-phase, before the actual pilots' execution can take place, the following steps and requirements must be accomplished by pilots:

- **Prioritize and translate materials for pilots**: ECSA provides some extra communication materials for campaign launch (framework) which later pilots adapt to pilots and request from ECSA and HYP some graphics. HKU and DEUSTO prepare on boarding presentations to recruit people interested on the project. The slides are translated into the local language.
- **Design the campaign/s for the corresponding pilot**. DEUSTO distributes Campaign Template to pilots, who receive support from local partners for campaign definition (16 December 2023 was the set deadline), at least 2 campaigns/pilot have been defined through a focus group or co-design workshop organized by pilots.
- **Alpha tester users' engagement and training**. Whilst the upgrades to the technology are not fully verified, alpha testers have the chance to interact with mock/ups and provide feedback. Training materials, led by HOPU, are prepared, including an assortment of materials about air quality and citizen science to distribute to pilots. This step is carried out until March 2024, when "D5.9- Pilot Site Preparation & End User Training - 2nd release" [9] will be made ready.
- **Internal pre-testing** (cross-testing session), including SOCIO-BEE project's members and a set of alpha testers (5 to 10 people) from SOCIO-BEE partners. Such activity takes place in January- February so that the feedback collected can be used to refine the SOCIO-BEE platform v2 (in alpha status) and turn it into v2 (beta status) by end of March 2024. Before and after the cross-testing sessions, SOCIO-BEE technical partners validate that the alpha release of the platform v2 is fully functional by applying an exhaustive user acceptance test template, which includes all use cases that SOCIO-BEE platform users can go through with the help of the platform, including those new ones which resulted from analysing the conclusions of D5.12[2].
- **Pre-testing of logging, data model and questionnaires** to be used for collecting and gathering end-users' feedback. Apart from testing the technical solution made available, the evaluation's measurement instruments put in place which have also been upgraded for iteration 2, as described in section 4.5, e.g. diverse range of questionnaires, logs and queries over the data model of SOCIO-BEE, are tested to ensure that they are operational by the beginning of pilot execution sub-phase in April 2024.

- **Pre-pilot sub-phase monitoring and evaluation**. Possible technical deficiencies both for the technical solution and the evaluation instruments for iteration 2 are addressed by SOCIO-BEE members of the support and technical team. They work on this polishing in the second half of January-March 2024.
- **Communication campaigns** for engaging end-users and ensuring the participation of citizens and other local stakeholders is critical for successful evaluation of SOCIO-BEE potential. From December 2023 and until February 2024 upgraded versions of material are already used by pilot owners during the recruitment of alpha testers. Materials (presentations, communication kits, guidelines, and training materials) are further enhanced so that they can be used for beta testers from April 2024 onwards.
- **Appoint trial support team and set up help desk**. Assure that appointed pilot representatives have received appropriate training and have access to technical documentation. For that several email addresses have been set up, e.g. zaragoza-support@SOCIO-BEE.eu, a Redmine server has been configured, a slack channel (SOCIO-BEE.slack.com) has been established to foster within consortium communication, and some pilot specific support mechanisms have also been established, e.g. Telegram in Zaragoza case.
- **Training of SOCIO-BEE platform components and campaigns** designed to test users through several workshops in each public administration, walk them through the mobile app, web app and wearables in case that it is needed, and provide them with basic information about how problems can be resolved using the helpdesk established in SOCIO-BEE (see section 2.9 for more details). Such training will take place between January and March 2024.
- **Inform test users about planned pilot duration and subsequent surveys plus privacy procedures and policies**. All test users (beta testers) will have to accept the SOCIO-BEE terms of use before accessing the SOCIO-BEE ecosystem tools and for those who will collaborate for assessing the ecosystem they will have to sign a consent form. In addition, anonymous information on customer feedback provided by the SOCIO-BEE system will be utilized in research. Such materials were already translated to pilots' local languages in iteration 1 and will be reused as such for iteration 2.

2.4.4 Pilot work plan definition

Each pilot needs to define a work plan during the whole duration of iteration 2, taking as a guideline the two-phase methodology consisting of the step types earlier shown in Figure 4. To accomplish a pilot's workplan, the planning pilot owners are requested to complete the workplan template, outlined in Table 2. In this exercise, pilots must identify what tasks they will need to execute across the whole pilot iteration's two sub-phases. The outline of the tasks defined should be associated to different milestones. Below, an orientation of what milestones and their associated timelines, could be considered, is shown:

- *Milestone 1 (MS) – Pre-pilot launch subphase* (M28 – January 2024 to M30 – March 2024).
- *Milestone 2 (MS) – Pilot execution sub-phase* (M31 – April 2024 to M33 – June 2024).
- *Milestone 3 (MS) – Post-Pilot execution sub-phase* (M34 – July 2024 to M35 – August 2024).

Some pilots might even define tasks before the official iteration 2's timespan and include a *Milestone 0 – Before pilot iteration launch*. Table 2 shows the layout of the table to fill in, together with an exemplary row.

Table 2. Pilot's workplan template table.

ID	MS	Phase	When	Action	Description	Target	Comments
C1	1	Pre-pilot launch subphase	M28-30	Communication	Pilot X announces with two separate communication	All Pilot X stakeholders:	

					campaigns the start of the SOCIO-BEE pilot informing its stakeholders (Public Bodies and Civil Servants) about the project's objectives, the co-designed campaigns' purpose and its goals, the activities they are going to be involved in, the participation benefits, rights, and rules and the "next steps".	- Public Bodies: -Civil Servants - Science museum staff	

Table 3 shows the legend to be used to describe the types of actions that may be considered in pilots' workplan planning.

Table 3. Pilot's workplan action types.

Action	Comment
IR	Stands for Internal Release
C	Communication
T	Training
S	Support
MM	Measuring & Monitoring
ER	External Release
E	Execution
M	Monitoring
EX	Execution
EV	Evaluation
R	Reaction

The final objective is to get ready for the pilots' execution plan, delivering as result, a Gantt diagram and, also define the main event arrangements for the pilot to be executed smoothly.

Importantly, as part of the work for SOCIO-BEE toolkit v2, reported in "D2.9 - SOCIO-BEE toolkit final release"[8] a wide assortment of materials to support the execution of different types of activities shown in Table 3, have been provided, as shown in Figure 5. For instance, "001 How to organise a cs project" or "036 IT Tutorial how to measure", as shown in Figure 5.

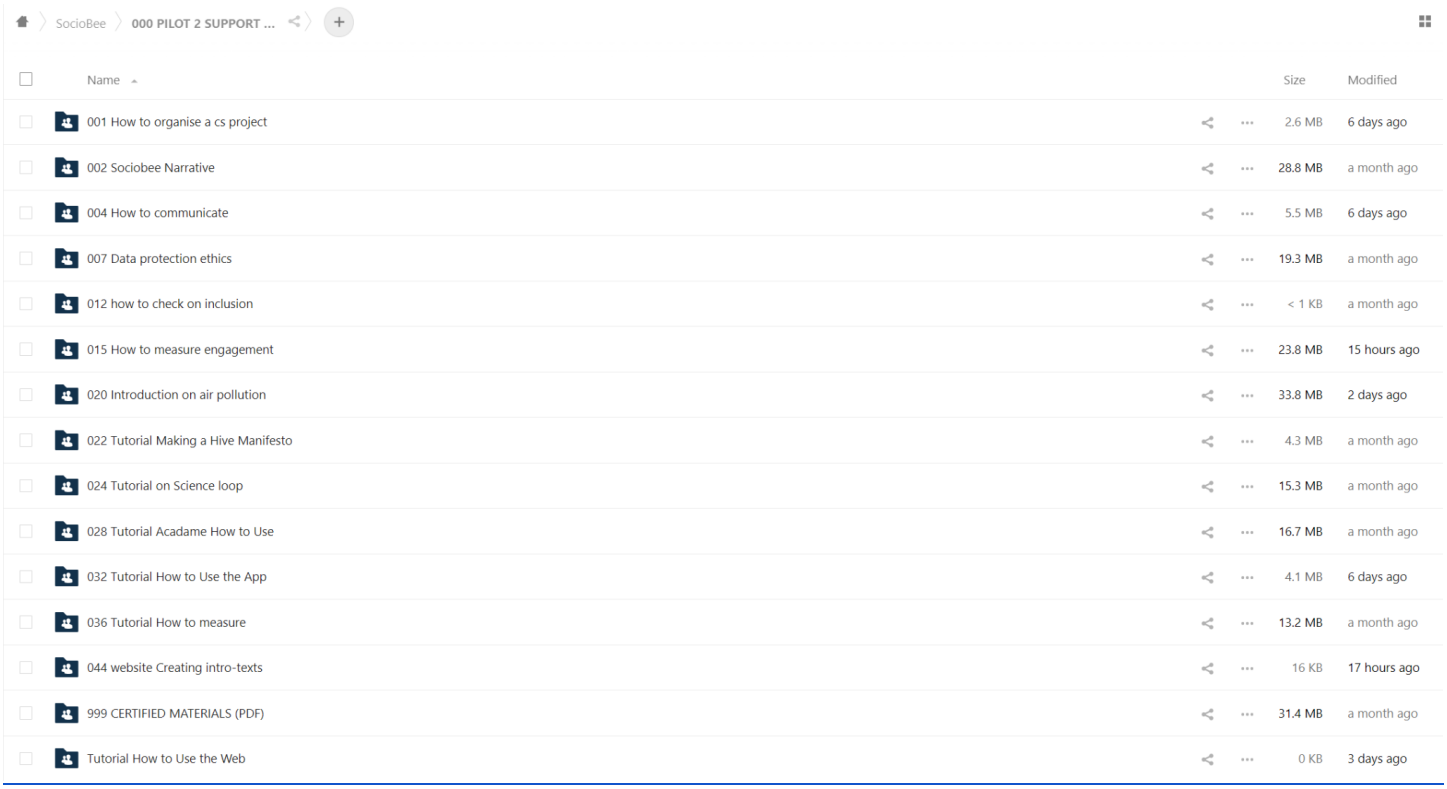


Figure 5. SOCIO-BEE's iteration 2's support materials.

2.5 Engagement and cooperation plan for community building

The following organizational steps (see Figure 6) are required per pilot (based on cascading **SOCIO-BEE hive assembly process** from D2.8 [1]), to realize community building (engagement + involvement) in the pilot cases. Indicative dates per action are indicated:

- **Municipality** promotes **organic hives** for iteration 2 (**Task 5.4**) – January-March 2024
- **Beekeeper**/s is/are **appointed** – February 2024
- **Hive** is **created** including Queen Bee/s and Worker Bees – February 2024
- **Beekeeper/s and Queen Bee/s** cooperate to **co-refine campaign** based on **Campaign Blueprint** and **CS experiments** knowledge base from **SOCIO-BEE** (**Task 5.4**) – February 2024. Consortium partners in cooperation with alpha testers have already sketched the candidate campaigns for iteration 2 which are described in chapter 3.
- **Experimentation** is **launched** for a period in each region (**Task 5.5**) – April-June 2024
  - Worker bees continuously perform measurements with support of SOCIO-BEE mobile app and wearable sensor.
  - Queen Bee continuously monitors evolution of campaign and reflects with Worker Bees about results being gathered.
- **Measurement period** is **concluded**, data is aggregated and analysed with support of **Task 5.6** – reporting results in "D5.13 - Evaluation of pilots and behaviour change assessment.R2" by August 2024
  - We will prepare dissemination outcomes, create communication campaigns with results, and so on.

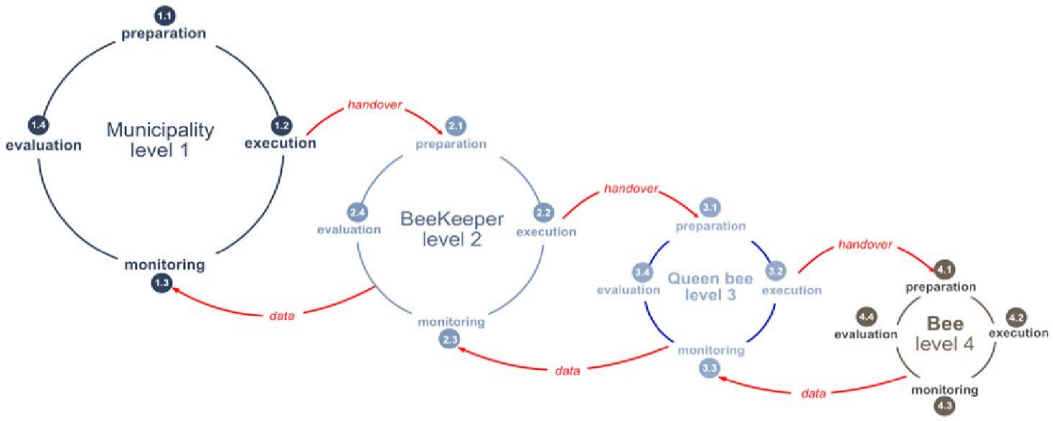


Figure 6. SOCIO-BEE's hive assembly process.

According to the results of "D2.6. SOCIO-BEE methodology for ecosystem and hive creation - 2nd release"[10], the project suggests a categorization of community building activities inspired by the principles of IAP2 Public Participation Spectrum and, based on our previous experience in the WeLive[11] and INTERLINK [12] projects, where a co-creation methodology was created. Thus, we have come up with the following categorization of community building activities suitable to address the SOCIO-BEE's evaluation objectives. These are the different types of activities that can be carried out to attain the participation objective:

- **INFORM**: activities to create awareness using traditional communication methods and channels. Within this type of activity, communication materials must be ready for pre- and pilot execution subphases.
- **GUIDE**: activities to assists end-user stakeholders and give them guidance for how to use the SOCIO-BEE platform. Within this type of activity, training materials, HOW-TOs to support pilot owners, and support mechanisms are made available.
- **CONSULT**: activities to obtain end-user stakeholders' feedback on the SOCIO-BEE platform and associated citizen science campaigns. For it, questionnaires, focus group sessions, cross-testing sessions, and interviews are used.
- **WORK WITH**: activities which consider end-user stakeholders' concerns and aspirations on the SOCIO-BEE platform and Citizen Science. Their objective is not only to involve users but also to empower them to partake with support tools and guidelines. Such activities are supported by SOCIO-BEE platform and toolkit designed to aid planning, execution, and evaluation of campaigns.

For the purpose of defining a community building strategy, details about planned activities has been requested to be completed by pilots through a template entitled "SOCIO-BEE Pilots-Community Building Activity Planning". Besides, tracking and evaluation after the actual execution of the planned activities will be performed by filling in the template entitled "Engagement Activities Registry-PilotX". Such template contains the following fields:

- *Activity ID*: which links the activity realized with the activity planned and registered in the activity planning spreadsheet.
- *Engagement phase*: corresponding to one of the engagement phases defined in SOCIO-BEE which depict the clear purpose of each community building activity, namely, INFORM, GUIDE, CONSULT and WORK WITH.
- *Activity Type*: which further clarifies the purpose of the activity. Some possible values are a) awareness; b) training; c) testing; d) communication; e) monitoring & evaluation; or f) other.

- *Activity Description*: thorough description of the activity.
- *Date*: when the activity is celebrated in format YYYY/MM/DD.
- *Target components*: those SOCIO-BEE components used or promoted in the activity.
- *Target audience*: citizens, public administration, SMEs, developers, research organisations or others.
- *Attendance to the Event*: statistics including number of people types, gender, age range, occupation, or ICT literacy level.
- *Drivers and incentives*: if applicable, it might be that gifts, prizes or diplomas may be issued to those taking part in the activity.
- *Quantitative outputs*: number of consent forms signed, number of online questionnaires, number of specific dissemination material created.
- *Comments*: additional details about the activity celebrated which are worth mentioning.

Table 4. Catalogue of potential community engagement activities per participation goal.

	Inform	**Consult**		**Co-Create**	
				Involve	**Collaborate**
PARTICIPATION GOAL	To provide PILOT users with balanced and objective information and assist them.	To obtain PILOTs users' feedback		To consider public's concerns evaluation and aspirations	To achieve PILOTs users' participation on CS campaign realization and evaluation
PILOT USERS' ROLE	PILOT users are informed	PILOT users are informed, listened to, and their concerns acknowledged		PILOT users´ concerns and aspirations are taken into consideration, and they are provided with feedback.	PILOT users's prosume data and reflect with campaign hives about results of CS experiments run.
ACTIVITY TYPE	**INFORM + GUIDE**	**CONSULT**		**WORK WITH**	
ACTIVITIES	*Use-Case Community Building* - Public Meetings - Training Sessions - Hackathons - Seminars - Contests - Briefings (to reach out to established groups) - Printed information (Factsheets, Newsletters, Leaflets, Posters, and Bulletins) - Websites - Information Repositories	*Use-Case Community Building* - Focus groups (to explore attitudes and opinions in depth) - Public Meetings & Hearings - Public Workshops - World Cafes (fostering open discussion of a topic/aspect)	*Evaluation, Assessment, and Monitoring* - Pre-Evaluation Sessions (e.g., think aloud evaluation and heuristic evaluation) - Mid-Evaluation Sessions (e.g., interviews, open-ended questions in questionnaires) - Post-Evaluation Sessions (e.g., interviews, open-ended questions in questionnaires)	*Use-Case Community Building* - Focus groups - Consensus workshops (to identify shared values and agreement)	*Evaluation, Assessment, and Monitoring* - Administration of questionnaires during the pilots while SOCIO-BEE is in use by the CS hives running the co-designed campaigns - Focus groups - Consensus Workshops (to identify shared objectives and agreement)

	- Information Hotlines and Kiosks - Press and Media - Social Media - Exhibitions & Stands				

Importantly, each executed activity should be evaluated. Use-case community building activities should be evaluated because such activities are intrinsically linked to evaluation, assessment, and monitoring of the whole pilot. This explains the inclusion of the field in the Engagement Activities Registry-PilotX spreadsheet named "*quantitative outputs*", where references to the evaluation mechanisms used should be included.

2.6 Communication and training materials

To inform and recruit people in the pilot cities, several different materials have been created. So far, we have the following materials:

- **Generic SOCIO-BEE presentation**: it contains a general introduction to the project, the motivation and the beehive metaphor used in the project for social engagement. Although the slides in this presentation are very general and the language is simple, it is not aimed at citizens, rather at stakeholders and other citizen science practitioners.
- **Generic SOCIO-BEE flyer**: It is a two-sided flyer with the shape of three hexagons together. In the front of the flyer the project logo and name are visible, three words that represent the project, namely "*clean air, engagement and wearables*". In the back, the *mission* of the project, as well as the *objectives and methods*. This flyer is meant for stakeholders and professional networking.
- **Pilots' flyer**: This is a rectangular flyer size A5 and is available in English and all pilot languages (Greek, Italian and Spanish). Similarly, to the first flyer, the main content is divided in three hexagons. The first one answers the question "What is SOCIO-BEE" and lists how citizens can benefit from joining SOCIO-BEE. In the second one the beehive analogy is explained, and we explain the different levels of engagement. The third one invites citizens to join one of the hives in a pilot city and provides contact information. This flyer is directly aimed at attracting citizens to join the hives and will be distributed physically in the pilot cities. Screenshots of the flyers can be found in the ANNEX A. Exemplary communication materials.
- **Poster**: This document can be used at professional settings to introduce the project. Aimed at stakeholders and professional networks.

Figure 7. SOCIO-BEE's generic flyer (front-part).

Figure 8. SOCIO-BEE's generic flyer (back-part).

We are still developing other materials for this second iteration and that can be found in this folder. For a complete list with what is currently being developed we have also a Miro, an online tool that helps teams scattered across different places talk and work on projects together more easily.

Other materials to be used during pilots, such as **onboarding and training materials** are also in preparation and made publicly available. Such slides include, see examples in Figure 9, the following types of contents:

- Slides to increase citizen awareness about air quality.
- Recruiting volunteers to enhance their neighbours or districts.

- Slides can be used for onboarding of interested volunteers of different backgrounds.
- City and campaign specific slides with information about the things they will do after joining the hives.
- Tutorials about the tools provided by SOCIO-BEE platform to foster Citizen Science driven evidence gathering.
- How to measure participant engagement.

All prepared materials and particularly the outcome of the CS experiments will be translated to pilot languages (Greek, Italian and Spanish).

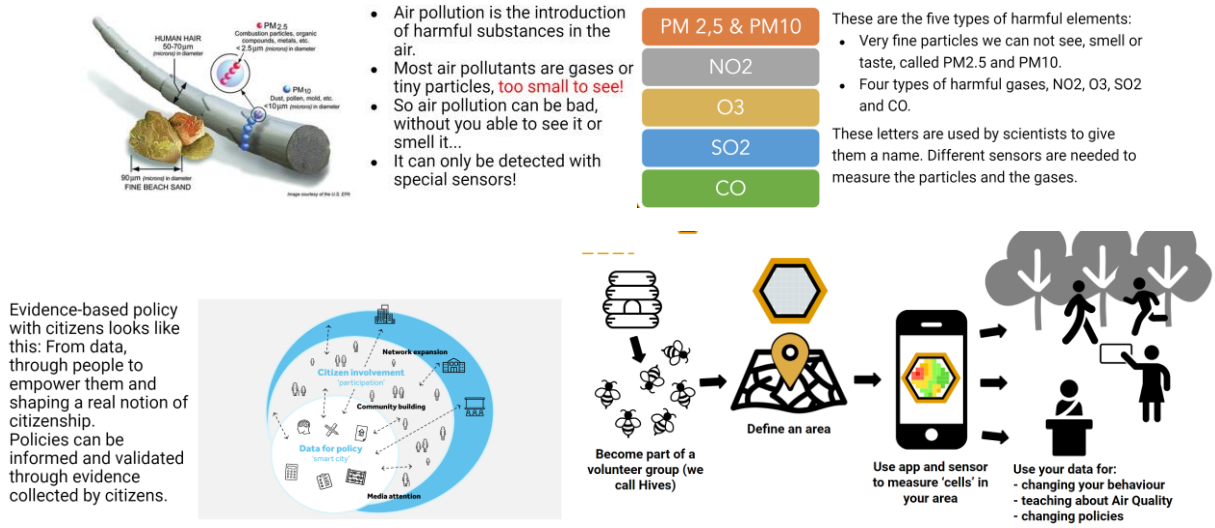


Figure 9. Some screenshots taken from the on-boarding presentation for all audiences.

2.7 Technology to be tested: SOCIO-BEE platform

The technology handed to the pilot for testing is going to be the upgraded integrated SOCIO-BEE platform, currently in v2. This consists of a set of interconnected components working towards supporting the CS campaigns but also summarising their results and providing insights about air pollution. Figure 10 presents the architecture of the platform. The platform integrates a set of internal and external components. Namely, in Figure 10, the central container shows all the back-end components were most of the AcadeMe services are hosted. There, almost all the algorithmic tools will be hosted. The only services that are hosted remotely, on the partners' servers, are the micro-volunteering engine that suggests campaigns' measurement cells to users and the BEE-MATE services that detect the sources of pollution through audio and video. All the data collected and generated is stored in the two databases. Moreover, the platform communicates with external data to get more accurate data about weather and pollution, see red box. Lastly, the platform, is accessible to the users through a web interface (bears, beekeepers queen bees) and a mobile interface (working and drone bees). More details can be found in "D4.4 - Data Services for collection connection, harmonization, processing and annotation - 2nd release"[6].

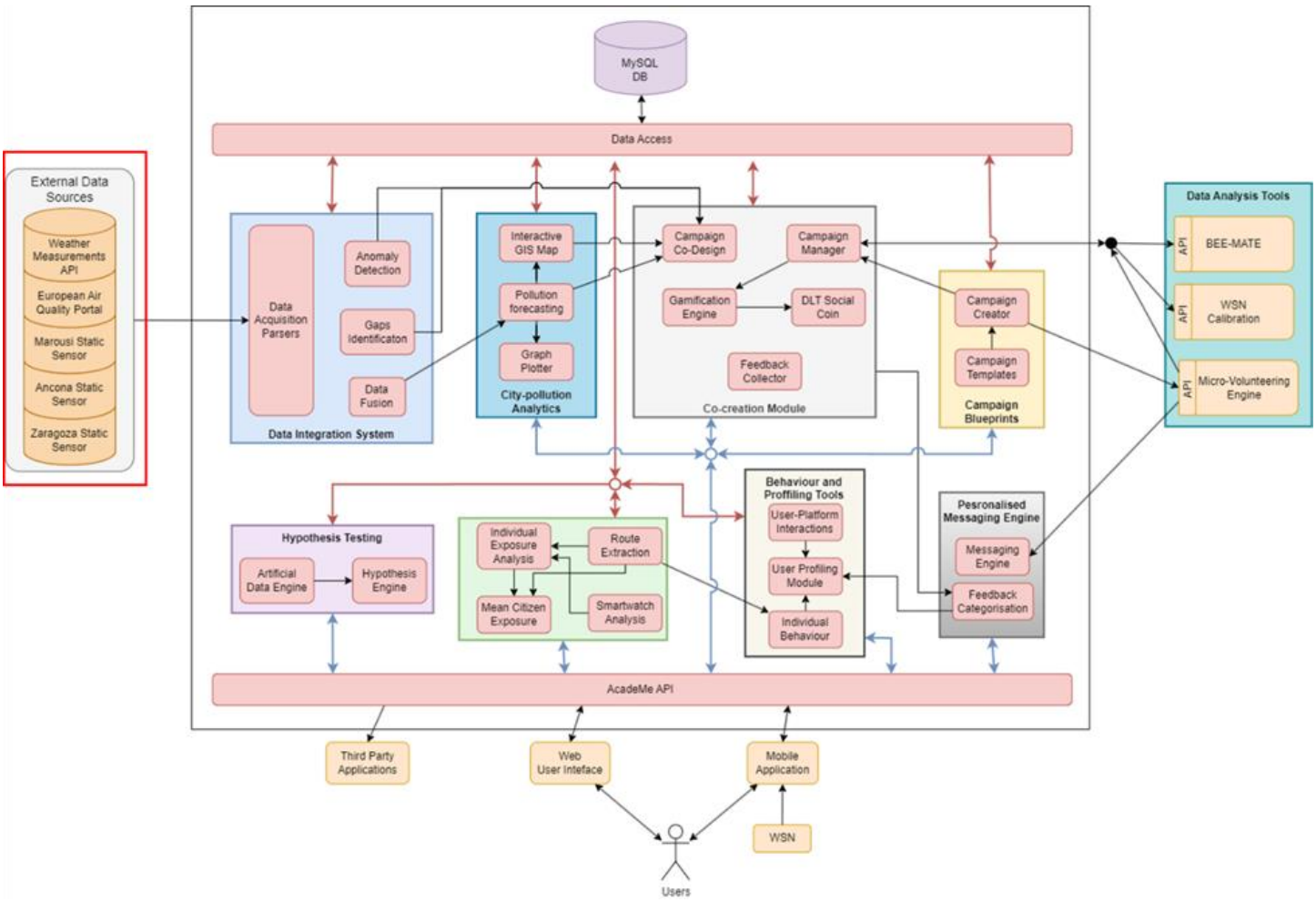


Figure 10. SOCIO-BEE's AcadeMe platform architecture.

Figure 11 and Figure 12 show an indicative mock-up from the web and the mobile interface, respectively. Lastly, the mobile device will be connected to the wireless sensor node (WSN) to receive the air quality measurements and upload them to the platform.

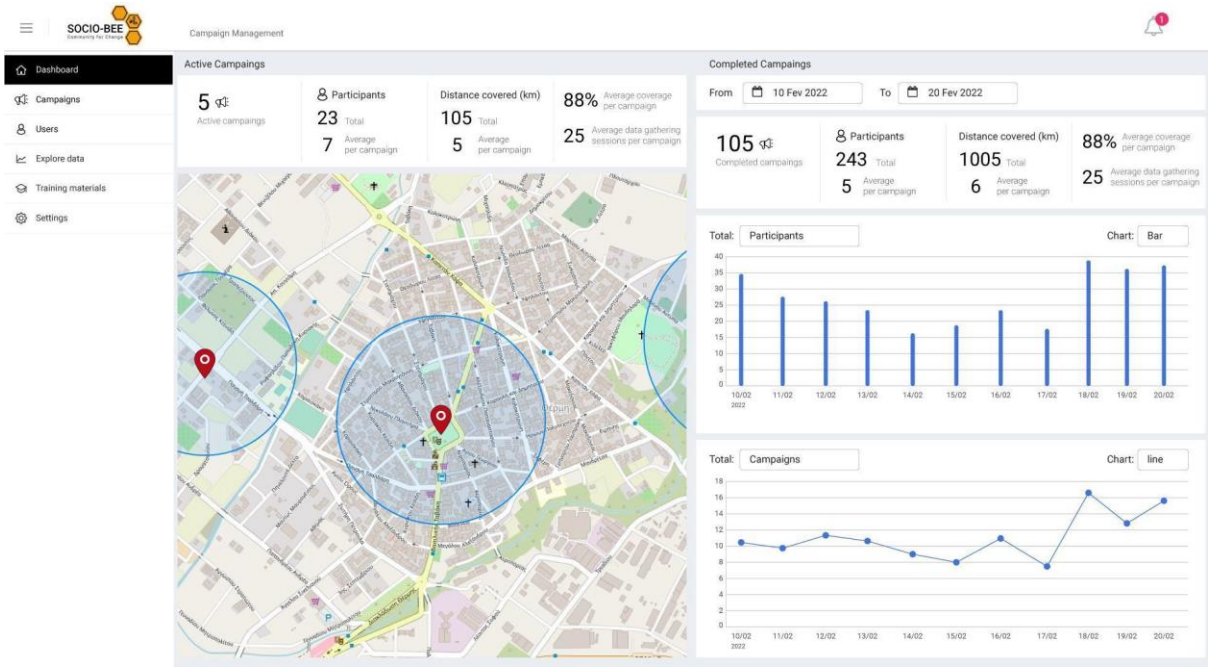


Figure 11. SOCIO-BEE's platform web front-end mock-up.

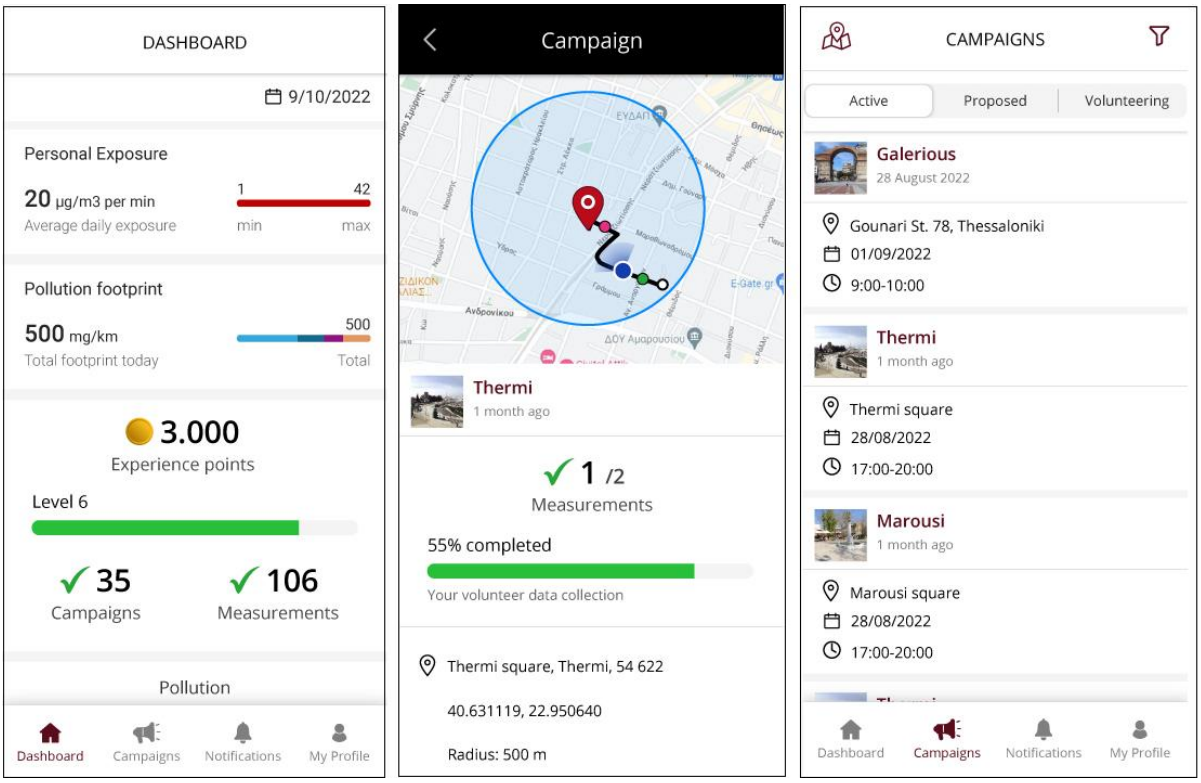


Figure 12. SOCIO-BEE's platform mobile front-end mock-up.

Figure 13 shows the process that must be carried out within SOCIO-BEE to set-up a campaign in a pilot where air quality measurements will be gathered in a certain area and period to deliver visualizations and indicators summarizing the air quality situation and evolution in a spatiotemporal manner. Essentially, such diagram illustrates the different steps that must be carried out to configure a campaign. Once the campaign is configured the recommendation service from Micro-Volunteering Engine (MVE) can be requested, which will guide hive members in their capture of air quality measurements.

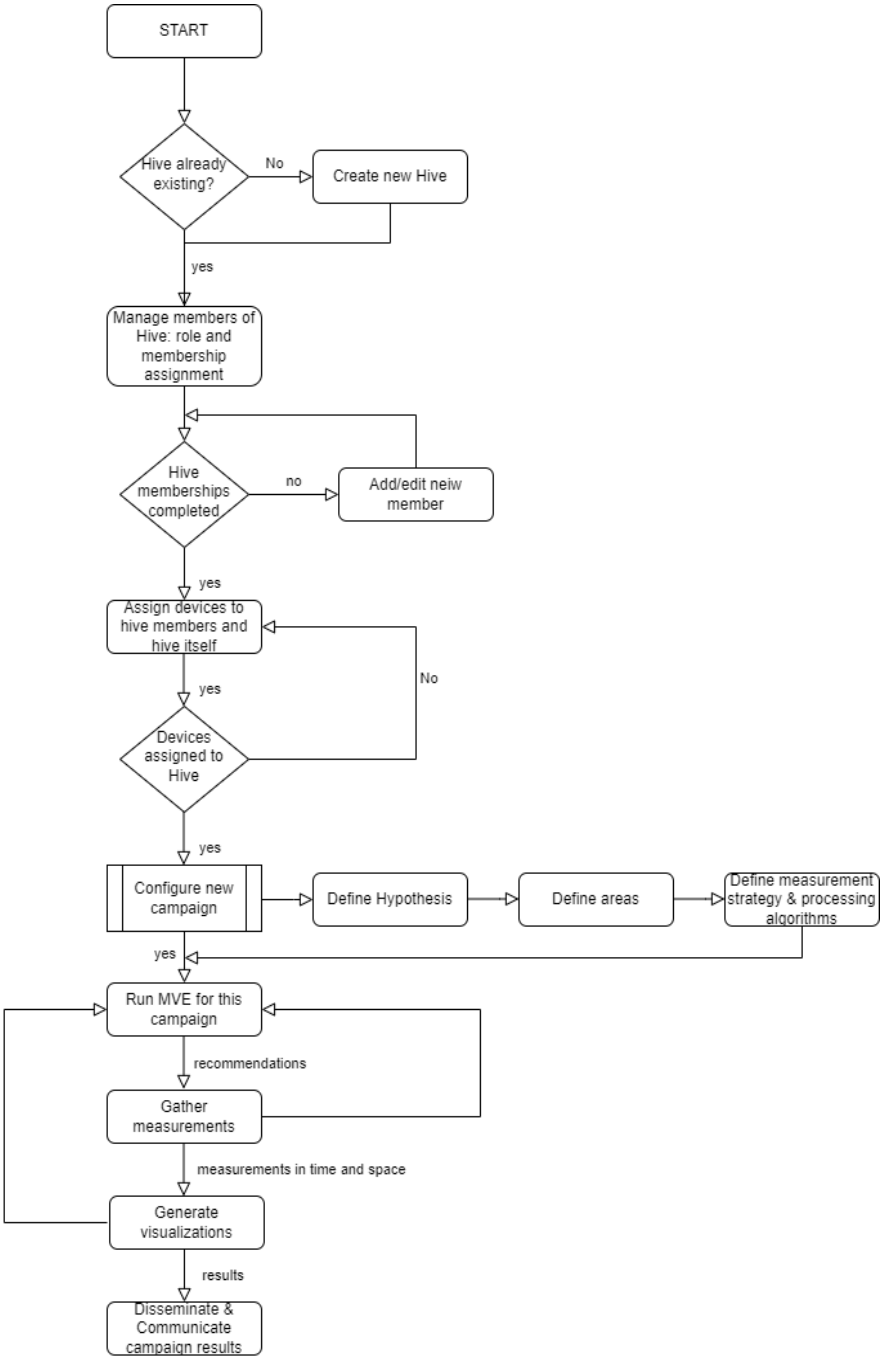


Figure 13. SOCIO-BEE's technology supported process.

Through the SOCIO-BEE platform the following data model entities are orchestrated and managed to make running CS campaigns feasible:

- Members of the SOCIO-BEE community who join Hives in different roles.
- Hives which are teams of heterogeneous members who are willing to participate in campaigns.
- Campaigns which allow a hive to realize a Citizen Science experiment with a specific purpose (hypothesis to validate).
- Campaign blueprints that define the strategy and analysis methods under which the campaign will be executed.
- Devices in the form of wearables, drones or physical devices that allow AQ measurements to be taken.
- Measurements are taken either from wearable devices of users or from fixed sensors allocated in the area assigned to the campaign.
- Data analysis pipelines are configured to deliver visualizations and insights.
- Decision support tools in the form of visualizations or KPIs population, useful for fellow citizens and promoters of the campaign to understand better effects and mitigation mechanisms for Air Quality, are provided.
- Toolkit elements are available which support hives to organize, execute and reflect about the execution of campaigns.
- Training and communication materials to enhance the awareness and learning about AQ are also provided.

2.8 Ethical & legal requirements

In the SOCIO-BEE pilots, the consortium (VUB at front) is firmly committed to ensure full respect for participants' fundamental rights to privacy and data protection. Specific actions are discussed in WP3 (D3.1[13]) and will be regularly overseen in WP6 and in the Ethical Management Plan of D1.5. There are eleven areas which raise relevant considerations – SOCIO-BEE apps, frequency of data collection, support to citizen scientists, usage of data from Copernicus and satellites, data curation and access, digital tools for co-creation, push notifications, valorisation mechanisms, information requirements and data collection in the app.

Specific actions in the pilots that have already been taken or are planned to take place refer to consortium's obligations under the GDPR and the Commission's research ethics guidelines and include informed consent forms for the participation in pilots and the use of participants' personal data. Since the pilots will include adult data subjects, the forms are aligned to the requirements laid down in art. 6, 7 and 13 of the GDPR. Namely, only subjects whose consent is freely given have been or will be included in the research, and they are informed of their right to withdraw their consent at any time (art. 7(3) of the GDPR). Moreover, the participants are given all the relevant information pursuant to the art. 13(1) and 13(2) of the GDPR, including but not limited to the identity and contact details of the controller, the storage period, the recipients of personal data and the purpose of data collection. As in this second iteration, Zaragoza pilots include minors, the consent forms have been updated to reflect the specific conditions for children's consent laid down in art. 8 of the GDPR and other applicable frameworks. Consent forms have been translated by the end-users into their local language(s).

Further measures to foster privacy and data protection in the pilots are carried out with the applicable legislation and include drafting a privacy policy and terms of use for the materials developed in the project (where applicable), and data processing agreements insofar the project activities fall under the art. 26 of the GDPR. Evaluation questionnaires will be passed at the beginning of a campaign and end of campaign within a pilot to check whether positive change has occurred towards air quality.

Finally, the task of continuous legal and ethical monitoring is run throughout the project and will result in two applied impact assessment reports corresponding to two waves of pilots. A repository of measures is also foreseen in the update of the Data management plan (D1.5) [9].

2.9 Help Desk: problem resolving approach and support mechanism

Contingency plans for both kinds of problems (i.e. technical and non-technical (mainly community building related)), are tackled through the Help Desk defined in SOCIO-BEE. Focusing on the potential issues expected, a clear support plan has been defined for the two pilot iterations. In this plan, the methodology to be applied in each public administration and the technical tools available and offered by the SOCIO-BEE platform to the end-users are explained in detail. As for the methodology to be followed, it has been broken down into two different support levels (see Figure 14):

- **1st Level of support (L1)**: SOCIO-BEE Pilot owners (i.e., MAROUSSI, ANCONA and ZARAGOZA) are the first points of contact between SOCIO-BEE end-users (i.e. citizens, civil servants, companies, air quality specialists and citizen scientists, and the SOCIO-BEE project consortium). Thereby, every public administration must set up disseminate an email address to be used by end-users for reporting issues, and indicate who will be the people responsible behind. Thus, three email addresses have been generated by ECSA/IBERCIVIS in each of the three cities: (1) Maroussi: maroussi-support@socio-bee.eu; (2) Ancona: ancona-support@socio-bee.eu; and (3) Zaragoza: zaragoza-support@socio-bee.eu, respectively. Another way of reporting issues is through the "*word of mouth*" method. During the training sessions and some other events, users will have the chance to directly communicate the problems found. In addition to the email address, some of the SOCIO-BEE public administrations might have an internal system for issues tracking, e.g. Telegram in Zaragoza. Moreover, the SOCIO-BEE consortium has set up a range of tools to offer technical support to all end-users which will be accessible from the project website. These tools vary from a Telegram channel that will be created in Zaragoza by ICERVIS, to a Slack space where different channels for SUPPORT and DEVELOPMENT which has been created by ECSA or a direct contact phone number for the pilot of MRSI. Finally, an in app questionnaires has been designed to provide feedback and thus help to solve potential issues, and a user manual was created in iteration 1 and will be upgraded and reported in "D5.9 - Pilot Site Preparation & End User Training - 2nd release"[9] to support the PILOT participants to use the SOCIO-BEE platform before the pilot execution sub-phase for iteration 2.
  From all these supporting assets, a specific person (pilot coordinator) for each pilot city has been appointed as responsible for monitoring, solving, and reporting these issues to a 2nd level in case of need. If possible, the pilot owners (either ANCONA, MAROUSSI or ZARAGOZA) and the cross-pilot coordinator (CERTH) may take corrective actions and/or direct these actions to the trial support team (2nd Level). The L1 team collects incident details from users via all the available sources of information mentioned before (e.g., email, slack) and properly logs every incident into the issue management system (i.e., Redmine, a support mechanism set up by Deusto at https://redmine.sociobee.apps.deustotech.eu/) which is used both by L1 and L2. The L1 team classifies incidents by type and filters those that require attention from the L2 support team. In addition, common issues are added to what is known as FAQs (Frequently Asked Questions), published in the project website by ECSA.
- **2nd Level of support (L2)**: Further technical problems and non-technical problems which cannot be addressed by the each Pilot Coordinator internally are reported to the SOCIO-BEE 2nd level of support: a support team (pilots' support team) composed by a team of engineers, all of them members of the SOCIO-BEE technical partners (CERTH, BETTAIR, AUTH, HYP, DEUSTO), and a representative of pilot sites (MRSI – Maria Kotzagianni) has been appointed. They are responsible for all CS campaigns and SOCIO-BEE environment configuration issues in the infrastructure. All the identified issues are reported and tracked in the internally set-up Redmine [10] where issues

are individually evaluated, assigned, and treated. Once these issues are solved, the final users are reported through a response mail, from L1 representatives.

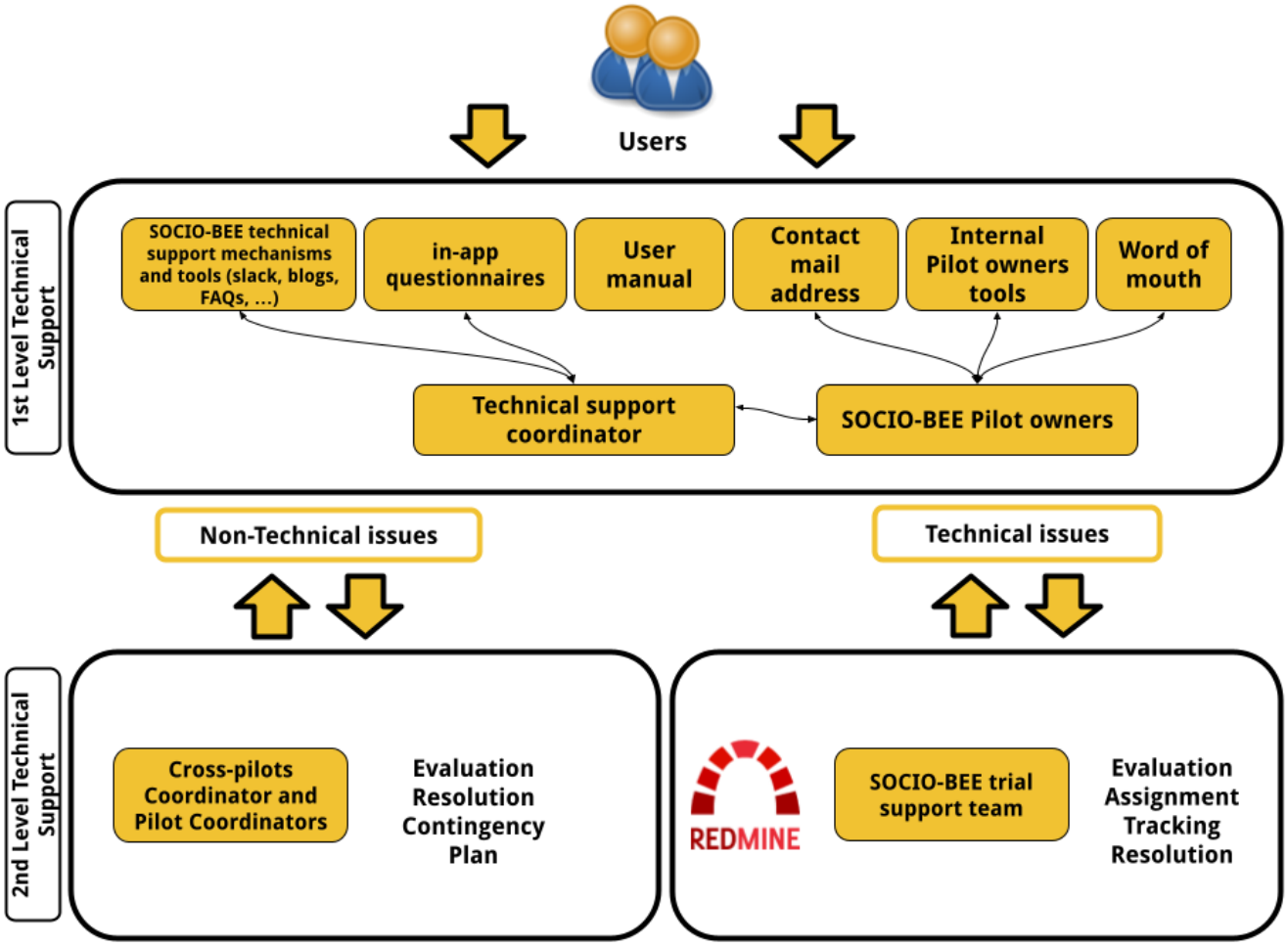
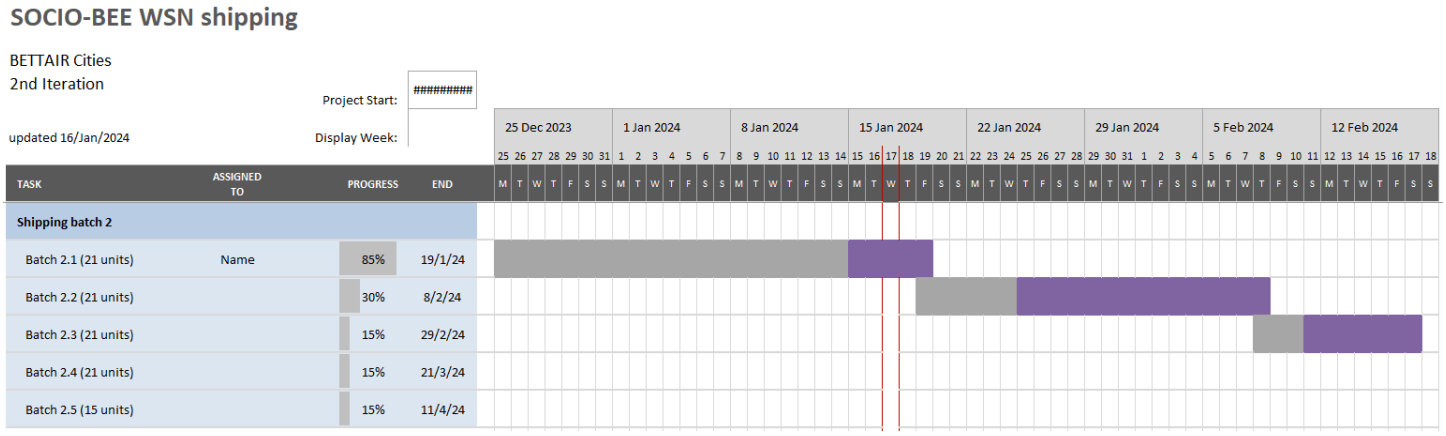


Figure 14. SOCIO-BEE's support-process.

2.10 Sensors' distribution

A production of 99 WSN devices has been planned for the second iteration of pilots. 99 selected units will be distributed evenly among the pilot sites in iteration 2, 33 units to each pilot that add to the previous 18 received by each pilot in the first iteration for a total of 51 per pilot. Moreover, one sensor will be delivered to ID2Move to prepare it for integration onto a drone. The calibration process of the sensors is done in batches and has a variable duration of 1.5 to 2.5 weeks depending on environmental factors. The first batch of 7 sensors per pilot (total of 21) is going to be delivered during January 2024, and following batches will be delivered according to Table 5.

Table 5. Planned shipping of SOCIO-BEE wearables in the project.



3 Specification of pilots' experimentation

The SOCIO-BEE pilots are described in the following sections in alphabetical order, namely, Ancona, Maroussi and Zaragoza. For each pilot, its requirements, stakeholders, campaigns co-designed, workplan and community engagement plan are detailed.

Notice that in the design of campaigns, pilot owners have taken as reference the guide "Campaign template and blueprints_iteration2" document, which details the following types of CS Blueprints.

- *Campaign Blueprint 1*: Pollinate a specific area in a short period of time. (Type I)
- *Campaign Blueprint 2:* Pollinate an area over a longer period (type I)
- *Campaign Blueprint 3:* Pollinize an area around a source of pollution over a short period of time (type II)
- *Campaign Blueprint 4:* Pollinize an area around a source of pollution over a longer period (type II)
- *Campaign Blueprint 5:* Pollinate a specific area in a short period of time with initial referencing. (Type I)
- *Campaign Blueprint 6:* Pollinate a specific area in a short period of time with group measuring (Type I)

Notice that *Campaign blueprints* are templates of potential campaigns to be run in the context of the SOCIO-BEE project. They can be consulted by Beekeepers and QBs to select the one(s) which is/are more convenient to prove the hypothesis raised collectively by the hive. The campaign's blueprint helps bees to address questions related to HOW, WHAT, and WHEN making measurements (aka, do pollen gathering and pollination activities). The campaign blueprints are tightly coupled with the wearable sensor developed in the context of the project, but they can be reused/applied in other contexts beyond SOCIO-BEE (e.g., citizens aiming to explore their environments with other low-cost sensors such as ATMO Tube PRO or Do-it-Yourself, DiY sensors). Notice that this document upgraded for iteration 2 includes new blueprints 5 and 6. These newly developed blueprints are devised towards enhancing the quality and underlying reliability of the measurements gathered in campaigns by Worker Bees

Besides, for the specification of actions and activities to be carried out in iteration 2 of piloting, the following schedule, and associated milestones, have been considered:

- *Milestone 1 (MS)* – Pre-pilot launch subphase (M28 – January 2024 to M30– March 2024).
- *Milestone 2 (MS)* – Pilot execution sub-phase (M31 – April 2024 to M33 – June 2024)

- *Milestone 3 (MS)* – Post-Pilot execution sub-phase (M34-35 – July to August 2024)

3.1 Ancona

Figure 15. Ancona city's picture.

Ancona, situated within the Marche region of central Italy, functions as both a prominent seaport and a populous city with an approximate population of 101,031 as recorded in 2019. Serving as the administrative centre, Ancona holds the dual distinction of being the capital of both the province bearing its name and the broader region.

Positioned strategically along the Adriatic Sea, Ancona occupies a geographical space nestled between the slopes of Monte Conero's two distinctive extremities, namely Monte Astagno and Monte Guasco. This location lends Ancona its significance as a pivotal hub for maritime activities and trade, emphasizing its role as a vital center for economic exchange within the region.

Ancona is one of the main ports on the Adriatic Sea, especially for passenger traffic, and it is the main economic and demographic centre of the region. With an extension of about 184,24 km², it has a density of 809,28 inhabitants per km². The substantial urbanization in Ancona correlates with a notable upsurge in diverse pollution types, significantly impacting the city's environmental quality and, consequently, its residents' quality of life. A pivotal consideration revolves around pollen exposure, encompassing both the abundance of allergenic pollen and its potential chemical interplay with PM10 and PM2.5 pollutants.

When the air quality is poor, it is important to adjust the physical activity routes of citizens to prevent them from breathing too much air pollution that could lead to the outbreak of respiratory diseases. At the same time, traffic congestion is also a critical aspect, because it degrades ambient air quality and is hazardous for people that live in the most polluted neighbourhoods. Residents in these areas might refrain from outdoor activities to evade exposure to pollutants, leading them to rely more on personal vehicles, fostering a sedentary lifestyle while perpetuating the emission of further pollutants into the atmosphere. This exacerbates the cycle of environmental degradation and health risks, demanding strategic interventions for sustainable urban living.

Given these premises, the focus of this pilot initiative is to actively engage vulnerable groups, particularly the elderly, in adopting healthier and safer lifestyles, with a specific emphasis on the city's air quality. This choice is substantiated by the demographic landscape, as currently, 26% of Ancona's population is over 65 years old, a percentage expected to rise. The primary goal of the pilot is to empower seniors by enhancing their awareness regarding the city's air quality and motivating them to implement strategies that reduce air pollution. Encouraging elderly individuals to embrace outdoor activities in less polluted and less congested environments is pivotal, promoting a lifestyle conducive to better health. The data and indicators generated from this initiative will serve the municipality in crafting tailored social assistance programs and defining effective mobility policies. Within the project framework, 'Queen Bees' represent citizens, specifically the elderly,

who exhibit interest in leading city-based actions or projects. Meanwhile, 'Working Bees' encompass volunteers selected through predefined criteria such as age range, location, local population density, and traffic conditions.

3.1.1 High level requirements of pilot

The goal is to map the levels of air pollution around the city, by involving seniors in the process of air quality measurement, using the technology developed within the project. This will be aimed by a large deployment of wearable sensors carried around the city by the recruited citizens. The air quality mapping is also aimed at identifying locations of critical importance, typically visited by vulnerable ged populations. To enable this vision, the pilot will combine a progressive environmental monitoring, including the installation in specific neighbourhoods of urban furniture (i.e., pedestrian and traffic monitoring) combined with air quality sensors already available.

Through micro-volunteering tools provided by DEUSTO and AUTH connected to the AcadeMe mobile app supplied by HYP and CERTH, we expect to increase and facilitate the engagement of citizens in the initiative, indicating the status of the neighbourhood air quality and the most suitable areas to perform CS tasks provide by SOCIO-BEE. The use case will promote open-air activities and suggested paths for walking or jogging for elderly people to increase their wellbeing.

Furthermore, the SOCIO-BEE app will collect information about the citizen engagement. It is crucial for policy makers to adopt sustainable and integrated approaches for air quality management, which will closely involve citizens and their actions.

3.1.2 Stakeholders' map of pilot

Table 6 shows the allocation of people and associations to the different roles that stakeholders will play within the Ancona pilot and its planned campaigns.

Table 6. Stakeholder's map for Ancona.

Stakeholder name or group	Stakeholder type	Role and activities	Level of involvement	Barriers of engagement	Motivations and expectations	Recruitment strategies and channels	Stage of involvement	Support
Municipality of Ancona	**Beekeeper**	Coordination, dissemination, workshops, campaigns	High: Coordination / Action / Supervision	Time constraints, lack of seniors participation	Check the technology of the project	They're all members of the Pilots team	All phases of the pilot	Chronogram of the pilot activities coordination
Social Services					Check the project engagement strategies for building communities			

Università Politecnica delle Marche					Analyze air quality in the different areas of the city center			Work in project WP's deliverables /Technological support to the Ancona municipality
Association for seniors' right (ADA)								Collect Data, bring help and support, workshop organisation, communication & dissemination activities, bees' recruitment
Municipality of Ancona - Social Services	**Queen Bee**	Participate actively to the pilot	Low: Facilitation / Supervision	Time constraints /not familiar with technologies	Analyse the behavioural change about air quality between the community (hive) members	Internal channels	All phases of the pilot	Facilitate time and spaces to run the pilot activities
Association for seniors' right (ADA)								
Università Politecnica delle Marche	**Bear**	Help with communication and dissemination strategies	Medium: Facilitation	Time constraints	Have scientific evidence that allows to improve municipal regulations about air quality, being part of a European innovation project	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face conversations)	All phases of the pilot	Facilitate spaces and channels for communication and dissemination of the project and its results
Municipality of Ancona		Receive and study the final scientific reports						
ARPA Marche								
ASUR Marche								

Municipality of Ancona - Social Services	**Working bees**	test technology	High: Action	Time constraints, success in content adaptation and engagement strategy	Contribute to the pilot success	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face talks)	Pre-pilot phase	Bring experience in previous citizen science projects and scientific experiments related to air quality.
Municipality of Ancona - Press Office			Inform, Guide and Work with	Informatio, dissemination, events, and workshops promotion				
Associations' members			Data collection and work with			Via email, phone, in person or by workshops		
Volunteers/Seniors			Data collection and work with			Via email, phone, in person or by workshops		
UNIVPM Social media managers, Municipality Press Office and Communication Office	**Drone Bee**	Dissemination, workshops promotion,spread information	Low: Supervision / Advice	Lack of communication with pilot representatives, lack of information of the pilot aims and outcomes	Be aware of the pilots' development to introduce air quality improvement activities in their organisations	Pilot communication channels: Email, social media, newsletter	Pilot Phase	Dissemination of the results through their communication channels

3.1.3 Campaigns co-designed

This section presents the campaigns devised by the Municipality of Ancona and UNIVPM for the pilot. These campaigns were crafted based on insights gained from the initial pilot phase, incorporating various aspects. This encompasses users' capability in adopting the proposed technologies, the feasibility of conducting measurements in key city zones, and the mindful consideration of potential limitations arising from the demographics participating in the pilot, which are the seniors aged > 65 years old. Given these premises, **4 different air quality measurement campaigns** have been planned for the city of Ancona, focusing on two central areas frequently used by individuals for physical activities, and a zone outside the center where measurements can also be tested using drones.

For more details about the co-designed campaigns check “ANNEX B. Campaign templates filled in by pilots“

Campaign #1 Evaluate the level of air pollution in the city centre, focused on the main lane used by pedestrians “Viale della Vittoria”. Type I campaign, area investigation

Research questions: The area under investigation stands as a primary communal gathering space within the city, frequented by individuals meeting up, strolling, and engaging in activities like jogging. This campaign aims to measuring the levels of pollutants and the exposition of citizens throughout the day in this area to gather the pollution levels and associated risks.

While this location serves as a hub for social interaction, walking, and jogging, the question arises: is prolonged exposure to high traffic zones conducive to good health? Are there specific times of the day more suitable for these activities, considering air quality? But is prolonged exposure to high traffic zones conducive to good health? Are there specific times of the day more suitable for these activities, considering air quality?

Understanding the implications of spending extended periods in such a central traffic zone is crucial, especially for vulnerable groups like the elderly. Evaluating optimal times for citizens to partake in these practices aligns with fostering healthier and safer urban environments.

Hypothesis: *It is advisable to avoid prolonged exposure to high traffic times, such as the early evening rush hour when people are returning home from the office.* This period typically witnesses increased vehicular activity, leading to higher levels of air pollutants. As such, it is prudent to minimize extended stays or activities in these areas during these peak traffic hours to reduce potential exposure to pollutants, thereby promoting better health outcomes.

Stakeholders: Ancona is establishing site associations to designate locations for a potential campaign, with the Municipality, UNIVPM, and ARPAM collaborating as key players. Seniors from the Association for Elderlies' Rights (ADA) and the municipality will serve as Queen Bees, while elders from associations and volunteers will play the role of Bees. UNIVPM's social media, the Municipality Press Office, and the Communication Office will act as Drone Bees, assisting in spreading the campaign's results.

Goal: The goal of the Ancona pilot campaign is to assess air quality in a specific area of central Ancona, known for its long avenue often used for socialising and physical activities. The campaign aims to measure air quality at various times of the day (from 7a.m. to 20 p.m. at least), evaluate the variations in air quality throughout the day, and ultimately offer a coaching solution to guide citizens on the most suitable times for engaging in physical activities based on air quality levels.

Workplan: Ancona's work plan outlines a series of strategic meetings to facilitate the successful implementation of the campaign. The plan includes initiating 2 to 3 meetings with seniors' associations by January 2024 to develop effective strategies for training seniors in using SOCIO-BEE technology. In February 2024, the focus shifts to engaging potential seniors (Queen Bees and Worker Bees), introducing the technology, conducting initial tests, and collaboratively planning the campaign timeline. Following these preparatory stages, sensors will be allocated to the Worker Bees and Queen Bees for the measurement phase. The iterative distribution of Wearable Sensor Networks (WSN) will depend on seniors' involvement, with each user having access to the sensor for one to two weeks during the month-long campaign (March 2024 - April 2024). After sensor usage, devices will be returned to the municipality, culminating in a final event to present campaign results to HIVE stakeholders.

Risks: The campaign has potential risks, including challenges in recruiting a sufficient number of participants (bees) to form a hive, potential disinterest from key stakeholders (bears) in utilising campaign results for policy development, and concerns about the functionality and complexity of sensors or the mobile application for the target audience. To mitigate these risks, the campaign will be personalized to accommodate the schedules of participating seniors, minimizing disruption to their daily routines. Additionally, efforts will be made to identify seniors who regularly travel to the designated path in the campaign area.

Location: The location of the campaign is an avenue long about 1 km (around 0,6 miles) that is a main part of the centre of Ancona, named Viale della Vittora (Victory avenue in literal English translation).The campaign blueprint chosen is the number 2: *Pollinate an area over a longer period (type I).*

Materials & Equipment: It is strictly needed a full manual of the overall platform will be must both for trainers and users, the given 18 sensors and a sharp definition of the minimum technological requirement.

Recommendations: During the first iteration of the project come out the strong wish by the users to be able to have an indication or the value of the pollutant immediately after the measurement. Another need is the orientation of the map depending on the user position, it seems important in particular to understand how exactly to reach the next suggested point of measurement.

Methodology: To ensure the campaign's timely and efficient execution, a structure of recurring meetings with Hive members has been established along with an online communication system. This platform, building upon the success of WhatsApp in iteration 1, will serve as a central hub for reminders and updates on campaign achievements. The approach involves collecting air quality data and questionnaires from committed CS activists. Ancona plans to analyse this diverse dataset using a combination of traditional statistical methods and cutting-edge AI techniques. The goal is to generate comprehensive visualizations identifying the most and least polluted areas within the city centre, while also gaining valuable insights into citizen engagement levels during the campaigns.

Reasoning: The Hive's campaign aims to analyze air quality in the city centre while promoting an active lifestyle and engagement in mitigation strategies. It benefits various stakeholders, including Bears, Queen Bees, Beekeepers, bees, and all citizens, especially the senior community. The expected outcomes are diverse, generating a comprehensive air quality dataset for the city centre and potentially influencing new policies supporting open-air activities and urban improvements. The campaign's data will facilitate engagement with stakeholders, fostering discussions on expanding green spaces, implementing traffic management strategies, and introducing pollutant barriers. Additionally, the initiative seeks to promote inclusivity by actively involving senior citizens in environmental actions, positively impacting the overall quality of city life.

Success indicator/s:

- # of valid measurements taken by citizens (>300)
- # of hours in one week for which an effective area of interest pollution mapping was achieved with an estimated accuracy of class 3 (>30)
- # of devices directly referenced against reference station (primary device) and number of devices referenced to a primary device (>15)
- total # of measurement hours of WSN device referencing against reference station (>400)
- Surface covered in the campaign (>1km2)

Campaign #2: Assess the air pollution levels in the city centre to determine the suitable timing for engaging in physical exercise. Type II campaign, Source investigation

Research questions: The goal of this initiative within the Ancona pilot project is to assess the air quality in a designated area within downtown Ancona. This area features a pedestrian street near the port, commonly used for leisurely walks or jogging. By conducting measurements in this campaign, our objective is to determine the optimal times for citizens to engage in physical activities considering air quality conditions. The specific research question is "*What is the effect of possible pollution source to the air quality in this area*?"

Hypothesis: If air quality reaches poor levels, it might be advisable for citizens to consider refraining from engaging in physical activities during that time of day.

Stakeholders: Ancona will have site associations to create or assign a hive for a potential campaign. Municipality, UNIVPM and ARPAM will work as Bears in the campaigns. Seniors recruited from Association for elderlies' Right (ADA) and municipality will have the role of Queen Bee. Moreover, elders recruited from associations and volunteers will have a role as Bees. UNIVPM social media, Municipality Press Office and Communication Office will be the Drone Bees, helping to disseminate the outcomes of the campaign.

Goal: The purpose of this campaign within the Ancona pilot is to measure the air quality in a specific area of downtown Ancona, which presents a pedestrian street close to the port, typically suitable for taking a walk or jogging. Through the measurement that will be taken within this campaign, the aim is to understand the most suitable times of the day for engaging citizens in physical activities based on the air quality:

1. Measure AQ in different time of the day (from 7 to 20 at least)
2. Evaluate across the different time of the day the air quality.
3. Provide a coaching solution.

Workplan: In the Workplan, Ancona aims to conduct a series of targeted meetings to ensure effective implementation. Initially, we plan to schedule a minimum of 2 to 3 meetings with representatives from seniors' associations. These meetings, slated to commence by January 24, will be aimed at devising optimal strategies for training seniors in utilizing SOCIO-BEE technology. The subsequent step, scheduled for February 2024, involves engaging potential seniors (both QB and WB). During these sessions, we will introduce the technology, conduct initial tests, and collaboratively plan the campaign's timeline. Following these preparatory phases and in alignment with project milestones and technological advancements, our goal is to allocate sensors to the WB and QB for the campaign's measurement phase. Depending on the seniors' level of involvement, we envisage an iterative distribution of wearable Sensor Networks (WSN) to individuals for periods of 1 or 2 weeks. Ideally, considering a month-long campaign (March 24 - April 24), each user will have access

to the sensor for one to two weeks. Upon the completion of their sensor usage, the devices will be returned to the municipality, with a final event. This event will serve as a platform to present the campaign results to the HIVE stakeholders.

Risks: Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. There is also the lack of interest from bears to use campaign results as inputs for new policies. And, the sensors and/or the mobile application are not working properly or are too complicated to use for the target audience. To mitigate these risks campaign will be tailored according to the seniors involved, trying not to disrupt their daily routine, and trying to find seniors that typically travels the desired path in the area individuated for the campaign.

Location: Regarding campaign blueprints, Ancona has selected the blueprint chosen to “Pollinate an area around a source of pollution over a long period of time (type II)”. The area of interest is marked in the picture below in red.

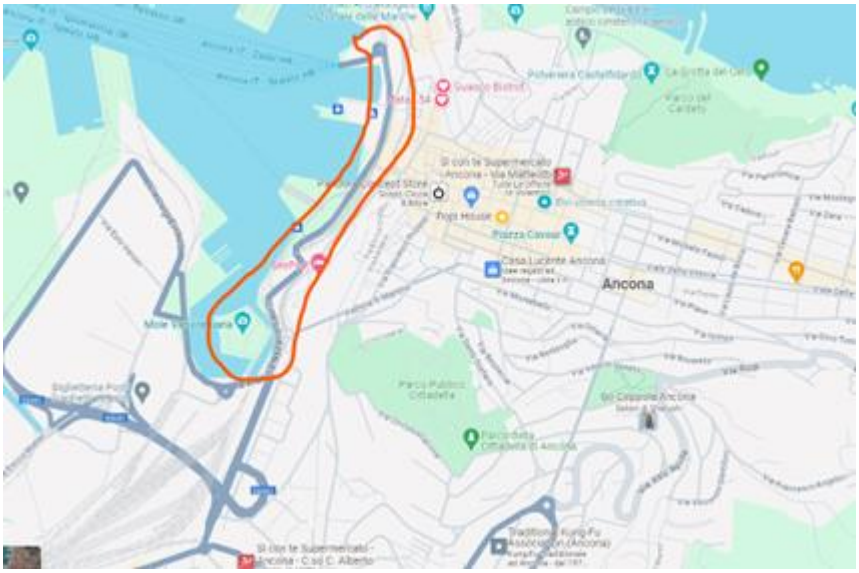


Figure 16. Ancona’s campaign #2 pilot location.

Materials & Equipment: "It would be ideal to commence collaboration with the QB and WB once the platform is thoroughly prepared and after a testing phase conducted by UNIVPM and ANCONA. This approach will ensure that the platform is robust and optimised for seamless integration with the Hive. In terms of resources required, Ancona will need the following:

- Materials for engaging potential representatives for the Hive.
- Provision of at least 20 devices essential for the initiative.
- Development of user manuals for both the mobile and web applications.
- Conducting workshops in collaboration with technology partners to familiarise ourselves with the tools earmarked for use during the pilot.

Securing these resources will be pivotal in ensuring a successful launch and sustained effectiveness of the pilot initiative.

Recommendations: Ancona considers that it would be good that Beekeepers and QBs could see the activities performed by each WB separately and be able to contact them to activate them in case of inaction. They also think that it would be very important for the Beekeepers to know the exact time spent of each sensor in the vicinity of the air quality station per individual sensor for validation purposes. Additionally, Ancona thinks that it is crucial for the end user to be able to get an indication of the pollution instantly after their measurement.

Methodology: To ensure the timely and efficient execution of the campaign, we have structured recurring meetings with Hive members and established an online communication system. This platform will serve as a hub for reminders and updates on campaign achievements, building upon our successful use of WhatsApp during iteration 1. Our approach involves the collection of air quality data and questionnaires from our committed CS activists. To analyse this diverse dataset, Ancona will employ a combination of traditional statistical methods and cutting-edge AI techniques. By leveraging these approaches, we aim to produce comprehensive visualizations pinpointing the most and least polluted areas within the city centre. This analysis will also provide valuable insights into citizen engagement levels within the campaigns.

Reasoning The Hive's campaign has the purpose of analysing the air quality in the city centre while promoting active life and engagement in mitigation strategies. This initiative aims to benefit various stakeholders, including Bears, Queen Bees, Beekeepers, bees, and all citizens, encompassing the senior community. The expected outcomes from this campaign are multifaceted. Firstly, it will generate a comprehensive dataset on air quality in the most crowded place of the city. Moreover, the campaign could be used to influence the formulation of new policies that may advocate for the promotion of open-air activities and urban enhancements. The data collected will serve as a valuable resource for engaging relevant stakeholders, fostering discussions on expanding green spaces, devising effective traffic management strategies, and implementing pollutant barriers. Simultaneously, it seeks to foster inclusivity by actively involving senior citizens in city activities aimed at addressing environmental concerns. The proactive involvement of our senior community in these actions is poised to positively impact the overall quality of city life**.**

Success indicator/s:

- # of valid measurements taken by citizens (>300)
- # of hours in one week for which an effective area of interest pollution mapping was achieved with an estimated accuracy of class 3 (>30)
- # of devices directly referenced against reference station (primary device) and number of devices referenced to a primary device (>15)
- total # of measurement hours of WSN device referencing against reference station (>400)
- Surface covered in the campaign (>1km2)[NM2]

Campaign #3 ANCONA: combination of one and two to evaluate the differences and comparisons with the reference station

Research questions: This is an important phase of the whole pilot. We want to compare the data collected in iterations #1 and #2 and with data from local monitoring stations, evaluate them and start to have a clear and true picture of the city. Are the actual local stations enough to monitor the pollutant levels? Is the picture of the city still realistic? There are time windows during day useful for outside activities.

Hypothesis: Due to the actual location of the 2 monitoring stations, the city needs at least one more station positioned in the centre of the city, to gain more realistic data?

Stakeholders: At first UNVIPM and Municipality, in a second moment involving ADA and ARPAM. This is more an evaluation phase, so no research “on field”.

Goal: The main goal is to verify if the actual monitoring stations are enough to check the air quality of the city and to have a more capillary net of measures in particular during the daytime, when traffic is frenetic.

Workplan: This is phase where the team will analyse and arrange data, comparing them. In a second moment, discussing it with the associations.

Risks: No risks expected, just potential ones in case some sensors will have a malfunctioning.

Location: Regarding campaign blueprints, Ancona has selected the blueprint chosen to "Pollinate an area a long period of time (type II)". The area of interest is marked in the picture below in red and blue.

Materials & Equipment: No special equipment needed.

Success indicator/s:

- # of valid measurements taken by citizens
- # of hours in one week for which an effective area of interest pollution mapping was achieved with an estimated accuracy of class 3
- # of devices directly referenced against reference station (primary device) and number of devices referenced to a primary device
- Total # of measurement hours of WSN device referencing against reference station (>400)
- Surface covered in the campaign.

Campaign #4 Evaluate green areas in the city of Ancona (also using the drone); type I, area investigation.

Research questions: The purpose of this campaign within the Ancona pilot is to the specific research question of "*What is the effect of possible pollution source to the air quality in this area*?"

Hypothesis: if there is a green area, air quality should improve in that area.

Stakeholders: Staff of UNIVPM and Possibly group of students @UNIVPM

Goal: The purpose of this campaign within the Ancona pilot is to measure the air quality in specific area of the city where there are parks and green areas. The aim is to compare the data of green areas with the one collected from campaign #1, #2 and #3 to evaluate the impact of green area in the air quality of the city. Through the measurement that will be taken within this campaign, the aim is to understand the most suitable times of the day for engaging citizens in physical activities based on the air quality:

- Measure AQ in different time of the day (from 7 to 20)
- Evaluate the AQ with reference to the city centre
- Use the drone in places that citizens cannot reach in green areas
- Compare the measurement with the reference stations

Workplan:
The work plan for this campaign is different from others because it involves conducting a campaign for a short period of time. First, there will be a platform training phase (composed of the drone and WSN) in a test area. Then, the real campaign in the park could start (May/June 2024).

Risks: No particular risks have been identified.

Location: Regarding campaign blueprints, Ancona has selected the blueprint chosen to “Pollinate an area short period of time (type I)”. The area of interest is marked in the picture below in red.

Figure 17. Ancona’s campaign #4 pilot location.

Materials & Equipment: To implement the campaign, instructions will be needed to incorporate the WSN onto the drone, along with the integration between the drone and the SOCIO-BEE system.

Recommendations:

Methodology: To ensure the proper execution of the campaign, UNIVPM will be supported by the project partner, ID2MOVE. The campaign will take place over a period ranging from 1 week to 10 days. Our approach involves measuring air quality at various altitudes and considering different ground-based measurements.

Reasoning

Success indicator/s:

- # number of measurement taken both on the ground and at different altitudes.

3.1.4 Pilot execution plan

The actions foreseen for Ancona pilot are shown in Table 7:

Table 7. Ancona's workplan for iteration 2.

ID	MS	Phase	When	Action	Description	Target	Comments
C1.1	1	Pre-pilot launch subphase	March	Communication	Announcement of SOCIO-BEE pilot and purpose (press release, social media posts) among alpha testers	UNIVPM Staff, Ancona Staff	Meeting
T1.1	1	Pre-pilot launch subphase	March	Training	Workshop with potential alpha testers informing about purpose, privacy procedures and policies	UNIVPM Staff, Ancona Staff	Planning and building a metodology, internal training about infrastructures and training material
IR1.1	1	Pre-pilot launch subphase	March	Internal release	Training of pilot owner representatives about SOCIO-BEE support system	UNIVPM Staff, Ancona Staff	Testing devices and infrastructure

C1.2	1	Pre-pilot launch subphase	March	Communication	Physical and/or online workshop about SOCIO-BEE platform	Group of alpha testers	Communicating of the start of the pilot
T1.2	1	Pre-pilot launch subphase	March	Training	Training of alpha testers	UNIVPM Staff, Ancona Staff, alpha testers	Improvements and quick reaction about potential issues or bugs
S1.2	1	Pre-pilot launch subphase	March	Support	Physical, mobile or online support to alpha testers	Alpha testers	First level of potential issues
T1.3	1	Pre-pilot launch subphase	March	Training	Workshop 2: training on SOCIO-BEE platform (sensors, mobile app and web). Performing measurements in real environments to ensure the proper functioning of the sensors.	Alpha testers	
MM.1.1	1	Pre-pilot launch subphase	March	Monitoring	Feedback from alpha testers	Alpha testers	
MM1.2	2	Pre-pilot launch subphase	April	Monitoring	Continuous monitoring during the pre-pilot phase	Alpha testers	Identification of new actions to be undertaken to improve the testing experience and maximize the results of the process.

ER1	2	Pilot-execution subphase	April	External release	External release of SOCIO-BEE platform and citizen science campaigns, knowledge base and toolkit		
C2.1	2	Pilot-execution subphase	April	Communication	Announcement of pilot public start		
EX2.1	2	Pilot-execution subphase	April	Execution	First turn of results, hypothesis	All the involved subjects	
M2.1	2	Pilot-execution subphase	April	Monitoring	Questionnaires, issues report and troubleshooting	Alpha testers	Reports to the technical team
EV2.1	2	Pilot-execution subphase	April	Evaluation	Campaign 1: share the results - verify the hypothesis		Analysis and interpretation of the results collected during the campaign. Verification of the validity of the hypothesis.
EX2.2	2	Pilot-execution subphase	May	Execution	Execution of the second campaign		
MM2.1	2	Pilot-execution subphase	May	Monitoring	Continuous monitoring during the whole phase		
EV2.2	2	Pilot-execution subphase	May	Evaluation	Campaign 2: share the results - verify the hypothesis		

EV2.3	3	Post-execution subphase	June	Evaluation	Preparation of the final evaluation report on the outcome of the campaigns: analysis of key performance indicators, records and questionnaires.		

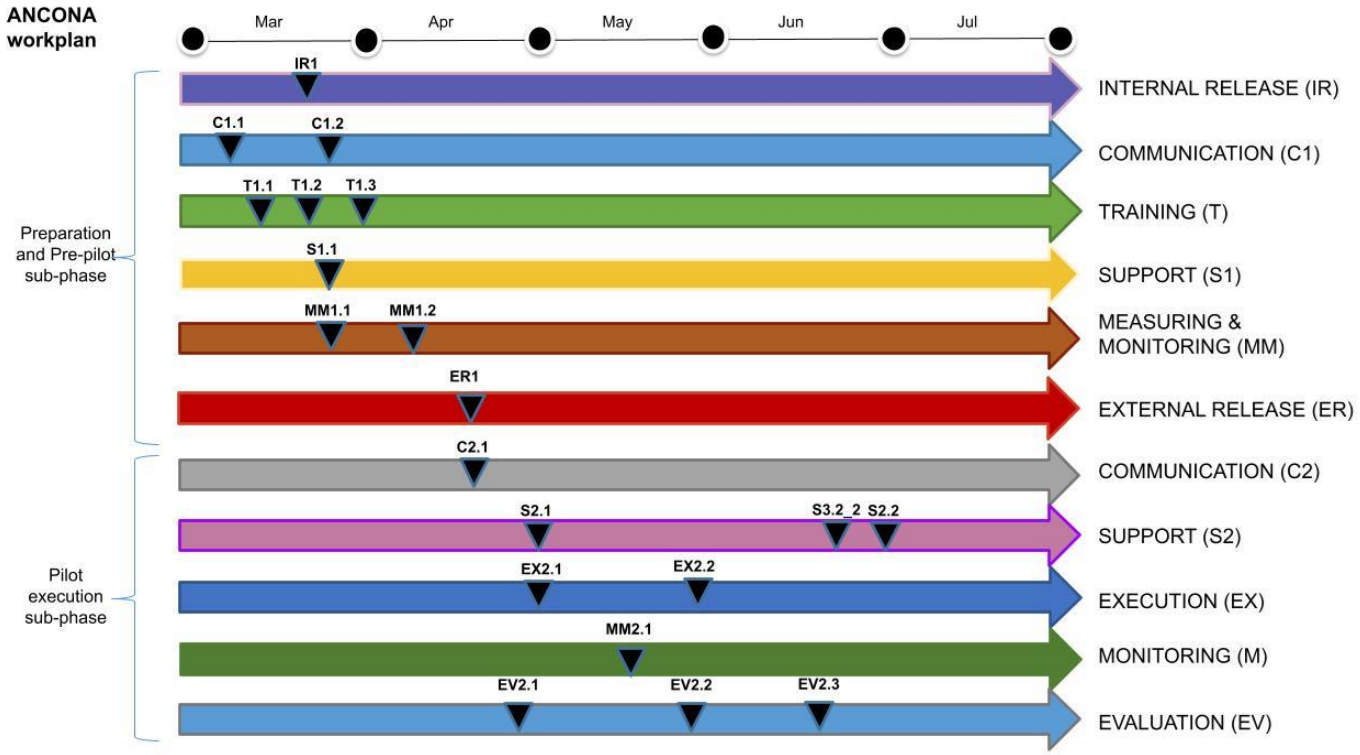


Figure 18. Ancona's workplan for iteration 2.

3.1.5 Community building plan

This pilot will organize different types of engagement and involvement activities for community building where it will use various materials for the correct development and understanding of the for Ancona's community. Some examples of those materials customized to Italian and to the context of this pilot are posters, forms, brochures, marketing material (INFORM, GUIDE, CONSULT). Ancona may also offer minor prizes in contests or hackathons (WORK WITH).

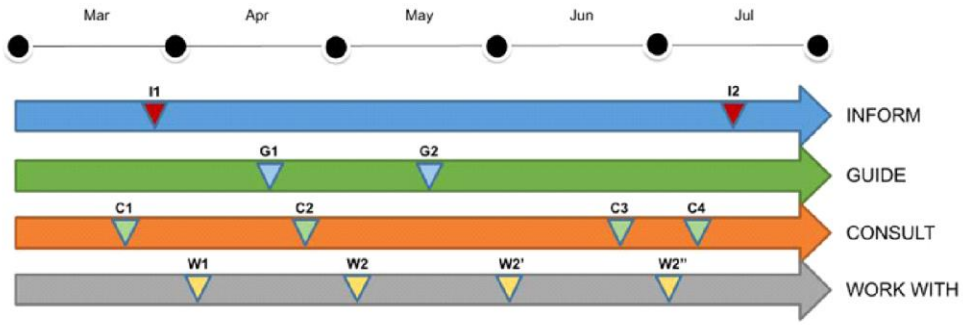


Figure 19. Ancona's community building plan for iteration 2.

Next, a table is filled in for each of the 12 activities planned for Ancona which are depicted in the timeline in Figure 19. The following code is used to define the type of activity described I (INFORM), C (CONSULT), G (GUIDE) and W (WORK WITH).

Table 8. Ancona's I1 engagement activity description.

I1	INFORM - Disseminating SOCIO-BEE internally
Objective	Inform and make internal stakeholders aware about SOCIO-BEE and this pilot's use-cases.
Phase	BEFORE PRE-PILOT (MAR)
Target artefacts	SOCIO-BEE toolkit and engagement strategies
Target groups	Stakeholders in the municipality
Dissemination materials	First version of SOCIO-BEE leaflet and a figure/presentation describing the concept of the project
Evaluation mechanisms	Demographic and satisfaction questionnaires and consent forms gathered.
Outcomes	Express of interest (by answering affirmatively in question indicating willingness to be contacted)
Location	ANCONA town hall
Date	Early March 2024
Responsible	Ancona municipality

Table 9. Ancona's C1 engagement activity description.

C1	CONSULT - Introduction to SOCIO-BEE project to potential Alpha testers
Objective	Enrol at least 5 Alpha testers
Phase	BEFORE PRE-PILOT (MAR)
Target artefacts	SOCIO-BEE toolkit and engagement strategies
Target groups	Alpha testers
Dissemination materials	First version of SOCIO-BEE leaflet and a figure describing the concept of the project
Evaluation mechanisms	# attendees to the onboarding event
Outcomes	Expressions of interest
Location	ANCONA town hall
Date	March 2024
Responsible	Ancona municipality and UNIVPM

Table 10. Ancona's W1 engagement activity description.

W1	WORK WITH - Training session (workshop) about Citizen Science and Air quality
Objective	Promote and reinforce the Citizen science and air quality concepts between the alpha testers
Phase	PRE-PILOT PHASE (MAR)
Target artefacts	SOCIO-BEE toolkit for engagement items (didactic material about CS)
Target groups	Testers Team
Dissemination materials	email
Evaluation mechanisms	number of attendees
Outcomes	A testers team aligned with the objectives of the pilot
Location	UNIVPM / Municipality town hall
Date	Second half March 2023

Table 11. Ancona's G1 engagement activity description.

G1	GUIDE - Training on Internal Release
Objective	Hands on learning session for the pilot team about the pilot technology
Phase	PRE-PILOT PHASE (APRIL)
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	sensors, web platform, mobile app, training materials
Dissemination materials	N/A

Evaluation mechanisms	Number of attendees
Outcomes	A tester team full understanding about the technology to be used in the campaigns
Location	UNIVPM/ Municipality hall
Date	March 2024

Table 12. Ancona's C2 engagement activity description.

C2	**CONSULT - Post Execution Phase**
Objective	Review of Hive's Operation, Recommendations and Lessons Learnt
Phase	Post-pilot sub-phase
Target artefacts	SOCIO-BEE platform, Sensors, SOCIO-BEE app, CS campaigns, knowledge base and toolkit
Target groups	QBs, WBs, DBs, Beekeepers, Hives
Dissemination materials	Conclusions driven from analysis of first iteration, analysis and discussion of results obtained, evaluation of KPIs' fulfilment.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	April 2024
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 13. Ancona's W2 engagement activity description.

W2	WORK WITH - Cross-Testing workshop
Objective	Get feedback on all SOCIO-BEE components separately and as a whole
Phase	PILOT SUB-PHASE
Target artefacts	Sensors, App, Platform, Campaign design
Target groups	Beekeepers
Dissemination materials	Training material, Presentations
Evaluation mechanisms	Acceptance tests
Outcomes	Questionnaires
Location	On-line
Date	April-May 2024
Responsible	Technical experts

Table 14. Ancona's G2 engagement activity description.

G2	GUIDE - Kicking off the first campaign.
Objective	● Session with the entire group of beta testers. To review the modus operandi to be followed in the measurements of campaign 1. ● One of the objectives is to make sure that all testers understand the purpose of the campaign and how the sensors and the application work. ● Setting last details before going out to take the measurements on the street.
Phase	PILOT SUB-PHASE
Target artefacts	SOCIO-BEE toolkit for engagement items and wearable sensors
Target groups	Pilot team members (ANCONA, UNIVPM)

Dissemination materials	Flyers, Mockups, Business canvas, etc - Collaborative environment (project INTERLINK)
Evaluation mechanisms	- Attendee's list - short survey
Outcomes	A fully agreed chronogram and the distribution of task between the team members
Location	Municipality hall
Date	May 2024 Campaign 1 and related activities will be carried out during the month of April. The specific dates of each activity will be specified as they are carried out in the activity sheet provided for this purpose.

Table 15. Ancona's W2' engagement activity description.

W2'	**WORK WITH - Cross-Testing workshop**
Objective	Get feedback on all SOCIO-BEE components separately and as a whole
Phase	PILOT SUB-PHASE
Target artefacts	Sensors, App, Platform, Campaign design
Target groups	Beekeepers
Dissemination materials	Training material, Presentations
Evaluation mechanisms	Acceptance tests
Outcomes	Questionnaires
Location	On-line
Date	End of May - Start of June 2024
Responsible	Technical experts

Table 16. Ancona's W2''engagement activity description.

W2''	WORK WITH - Cross-Testing workshop
Objective	Get feedback on all SOCIO-BEE components separately and as a whole and examination of potential issues found during the phases
Phase	PILOT SUB-PHASE
Target artefacts	Sensors, App, Platform, Campaign design
Target groups	Beekeepers
Dissemination materials	Training material, Presentations
Evaluation mechanisms	Acceptance tests
Outcomes	Questionnaires
Location	On-line
Date	End of June - Start of July 2024
Responsible	Technical experts

Table 17. Ancona's C3 engagement activity description.

C3	CONSULT - Post Execution Phase
Objective	Review of Hive's Operation, Recommendations and Lessons Learnt
Phase	Post-pilot sub-phase
Target artefacts	SOCIO-BEE platform, Sensors, SOCIO-BEE app, CS campaigns, knowledge base and toolkit
Target groups	QBs, WBs, DBs, Beekeepers, Hives
Dissemination materials	Conclusions driven from analysis of first iteration, analysis and discussion of results obtained, evaluation of KPIs' fulfilment.
Evaluation mechanisms	Questionnaires and Notes

Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	End of June 2024
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 18. Ancona's C4 engagement activity description.

C4	**CONSULT - Post Execution Phase**
Objective	Review of Hive's Operation, Recommendations and Lessons Learnt
Phase	Post-pilot sub-phase
Target artefacts	SOCIO-BEE platform, Sensors, SOCIO-BEE app, CS campaigns, knowledge base and toolkit
Target groups	QBs, WBs, DBs, Beekeepers, Hives
Dissemination materials	Conclusions driven from analysis of first iteration, analysis and discussion of results obtained, evaluation of KPIs' fulfilment.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	Early July 2024
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 19. Ancona's I2 engagement activity description.

I2	**INFORM - Pilot preparation meeting**
Objective	Meeting between UNVIPM and ANCONA teams to set a baseline to reflect about the results of the campaign.

Phase	POST - PILOT (JUL)
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	Pilot team members
Dissemination materials	N/A
Evaluation mechanisms	A review meeting after the pilot activities start
Outcomes	Definitive chronogram and task distribution between the team members
Location	ANCONA town hall
Date	July 2024

3.2 Maroussi

The features of Maroussi pilot are:

- **Target population**: In the SOCIO-BEE, the pilot of Amaroussion targets at engaging the commuters in its Citizen Science activities. Seeing that MRSI is an important commercial and business centre in Athens, attracting a lot of employees from across Athens, and that there are two main highways crossing MRSI with approximately 1 million cars passing on a daily basis, the commuters form a very important group not only exposed to but also responsible for the air quality problem. Thus, the commuters will be the focus of MRSI pilot. People included in this particular target population may be either citizens of MRSI or people commuting to MRSI regularly (e.g., for work) regardless of age, gender, socioeconomic status, etc. Thus, our strategic plan is to involve commuters representing diverse segments of the society. This spans from engaging actively with schools, meaning students and educators, while we aim to collaborate closely with NGOs and volunteering groups, leveraging their community network and shared commitment to environmental awareness. Additionally, our intentions are to partner with public transportation authorities to assess the exposure of commuters who rely on these systems, and if possible, collaborate with institutes catering individuals with mental conditions, aiming to adapt an accessible and inclusive approach for SOCIO-BEE concept. Finally, MRSI will try to enrol SMEs and their personnel, in an attempt to amplify the SOCIO-BEE impact within the business community and further support the cause of improving air quality collective efforts.
- **Goal**: The goal of Municipality of Amaroussion is to make MRSI citizens and employees more aware about the air pollution problem, and enact a pro environmental attitude toward this issue, by empowering the general population in acting and actively participating in Air quality monitoring campaigns.
- **Challenge**: In this endeavour, MRSI is expected to face three main challenges:
    1. *Lack of authoritative data*: Like the 1st iteration, the challenge of limited spatial resolution in available air quality data persists within MRSI borders. During the initial pilot, volunteers showed hesitancy in

measuring air quality in predetermined locations. To address this, the 2nd iteration will implement group measurements, encouraging two or more participants to measure simultaneously. This approach aims to enhance volunteer enthusiasm and engagement while addressing the spatial limitation challenge.

2. *Lack of interest in participating in the project*: Although this challenge remains, the positive response from the NGO "Friends of Forest Syggrou" during the 1st iteration shows that the lack of interest might not be as low as initially foreseen, suggesting that there might be potential interest from other similar organizations and volunteering groups. Building on this first positive experience, efforts will focus on engaging additional NGOs and volunteer groups to amplify participation and community involvement.
3. *Data quality issues*: Ensuring the reliability of data collected by citizen scientists remains a significant challenge for MRSI pilot. In the 2nd iteration, improvements are anticipated through the implementation of advanced calibration strategies by Bettair. Moreover, volunteers will be educated using updated guidelines provided by technical partners, aiming to enhance data quality. These novel calibration strategies and updated educational materials are expected to significantly improve the accuracy and reliability of the collected data.
4. *Difficulties in closing the citizen science circle:* Closing the citizen science loop, meaning that collected data are processed by the volunteers and are translated into actionable insights or policy implementations, poses a significant challenge for MRSI. Thus, in the 2nd iteration, efforts will concentrate on refining methodologies for data analysis and interpretation.

Figure 20. Maroussi's city's picture.

- **Recruitment strategy**: The recruitment strategy is divided in 3 phases:
    1. *General public*: To recruit the general public, MRSI will continue to have an active presence through a series of posts in social media, local press, MRSI website, etc. Moreover, it will leverage its presence in several social and cultural events held in the meantime (after the end of the 1st pilot iteration and until the end of the 2nd pilot iteration) creating alliances and synergies with key stakeholders.
    2. *Hive creation*: For the hive creation, the beekeepers will have in person meetings with representatives from potential hives.

3. *Bees in each hive*: Once an organization/company/volunteering group agrees in becoming a SOCIO-BEE Hive, an in person presentation and a workshop will be used to recruit citizens as bees. This approach was used also in the 1st pilot iteration, and it was proven to be successful and efficient.

- **Beekeepers**: Dr. Maria Kotzagianni, Mr. Anargyros Roussos, Ms. Eleutheria Stamati and Mr. Dimitris Tsiantopoulos from MRSI will be the beekeepers.
- **Queen Bees & Working Bees**: General population and members of hives.
- **Type of engagement**: Physical and digital engagement.

3.2.1 High level requirements of pilot

MRSI pilot will focus on engaging commuters in citizen science experiments for measuring the air quality within the Municipality borders. From the two pilot phases planned for the upcoming semester, which are the pre-pilot and the pilot execution phase, MRSI has two main high-level requirements:

1. To successfully enrol as many citizens as possible, SOCIO-BEE consortium and in particular technical partners have developed the SOCIO-BEE toolkit which includes among others, portable AQ sensors, gamified mobile application, a micro-volunteering engine, a campaign building platform and detailed engagement strategies. All these technological and non-technological tools were tested initially during the 1st pilot iteration. Based on volunteers' feedback and the experiences gained during the first pilot round, new requirements and several improvements were suggested, therefore multiple modifications and novel services will be delivered prior to the 2nd pilot iteration. Seeing this, it is envisaged that all these new features are going to be tested initially by *alpha testers* during the pre-pilot phase. In this phase, alpha testers will use, test and provide feedback on all SOCIO-BEE components both separately and as a holistic engagement strategy, trying to fulfil the first high level requirement of MRSI which is having access to a *useful, attractive and with high acceptance engagement approach/tool to be widely spread among citizens for the successful orchestration of pro-environmental actions.*

2. Moreover, MRSI aims to utilise the WSN sensors together with the SOCIO-BEE toolkit including the micro-volunteering tools integrated into the SOCIO-BEE mobile application and the AcadeMe platform to increase citizen engagement, providing real-time information on air quality status locally. The novel calibration strategies of the WSN, the detailed user guidelines for data collection and the colocation activities are foreseen to fulfil the second high level requirement of MRSI which is *reliable, accurate and complete CS data for policy makers* towards the adoption of sustainable approaches and strategies for air quality improvement.

   The last but not least high-level requirement of MRSI is to implement strategies using the SOCIO-BEE toolkit to *enhance citizen engagement and raise awareness regarding air pollution.* This requirement underscores the significance of not just gathering data but actively engaging and informing citizens to inspire and provoke meaningful behavioural changes and community-driven actions in response to air quality issues fostering a sense of ownership and responsibility among citizens.

3.2.2 Stakeholders' map of pilot

Table 20 summarises the stakeholders' map as it is foreseen for the 2nd pilot iteration. However, as the participation of some stakeholders is not yet confirmed, the information in specific cells may change during the pilot execution.

Table 20. Stakeholder's map for Maroussi.

Stakeholder name or group	Stake-holder type	Role and activities	Level of involvement	Barriers of engagement	Motivations and expectations	Recruitment strategies and channels	Stage of involve-ment	Support
Maria Kotzagianni (MRSI) Anargyros Roussos (MRSI) Eleutheria Stamati (MRSI) Dimitris Tsiantopoulos (MRSI)	**Bee-keeper**	Prepare campaigns and communication and training material Coordinate pre-pilot and pilot activities Prepare, coordinate and run engagement, communication and dissemination actions. Run workshops	High: Coordination / Action / Facilitation / / Supervision	No barriers are foreseen	Check SOCIO-BEE technological components (sensors, platform, app, etc) Check SOCIO-BEE engagement strategies for building communities and creating behavioural change Check if collected CS data can inspire policy makers and influence the decision making processes	Not necessary (They're all members of the Pilots team)	All phases of the pilot	Design, plan and execute all pilot activities Build hives and recruit all types of bees: QBs, WBs and DBs Perform all communication & dissemination activities Attend to pre-pilot and pilot execution activities (i.e. meetings, trainings/ workshops, campaigns, etc) Work in project WP's deliverables Provide help and support to hives and all types of bees during the pilot phase Support hives and their members in the analysis of the collected data in order to close the citizen science circle.
Employees of Municipality of Amaroussion	**Queen Bees**	Recruit WBs Co-design and coordinate experimental campaigns Perform	Medium: Coordination High: Execution Medium: Supervision	Time constraints, Low interest, Lack of technical knowledge	Check engagement strategies and bees' participation level Reach solid	Not necessary (They're all members of the Pilots team)	All phases of the pilot	Facilitate time and spaces to run the pilot activities Provide necessary directions and training material to successfully enrol WBs
Future QBs						This group	Pilot	

recruited from the new hives such as leading members of voluntary associations, teachers from schools, members of the Local Public Transport Department, Members of Board of directors of Non-profit organisations providing mental health services, Senior members of scouts, directors or owners of SMEs etc.		engagement and communication actions to WBs. Supervise WBs if possible.			conclusions concerning research questions from collected data Recognition of their contribution and efforts	will be reached in person by the beekeepers	execution and post-pilot phase	
Departments responsible or involved in policy making within MRSI Municipality Department of local public transport in MRSI Department of Gender and Equality Universities and research institutes	**Bear**	Consult on areas and activities of interest to be covered by the campaigns. Help with communication strategies leveraging their network. Receive, study and exploit the CS data and/ or even produce final scientific reports especially in the case of universities and	High: Consultation	Time constraints, Bureaucracy, Lack of interest	Raise awareness among citizens Have scientific evidence that allows to influence municipal regulations about air quality, being part of a European innovation project Have access to reliable and accurate citizen	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face conversations, social and cultural events, personal network, etc.)	All phases of the pilot	Facilitate spaces and channels for communication and dissemination of the project and its results Provide guidelines on how to best leverage collected results and provide best practices as examples for policy making. Provide access to air quality data and to any scientific reports if available.

		research centres			science air quality data for further more in depth and scientific analysis			
Staff members of MRSI Town Hall	**Worker bees**	Consist alpha and beta testers group. Use SOCIO-BEE technological solution and provide feedback. Participate in workshops and/or training activities. Participate in CS campaigns and in data collection	High: Consultation High: Action	Time constraints, lack of initial interest, feeling of disappointment after participation	Checking the pilot technology Contribute to the pilot success. Get informed about the air quality in areas of personal interest Recognition of their contribution and efforts	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face talks) Communication campaigns and talks in the future hives Word of mouth by Queen Bees	Pre-pilot sub-phase Pilot execution sub-phase	Bring personal time and effort to run citizen science campaigns
Staff members of MRSI Public transport Students and scouts Members of volunteering groups, associations, and/or employees of SMEs/LEs		Participate in workshops and/or training activities Participate in CS campaigns and in data collection	High: Action	Time constraints, lack of initial interest	Get informed about the air quality in areas of personal interest Recognition of their contribution and efforts Contribute to the pilot success		Pilot execution sub-phase	
Department of communication in MRSI Municipality Representatives of all involved institutions	**Drone Bees**	Receive and study the final scientific reports Help with communication and dissemination activities	Low: Supervision / Advice	Lack of time and interest, Lack of awareness about hive's results, outcomes	Be aware of the pilots development to keep the local community updated and engaged	Pilot communication channels: Email, social media channels, newsletter, local press, dissemination	Pilot Phase	Dissemination of the results through their communication channels

(future hives)		Advice on context of communication material		and activities		events		

3.2.3 Campaigns co-designed

At this stage of the project, the beekeepers from Municipality of Amaroussion together with alpha testers and volunteers from the 1st pilot iteration, have co-designed two experimental campaigns based on the needs and experiences gained in the project so far. These two campaigns are going to be carried out one from the "Town Hall Hive" and one from the "Friends of Forest Syggrou Hive". The first hive will put emphasis on running colocation campaigns which are expected to contribute to the overall performance of the WSN sensors, while the second hive will run campaigns in order to assess the impact of Forest Sygrou in the air quality locally. However, more campaigns during the actual pilot execution are foreseen to be carried out. These will be determined and co-designed by the new hives and their members and they will be strongly influenced by the preferences, specific interests and engagement levels of the established hives, ensuring alignment with their motivations and objectives. It is also expected to introduce a drone in a one of the campaigns.

Campaign MRSI 1: Colocation campaigns run by the "Town Hall Hive"

Campaign 1 is in close vicinity with the Air Quality Station located within the borders of Municipality of Amaroussion. The results from this campaign will be used to assess the performance of the WSNs compared to certified and accurate results provided by the station, while it will be explored whether the colocation campaigns can potentially be carried out solely by citizen scientists and through sparse measurements.

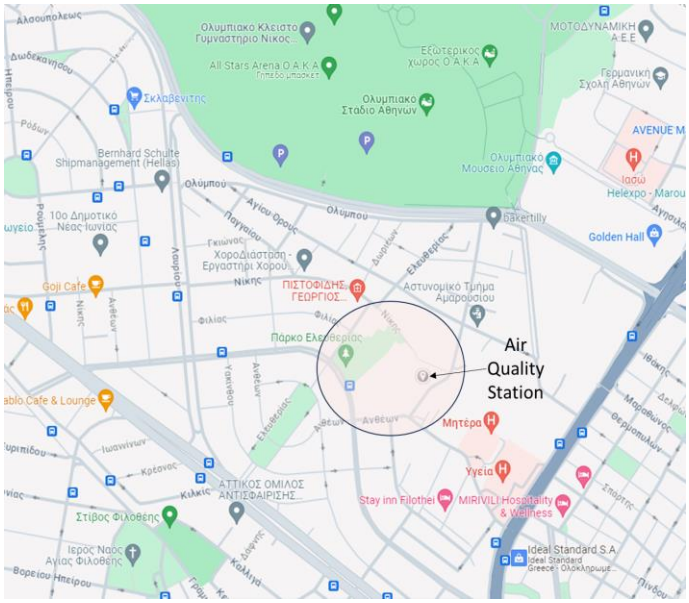


Figure 21. MRSI Campaign 1 map.

Research questions: To what extent can WSNs, situated in proximity to the Air Quality Station, collect air quality data comparable to certified and accurate results provided by the station when conducted: a) in stationary mode, b) via sparse measurements collected by citizen scientist or even c) through a Drone at different heights?

Hypothesis: If the WSNs operate in stationary mode for a long period of time, then the collected AQ results are expected to be reliable and accurate. Furthermore, if citizen scientists allocate the required time and effort to collect sufficient amounts of data, then the collected results retrieved from sparse measurements collected by citizen scientists will also be reliable and accurate. If a validated WSN is located in a Drone, then the collected AQ results at different heights may be considered as reliable.

Stakeholders: Maroussi will have Maria Kotzagianni and Dimitris Tsiantopoulos as Beekeepers to coordinate and support the activities of the "Town Hall Hive" for the campaign execution. Technical Services Division of Municipality of Amaroussion, SOCIo-BEE technical partners and Universities and research centres will act as Bears in the campaigns. Stella Chatzichristou (MRSI) will have the role of Queen Bee as in the first pilot iteration. Moreover, staff members and other volunteers will have a role as Worker Bees. The Communication Department of Municipality of Amaroussion will be the Drone Bees, helping to disseminate the outcomes of the campaign leveraging its social media channels and the high number of subscribers/followers.

Goal: The main goal of this campaign is to find ways and strategies to generate precise data sets that can be used to support policy-making efforts. In that view, the Town Hall Hive will try to shed light on the accuracy of the results collected by colocating the WSNs in stationary mode and by sparse measurements by Worker Bees.

Workplan: Maroussi will initiate the colocation activities already from December 2023. Worker bees together with the beekeepers will place next to the Air Quality Stations 8 WSNs in stationary mode. The WSN are expected to be collocated for at least 2 months, depending also on the needs of the pilot execution phase (i.e. the number of available WSNs). During this period, regular visits and inspections are foreseen to ensure that the sensors are secured and perform as expected. Subsequently, the beekeepers and the queen bee will communicate the activities of the hive probably via in-person meetings or via mailing lists and they will try to enrol more volunteers (employees of MRSI). For the Bears, they will be involved prior to the pilot execution phase through INFORM and CONSULT type activities. It is foreseen to carry out interviews with Bear's representatives to inform them about the SOCIO-BEE project and consult them about best strategies to carry out colocation experiments. Thus it is foreseen, that after consultation with the technical providers and the air quality experts, the duration and the number of the sparse AQ measurements to be collected by the Worker Bees will be decided. Finally, it is intended that all members of the hive collaboratively work on the acquired results and provide concrete answers to their research question.

Risks: Some risks are anticipated, firstly, not having enough participants, which can be possibly mitigated by performing an additional information event workshop. Secondly, another risk may arise from the lack of interest of the worker bees in carrying out measurements in this specific location (far from their daily routes), which can be mitigated by recruiting more WBs. Finally, one critical risk might be not reaching a solid conclusion concerning the research question and/or the volunteers being unable to have access and process the collected data. Here, issues are expected to be addressed prior to the initiation of the 2nd pilot iteration.

Location: Regarding campaign blueprints, MRSI has selected the Campaign Blueprint called "Pollinate a specific area in a short period of time (Type I)". The area that will be covered by this campaign will be around the Air Quality Station (38.030837, 23.787372).

Materials & Equipment: Regarding the resources needed, Maroussi requires at least 8 devices to be placed next to the Air Quality Station and an approach to configure successfully the sensors operating in stationary mode and later on be used by the Worker Bees. Additionally, MRSI will need a fully functioning AcadeMe platform and the mobile application, while MRSI will need new training material to better educate the volunteers to further enhance the WSN performance.

Recommendations: MRSI considers that it would be good to have a novel campaign blueprint to better fit the needs of the colocation activities. Furthermore, MRSI thinks that there should be an easy and accessible way for the volunteers to have access to their data while it is very important to have clear guidance and methodologies on how to process the data and extract useful conclusions. Finally, MRSI believes that a clear strategy on how to engage the Bears should be designed, in order to support their participation, document their insights and inputs and keep them informed about the results and outcomes of the pilot campaigns.

Methodology: The pilot coordination team, meaning the Beekeepers together with a few Worker Bees will initially place the WSNs in stationary mode on the roof of the Air Quality Station. Furthermore, the second part of this campaign will be conducted by using the SOCIO-BEE toolkit. The campaign will be designed either according to blueprints available or based on new blueprint tailored to the colocation experiment's needs. Finally, emphasis will be put on communicating and disseminating the results to the identified bears. Some tests locating a validated WSN on a Drone will also be performed.

Reasoning: The rationale behind MRSI Campaign 1 lies in the assessment of the performance of the WSN in comparison to the certified and precise results obtained by the AQ station. Additionally, it seeks to investigate whether colocation campaigns carried out by citizen scientists through sparse measurements, can effectively contribute to the air quality data validation process.

Success indicator/s: The KPI's to be fulfilled, during this campaign are the following:

- **MRSI1.KPI1**: # capture of aggregated AQ measurements in the vicinity of the AQ station (>= 200)
- **MRSI1.KPI2**: # number of sensors collocated (>=8)

Other alternative KPIs that might be considered are:

  - Number of worker bees joining MRSI Campaign 1 (>= 10)
  - WSN AQ measurements in stationary mode for sufficient period (>= 2 months)

Campaign MRSI 2: Exploring the Impact of Green Spaces on Air Quality near High Traffic Zones using Wearable Sensors by Citizen Scientists

Research questions: How does the presence of a green park and in particular of Forest Syggrou influence the air quality in areas adjacent to high-traffic streets particularly during peak rush hours and in locations within the forest?

Hypothesis: If monitoring air quality within a green park situated adjacent to a high-traffic highway, WSNs will indicate better air quality levels within the forested interior compared to the border areas, particularly during rush hours, suggesting that the green park serves as a mitigating factor against the air quality deterioration caused by the high traffic.

Stakeholders: Maroussi will have Anargyros Roussos, Maria Kotzagianni and Eleutheria Stamati as Beekeepers to facilitate all activities envisaged to be carried out by the hive "Friends of Forest Syggrou". The Urban Planning Division of Municipality of Amaroussion will work as Bear in this campaign, while the beekeepers will try to enrol also Universities and Research Centers. Ms Theodorakopoulou (President of Friends of Forest Syggrou) will have the role of Queen Bee, and the members of this volunteering group will act as Worker Bees. The responsible person of the social media accounts

of Friends of Forest Syggrou and the Communication Department of Municipality of Amaroussion will be the Drone Bees, helping to disseminate the outcomes of the campaign.

Goal: The Municipality of Amaroussion is for the first time participating in a citizen science project with focus on air quality analysis for behavioural and policy change. This requires among other aspects: active citizen engagement, data collection and methodologies for safe conclusion extraction. So, the aim of this particular campaign of this pilot is to not only collect and evaluate the air quality within and in the borders of Forest Syggrou but also to gain experience and establish a solid approach to engage citizens in pro- environmental activities, since MRSI intends to reach more NGOs and SMEs to recruit them as hives. Thus, the objectives of this campaign will be the following:

1. Recruit and raise awareness of citizens to participate in a citizen science project related to air pollution.
2. Validate already available and novel components and services of the SOCIO-BEE toolkit putting emphasis on the processing and analysis of the results in order to close the citizen science loop.
3. Test the impact of green areas close to heavy traffic roads on air quality and collect preliminary air pollution measurements to be potentially used for policy making.

Workplan: MRSI plans to carry out in person meetings with volunteers of this hive to firstly educate and train them on the new features of the SOCIO-BEE solution. Special support will be provided to new members of the Hive while novel training material will be distributed to all participants. Furthermore, the Queen Bee under the supervision of the Beekeepers will co-design the campaign and specify its details together with the Worker Bees. The volunteers will then be responsible to collect the air quality data and at a later stage to proceed with the interpretation of the results in order to answer their research question. All these activities will become publicly available and posted on the social media channels, in order to: 1) keep volunteers engaged, interested and updated, 2) acknowledge their efforts and contribution to society and to their local community and 3) attract the attention of the general public in order to enrol more participants.

Risks: Also in this campaign, some risks are anticipated. First, not having enough participants can be a major barrier to successful campaign execution. However, this can be mitigated by performing additional posts on social media channels and/or participating to event(s) or workshop(s). Secondly, being unable to process the results and extract valuable conclusions can be a very big challenge for the volunteers, while the accuracy of the acquired air quality data may raise some doubts for the whole approach. These issues are expected to be addressed prior to the initiation of the 2nd pilot iteration.

Location: Regarding campaign blueprints, MRSI has selected the Campaign Blueprint called “Pollinate a specific area in a short period of time (Type I)”. The area covered will be around Location A, with the following coordinates: (38.059220197880244, 23.80883386623799).

Materials & Equipment: Regarding the resources needed, Maroussi requires: firstly, some educational, information and training material to contact hive’s representatives and old and new members of the hive; secondly, several devices (depending on the number of worker bees), the SOCIO-BEE app and the AcadeMe platform working properly; thirdly, some communication material such as brochures, leaflets or online material to communicate the progress of the activities via various digital channels and finally instructions or guidebook on how to process the acquired data.

Recommendations: MRSI considers that it would be good that Beekeepers and QBs can see the activities performed by each WB separately in order to be able to contact them and activate them in case of inaction. MRSI also thinks that it

would be very important for the Worker Bees to know their exposure to air pollution at the time of the measurement as this is expected to trigger further their interest and motivation.

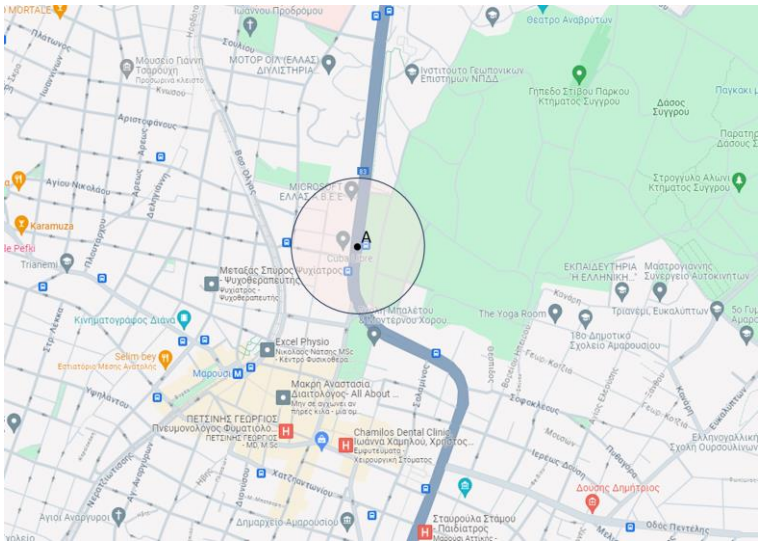


Figure 22. MRSI Campaign 2 map.

Methodology: In order to pollinate cells in a campaign's surface, MRSI suggests doing it at different distances from a main highway (pollution distribution) over a short period of time (Type II). Thus, a circular area of diameter extending around **Location A**: Kifissias Avenue (38.059220197880244, 23.80883386623799) is foreseen. This area is selected in such a manner so it covers both parts of the Kifissias avenue and parts of Forest Syggrou (green area). This will help the volunteers compare the air quality results from the two areas and evaluate the impact of the green area at higher spatial resolution. Additionally, sound samples, free texts (insights), pictures, videos, and questionnaires from CS activists will be gathered to shed light on other aspects of the air pollution issue and on the execution of a pilot campaign. The collected data are expected to contribute to the visualisation of the results through heatmaps and depending on the volume of collected data also have a temporal profile of the air quality for these areas (KPI 3).

Reasoning: The purpose of this campaign is to foster awareness among citizens, especially volunteers, about the pivotal role of green spaces in enhancing local air quality. Simultaneously, all involved stakeholders will gain valuable insights into the air quality of areas that directly impact them. Beyond these primary objectives, the campaign will yield a diverse range of outcomes including air quality measurements, visual and audio records, which can serve as valuable resources for communication and dissemination endeavours, specifically highlighting the significance of green spaces in urban settings. Finally, in the long run, the results of this campaign may trigger similar experiments to other areas which may also advocate for policy decisions related to the establishment of pocket parks (and/or planting trees) in other regions within MRSI.

Success indicator/s: The KPI's to be fulfilled fully or partially during this campaign are the following:

- **MRSI2.KPI1**: # capture of aggregated AQ measurements from green and highway locations (>= 70)
- **MRSI2.KPI2**: # number of volunteers involved in the measurements (>=5)

3.2.4 Pilot execution plan

The actions foreseen for MRSI's pre-pilot phase and 2nd pilot iteration are listed below. Please note that MRSI aims to create at least three hives during the 2nd Pilot Iteration. The hives to be established could be either public bodies, and/or NGO (s) and/or Volunteering Group(s) and/or schools and/or SME(s) / LE (s), etc. However, this remains unclear for the moment, as the contact activities to approach potential hive's representatives have just been initiated and the creation/ final selection of hives is not yet completed. The expected "lifespan" of each hive for the second pilot iteration is designed to be 2 to 4 weeks to engage as many as possible citizens, due to restraints originating from the limited number of available technical equipment.

Table 21. Maroussi's workplan for iteration 2.

ID	MS	Phase	When	Action	Description	Target	Comments
IR1	1	Pre-pilot launch subphase	December 2023 to at least January 2024	Internal Release	Deployment of SOCIO-BEE platform, toolkit, knoweldge base and instantiation of test campaigns in Pilot.	Validate at least 8 WSNs against measurements from the AQ station	
MM2.6	3a	Pilot-execution subphase	Dec 2023 - TBD	Measuring & Monitoring	Calibration of sensors, co-location activities	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos and WBs	Goal: Calibrate sensors /co-location with AQ station to enhance CS AQ data accuracy and quality etc.
C1.3	1	Preparation of pre-pilot and pilot subphase	December 2023 to March 2024	Communication	Communication with potential current and new hive's representatives	Communities, Public Bodies, Schools, Scouts, Companies, etc.	Goal: Create hives if possible of different type to validate the applicability of SOCIO-BEE toolkit from various societal groups
S3.2	1	Preparation of pre-pilot and pilot subphase	December 2023 to March 2024	Support	Enhance pilot documentation, materials and FAQ	All end users	Goal: Finalise/Translate Material (Brochures, Website, Presentations, Training, consent forms, etc.) Taylor the

							material to specific target groups to the extent possible.
C1.2	1	Preparation of pre-pilot and pilot subphase	December 2023 to March 2024	Communication	Meeting/Workshop with potential hive representatives informing about SOCIO-BEE purpose and activities, privacy procedures and policies	Communities, Public Bodies, Schools, Scouts, Companies, etc.	Goal: Creation of at least 2 more hives
C1.1	1	Pre-pilot launch subphase	January to March 2024	Communication	Announcement of SOCIO-BEE pilot and purpose among alpha (press release, social media posts)	Alpha testers and the general public	
Pre - pilot sub-phase							
MM2.7	2	Pre-pilot launch subphase	February - March 2024	Consult	Interviews with Bears	1)Representatives from departments related to policy making and 2) contact universities and research groups related to air quality	Goal: Interview at least 3 bears in order to: 1) gain insights on specific areas of interest 2) leverage their network and communication channels and 3) consult them about colocation activities
C1.2'	2	Pre-pilot launch subphase	March 2024	Internal release	Workshop with potential alpha testers informing about purpose, privacy procedures and policies	Alpha testers: MRSI employees	Outcome: 1) at least 5 new participants willing to participate and 2) 2 campaign blueprints for the pilot phase Hive Town Hall
T2.1	2	Pre-pilot launch subphase	March - April 2024	Training	Training of pilot owner representatives about SOCIO-BEE support system	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D.	

						Tsiantopoulos	
MM2.3	2	Pre-pilot launch subphase	March - April 2024	Training	Internal testing workshop about SOCIO-BEE toolkit and its components	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Beekeepers training on: Sensors, App, Platform, Campaign design, Presentation material, Training material
MM2.1	2	Pre-pilot launch subphase	March 2024	Internal release	Guidelines with usage scenario for Pilot case produced	Alpha testers: MRSI employees	
MM2.2	2	Pre-pilot launch subphase	March - April - May 2024	Training	Cross-testing workshop to be carried out once all technical components are available	Alpha testers: MRSI employees	Alpha testers training on Sensors, App, Platform, Campaign design, Presentation material
T2.2	2	Pre-pilot launch subphase	March - April 2024	Training	Physical and/or online workshop about SOCIO-BEE toolkit	Alpha testers: MRSI employees	
MM2.4	2	Pre-pilot launch subphase	March - May 2024	Execution	Alpha questionnaire issued to gather feedback from alpha testers	Alpha testers: MRSI employees	Goal: at least 5 questionnaires
MM2.5	2	Pre-pilot launch subphase	April 2024	Evaluation	Verification pilot associated logs and questionnaires are correctly gathered	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Outcome: at least 50 questionnaires and some indicative datasets collected
EV3.1	2	Pre-pilot launch subphase	April 2024	Evaluation	Monthly review of progress of pre-pilot: analysis of KPIs, logs and questionnaires to check that measurement mechanisms are working	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	

					and can feed KPIS		
IR1'	2	Pre-pilot launch subphase	April 2024	Training	Deployment of SOCIO-BEE platform, toolkit, knoweldge base and instantiation of test campaigns in Pilot	Alpha testers: MRSI employees	Outcome: Insights provided by alpha testers
ER2	4	Pre-pilot launch subphase	April 2024	Communication	External release of SOCIO-BEE platform and citizen science campaigns, knowledge base and toolkit	General Public	One event related to SOCIO-BEE activities (not exact date available yet)
Iteration 2 - Pilot-execution sub-phase with for example 3 intervals. The number of intervals will be determined by the number of created Hives for Iteration 2, while the lifespan of each hive will strongly depend on the availability and motivation of the members of each hive. Thus, the planning of the following activities is just indicative as it is expected to follow an agile approach based on the wishes, requirements and interests of involved volunteers. According to technical partners, the final version of the SOCIO-BEE toolkit is expected to be delivered in March thus the launch of the pilot activities is expected to be around the beginning of April. In case of delay, this execution plan will be subject to changes impacting the duration of all activities. 15-30.04.2024, 01.05-31.05.2024 and 01.06-30.06.2024							
Horizontal Activities							
C3.1	3a	Pilot-execution subphase	March to April 2024	Communication	Announcement of pilot public start - Anticipating communication strategy	General Public	Actions: Press release/newsletter mailing list of Municipality, posts on social media and municipality official page, publication in local press
EX3.1	3a	Pilot-execution subphase	April - June 2024	Execution	Engaging material to prepare quiz/gamified description of challenges to be addressed by users online	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	

S2.1	3a	Pilot-execution subphase	April - June 2024	Support	Address inquiries and issues related to usage of SOCIO-BEE components	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Provide support to end-users
Type A: Hive(s) - Town Hall							
C1.2''	3b	Pilot-execution subphase	April 2024	Communication	Workshop with potential end users informing about purpose, privacy procedures and policies	MRSI employees	Action: 1h presentation to MRSI employees about AQ, SOCIO-BEE, recruitment of users, membership assignment Goal: recruitment of 20 or more bees
MM2.8	3b	Pilot-execution subphase	April 2024	Training	Profile questionnaires, Pre-evaluation questionnaires and other	MRSI employees	Action: collect questionnaires
C3.2	3b	Pilot-execution subphase	April 2024	Training	Public training for MRSI employees	MRSI employees	Goal: Educate and train participants
MM2.1'	3b	Pilot-execution subphase	April 2024	Training	Guidelines with usage scenario for Pilot case produced	MRSI employees	Goals: 1) Selection of 1 or more scenarios, 2) creation of 2 or more campaigns
EX3.2	3c	Pilot-execution subphase	June 2024	Execution	Workshop with Volunteering group to organise challenge / contest about improving co-designed citizen science experiments	Childers, SME employees, etc.	
EV3.1	3b	Post-execution subphase	April 2024	Evaluation (CW21)	Hive's performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with	Goal: Monitor progress and take mitigation measures if required

						QB	
R3	3b	Pilot-execution subphase	April 2024	Reaction	Biweekly new actions will be taken to enhance the testing experience and maximise outcomes of the process	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with QB	Action: Review the campaigns' progress. If required, organise video conference(s), visit the hives, offer them some additional support, provide them additional tips, etc.
Type B: Hive(s) - Volunteering Group							
C1.2'''	3c	Pilot-execution subphase	May 2024	Communication (CW22)	Workshop with potential end users informing about purpose, privacy procedures and policies	Volunteers	Action: 1h presentation to volunteers about AQ, SOCIO-BEE, recruitment of users, membership assignment Goal: recruitment of 7 or more bees in average
MM2.8'	3c	Pilot-execution subphase	May 2024	Training	Profile questionnaires, Pre-evaluation questionnaires and other	Volunteers	Action: collect questionnaires
C3.2'	3c	Pilot-execution subphase	May 2024	Training	Public training presentation for interested volunteers	Volunteers	Goal: Educate and train participants
MM2.1''	3c	Pilot-execution subphase	May 2024	Training	Guidelines with usage scenario for Pilot case produced	Volunteers	Goals: 1) Selection of 1 or more scenarios, 2) creation of 2 or more campaigns
EX3.2'	3c	Pilot-execution	June 2024	Execution	Workshop with Volunteering group to	Childers, SME employees, etc.	

		subphase			organise challenge / contest about improving co-designed citizen science experiments		
EV3.1'	3c	Post-execution subphase	May 2024	Evaluation	Hive's performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with QB	Goal: Monitor progress and take mitigation measures if required
R3'	3c	Pilot-execution subphase	May 2024	Reaction	Biweekly new actions will be taken to enhance the testing experience and maximise outcomes of the process	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with QB	Action: Review the campaigns' progress. If required, organise video conference(s), visit the hives, offer them some additional support, provide them additional tips, etc.
Type C: Hive(s) - Schools, scouts, SME(s), other							
C1.2''''	3c	Pilot-execution subphase	June 2024	Communication	Workshop with potential end users informing about purpose, privacy procedures and policies	Childers, SME employees, etc.	Action: 1h presentation to SME employees about AQ, SOCIO-BEE, recruitment of users, membership assignment Goal: recruitment of 15 or more bees on average
MM2.8''	3c	Pilot-execution subphase	June 2024	Training	Profile questionnaires, Pre-evaluation questionnaires and other	Childers, SME employees, etc.	Action: collect questionnaires
C3.2''	3c	Pilot-execution subphase	June 2024	Training	Public training presentation for interested volunteers	Childers, SME employees, etc.	Goal: Educate Queen Bees which are expected to educate participants

MM2.1'''	3c	Pilot-execution subphase	June 2024	Training	Guidelines with usage scenario for Pilot case produced	Childers, SME employees, etc.	Goals: 1) Selection of 1 or more scenarios, 2) creation of 2 or more campaigns
EX3.2''	3c	Pilot-execution subphase	June 2024	Execution	Workshop with SME employees to organise challenge / contest about improving co-designed citizen science experiments	Childers, SME employees, etc.	
EV3.1''	3c	Post-execution subphase	June 2024	Evaluation	Biweekly Hive's performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with QBs	Goal: Monitor progress and take mitigation measures if required
R3''	3c	Pilot-execution subphase	June 2024	Reaction	New actions will be taken to enhance the testing experience and maximise outcomes of the process	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos together with QBs	Action: Review the campaigns' progress. If required, organise video conferences, visit the hives, offer them some additional support, provide them additional tips, etc.
Post-pilot execution sub-phase							
S3.2'	4	Post-execution subphase	June - July 2024	Support	Enhance pilot documentation, materials and FAQ	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	
S2.2	4	Post-execution subphase	June - July 2024	Support	Populate FAQ and lessons learnt catalogue with common questions and support requests received in piloting	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	

EV3.2	4	Post-execution subphase	June - July 2024	Evaluation	Generation of final evaluation report	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	

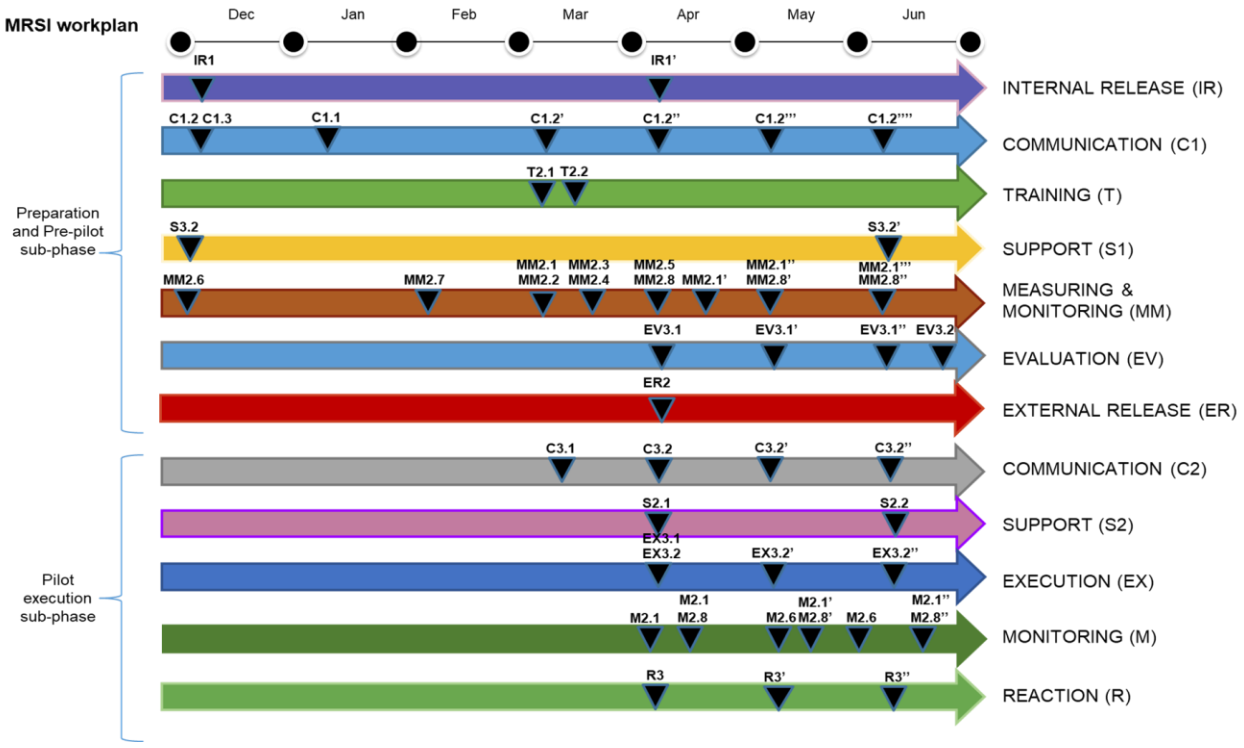


Figure 23. Maroussi's workplan for iteration 2.

3.2.5 Community building plan

Figure 24 shows the community building plan for MRSI.

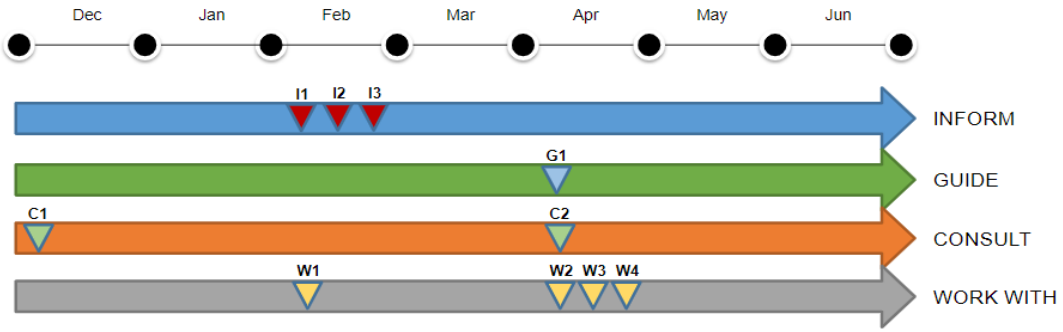


Figure 24. Maroussi's community building plan for iteration 2.

During the pre-pilot phase and the 2nd Pilot Iteration, MRSI plans to conduct several community building activities aiming at:

1. Raising public awareness on Air Quality problem and SOCIO-BEE Project,
2. Enhancing citizen engagement and active participation on SOCIO-BEE Citizen Science experiment,
3. Nurturing a pro-environmental attitude at various NGOs and volunteering organisations, public bodies, schools, institutes, SME(s), etc. by encouraging them to become SOCIO-BEE hives and finally,
4. Supporting the activities of volunteering groups by providing access to community building material and to the SOCIO-BEE toolkit to conduct AQ monitoring campaigns with their members' aid.

For all these actions, MRSI will use various types of material for the correct development and understanding of the SOCIO-BEE concept and its activities. These materials will take the shape of posters, brochures, leaflets, marketing material (INFORM, GUIDE, CONSULT) as well as questionnaires (WORK WITH). In the tables below, the reader can find some of the main MRSI's engagement activities planned together with their description.

Table 22. Maroussi's I1 engagement activity description.

I1	**INFORM-First communication with potential new hive's representatives and if interested meeting/workshop**
Objective	Establish at least 2 more new hives
Phase	Pre-pilot execution sub-phase
Target artefacts	SOCIO-BEE overall concept
Target groups	Communities, Public Bodies, Companies
Dissemination materials	SOCIO-BEE leaflet and a figure describing the narrative of the project
Evaluation mechanisms	Notes
Outcomes	Creation of at least 2 new hives
Location	Town hall and at the premises of each stakeholder
Date	February-March 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 23. Maroussi's W1 engagement activity description.

W1	**WORK WITH - Discussion about SOCIO-BEE project and co-design of CS campaigns with Alpha testers**

Objective	Create Alpha testers team and Co-design 2 campaigns
Phase	Pre-pilot sub-phase
Target artefacts	SOCIO-BEE toolkit and engagement strategies
Target groups	Alpha testers
Dissemination materials	SOCIO-BEE leaflet, a figure describing the narrative of the project, Educational and Training material
Evaluation mechanisms	Attendees' List and Notes
Outcomes	Enrol 10 Alpha testers and 2 campaigns co-created
Location	Town hall
Date	February 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 24. Maroussi's C1 engagement activity description.

C1	**CONSULT - Consult Bears**
Objective	Conduct at least 3 interviews with 3 different bears
Phase	Pre-pilot sub-phase
Target artefacts	SOCIO-BEE overall concept
Target groups	Various departments of Municipality responsible for policy making, Decision makers and Universities and Research Institutes
Dissemination materials	SOCIO-BEE leaflet, presentation and clear structure of interview, predefined questions and topics of interest to be discussed
Evaluation mechanisms	Notes and maybe photos
Outcomes	Useful insights for campaign planning particularly for colocation experiments and 3 interviews
Location	Town hall and/or virtually

Date	December 2023-March 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 25. Maroussi's G1 engagement activity description.

G1	**GUIDE - Internal testing workshop**
Objective	Get feedback on SOCIO-BEE platform components, communication materials and evaluation mechanisms
Phase	Pre-pilot sub-phase
Target artefacts	SOCIO-BEE platform components, communication materials and evaluation mechanisms
Target groups	Alpha testers
Dissemination materials	Communication material and evaluation mechanisms
Evaluation mechanisms	Alpha Questionnaires
Outcomes	Alpha Questionnaires
Location	On-line
Date	April 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 26. Maroussi's W2 engagement activity description.

W2	**Cross-Testing workshop**
Objective	Get feedback on all SOCIO-BEE components separately and as a whole
Phase	Pre-pilot sub-phase
Target artefacts	Sensors, App, Platform, Campaign design
Target groups	Beekeepers

Dissemination materials	Training material, Presentations
Evaluation mechanisms	Acceptance tests
Outcomes	Questionnaires
Location	On-line
Date	April 2024
Responsible	Technical experts

Table 27. Maroussi's I3 engagement activity description.

I2	**INFORM - External Release of SOCIO-BEE**
Objective	Inform general public about the SOCIO-BEE project - Anticipation communication strategy
Phase	Pre-pilot sub-phase
Target artefacts	SOCIO-BEE platform, CS campaigns, knowledge base and toolkit
Target groups	General public
Dissemination materials	Leaflets, banners (maybe), social media presence and presentations
Evaluation mechanisms	-
Outcomes	Visibility of SOCIO-BEE project and new participants
Location	Printed material probably available at MRSI Town Hall and on social media channels
Date	February 2023 - April 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 28. Maroussi's I4 engagement activity description.

I3	**INFORM - 2nd Iteration Official Launch**

Objective	Inform public about the start of 2nd Pilot Iteration and invite people to participate
Phase	Pilot execution sub-phase
Target artefacts	SOCIO-BEE SC experiment
Target groups	General public
Dissemination materials	Series of posts on social media, and/or local press, etc.
Evaluation mechanisms	-
Outcomes	Visibility of SOCIO-BEE project and new participants
Location	On-line
Date	February - March 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 29. Maroussi's W3 engagement activity description.

W3	**WORK WITH - 1st day in the new Hive**
Objective	Present SOCIO-BEE project to the members of the hive and educate/train/work with people willing to participate
Phase	Pilot execution sub-phase
Target artefacts	SOCIO-BEE toolkit
Target groups	At least 4 Groups (1 from each hive)
Dissemination materials	Presentation material and questionnaires
Evaluation mechanisms	Questionnaires
Outcomes	4 Hives with at least 5 Bees each
Location	At each hive's premises

Date	April - June 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 30. Maroussi's W4 engagement activity description.

W4	**WORK WITH - Running Campaigns**
Objective	Successful Hive's Operation and Data collection
Phase	Pilot execution sub-phase
Target artefacts	SOCIO-BEE platform, Sensors, SOCIO-BEE app, CS campaigns, knowledge base and toolkit
Target groups	QBs, WBs, DBs, Beekeepers, Hives
Dissemination materials	Training material, Campaign Blueprints
Evaluation mechanisms	Logs and questionnaires
Outcomes	Active and successful hive operation
Location	MRSI area
Date	April - June 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 31. Maroussi's C2 engagement activity description.

C2	**CONSULT - Post Execution Phase**
Objective	Review of Hive's Operation, Recommendations and Lessons Learnt
Phase	Post-pilot sub-phase
Target artefacts	SOCIO-BEE platform, Sensors, SOCIO-BEE app, CS campaigns, knowledge base and toolkit
Target groups	QBs, WBs, DBs, Beekeepers, Hives

Dissemination materials	Report with conclusions driven from retrospective analysis of iteration 2 and analysis of results obtained, regarding fulfilment of KPIs.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's premises
Date	April - June 2024
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

3.3 Zaragoza

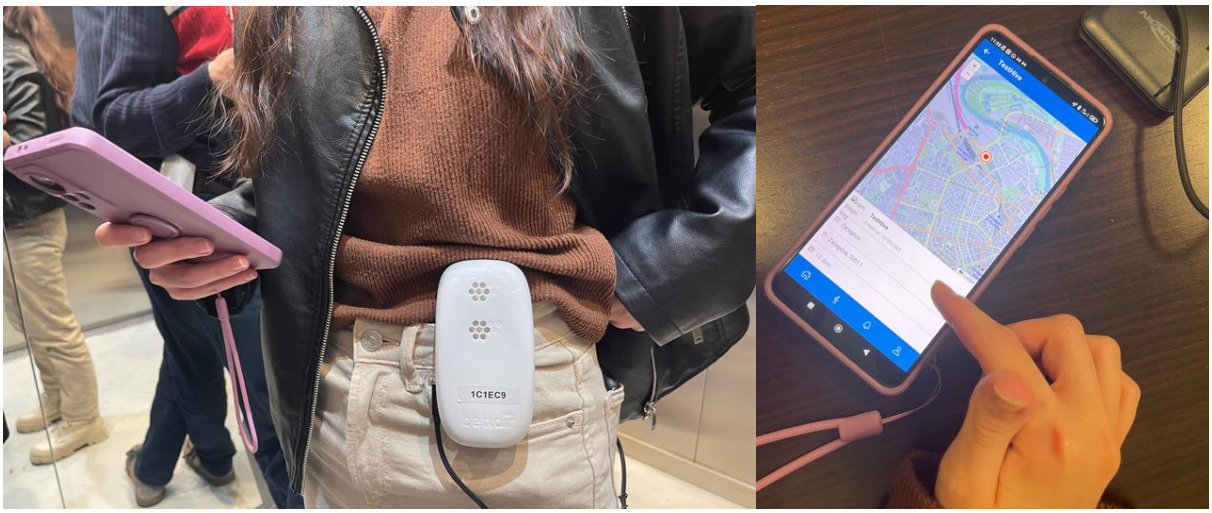


Figure 25. Images of Zaragoza campaign in its first pilot iteration.

This pilot exhibits the following features:

- **Target population**: In the second iteration, the target audience will be students (aged 11-16). It will also be complemented by a number of static stations in Etopia. Besides, a community of air observers -with researchers, makers and technology enthusiasts concerned about air quality- will be created.
- **Goal**: raising environmental awareness and encouraging environmentally friendly behaviour by using technology to engage students
- **Challenge**:
    - Active participation of young people in the analysis of Zaragoza's air quality.
    - Analize, draw and display conclusions about air quality data in Zaragoza.
    - Facilitate an analysis of air quality after a process of co-creation and community work done by the participants.

- Test the improvements done in the technology of the project (software and hardware), based on the experience of the pilots in their campaigns in their first iteration

- **Recruitment strategy**: Through the contacts that eTOPIA has with different schools thanks to the eTOPIA kids program and dissemination through an open call to all schools in Zaragoza.
- **Beekeepers**: Zaragoza City of Knowledge Foundation - Ibercivis Foundation - Zaragoza Municipality
- **Queen Bees**: staff from ZGZ, ZKF, Ibercivis, people interested in air quality -researchers, makers and technology enthusiasts concerned about air quality- and teachers
- **Working Bees**: students, staff of three Zaragoza participating institutions.
- **Drone Bees**: General public, other teachers, parents, staff from ZGZ, ZKF and IBER
- **Type of engagement**: Physical + digital engagement

3.3.1 High level requirements of pilot

The Zaragoza Pilot in this second iteration will be used to consolidate the air quality measurement technology and digital tools provided by the project, following the results obtained in iteration one. In this second iteration, **the target audience will be young people aged 11-16**, as well as the participatory strategies for community building (beehives) among this age group, derived from the toolkit developed in work package 2.

This second iteration of the SOCIO-BEE pilot in Zaragoza will be developed in two phases:

- **A pre-piloting phase** when the technology -both hardware and software- will be re-tested to ensure the good work of their Zaragoza Pilot in this second iteration will be used to consolidate the air quality measurement technology and digital tools provided by the project, following the completion of iteration one, according to the suggestions made after the first iteration. This phase will be carried out in December 2023 to March 2024.
- **A piloting phase**, from April to June 2024, when the citizen science campaigns and activities will take place. Several schools will be chosen through an open call. An organic hive assembled with citizens will be put on motion too to explore the possibilities of air quality measurements in the city.

As a result of this piloting phase, several communities will be built to contribute to the pilot goals: A **Zaragoza Air Quality Community hive** -an organic one by adding citizens through the pilot execution, **several hives in schools**, where their own citizen science campaigns will be carry out, and **Zaragoza Staff hive**, built on the three institutions staff members. This hive **Zaragoza Air Quality Community hive** will run their activities with a static sensor settled in Etopia facilities.

Data will be collected both scientifically, on the measurements obtained by the sensors, and on the level of commitment to the project to consolidate both the effectiveness of the technology developed and the project's strategies for commitment and behavioural change.

During this second iteration, Zaragoza will also conduct campaigns to address the issue of **noise pollution** to make participants more aware of this issue. To meet this objective Zaragoza plans to make "sound walks" through different areas of the city to capture and study the different sounds of urban life.

3.3.2 Stakeholders' map of pilot

Table 32. Stakeholder's map in Zaragoza.

Stakeholder name or group	Stakeholder type	Role and activities	Level of involvement	Barriers of engagement	Motivations and expectations	Recruitment strategies and channels	Stage of involvement	Support
Ana Jimenez (ZGZ Municipality)	**Beekeeper**	Coordinate pilot activities, communication and dissemination actions, run the workshops, prepare campaigns	High: Coordination / Action / Supervision	Time constraints, lack of technical knowledge	Check the technology of the project	They're all members of the Pilots team	All phases of the pilot	Chronogram of the pilot activities coordination
Pilar Martín (ZKF Foundation)					Check the project engagement strategies for building communities			Attend to the pilot meetings
Daniel Lisbona (Ibercivis Foundation)					Analyse the behavioural change about air quality between the community (hive) members			Work in project WP's deliverables
Carlos López (ZGZ Municipality)								Collect Data, bring help and support, workshop organisation, communication & dissemination activities, bees recruitment
Marina Abadía (ZGZ Municipality)	**Queen Bee**	Facilitate time and spaces to run the pilot activities	Low: Facilitation / Supervision	Time constraints	Analize the behavioural change about air quality between the community (hive) members	They're all responsible of the institutions involved in the pilot	All phases of the pilot	Facilitate time and spaces to run the pilot activities
Elena Giner (Etopia Center of Art & Technology)								
Francisco Sanz (Ibercivis Foundation)		Supervision of pilot activities						
Teachers		Coordinating students to carry out campaigns in		Time constraints	Contribute to the pilot success	Open call	Pilot phase	Materials for teachers and students

		schools						
People interested in air quality		Helping to keep Zaragoza's hive active		Time constraints, success in content adaptation and engagement strategy	Contribute to improve air quality in the city and create a community.	communication channels (mailing list, face to face...) RRSS, news.	Pilot phase	Contribute personal time and expertise to run the experiments.
Zaragoza City of Knowledge Foundation	**Bear**	Help with communication and dissemination strategies	Medium: Facilitation	Time constraints	Have scientific evidence that allows to improve municipal regulations about air quality, being part of a European innovation project	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face conversations)	All phases of the pilot	Facilitate spaces and channels for communication and dissemination of the project and its results
Municipality of Zaragoza		Recieve and study the final scientific reports						
Ibercivis Foundation								
LIA Open Innovation Labs (Zaragoza)								
Ibercivis staff members	**Worker bees**	test technology	High: Action	Time constraints, success in content adaptation and engagement strategy	Contribute to the pilot success	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face talks)	Pre-pilot phase	Bring experience in previous citizen science projects and scientific experiments related to air quality.
ZKF Foundation staff members		collect data			Checking the pilot technology		Pilot phase	Bring personal time to run the experiments
ZGZ Municipality staff members		Assist to workshops			Analyse the air quality of the city			
Students		Assit to workshops and callect data			Participate in a citizen science experiment that affects their city.	Open Call, engagement materials.	Pilot phase	Bring personal and school time
Representatives of Ibercaja	**Drone Bee**	Receive and study the final	Low: Supervision / Advice	Lack of communication with	Be aware of the pilots development	Pilot communication channels: Email, social media,	Pilot Phase	Dissemination of the results through their

		scientific reports		pilot representatives, lack of information of the pilot aims and outcomes	to introduce air quality improvement activities in their organisations	newsletter		communication channels
Representatives of Hiberus		Help with communication and dissemination activities						
Representatives of the Water and Environment documentation center		Advice						
Other Teachers								
Representatives of INIT						Face to face conversation		
Representatives of Zaragoza University						Project dissemination events		

3.3.3 Campaigns co-designed

Campaign Zaragoza Staff:

Development: Through engagement strategies with Etopia staff, short measurement campaigns will be conducted, using the project's technology, around the Etopia Center for Art and Technology.

Stakeholders: Staff from Etopia, Zaragoza City Council, Zaragoza city of knowledge foundation and Ibercivis.

Goal: Objective: to test that the technology works correctly in order to be able to offer good technical support to the rest of the hives.

Work plan: the campaigns with the Etopia Staff will be carried out during the second Zaragoza Pilot, from February to June. The aim is to carry out short campaigns in terms of time and measurement area. The idea is to carry out small internal tests of the application and the sensors in order to ensure that everything works correctly.

After each campaign, a small internal evaluation will be carried out in order to have a control of possible failures and to be able to communicate them internally in a fast and efficient way.

Risks: Some risks are foreseen, such as sensors and/or the mobile application not working properly or problems being too complicated to solve internally at ZGZ. To carry out this campaign we require the voluntary participation of our colleagues, so a possible risk may be the lack of time due to the workload of each one.

Location: Around the Etopia Center of art and technology.

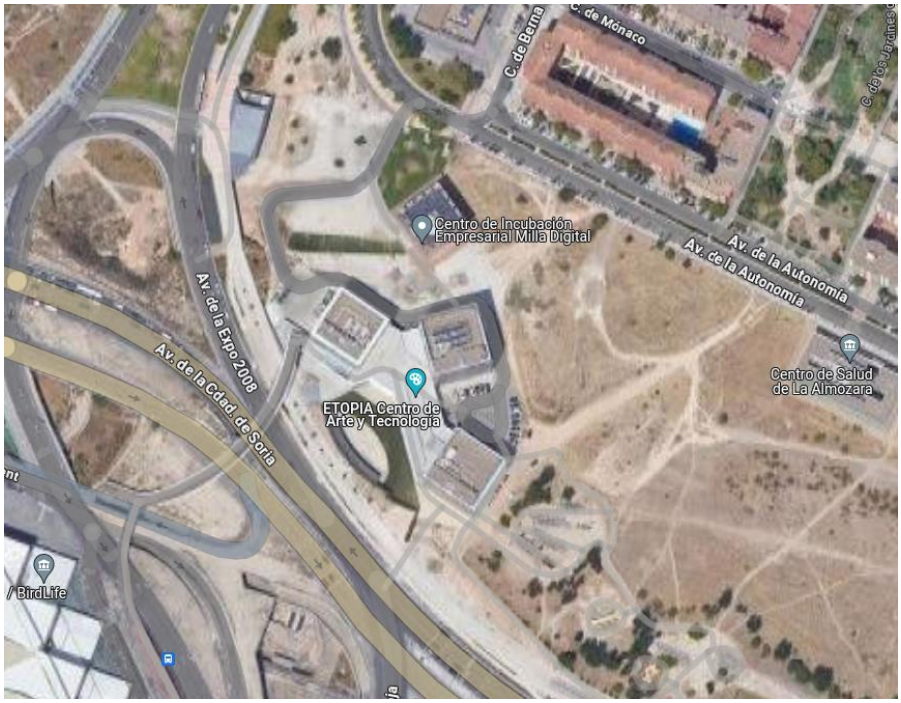


Figure 26. Location Etopia Center of art and technology. (Google Maps).

Materials & Equipment: Materials and equipment: In terms of resources needed, Zaragoza requires: 6 sensors; the AcadeMe backend platform, the mobile application, some training materials on air quality and citizen science, some user manuals for the mobile application and the web application, and some Workshops with technology partners to learn how to use the tools that will be used during the pilot.

Recommendations: After the first iteration where staff from the three organisations (Ibercivis, FKF, Zgz) tested the devices and applications, the conclusions were reported. And once they are corrected, it will be possible to collect better quality data and thus obtain quality hypotheses. As recommendations in the design of campaigns, it is observed that short and intense campaigns obtained better results

Methodology: Data will be collected on air quality, sound, free text (insights), images and videos, and questionnaires from CS activists. To analyse all this data, Zaragoza will establish a grid of zones for measurements and repeat them in time and space until scientifically relevant data is available, according to platform and device standards. The data collected and the testing of the technology will contribute to better support the rest of Zaragoza's hives.

Reasoning: This internal hive with the Etopia staff has to test the technology, the platform and all the materials simultaneously with the rest of the hives. These campaigns will allow us to be able to determine the problems in time and offer good technical support to the rest of the hives in Zaragoza.

Success indicator/s:

- Carry out a monthly internal testing campaign
- Recurring monthly meeting with the members of the 3 institutions of the Pilot of Zaragoza.

Campaign Zaragoza Air Quality Community hive:

Development: An organic hive to study the air quality will be set to use the data obtained through the static sensor in Etopia, among the data obtained in the school campaigns and the data from the reference stations of the Zaragoza City Council. This hive, called “The Community Air Quality Hive of Zaragoza'' will be formed by members of the pilot staff, researchers, teachers, makers and anyone interested in air quality.

Stakeholders: Zaragoza will have Pilar Martín and Guillermo Malón (ZFK), Ana Jimenez and Carlos Lopez (ZGZ), and Daniel Lisbona (IBER) as Beekeepers to create or assign a hive for a potential campaign. The institutions ZKF, ZGZ, IBER and LIA CESAR LABS will work as Bears in the campaigns. Marina Abadía and Elena Giner (ZGZ), with Daniela Sarasa (ZKF) and Fran Sanz (IBER) will have the role as Queen Bee. Moreover, staff from ZKF, ZGZ, IBERCIVIS and LIA LABS will have a role as Bees. Representatives or staff from Ibercaja, Unizar, Hiberus, Init, Water and Environment documentation center and teachers from some of schools (Juan de Lanuza School, Santo Domingo School) will be participating as Drone Bees, helping to disseminate the outcomes of the campaign. Finally, the intention of Zaragoza is that while the first iteration is ongoing, no other groups apart from the indicated ones will be added. However, if during the execution of the campaigns they detect any new group interested in participating, they will try to incorporate them whenever possible and if not, they will incorporate them in the second iteration.

Goal: The objective of this hive will be the implementation of engagement strategies for the assembly of an organic community, as well as the use of the project's technology to obtain air quality data, its work and subsequent visualisation. This hive will serve to attract talent and expertise to the project to explore possible new uses and integrations of SOCIO-BEE’S technology in other areas of interest to citizens.

Work plan: A working group of citizens interested in air quality will be set: a dynamic group of people who will analyse the campaign's progress and run their own ones. This hive during the pilot will work from February to June.

There will be recurring meetings with the hive members and an online communication with the hive members with reminders and the campaign achievements.

Queen and worker bees will be incorporated as soon as we have the static sensor taking data. In the specific case of the QBs, Zaragoza will meet with them before starting the campaign to jointly design the content as well as formulate the hypotheses to work on. For the Bears, the objective is to involve them from the beginning of the campaigns by telling them what SOCIO-BEE is and what its purposes are, trying to convince them to collaborate in the design of the campaigns and the hypotheses (this would facilitate their subsequent commitment once we have the results of the campaign), and sharing the results of the hypotheses as well as the data obtained with the purpose of serving decision makers as input for the formulation of policies, guidelines, recommendations, etc. about environment.

Risks: Some risks are foreseen, firstly, not achieving a minimum number of people to create a hive. Secondly, not getting the bees to want to continue to participate after the end of the campaign. Thirdly, the lack of interest of the bees to use the results of the campaign as input for new policies. And fourthly, the sensors and/or the mobile app do not work properly or are too complicated to use for the target audience.

Location: Around the Etopia Center of art and technology.

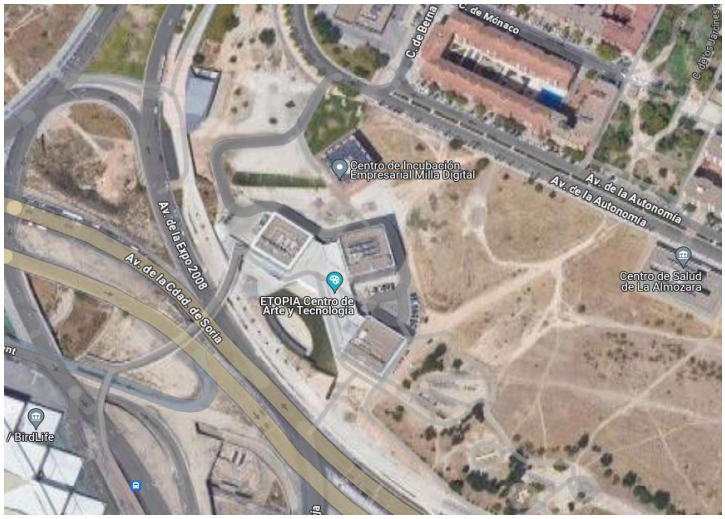


Figure 27. Location Etopia Center of art and technology. (Google Maps).

Materials & Equipment: Regarding the necessary resources, Zaragoza requires several static sensors located in Etopia and several laptops; the AcadeMe backend platform, the mobile application, some training materials on air quality and citizen science, some user manuals for the mobile application and the web application, and some Workshops with technology partners to learn how to use the tools that will be used during the pilot.

Recommendations: This organic hive for the study of air quality will use the data obtained through the static sensors of Etopia, between the data obtained in the school campaigns and the data from the reference stations of the Zaragoza City Council. After the first iteration where staff from the three organizations (Ibercivis, FKF, Zgz) tested the devices and applications, the conclusions were reported. And once they are corrected, it will be possible to collect better quality data and thus obtain quality hypotheses. As recommendations in the design of campaigns, it is observed that short and intense campaigns obtained better results.

Methodology: air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activists will be gathered. To analyse all these data Zaragoza will set an area grid for measurements and repeat them in time and space until have scientific relevant data, according to the platform and devices' standards. The collected data will contribute to complete visualisations of the state of air quality in the studied areas.

Reasoning: This hive from the Zaragoza Air Quality Community has to test the technology, the platform and all the materials simultaneously with the rest of the hives. These campaigns will allow us to obtain consolidated hypotheses, since they will take into account the hypotheses obtained by the other hives.

Success indicator/s:

- capture of AQ measurements added in Etopia (static sensor),
- capture of AQ measurements from other campaigns (number of schools greater than three)
- capture of staff AQ measurements (one for moth)

Campaign Schools:

Development: Through participatory strategies, several schools of Zaragoza will join the project becoming SOCIO-BEE Beehives, ready to conduct citizen science campaigns by using the technology of the project.

Stakeholders: Schools in Zaragoza interested in air quality and the environment.

Goal: The schools selected to participate in the SOCIO-BEE pilot will be provided with the project's technology (sensors, app as well as training to become familiar with and understand their use) to design their own citizen science campaigns related to air quality in their environment. The main objective will be the collection of data, their scientific work in the classroom and making the results available to the public in dissemination activities.

Work plan: SOCIO-BEE will launch in April 2024 an open call for schools and educational centres willing to participate in the project by carrying out air quality measurement campaigns in their environment.

The selected schools will be notified in May 2024 and, after a series of training activities for their teachers - workshops that will turn them into queen bees of each hive - the students will be able to co-design the citizen science and air quality measurement campaigns they want to carry out. The months of May and June 2024 will be dedicated to the implementation of the citizen science campaigns and in May the results will be presented in a public data visualisation and dissemination event.

Throughout the project's piloting period, engagement activities will be carried out with the centres, as well as communication and dissemination of everything achieved to date.

Risks: Some risks are foreseen:

- Failure to involve a minimum number of schools to reach a reasonable number of participants.
- Low level of interest from participants to continue being part of the hives once the pilot phase is over.
- The sensors and/or the mobile application are either not working properly or are too complicated to use for the target audience.
- Data obtained from measurements are not accessible or not easily understood by the participants.
- Resistance on the part of participants to fill out too many questionnaires.

Location: The areas where the campaigns will take place will be set by the participating schools, as part of their co-design process. All of these areas will be placed in the city of Zaragoza and its surroundings.

Materials & Equipment: Regarding the necessary resources, Zaragoza will require:

- Several portable sensor devices for the schools campaigns
- The AcadeMe platform and the mobile application,
- Training materials on air quality and citizen science,
- User manuals for the mobile application and the web application,
- Didactic material for running the teachers' workshops on how to use the tools that will be used during the pilot.

Recommendations: For this second iteration the coordination team would recommend to the future hives in school to search and find plausible hypothesis to be probed through the citizen science campaigns, taking into consideration their location in the city, their surroundings or mobility aspects of each case: existence of good public transportation networks, use of private vehicles to arrive or crowding at school entrances and exits.

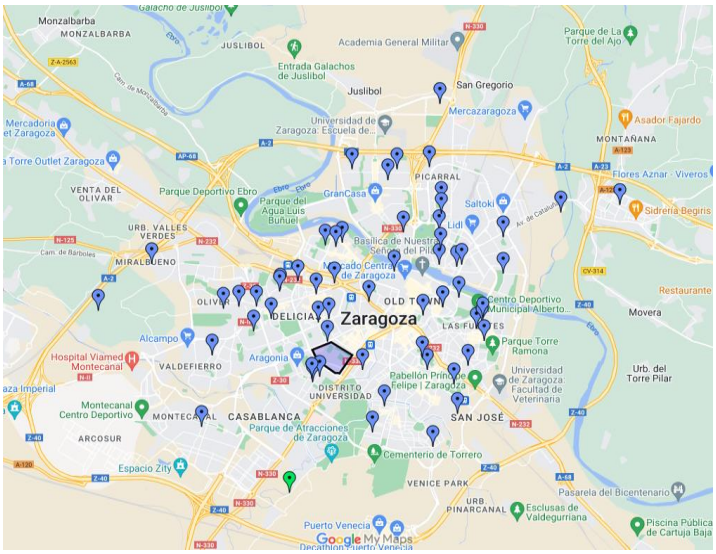


Figure 28. Map of primary schools in Zaragoza (Google Maps).

Methodology: Each school will be able to design its own citizen science campaign, according to the blueprints provide for the project. These campaigns will be conducted by using the technology provided by SOCIO-BEE, and they will cover all the stages of the scientific loop.

Teachers will become queen bees (following the metaphor of the beehive) and help their students to design the campaign, take the measurements and interpret the results. The pilot coordination team will play the role of bee-keeper, providing the necessary support. Dissemination of results will take place at a closing event where the results will be visualised and possibly attended by representatives of local institutions (the bears in the SOCIO-BEE beehive metaphor).

Reasoning: In this second iteration, more weight will be given to citizen science. Campaigns will be useful for our target audience (youngsters) to probe their scientific hypothesis about air quality, and they will be able to go through all stages of the research cycle. This path would raise awareness about climate change among students that participate in these campaigns.

Success indicator/s:

- Nº of schools involved in the project: =>3
- Overall school satisfaction => 60%

Pilot execution plan

Table 33. Zaragoza's workplan for iteration 2.

ZGZ Pilot	MS	Phase	When	Action	Description	Target	Comments

IR1	static sensors installed	Pre-pilot launch subphase	DIC23/JAN24	Internal release	static sensors installation in etopia	Have three static sensors to help monitoring and calibration for the rest of devices	
IR2	technology ready	Pre-pilot launch subphase	DIC23/JAN24	Internal release	internal testing of devices and technology	Make sure that the technolgy works before start the 2nd iteration of pilot	
IR3	open call launched	Pre-pilot launch subphase	FEB24	Internal release	Open call for schools preparation	Have ready the documentation for the open call for schools that want to participate in the 2nd iteration campaigns	open call for proposals text / define deadline for acceptance of proposals
S1	organic hive development	Pilot-execution subphase	FEB/JUN 24	Support	ZGZ Air Qulity Air Meetings	Development of the hive	Regular meeting to share data and prepare campaigns

T1	organic hive development	Pilot-execution subphase	FEB/JUN 24	Training	Workshops	Working in the Citizen science and engagement part of the project with the hive members	Regular meetings to share knowledge, propose new activities, visualize data...
MM1	organic hive development	Pilot-execution subphase	FEB/JUN 24	Measuring & Monitoring	Local campaigns	Citizen science local campaigns for measuring and monitoring air quality	Bimonthly according to the hive timeline
C1	open call document	Pilot-execution subphase	APR 24	Communication	Open call for schools launch and communication	Disseminate the Open call and wait for applications	
R1	shools enrolled	Pilot-execution subphase	APR 24	Reaction	Announcement of selected schools	Get the selected schools ready to start campaigns	
T2	teachers trained	Pilot-execution subphase	APR 24	Training	Workshop for teachers	Involve teachers and give them all the information and training to conduct CS campaigns in their schools	
MM2	data	Pilot-execution subphase	APR /JUN 24	Measuring & Monitoring	Citizen Science Campaigns in Schools	Get data about Air Quality,	If technology is not ready in MAR24 activities in classroom will be conducted with the

						Complete the science loop in the classroom	didactic materials only. The scope of the measurements and their impact in KPI's will be affected
EV1	schools and hives involved	Pilot-execution subphase	JUN24	Evaluation	Final event	Meeting of all schools and beehives to celebrate the end of the project, to visualise the results obtained and to reward the participants.	
C2	guidelines document with results visualization	Post-execution subphase	Jun 2024	Communication	Dissemination of results activities	Communicate the results and reach local institutions	

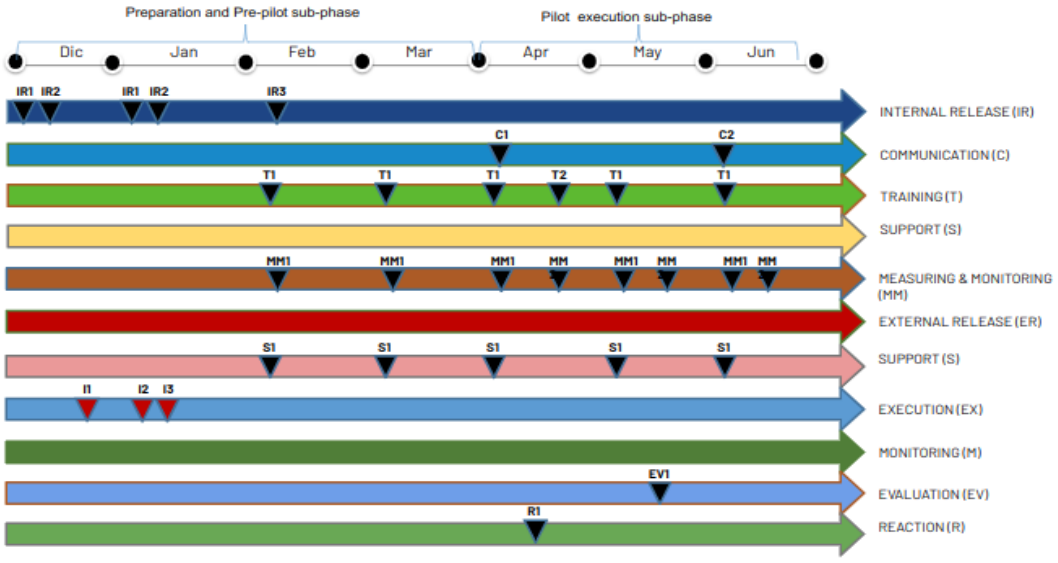


Figure 29. Zaragoza's workplan for iteration 2.

3.3.4 Community building plan

During the second iteration of the Pilot, Zaragoza will execute several community building activities intended to:

- To sensitize the participating groups on environmental issues such as air quality, noise pollution, etc. in our city.
- Encourage active and lasting citizen participation beyond the implementation of the campaigns.
- Provide valuable material to maintain the interest of participants (mainly children) and to facilitate the creation of new campaigns.

Zaragoza will use various materials to achieve efficient recruitment and engagement campaigns. These materials include posters, surveys, brochures, flyers, marketing materials, etc. From a practical approach, we will conduct sessions such as INFORM, GUIDE, CONSULT and WORK WITH. The aim is to make the pilot understandable and the campaigns comprehensible and inviting. Another important objective is to involve as many participants as possible, not only to work actively on the campaign, but also to make them participants in the results.

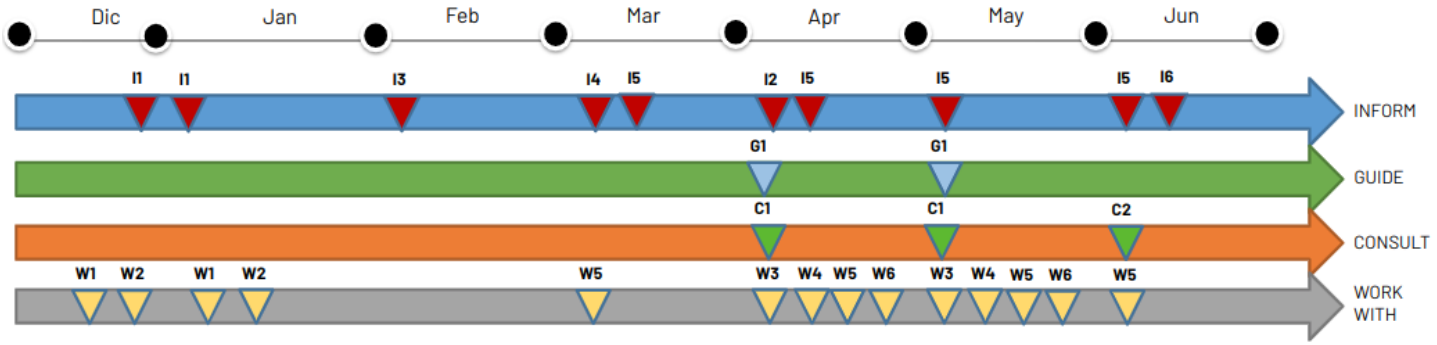


Figure 30. Zaragoza's community building plan for iteration 2.

Below are some of the activities planned to be carried out during the second iteration of the Zaragoza pilot. As shown in the tables, there are some activities scheduled for a pre-pilot phase and others that will be carried out in the pilot execution phase. It is in this execution phase where it is expected that more activities will be carried out since it includes the participation of schools, citizens, and staff.

Table 34. Zaragoza's W1 engagement activity description.

W1	WORK WITH - Static sensors installation in Etopia
Objective	Installing static sensors to improve data quality
Phase	BEFORE PRE-PILOT
Target artefacts	SOCIO-BEE sensors and platform components

Target groups	Bee-keepers
Dissemination materials	Documentation of the process
Evaluation mechanisms	
Outcomes	
Location	Etopia Center for Art and Technology
Date	Dic 2023 / Jan 2024

Table 35. Zaragoza's I1 engagement activity description.

I1	**INFORM -Internal testing workshop**
Objective	Deployment of SOCIO-BEE platform, toolkit, knowledge base and instantiation of test campaigns in Pilot
Phase	PRE-PILOT
Target artefacts	SOCIO-BEE platform components, communication materials and evaluation mechanisms
Target groups	Bee-keepers
Dissemination materials	Communication material and evaluation mechanisms
Evaluation mechanisms	Alpha Questionnaires
Outcomes	Alpha Questionnaires
Location	Etopia Center for Art and Technology
Date	Dic 2023 / Jan 2024

Table 36. Zaragoza's W2 engagement activity description PRE-PILOT PHASE (March).

W2	**WORK - Campaigns design meeting**

Objective	Design the second pilot iteration campaigns
Phase	PRE-PILOT
Target artefacts	SOCIO-BEE platform components, engagement materials
Target groups	Bee-keepers
Dissemination materials	SOCIO-BEE campaigns templates
Evaluation mechanisms	
Outcomes	
Location	Etopia Center for Art and Technology
Date	Dic 2023 / Jan 2024

Table 37. Zaragoza's I2 engagement activity description.

I2	**INFORM -Open call for schools preparation**
Objective	Design the open call for schools
Phase	PRE-PILOT
Target artefacts	SOCIO-BEE platform components, communication materials and evaluation mechanisms
Target groups	Schools
Dissemination materials	Communication and engagement material
Evaluation mechanisms	
Outcomes	
Location	Etopia Center for Art and Technology

Date	April 2024

Table 38. Zaragoza's I3 engagement activity description.

I3	**INFORM - Creation of the communication Plan**
Objective	Announcement of SOCIO-BEE pilot and purpose (press release, social media posts) among alpha testers
Phase	PRE-PILOT
Target artefacts	SOCIO-BEE communication materials
Target groups	citizens
Dissemination materials	Communication and engagement material
Evaluation mechanisms	
Outcomes	
Location	Online
Date	FEB 2024

Table 39. Zaragoza's I4 engagement activity description.

I4	**INFORM -open call launch for schools**
Objective	Opening of the open call for schools.
Phase	PILOT-EXECUTION
Target artefacts	SOCIO-BEE communication materials
Target groups	Schools
Dissemination materials	Terms and conditions of the call for applications

Evaluation mechanisms	
Outcomes	
Location	On lIne
Date	MAR 2024

Table 40. Zaragoza's C1 engagement activity description.

C1	**CONSULT- Schools recruitment period**
Objective	Application period and answers to doubts
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE communication materials
Target groups	Schools
Dissemination materials	Terms and conditions of the call for applications
Evaluation mechanisms	
Outcomes	
Location	
Date	APR-MAY 2024

Table 41. Zaragoza's W3 engagement activity description.

W3	**WORK - Campaigns with schools**
Objective	Get data about Air Quality, Complete the science loop in the classroom
Phase	PILOT EXECUTION

Target artefacts	SOCIO-BEE platform components, communication materials and evaluation mechanisms
Target groups	Schools
Dissemination materials	Communication and engagement material
Evaluation mechanisms	Questionnaires / Interviews
Outcomes	Questionnaires
Location	Zaragoza
Date	APRIL - MAY 2024

Table 42. Zaragoza's W4 engagement activity description.

W4	**WORK - Meetings with AGZ air quality hive**
Objective	Working in the Citizen science and engagement part of the project with the hive members
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE platform components, engagement materials
Target groups	citizens
Dissemination materials	data review, campaigns, and evaluations mechanisms
Evaluation mechanisms	
Outcomes	
Location	Etopia Center for Art and Technology
Date	APRIL - MAY 2024

Table 43. Zaragoza's I5 engagement activity description.

I5	INFORM -Dissemination activities and workshops with ZGZ hive
Objective	Communicate the results and reach local institutions
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE results
Target groups	citizens
Dissemination materials	Communication and engagement material
Evaluation mechanisms	
Outcomes	
Location	Etopia Center for Art and Technology / On Line
Date	MAR - JUN 2024

Table 44. Zaragoza's W5 engagement activity description.

W5	WORK - Local Campaingns
Objective	Working in the Citizen science and engagement part of the project with the hive members
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE platform components, engagement materials
Target groups	Bee-keepers / AGZ
Dissemination materials	Communication and engagement material
Evaluation mechanisms	Questionnaires / Interviews

Outcomes	Questionnaires
Location	Etopia Center for Art and Technology
Date	MAR - JUN 2024

Table 45. Zaragoza's G1 engagement activity description.

G1	**GUIDE -Supervision meetings with all the hives**
Objective	Review air quality data, complete the scientific hive loop.
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE data
Target groups	Bee.Keepers / School
Dissemination materials	data review, campaigns and evaluations mechanisms
Evaluation mechanisms	
Outcomes	Didactic Unit on air quality
Location	Online / School
Date	APR - MAY 2024

Table 46. Zaragoza's W6 engagement activity description.

W6	**WORK - Others campaigns with institutions and partnerships**
Objective	Working in the Citizen science and engagement part of the project with the hive members
Phase	PILOT EXECUTION

Target artefacts	SOCIO-BEE platform components, engagement materials
Target groups	citizens
Dissemination materials	Communication and engagement material
Evaluation mechanisms	Questionnaires / Interviews
Outcomes	Questionnaires
Location	Zaragoza
Date	APR - MAY 2024

Table 47. Zaragoza's I6 engagement activity description.

I6	**INFORM -Final event**
Objective	Communicate the results
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE results
Target groups	citizens
Dissemination materials	Communication materials and data results
Evaluation mechanisms	Results and hypothesis
Outcomes	
Location	Etopia Center for Art and Technology
Date	JUN 2024

Table 48. Zaragoza's C2 engagement activity description.

C2	CONSULT-Dissemination of results activities
Objective	Communicate the results
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE results
Target groups	Schools
Dissemination materials	Communication materials and data results
Evaluation mechanisms	Results and hypothesis
Outcomes	Didactic Unit on air quality
Location	Etopia Center for Art and Technology / On Line
Date	JUN 2024

4 Evaluation methodology

The SOCIO-BEE pilots are designed to assess the value provided by SOCIO-BEE platform and associated toolkit to foster the realization of Citizen Science experiments in the domain of Air Quality which may help citizenry and their public administrations to gain a better understanding on the effects of air pollution and to learn mitigation strategies which will lead to behaviour change and proactive policy making. This chapter explains the evaluation methodology proposed in SOCIO-BEE to assess the impact resulting from bringing together "citizen science" and "community of change" concepts to enact mitigation strategies and devise new policies to tackle air pollution.

4.1 Evaluation objectives and dimensions

In SOCIO-BEE we want to validate the value of the technology and campaigns designed in the 3 pilots scattered through Europe (Ancona-IT, Maroussi-GR and Zaragoza-ES), by meeting the following **project evaluation objectives**:

- Increase awareness of air pollution and possible reaction actions.
- Achieve inclusive empowerment of CS Hives with instruments to measure, analyse and understand impact of air pollution.

- Prove effectiveness of SOCIO-BEE engagement methodology, toolkit and tools to realise CS experiments for pollution understanding monitoring and remediation.
- Validate whether Citizen Science enables more open and sustainable decision-making processes or not, whilst complying with data privacy aspects.
- Assess SOCIO-BEE potential of repeatability, scalability, and sustainability.
- Gain data evidence for policy making in the form of recommendations - new ambition for iteration 2 which requires completion of the whole Citizen Science loop.

Consequently, we aim to answer to the following ***research question***:

Will SOCIO-BEE platform and approach change the behaviour of citizens towards Air Pollution, making them more aware, better-informed and reactive?

To assess this research question we are going to look at the following evaluation aspects, guided by a sophisticated KPI framework, inherited from the Grant Agreement and now refined for this second iteration. The proposal time provided KPI framework only defined generic cross-pilot KPIs which now have been extended and localized in each pilot, as shown in 3. Next, the evaluation goals with their depending dimensions and linked KPIs are introduced.

Global or pilot-agnostic goals. With the support of a rich set of global/cross-project KPIs we will be looking at the following evaluation dimensions:

- **SOCIO-BEE's Usage**. The number of CS campaigns launched, active and passive participants involved during the two iterations, related and reasoned upon the KPIs specified in the proposal and their targets. Notice that we have further divided the "usage" dimensions into sub-dimensions: a) *availability and compliance*, b) *operation*.
- **SOCIO-BEE's Users Perception**. Users' perceptions of SOCIO-BEE regarding *acceptance*, *satisfaction*, *usefulness*, *usability* and *accessibility*. The obtained values for each construct will be checked against objectives defined in the KPIs.
- **SOCIO-BEE's Value**. The value improvements provided by SOCIO-BEE to tackle air quality issues. Again, comparison with the Grant Agreement declaration will be performed.

Local or pilot-specific goals. These evaluation goals look at specific aspects of a pilot.

- **PILOT SPECIFIC goals**. Such goals will be measured by pilot specific KPIs to validate that such specific goals are met.

In summary, the set evaluation objectives will be met, and, hence, we may consider a given pilot successful, iff (if and only if), the following two **end of project ambitions** are met:

- If we can prove that deploying SOCIO-BEE makes a change in the pilots, i.e. positive **behaviour change** towards air quality is achieved at pilot sites.
- If we set the foundations for the replication of SOCIO-BEE to other pilots, i.e. replicability is achieved or at least targeted by releasing the tools, methodology and lessons learned during the pilots.
- If new mitigation strategies in the form of policy recommendations can be generated (policymaking) – new ambition for iteration 2.

4.2 Evaluation approach and process

Ex-ante and *ex-post* evaluations [11] can be useful for assessing the effectiveness of citizen science tools and processes. Ex-ante evaluation can be used to assess the potential risks and benefits of a citizen science tool or process before it is implemented. This can involve identifying the key objectives of the tool or process, assessing the feasibility of its implementation, identifying potential constraints, and establishing success metrics. Ex-ante evaluation can help to ensure that citizen science tools and processes are designed with clear objectives and are implemented in a way that maximizes their effectiveness. This type of evaluation can occur during the pre-piloting phase where a control group of users explores new features for a solution, e.g. in this case for version 2 of SOCIO-BEE platform.

Ex-post evaluation, on the other hand, can be used to assess the actual outcomes and impact of a citizen science tool or process after it has been implemented. This can involve analysing data collected during the citizen science project, reviewing feedback from participants, and conducting interviews with key stakeholders. Ex-post evaluation can help to identify strengths and weaknesses of the tool or process and provide insights for improving future projects. This is the type of evaluation that will be carried out in the actual pilot evaluation sub-phase of iteration 2.

Overall, *ex-ante and ex-post evaluations* are critical for ensuring that citizen science tools and processes are effective and sustainable in the long term. By conducting these evaluations, organizations can make informed decisions about the design and implementation of citizen science projects and improve the outcomes of future projects. During the planning process of pilots' iteration 2, the evaluation questionnaires handed in iteration 1 have been revised. Pilots provided some feedback in order to improve them for this second iteration. As an important addition, in iteration 2, questions about behavioural change have been added. This is one of the key aspects that were missing and highlighted in D5.12 [2].

SOCIO-BEE in second iteration adopts again ex-ante and ex-post evaluation approach, materialized through two iterations of a **PRE-POST longitudinal field experimental design** [12]:

- It has **2 phases**:
  - PRE-with SOCIO-BEE v1 phase
  - POST-with SOCIO-BEE v2 phase
- Within each iteration phase, two sub-phases are considered: a) *pre-pilot execution sub-phase* targeted to alpha testers where *ex-ante evaluatio*n is carried out, i.e. control group formed by partner members or close associates which are first exhibited to the updated SOCIO-BEE approach, tools and co-designed experiments for iteration 2; b) *pilot execution sub-phase* targeted to beta testers where *ex-post evaluation* is carried out, i.e. open to the actual stakeholder groups targeted in the pilot sites, namely elderly people in Ancona, commuters in Maroussi and young people in Zaragoza. In these second iteration bigger numbers of users will be considered.
- The PRE-with SOCIO-BEE v1 phase tackles the establishment of a baseline before SOCIO-BEE v2 upgrades are adopted to foster CS experiments mediated evidence gaining for decision-making by beta testers within interaction 2. It is executed during the second iteration of the pilots, within pre-pilot execution sub-phase. These alpha testers will not only help setting up the baseline regarding where Citizen Science stands at each of the pilot sites but will also help finetuning the new v2 of SOCIO-BEE platform (second version) which will be made available as final release to beta testers in pilot execution sub-phase of iteration 2. After the execution of this latter sub-phase (pilot-execution sub-phase), i.e. end of iteration 2, release 2 of the SOCIO-BEE platform will be produced.
- The POST-with SOCIO-BEE v2 phase encompasses the second pilot iteration: *Consolidation*. It will concretely cover two sub-phases of iteration 2. In the pre-pilot execution phase of iteration 2, alpha testers again get involved to help finetuning release 2 of the SOCIO-BEE platforms

- The manipulation (or intervention) of the field experiment is the *use of SOCIO-BEE to co-design CS campaigns to tackle air quality issues which produce insights useful for decision-making*. Put differently, the field experiment is designed to answer the following overall question (relevant in both, first and second iteration):

Will SOCIO-BEE platform and approach change the behaviour of citizens towards Air Pollution, making them more aware, better-informed and reactive?

Answering this question requires measuring:

- Effects on (A) *usage* – co-design of CS campaigns to promote air quality associated issues and their mitigation, (B) *end-user stakeholders' perceptions* (regarding acceptance, satisfaction, usefulness, usability and accessibility) and (C) *value of the executed CS experiments* based on the CS campaigns (efficiency and productivity), by looking at: a) differences in the process between PRE-with SOCIO-BEE v1 phase and POST-with SOCIO-BEE v2 phase and b) differences between end-user stakeholders participating in PRE-with SOCIO-BEE v1 phase and in POST-with SOCIO-BEE v2 phase. The final aim is *to test whether SOCIO-BEE performs better and thus improves the co-design and co-delivery of evidence-gaining CS experiments which aid decision-making in air quality aspects.*
- Evolution of the effects of SOCIO-BEE over time by comparing "Pilot Iteration 1 - Exploration" with "Pilot Iteration 2 - Consolidation" to test whether there are improvements in effects over time and after the second development effort. The final aim is *to test whether SOCIO-BEE`s performance in co-design of CS campaigns to execute air quality related CS experiments improves over time: in Pilot Iteration 2 (Consolidation) as a result of the feedback obtained in Pilot Iteration 1 (Exploration) and the second development iteration.*
- The evaluation takes the same PRE-POST longitudinal study [13] in all use-case sites; in addition, to account for the particularities of each use-case site and the Local dimension of the evaluation, some evaluation aspects (i.e., specific KPIs) might vary across use-cases. A key instrument for this regard is the PRE evaluation and POST pilot evaluation questionnaires updated for this iteration.

Figure 31 shows the pilots evaluation process planned for iteration 2. Departing from the alpha version 2 (with enhancements from v1 after conclusions driven from iteration 1's evaluation) of the platform, the pre-pilot execution subphase will be executed, with the help of alpha testers, delivering the v2 beta release of the solution of SOCIO-BEE. From the v2 beta release, the pilot execution subphase will be carried out delivering the final of the platform. As observed in Figure 31, different evaluation techniques may be applied to the SOCIO-BEE CS enabling platform by alpha (*pre-pilot execution subphase*) and beta (pilot execution subphase) testers to increasingly improve the SOCIO-BEE solution devised to gain data evidences for better air quality related decision making and its associated supporting tools. Notice that the techniques indicated in pre-pilot execution subphase are only indicative as they are the plans that have been elaborate by pilots and listed in chapter "3. Specification of pilots' experimentation". Next, a brief definition of each of the techniques indicated is provided:

- *Heuristic evaluation* [14] – is a process where experts use rules of thumb to measure the usability of user interfaces in independent walkthroughs and report issues.
- *Usability tests* [15] – refers to evaluating a product or service by testing it with representative users. Typically, during a test, participants will try to complete typical tasks while observers watch, listen and take notes.
- *Focus group* [16] – a market research method that brings together 6-10 people in a room to provide feedback regarding a product, service, concept, or marketing campaign
- *User acceptance testing* [17] – is a type of testing that is performed by end-users or clients of a software application to ensure that it meets their requirements and expectations.

- *Cross-testing session* – session where different partner members execute a pre-defined script to test the main features of a product and report any issues which may be encountered.
- *Behaviour analysis* [18] – provide insights into how people interact with technology, and how these interactions affect their work, communication, and personal lives.
- *Retrospective analysis* [19] – refers to the process of looking back at past events or situations in order to evaluate or assess them. It involves examining what happened, how it happened, and why it happened, with the goal of gaining insights and identifying lessons that can be applied to future situations.
- *Foresight analysis* [20] – the goal is to identify potential future scenarios and prepare for them, rather than reacting to unforeseen events.

In "pre-pilot subphase evaluation" (*formative evaluation*) the emphasis will be on usability and robustness, while in the "pilot's execution subphase evaluation" (*summative evaluation*), the focus will be on understanding whether the CS campaign/experiments co-design and co-delivery enabling methodology and tools integrated in the platform have supported the pilots to accomplish their air pollution mitigation objectives successfully or not. Remarkably iteration 2 wants to go further performing citizen behaviour analysis as results of the SOCIO-BEE campaigns and generating insights which may feed policy recommendations.

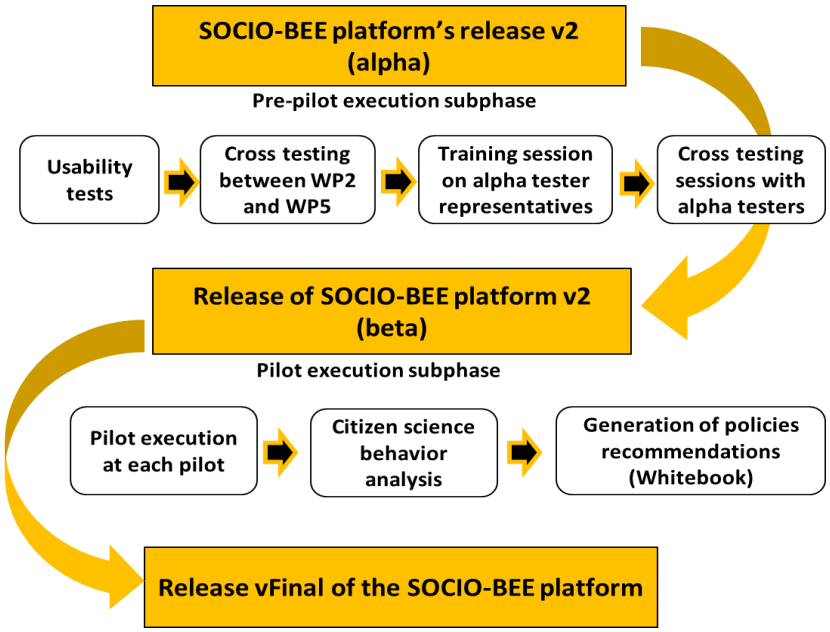


Figure 31. SOCIO-BEE's pilots' evaluation process.

4.3 Quality of Citizen Science projects

Product-based quality, user-based quality, and value-based quality [21] are three different evaluation dimensions for assessing the quality of processes or products, e.g. citizen science projects [22]. SOCIO-BEE will be considered as successful if it provides the methodology and instruments to deliver the highest quality possible CS experiments which deliver the highest possible impact. In other words, if SOCIO-BEE meets the three following quality criteria:

- *Product-based quality*: It is a measurement of the quality of the scientific outputs produced by a citizen science project. It measures the accuracy, precision, and reliability of the data collected by participants. This quality

dimension is focused on the scientific rigor of the research, and the product (data, findings, reports) generated by the citizen science project. The European Citizen Science Association (ECSA) Working Group on Data Quality and Guidelines developed the "Ten Principles of Citizen Science for Policy Makers" [23] that includes "Principle 5: Quality and Standards" that describes product-based quality in detail.

- *User-based quality*: This refers to the quality of the user experience in a citizen science project. User-based quality focuses on the satisfaction of participants in citizen science projects. It measures the participant's experience (easy of use, accessibility), engagement, and motivation. User-based quality is critical because it can influence the number of participants, the length of participation, and the quality of data collected. The "Ten Principles of Citizen Science for Policy Makers" [24] developed by ECSA Working Group on Policy provides detailed descriptions of user-based quality in Principle 1: Public Participation.
- *Value-based quality*: It measures the social and environmental impact of citizen science projects. This refers to the value provided by a citizen science project to the society, the environment, or the participants themselves. Value-based quality can be measured by criteria such as the social, economic, and environmental impact of the project, the public engagement, and the capacity building of the citizens involved in the project. It is about obtaining the benefits generated by the project for the participants, the local community, and the society at large. It is important for demonstrating the value of citizen science projects to society and for ensuring that they are addressing real-world problems.

Overall, citizen science projects should consider all three dimensions of quality in their evaluation to ensure that they are meeting their intended objectives and addressing real-world problems, while producing accurate and reliable scientific outputs and keeping participants engaged and motivated. In summary, product-based quality focuses on the scientific quality of the research, user-based quality focuses on the usability and satisfaction of the participants, and value-based quality focuses on the social, economic, and environmental impact of the project on the society. All three dimensions are important to ensure a successful citizen science project that generates high-quality data, engages and satisfies participants, and provides value to the community as it was done during iteration 1 and will be done in iteration 2.

To calculate the **associated quality of the Citizen Science endeavour promoted by SOCIO-BEE the following metrics will be considered**:

- **Product-based quality** - the following KPI groupings help towards assessing this quality dimension:
  - Low-cost modular wearable sensor
  - Citizen Science platform
  - Citizen Science application
  - Legal, ethical, inclusion
- **User-based quality** - the following KPI groupings help towards assessing this quality dimension:
  - Engagement rates per societal group and type of stakeholder
  - Scientific literary
  - Perception
- **Value-based quality** - the following KPI groupings help towards assessing this quality dimension:
  - Air pollution reduction
  - Open and sustainable decision-making
  - Business development
  - Behaviour change achieved

A high fulfilment of the objectives set for the KPIs proposed to measure each dimension of quality, e.g. >= 80%, should indicate that SOCIO-BEE meets the quality standards to be considered as a reference solution for Citizen Science promotion to gain air quality evidence for decision-making.

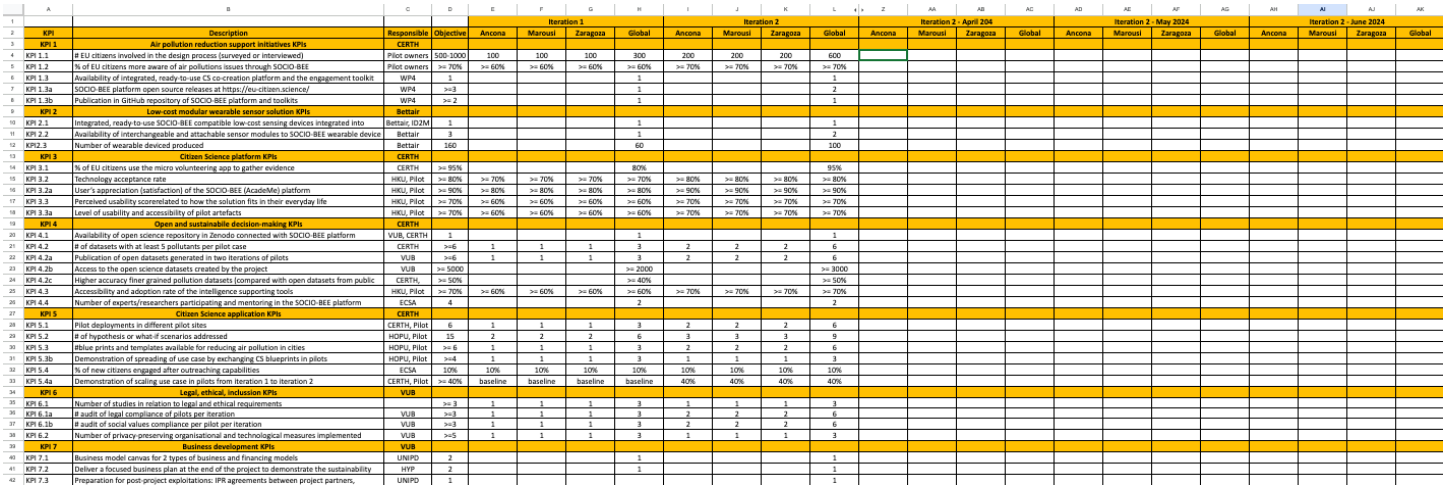
4.4 Evaluation dimensions' KPIs

In this section, the KPIs designed to feed the project evaluation dimensions that were outlined in section 4.1 are reviewed, refined if needed and, more importantly, grouped according to the defined evaluation dimensions. Notice that after each KPI title appears, enclosed by parentheses, the objective value sought in the whole pilot. Next, we provide more details about each of the evaluation dimensions which are governed by either the global or pilot specific KPIs earlier mentioned. A full listing of such KPIs is available in SOCIO-BEEs KPIs Master sheet. Such spreadsheet contains the following tabs:

- *KPIs management*: this KPI tab/view indicates (see Figure 34) what partner is responsible to monitor each KPI, what is the set objective and more importantly, how the value of each listed KPI will be calculated.
- *KPI monitoring*: this KPI view will be used for the monthly monitoring of KPIs. Notice (see Figure 33) how per each month of iteration 2 independent columns for each of the 3 pilots and the global value achieved in that month in iteration 2 for every KPI is included.
- *KPIs distribution per pilot*: this view distributes (see Figure 32) the load of contributing for each KPI among the three pilots. It only includes those KPIs that can be fed by pilots. There are other KPIs which are cross-project or global. Notice that although in the figures below the distribution of contribution from each pilot to the global KPI value has been considered as equal, it should be weighted by the relative population size of each pilot.

	A	B	C	D	E	J	K	L	M
1						Iteration 2			
2	KPI	Description	Responsible	Objective	Adjusted Objective	Ancona	Marousi	Zaragoza	Global
3	KPI 1	Air pollution reduction support initiatives KPIs	CERTH						
4	KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	Pilot owners	3000	500-1000	200	200	200	600
5	KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	Pilot owners	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%
6	KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	WP4	1	1				1
7	KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	WP4	>=3	>=3				2
8	KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	WP4	>= 2	>= 2				1
9	KPI 2	Low-cost modular wearable sensor solution KPIs	Bettair						
10	KPI 2.1	Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into	Bettair, ID2M	before 202	1				1
11	KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device	Bettair	3	3				2
12	KPI 2.3	Number of wearable deviced produced	Bettair		160				100
13	KPI 3	Citizen Science platform KPIs	CERTH						
14	KPI 3.1	% of EU citizens use the micro volunteering app to gather evidence	CERTH	>= 95%	>= 95%				95%
15	KPI 3.2	Technology acceptance rate	HKU, Pilot	>= 80%	>= 80%	>= 80%	>= 80%	>= 80%	>= 80%
16	KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	HKU, Pilot	>= 90%	>= 90%	>= 90%	>= 90%	>= 90%	>= 90%
17	KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	HKU, Pilot	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%
18	KPI 3.3a	Level of usability and accessibility of pilot artefacts	HKU, Pilot	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%
19	KPI 4	Open and sustainabile decision-making KPIs	CERTH						
20	KPI 4.1	Availability of open science repository in Zenodo connected with SOCIO-BEE platform	VUB, CERTH	1	1				1
21	KPI 4.2	# of datasets with at least 5 pollutants per pilot case	CERTH	>=6	>=6	2	2	2	6
22	KPI 4.2a	Publication of open datasets generated in two iterations of pilots	VUB	>=6	>=6	2	2	2	6
23	KPI 4.2b	Access to the open science datasets created by the project	VUB	>= 5000	>= 5000				>= 3000
24	KPI 4.2c	Higher accuracy finer grained pollution datasets (compared with open datasets from public	CERTH,	>= 50%	>= 50%				>= 50%
25	KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	HKU, Pilot	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%
26	KPI 4.4	Number of experts/researchers participating and mentoring in the SOCIO-BEE platform	ECSA	4	4				2
27	KPI 5	Citizen Science application KPIs	CERTH						
28	KPI 5.1	Pilot deployments in different pilot sites	CERTH, Pilot	6	6	2	2	2	6
29	KPI 5.2	# of hypothesis or what-if scenarios addressed	HOPU, Pilot	15	15	3	3	3	9

Figure 32. Snapshot of "KPIs management" tab of KPIs master sheet.



	A	B	C	D	E	F	G	H	I	J	K	L	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1					Iteration 1				Iteration 2					Iteration 2 - April 204				Iteration 2 - May 2024				Iteration 2 - June 2024		
2	KPI	Description	Responsible	Objective	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global
3	KPI 1	Air pollution reduction support initiatives KPIs	CERTH																					
4	KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	Pilot owners	500-1000	100	100	100	300	200	200	200	600												
5	KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	Pilot owners	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
6	KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	WP4	1				1				1												
7	KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	WP4	>=3				1				2												
8	KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	WP4	>= 2				1				1												
9	KPI 2	Low-cost modular wearable sensor solution KPIs	Bettair																					
10	KPI 2.1	Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into	Bettair, ID2M	1				1				1												
11	KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device	Bettair	3				1				2												
12	KPI2.3	Number of wearable devices produced	Bettair	160				60				100												
13	KPI 3	Citizen Science platform KPIs	CERTH																					
14	KPI 3.1	% of EU citizens use the micro volunteering app to gather evidence	CERTH	>= 95%				80%				95%												
15	KPI 3.2	Technology acceptance rate	HKU, Pilot	>= 80%	>= 70%	>= 70%	>= 70%	>= 70%	>= 80%	>= 80%	>= 80%	>= 80%												
16	KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	HKU, Pilot	>= 90%	>= 80%	>= 80%	>= 80%	>= 80%	>= 90%	>= 90%	>= 90%	>= 90%												
17	KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
18	KPI 3.3a	Level of usability and accessibility of pilot artefacts	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
19	KPI 4	Open and sustainable decision-making KPIs	CERTH																					
20	KPI 4.1	Availability of open science repository in Zenodo connected with SOCIO-BEE platform	VUB, CERTH	1				1				1												
21	KPI 4.2	# of datasets with at least 5 pollutants per pilot case	CERTH	>=6	1	1	1	3	2	2	2	6												
22	KPI 4.2a	Publication of open datasets generated in two iterations of pilots	VUB	>=6	1	1	1	3	2	2	2	6												
23	KPI 4.2b	Access to the open science datasets created by the project	VUB	>= 5000				>= 2000				>= 3000												
24	KPI 4.2c	Higher accuracy finer grained pollution datasets (compared with open datasets from public	CERTH,	>= 50%				>= 40%				>= 50%												
25	KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
26	KPI 4.4	Number of experts/researchers participating and mentoring in the SOCIO-BEE platform	ECSA	4				2				2												
27	KPI 5	Citizen Science application KPIs	CERTH																					
28	KPI 5.1	Pilot deployments in different pilot sites	CERTH, Pilot	6	1	1	1	3	2	2	2	6												
29	KPI 5.2	# of hypothesis or what-if scenarios addressed	HOPU, Pilot	15	2	2	2	6	3	3	3	9												
30	KPI 5.3	#blue prints and templates available for reducing air pollution in cities	HOPU, Pilot	>= 6	1	1	1	3	2	2	2	6												
31	KPI 5.3b	Demonstration of spreading of use case by exchanging CS blueprints in pilots	HOPU, Pilot	>=4	1	1	1	3	1	1	1	3												
32	KPI 5.4	% of new citizens engaged after outreaching capabilities	ECSA	10%	10%	10%	10%	10%	10%	10%	10%	10%												
33	KPI 5.4a	Demonstration of scaling use case in pilots from iteration 1 to iteration 2	CERTH, Pilot	>= 40%	baseline	baseline	baseline	baseline	40%	40%	40%	40%												
34	KPI 6	Legal, ethical, inclussion KPIs	VUB																					
35	KPI 6.1	Number of studies in relation to legal and ethical requirements		>= 3	1	1	1	3	1	1	1	3												
36	KPI 6.1a	# audit of legal compliance of pilots per iteration	VUB	>=3	1	1	1	3	2	2	2	6												
37	KPI 6.1b	# audit of social values compliance per pilot per iteration	VUB	>=3	1	1	1	3	2	2	2	6												
38	KPI 6.2	Number of privacy-preserving organisational and technological measures implemented	VUB	>=5	1	1	1	3	1	1	1	3												
39	KPI 7	Business development KPIs	VUB																					
40	KPI 7.1	Business model canvas for 2 types of business and financing models	UNIPD	2				1				1												
41	KPI 7.2	Deliver a focused business plan at the end of the project to demonstrate the sustainability	HYP	2				1				1												
42	KPI 7.3	Preparation for post-project exploitations: IPR agreements between project partners,	UNIPD	1								1												

Figure 33. Snapshot of "KPIs monitoring" tab of KPIs master sheet.

	A	B	C	D	E	F	G	H	I	J	K	L
1					Iteration 1				Iteration 2			
2	KPI	Description	Responsible	Objective	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global
4	KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	Pilot owners	500-1000	100	100	100	300	200	200	200	600
5	KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	Pilot owners	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
6	KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	WP4	1				1				1
15	KPI 3.2	Technology acceptance rate	HKU, Pilot	>= 80%	>= 70%	>= 70%	>= 70%	>= 70%	>= 80%	>= 80%	>= 80%	>= 80%
16	KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	HKU, Pilot	>= 90%	>= 80%	>= 80%	>= 80%	>= 80%	>= 90%	>= 90%	>= 90%	>= 90%
17	KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
18	KPI 3.3a	Level of usability and accessibility of pilot artefacts	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
21	KPI 4.2	# of datasets with at least 5 pollutants per pilot case	CERTH	>=6	1	1	1	3	2	2	2	6
22	KPI 4.2a	Publication of open datasets generated in two iterations of pilots	VUB	>=6	1	1	1	3	2	2	2	6
25	KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
28	KPI 5.1	Pilot deployments in different pilot sites	CERTH, Pilot	6	1	1	1	3	2	2	2	6
29	KPI 5.2	# of hypothesis or what-if scenarios addressed	HOPU, Pilot	15	2	2	2	6	3	3	3	9
30	KPI 5.3	#blue prints and templates available for reducing air pollution in cities	HOPU, Pilot	>= 6	1	1	1	3	2	2	2	6
31	KPI 5.3b	Demonstration of spreading of use case by exchanging CS blueprints in pilots	HOPU, Pilot	>=4	1	1	1	3	1	1	1	3
32	KPI 5.4	% of new citizens engaged after outreaching capabilities	ECSA	10%	10%	10%	10%	10%	10%	10%	10%	10%
33	KPI 5.4a	Demonstration of scaling use case in pilots from iteration 1 to iteration 2	CERTH, Pilot	>= 40%	baseline	baseline	baseline	baseline	40%	40%	40%	40%
35	KPI 6.1	Number of studies in relation to legal and ethical requirements		>= 3	1	1	1	3	1	1	1	3
36	KPI 6.1a	# audit of legal compliance of pilots per iteration	VUB	>=3	1	1	1	3	2	2	2	6
37	KPI 6.1b	# audit of social values compliance per pilot per iteration	VUB	>=3	1	1	1	3	2	2	2	6
38	KPI 6.2	Number of privacy-preserving organisational and technological measures implemented	VUB	>=5	1	1	1	3	1	1	1	3
44	KPI 8.1	# Queen Bees recruited by pilot and iteration	DEUSTO,	>= 3	1	1	1	3	1	1	1	3
45	KPI 8.2	# Bears involved by pilot and iteration	CERTH	>= 3	1	1	1	3	1	1	1	3
46	KPI 8.3	# Working Bees involved by pilot and iteration	CERTH	>= 20	20	20	20	60	20	20	20	60
47	KPI 8.4	# Societal groups involved	CERTH	>= 3	1	1	1	3	1	1	1	3
48	KPI 8.5	% Women participation	CERTH	>=50%	50%	50%	50%	50%	50%	50%	50%	50%
49	KPI 8.6	% Inclusivity rate target	CERTH	>= 85%	50%	50%	50%	50%	85%	85%	85%	85%
50	KPI 8.7	# Citizens actively collecting air quality data via wearables	DEUSTO	>=200	50	50	50	150	100	100	100	300
51	KPI 8.8	# Citizens actively collecting multimedia data of air quality pollution sources	CERTH	>=200	50	50	50	150	100	100	100	300
52	KPI 8.9	# Citizens using microvolunteering app to gather measurements	AUTH	>=450	100	100	100	300	200	200	200	600
57	KPI9.2	Mass communication campaigns per pilot	ECSA	>=2	1	1	1	3	1	1	1	3
58	KPI 9.3	"Word of mouth" communication campaigns per pilot	Pilot owners	>=2	1	1	1	3	1	1	1	3
61	KPI 9.6	Cities using SOCIO-BEE	CERTH	>=3	1	1	1	3	1	1	1	3
75	KPI 12.2	Intention to be involved in new citizen science projects	HKU	>= 75%	baseline	baseline	baseline		>= 75%	>= 75%	>= 75%	>= 75%
76	KPI 12.3	Improved participant understanding of science	HKU	>= 50%	baseline	baseline	baseline		>= 50%	>= 50%	>= 50%	>= 50%
77	KPI 12.4	Better participant attitudes toward science	HKU	>= 75%	baseline	baseline	baseline		>= 75%	>= 75%	>= 75%	>= 75%
78	KPI 12.5	Increased participant interest in science as a career	HKU	>= 35%	baseline	baseline	baseline		>= 35%	>= 35%	>= 35%	>= 35%

Figure 34. Generic KPIs which are fed by pilots, notice division of global objectives into iteration 1 and iteration 2.

Global or pilot-agnostic dimensions: each of the evaluation dimensions, namely *usage*, *perception,* and *value*, are calculated through KPIs applicable to all pilot sites. In practical terms, we have further divided usage dimension into availability & compliance, on one hand, and operation, on the other side. For each of the total 4 types of dimensions defined KPIs have been clustered in those 4 categories. Given a category, e.g. Usage, it will be estimated that SOCIO-BEE offers excellent usage if it achieves over 80% of the KPIs feeding such dimension. The same rule of thumb will be applied for all the other dimensions:

- **Usage: availability & compliance**. These sub-dimensions indicate the readiness of SOCIO-BEE's citizen science enabling infrastructure, tools and methodologies to realize air quality experimentation in an inclusive and accessible manner, still complying with data legislation. This is, to ensure that SOCIO-BEE is usable for air quality related CS experimentation. Next, the list of KPIs that feed this sub-dimension, for more details, e.g. how each KPI will be calculated and its objective value distributed in the two iterations, visit SOCIO-BEEs KPIs Master sheet. As indicated in the KPI master sheet these KPIs are measured by counting the availability of key assets to be able to launch, execute and monitor CS campaigns.

    - KPI 1.3 – Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit (Objective: =1)
        - KPI 1.3a – SOCIO-BEE platform open-source releases at https://eu-citizen.science/ (>=3)
        - KPI 1.3b – Publication in GitHub repository of SOCIO-BEE platform and toolkits (>=2).
    - KPI 2.1 – Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into personal wearables and drones (>=1 before 2024)
    - KPI 2.2 – Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device demonstrating versatility of the solution (>=3)
    - KPI2.3 – Number of wearable devices produced (>=160)
    - KPI 4.1 Availability of open science repository in Zenodo connected with SOCIO-BEE platform (>=1)
    - KPI 5.3 – Number of blueprints and templates available for reducing air pollution in cities (>=4)
    - KPI 6.1 – Number of studies in relation to legal and ethical requirements (>=3)
        - KPI 6.1a – Audit of legal compliance of pilots per iteration (>=3)
        - KPI 6.1b – Audit of social values compliance per pilot per iteration (>=3)
    - KPI 6.2 – Number of privacy-preserving organisational and technological measures implemented during the project lifecycle (>=5)
    - KPI 7.1 – Business model canvas for 2 types of business and financing models (>=2)
    - KPI 7.2 – Deliver a focused business plan at the end of the project to demonstrate the sustainability and reproducibility of the project in at least 2 different cities (>=2)
    - KPI9.2 – Mass communication campaigns per pilot (>=2)
    - KPI9.3 – "Word of mouth" communication campaigns per pilot (>=2)

- **Usage: operation**. This sub-dimension of Usage dimension encompasses metrics that prove the actual realization of CS experiments in the pilots by using SOCIO-BEE platform, toolkit, and its methodology. These metrics, among other factors, measure the number of CS campaigns launched, the set of active and passive participants involved during the two phases, which correspond to the KPIs specified in the proposal and their targets. Indeed, the following KPIs measure how SOCIO-BEE is applied in practice during the execution of pilots. As indicated in SOCIO-BEEs KPIs Master sheet, most of these KPIs can be solved by issuing SQL queries to the Data Model that holds the logic of SOCIO-BEE platform:

    - KPI 1.1 – Total number of EU citizens involved in the co-design process (surveyed or interviewed) (Objective: in range 500-1000)
    - KPI 3.1 – % of EU citizens use the micro volunteering app to gather evidence (>= 95%. It might be lower due to the fact that ACNONA will work with seniors)

- KPI 4.4 – Number of experts/researchers participating and mentoring in the SOCIO-BEE platform (>=4)
- KPI 5.1 – Pilot deployments in different pilot sites (>=6)
- KPI 5.2 – Number of hypothesis or what-if scenarios addressed (>=15)
- KPI 5.4 – Demonstration of spreading of use case by exchanging CS blueprints in pilots (>=4)
- KPI 8.1 – Queen Bees recruited by pilot and iteration (>=3)
- KPI 8.2 – Bears involved by pilot and iteration (>=3)
- KPI 8.3 – Working Bees involved by pilot and iteration (>=20)
- KPI 8.4 – Societal groups involved (>=3)
- KPI 8.5 – Women participation (>=50%)
- KPI 8.6 – Inclusivity rate target (>=85%)
- KPI 8.7 – Citizens actively collecting air quality data via wearables (>=200)
- KPI 8.8 – Citizens actively collecting multimedia data to identify air quality pollution sources (>=200)
- KPI 8.9 – Citizens using the micro volunteering app who have gathered at least one measurement (>=450)
- KPI 8.10 – National institutions reached by the project (>=10)
- KPI9.6 – Cities using SOCIO-BEE (>=3)
- KPI9.12 – Relevant financing institutions involved in the seminars (>=2)
- KPI10.1 – Visualizations of AcadeMe tutorial video (200 at most)
- KPI10.2 – Accesses to SOCIO-BEE AcadeMe portal (1000)
- KPI11.1 – User willing to follow recommendations (>= 70%)
- KPI13.1 – Total # of workshops/webinars by end of project (>=5)
- KPI13.2 – Number of Attendees per workshop (>= 30)
- KPI13.3 – # of Events by end of project (>=1)
- KPI13.4 – # of Attendees for the final event (>= 50)
- KPI13.5 – total # of project presence in events (national & international) (>= 15)
- KPI13.8 – Access to project website (>= 100)
- KPI13.9 – Numbers of participant visits to project Web sites (>= 5000)
- KPI13.10 – total # of visits (sessions) by end of project (>= 10000)
- KPI13.11 – AVG Duration (time spent) per session in minutes (>= 3)
- KPI13.12 – Total # of followers (Facebook, Twitter, LinkedIn) by end of project (>= 500)
- KPI13.13 – Total # of Newsletters by end of project (>= 20)
- KPI13.14 – # of readers per newsletter (>= 80)

- **Users' perception**. This dimension measures users' perceptions of SOCIO-BEE regarding acceptance, satisfaction, usefulness, usability and accessibility. Perceptions are capital since they highly influence the eventual adoption of SOCIO-BEE approach and tools; the better the perceptions of users the more likely might be the adoption of the solution. As indicated in SOCIO-BEEs KPIs Mastersheet, most of these KPIs can be solved by exploring the answers of a wide range of questionnaires designed by the project:
  - KPI 3.2 – Technology acceptance rate (>=80%)
    - KPI 3.2a – User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform (>= 90%)
  - KPI 3.3 – Perceived usability score (e.g. using the System Usability Scale - SUS) related to how the solution fits in their everyday life (>= 70%)

        - KPI 3.3a – Level of usability and accessibility of pilot artefacts (>= 70%)
    - KPI 4.3 – Accessibility and adoption rate of the intelligence supporting tools (>= 70%)
    - KPI 8.10 – Positive feedback from relevant institutions (>= 50%)
    - KPI 9.9 – Interest in the project by local populations - downloads of materials (>=100)

- **Value provided**. This dimension serves to assess what is the actual contribution of SOCIO-BEE. It includes metrics to measure the value improvements provided by SOCIO-BEE regarding air quality decision-making and its socioeconomic impact in pilots. For instance, it provides indications about the increase of awareness regarding air pollution, the generation of finer grained datasets relating to air pollution produced by the project, the more widespread and scale up participation of citizens in Citizen Science experiments across pilots, the generation of policy briefs for designing or verifying air pollution mitigation measures that will emerge from the project or the communication artefacts to aid more society-aware decision making in the area of air quality. As indicated in SOCIO-BEEs KPIs Master sheet, some of these KPIs can be solved by exploring the answers of a wide range of questionnaires designed by the project, whilst others having a look to the statistics of the dissemination and communication actions carried out in the project:

    - K1.2 – % of EU citizens who feel more aware of air pollutions issues after being involved in SOCIO-BEE (Objective:>= 70%)
    - KPI4.2 – Number of relevant datasets from pollutant types analysed, at least 5 datasets per pilot case (>=6)
        - KPI 4.2a – Publication of open datasets generated in two iterations of pilots (>=6)
        - KPI 4.2b – Access to the open science datasets created by the project (>= 5000)
        - KPI 4.2c– Higher accuracy finer grained pollution datasets (compared with open datasets from public stations) (>= 50%)
    - KPI 5.4 – % of new participating citizens engaged because of SOCIO-BEE outreaching capabilities after initial campaigns (>=1’0%)
    - KPI 5.4a – Demonstration of scaling use case in pilots from iteration 1 to iteration 2 (=40%)
    - KPI 7.3 – Preparation for post-project exploitations: IPR agreements between project partners, agreement on individual/ joint exploitation plans and business plan preparation activities (>=1)
    - KPI 9.1 – White book with recommendations on how CS can impulse citizen engagement and their pro-environmental behavioural change (>=1)
    - KPI 9.4 – Meeting with European Institutions regarding the management of citizen initiatives (>=4)
    - KPI 9.5 – Proof of Value outside the consortium uses of SOCIO-BEE artefacts (>=2)
    - KPI 9.7 – Institutional toolkit sent to local authorities (>=90)
    - KPI 9.8 – CO2 emission reduction related to citizens involved in the project (-15%)
    - KPI 9.10 – Improving social and open innovation capacity - new initiatives (>=6)
    - KPI 9.11 – Impact on employment - new employments (>=6)
    - KPI 12.1 – Increased interest or engagement in science (>= 80%)
    - KPI 12.2 – Intention to be involved in new citizen science projects (>= 75%)
    - KPI 12.3 – Improved participant understanding of science (>= 50%)
    - KPI 12.4 – Better participant attitudes toward science (>= 75%)
    - KPI 12.5 – Increased participant interest in science as a career (>= 35%)

- KPI 13.6 – total # of publications (conferences & journals) (>= 8)
- KPI 13.7 – Articles in local newspapers (>= 6)
- KPI 13.15 – total # of brochures by end of project (>= 2)
- KPI 13.16 – total # of videos produced for project purposes (>=2)
- KPI 13.17 – Increase favourable environment behaviour after taking part in campaigns (>=20%)

Local or pilot-specific goals: Custom made at each pilot site. Notice that a couple of KPIs per co-designed campaign have been specified in the sub-sections associated to each pilot.

In summary, we will consider that **iteration 2's piloting is successful if** the following three **conditions associated to its evaluation dimensions** are met:

- **Usage**:
  - **availability and compliance** - a legally compliant SOCIO-BEE platform v2 is delivered in time, i.e. before iteration 2's pilot execution sub-phase is started in April 2024.
  - **operation** - mainstream usage of the SOCIO-BEE tools to operate several CS campaigns effectively is demonstrated.
- **Positive perception** – ample acceptance of the SOCIO-BEE approach and methodology among pilots' participants. This should be linked to wide adoption on the pilots, i.e. a high engagement.
- **Value provided** - in terms of enhanced awareness, positive behaviour change, and reduction of air pollution can also be demonstrated.

When evaluating citizen science tools and processes, it is important to consider both, the scientific outcomes of the project, as well as the engagement of the citizen scientists. This can involve evaluating the quality and accuracy of the data collected, as well as the level of participation and satisfaction of the citizen scientists. Besides, in this project we will be able to get a quantification of the overall quality of SOCIO-BEE by considering the KPI groupings mentioned in section Quality of Citizen Science projects.

As previously commented, KPIs numbers have been adjusted during the SOCIO-BEE project. It has had an impact in iteration 1 but also in iteration 2. These adjustments have been made in response to the evolving dynamics and practicalities encountered in the project's implementation.

4.5 Qualitative and quantitative measures for evaluation

Table 49 depicts the evaluation dimensions and constructs that will be assessed in the pilots and what mechanism will be used to measure those dimensions.

The same approach will be employed for the second iteration of the SOCIO-BEE project; however, two significant adjustments have been introduced concerning the questionnaires. Firstly, as previously mentioned, questions addressing behaviour change have been incorporated. This aspect is crucial for measurement and was not addressed in the first iteration, as highlighted in D5.12. Identical questions (e.g., "I am concerned about the levels of air pollution in my city/neighbourhood") will be posed to participants in both the pre- and post-tests. This approach aims to assess potential changes in participants' perceptions and attitudes. Secondly, after the first iteration, pilot owners provided us some feedback in order to improve some of the questions. These improvements were about rephrasing the sentences (e.g.,

from “Using SOCIO-BEE tools as a Citizen Science (CS) activist I would be able to accomplish tasks more quickly” to “As citizen scientist and by using the SOCIO-BEE tools i could complete various relevant activities faster”) or about changing a sentence with a negative meaning to a sentence with a positive meaning (e.g., from “SOCIO-BEE solution to aid Citizen Science presents some issues regarding the need for high digital literacy, respect of diverse societal backgrounds, lack of accessibility adaptations to cope with disabilities, multilingual support or demand for Internet connection” to “I needed the support of a technical person to be able to use the SOCIO-BEE platform”). We hope that these changes will help to obtain more consistent answers among those completing the surveys.

Table 49. Dimensions explored and data collection techniques used at pilot subphases.

	PRE-PILOT SUBPHASE	PILOT EXECUTION SUBPHASE
DIMENSIONS EXPLORED	Usability User experience Product quality	User-based quality Value-based quality Adoption: as a mix of acceptance, satisfaction, usefulness, usability and accessibility
DATA COLLECTIONS METHODS EXPLOITED	Data Logs Acceptance tests Heuristic evaluation Alpha questionnaire Interviews	Data logs In-app questionnaire Online survey Think aloud methods Interviews

The following **measurement instruments** have been defined and prepared in SOCIO-BEE, to feed its KPIs, the quality criteria mentioned in section 4.3 and the evaluation objectives defined in section 4.1:

- **Data model queries and/or logging mechanism** for understanding CS Hives’ members usage of SOCIO-BEE and behaviour when partaking in citizen science experiments (D4.1 [4] contains the Data Model specification which will be populated when AcadeMe mobile and web app are used in the pilots). SQL queries to such Data Model will be performed to gather progress of some quantitative KPIs. For example, the KPI “KPI 8.7. Citizens actively collecting air quality data via wearables” can be solved through an “SQL query counting all those different

participants of SOCIO-BEE mobile app who have taken at the very least one measurement by means of a wearable within the project".

- **Questionnaires for alpha testers** that help us finetune and refine available toolkit and tools. The following type of questionnaires have been defined:
    - Alpha scripts questionnaires: contains questions to enable alpha testers to provide feedback about the technical tools made available to pilot participants, namely "SOCIO-BEE mobile app", "SOCIO-BEE web app" and "SOCIO-BEE wearable device". The following questions are included:
        - What works well?;
        - What does not work?;
        - What could be added?;
        - What is missing? and
        - How would you improve it? Users of the technological tools could answer this questionnaire any time they find an issue or wish to provide feedback.
    - Demographic and activity satisfaction questionnaire: this survey is designed to allow pilot owners to gather demographic data, satisfaction level and obtain feedback about the activities that they organize to INFORM, CONSULT, GUIDE or WORK WITH participants in pilots.
    - In-app questionnaire: designed to be embedded within SOCIO-BEE mobile app or web front-end allows users of the solution to quickly provide feedback. Below are some of the questions suggested to be included in this questionnaire:
        - Did you like the app design?
        - Was this app easy-to-use?
        - Was this app useful for you?
        - Does this app facilitate you to take part in Citizen Science campaigns?
        - How likely is that you would recommend this app?
        - Provide feedback about the app

- **Questionnaires for beta testers**, i.e. hive members partaking in CS experiments and/or that receive the results from such experiments (for working bees and drone-bees)
    - PRE SOCIO-BEE Citizen Science Activists Evaluation questionnaire: it is targeted to Queen Bees, Worker Bees and Beekeepers. Those more highly engaged in the Citizen Science experiments that are co-created with the expectation to enhance and address Air Quality issues in their communities. This questionnaire is completed by CS campaign participants, i.e. members of a hive, BEFORE the start of a campaign. It is a cut-down version of the POST campaign execution evaluation questionnaire (following one). It is designed to establish a BASELINE. To understand what the awareness level of participants regarding Air Quality and their understanding of the value of Citizen Science was, before they started the campaign. This questionnaire includes the following sections:
        - Socio demographic details about the respondent (role in SOCIO-BEE, age, gender, level of education, technical acquaintance, work status, pilot location)

- Acceptance related questions
- Interests and attitudes regarding citizen science
- Awareness towards Air Quality issues
- Behaviour change inducted by participating in CS experiments

- POST SOCIO-BEE Citizen Science Activists Evaluation questionnaire: it is targeted to Queen Bees, Worker Bees and Beekeepers. Those more highly engaged in the Citizen Science experiments that are co-created with the expectation to enhance and address Air Quality issues in their communities. This questionnaire is completed by CS campaign participants, i.e. members of a hive, AFTER the end of the campaign. This questionnaire includes the following sections:
  - Socio demographic details about the respondent (role in SOCIO-BEE, age, gender, level of education, technical acquaintance, work status, pilot location)
  - Acceptance related questions
  - Interests and attitudes regarding citizen science
  - Satisfaction related questions
  - Accessibility and inclusiveness related questions
  - Awareness towards Air Quality issues
  - Usability questions
  - Behaviour change inducted by participating in CS experiments

- Demographic and activity satisfaction questionnaire: this survey is designed to allow pilot owners to gather demographic data, satisfaction level and obtain feedback about the activities that they organize to INFORM, CONSULT, GUIDE or WORK WITH participants in pilots. It is the same questionnaire used by alpha testers which is also reused by beta testers in pilot execution sub-phase.

The demographic and activity satisfaction questionnaire, together with the PRE & POST SOCIO-BEE Citizen Science Activists Evaluation questionnaires have been designed to feed many of the KPIs which cannot be nurtured by the analysis of the platform logs or queries to its data model. As an example:

- KPI 1.1 *Total number of EU citizens involved in the co-design process (surveyed or interviewed)* - can be answered by counting the answers of the Users Demographics and Activity Satisfaction questionnaires collected at the different pilot sites.
- KPI 12.1 *Increased interest or engagement in science* - can be calculated by considering questions 13 to 20, those under the heading “Interests and attitudes” in POST Evaluation Questionnaire.

4.6 Operation and management of Evaluation, assessment, and monitoring

To organize the planning and then operation of the pilots, pilot owners have been provided with Table 50 where the main guidelines for pilots have been made available, including:

- A set of templates to co-design campaigns, device the pilot workplan and community engagement plan for iteration 2. They have been used to complete the campaign co-design sub-section in chapter 3. Specification of pilots' experimentation.
- A link to SOCIO-BEE's KPI's master sheet which has to be monitored during the execution of the pilot and which mark the objectives related to engagement, CS experimentation and impact defined for iteration 2 and the rest of the project.
- A set of questionnaires, including the above-mentioned questionnaires which are further elaborated in Table 51, used either for onboarding - process of introducing volunteers or community members to a campaign and engaging them in scientific data collection or analysis - and for evaluation of the activities and tools carried out and used in SOCIO-BEE campaigns.
- A deck with presentations covering key aspects for CS campaign organization, such as introduction to citizen science (CS), Air quality (AQ) or providing context for the experimentation around air quality analysis which will be carried out in the three selected pilots.

Table 50. Guideline for pilot management, operation, monitoring, and assessment.

Name	Explanation
Forms to organize pilots	
Campaign template	You can find documentation that should help you completing this template at the Campaign template and blueprint explanation document. In iteration 1, every pilot must organize at least 2 campaigns'
Pilot Workprogramme template	Fill in this document to specify clearly the timeline of your pilot. Notice the diagram included in the spreadsheet template which explains the meaning of acronyms, different types of activities, to include. The final goal is to have a Gantt related to the activities to be carried out in iteration 1 of the pilots of SOCIO-BEE. When completed offline, create a tab with your pilot name with all the workplan details to be centralized in this file
Community Building template	This template helps you with the community building plan of your pilot. There you should include a listing of events/activities to organize to approach your community, co-design campaigns, assemble hives, launch campaigns
KPIs for pilots' evaluation	

Check KPIs table	Every partner needs to check the KPIs such partner is responsible for. Notice that per KPI explanation about how will it be measured is included. Pilot owners notice that as part of the objectives of each pilot's campaign you may need to configure some additional KPIs per pilot.
Questionnaires to perform evaluation within pilots and feed KPIs	
See Table 51	
Presentations/Trainings for pilots	
Introduction citizen science	Presentation to explain what Citizen Science is about
Introduction air quality	Presentation to provide some background information about Air Quality and possible actions to enhance its quality
Introduction SOCIO-BEE campaigns	Template of presentation that will have to be extended or customized per pilot

The following Table 51 summarizes all the questionnaires designed to aid in the onboarding process for pilots (1 and 2) and in the evaluation process (3 to 7) of iteration 2. You may access the contents of the onboarding questionnaires by clicking on their associated links in column "resource location".

Table 51. Questionnaires for onboarding and evaluation in SOCIO-BEE.

#	Title	Description	Usage	Resource location
1	Profiling (ONBOARDING)	The purpose of this questionnaire is to be able to profile candidate participants in the campaigns, to identify what role would be most suitable for each of them.	Only to be used whenever participants have been identified but roles in the Hive are not known a priori. It should be executed, if needed, before a campaign can be organized	PDF publicly accessible
2	Inclusion checklist (ONBOARDING)	This checklist should be passed before Hives for a campaign are	It is recommended to go once over it before we complete	Available at https://docs.google.co

		configured. It will allow us to bear in mind inclusion, gender balance and accessibility when approaching the community or configuring the hives	the planning of engagement activities. It should be passed again before deciding the Hive composition for each Hive	m/forms/d/e/1FAIpQLSd0U4Fl5puxTM2I_Df-ZapP2s7O1fVIyB1PZAvKTmglbRa6Kw/viewform
3	SOCIO-BEE - Pilot Users' Demographics and Activity Satisfaction Questionnaire (EVALUATION)	The purpose of this questionnaire is known who attends to SOCIO-BEE events and to know their opinion/feedback about the activities celebrated	This questionnaire should be filled in by every participant in every community building activity organized within a pilot. It is a short questionnaire. It should not take longer than 3'. They should be submitted together with consent forms since pictures and some demographic data is gathered in those events..	PDF publicly accessible
4	SOCIO-BEE Alpha Questionnaire (EVALUATION) (OPTIONAL)	The purpose of this questionnaire is to give ALPHA testers during the pre-pilot execution sub-phase of iteration 1 to provide FEEDBACK regarding the SOCIO-BEE platform. This feedback will be used by the technical team to finetune the SOCIO.BEE technical solution.	It should be filled in by an alpha tester every time that s/he tests one of the components of the SOCIO-BEE platform.	PDF publicly accessible
5	User Acceptance test for SOCIO-BEE platform (EVALUATION)	The purpose of this spreadsheet is to allow a tester to go through every single functionality of the SOCIO-BEE platform and indicate whether it is functional or not. In case that it is not functional, it should indicate what is wrong, so that developers react and adapt the component.	This template should be completed every time new updates of the SOCIO-BEE platform wants to be released. It includes an exhaustive list of all the features that SOCIO-BEE platform will be enabling and that should be operative before users may use the platform. It will be applied several times before ALPHA release is launched for alpha testers to check SOCIO-BEE platform in pre-pilot execution sub-phase and also in the process where ALPHA releases is enhanced into BETA release which will be used by BETA testers during pilot execution sub-phase.	Document available in nextcloud: PILOTS' GUIDELINES spreadsheet (tab User Acceptance test)
6	PRE SOCIO-BEE Citizen Science Activists Evaluation Questionnaire (EVALUATION)	This questionnaire is filled in ONCE, for *ex-ante analysis*, by those participants about to start a campaign to provide info	Once per campaign participant BEFORE they start participating in the campaign. If they have not signed	PDF publicly accessible

		regarding their expectations, that will be then after the campaign be compared with answers to the same questions after having completed the campaign.	previously a consent form, they should sign it. It is a short questionnaire which should be answered in fewer than 5'.	
7	POST SOCIO-BEE Citizen Science Activists Evaluation Questionnaire (EVALUATION)	This questionnaire is filled in ONCE per campaign participant to enable *ex-post evaluation analysis*, once the campaign has concluded. It is a long questionnaire, because it requires feedback from participants in several dimensions (Acceptance, Interests and attitudes, Satisfaction, Accessibility, Inclusiveness, Awareness, Usability) measured in the project KPIs.	Once per campaign participant AFTER they start participating in the campaign. If they have not signed previously a consent form, they should sign it. This evaluation questionnaire is longer than the PRE evaluation questionnaire. It is important for KPI collection and to perform ex-post analysis.	PDF publicly accessible

By the start of iteration 2's pilot execution sub-phase in April 2024, the earlier mentioned master KPI sheet will be shared with pilots and their fulfilment distributed among pilots and project partners where monthly, from April to June 2024, the progress of the different KPIs will be collected. This will serve to establish a monitoring mechanism regarding the progress of the different pilots. Below, in Figure 35 you can see an extract of the monitoring table contents. Notice, on the right-hand side, how the columns associated to "April 2024" would be repeated for the May and June 2024 months. More details about the contents of this KPIs master sheet were given in section Evaluation dimensions' KPIs.

KPI	Description	Responsible	Objective	Iteration 1				Iteration 2				Iteration 2 - April 204				Iteration 2 - May 2024				Iteration 2 - June 2024			
				Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global	Ancona	Marousi	Zaragoza	Global
KPI 1	**Air pollution reduction support initiatives KPIs**	**CERTH**																					
KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	Pilot owners	500-1000	100	100	100	300	200	200	200	600												
KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	Pilot owners	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	WP4	1				1				1												
KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	WP4	>=3				1				2												
KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	WP4	>= 2				1				1												
KPI 2	**Low-cost modular wearable sensor solution KPIs**	**Bettair**																					
KPI 2.1	Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into	Bettair, IDJM	1				1				1												
KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device	Bettair	3				1				2												
KPI2.3	Number of wearable deviced produced	Bettair	160				60				100												
KPI 3	**Citizen Science platform KPIs**	**CERTH**																					
KPI 3.1	% of EU citizens use the micro volunteering app to gather evidence	CERTH	>= 95%				80%				95%												
KPI 3.2	Technology acceptance rate	HKU, Pilot	>= 80%	>= 70%	>= 70%	>= 70%	>= 70%	>= 80%	>= 80%	>= 80%	>= 80%												
KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	HKU, Pilot	>= 90%	>= 80%	>= 80%	>= 80%	>= 80%	>= 90%	>= 90%	>= 90%	>= 90%												
KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
KPI 3.3a	Level of usability and accessibility of pilot artefacts	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
KPI 4	**Open and sustainable decision-making KPIs**	**CERTH**																					
KPI 4.1	Availability of open science repository in Zenodo connected with SOCIO-BEE platform	VUB, CERTH	1				1				1												
KPI 4.2	# of datasets with at least 5 pollutants per pilot case	CERTH	>=6	1	1	1	3	2	2	2	6												
KPI 4.2a	Publication of open datasets generated in two iterations of pilots	VUB	>=6	1	1	1	3	2	2	2	6												
KPI 4.2b	Access to the open science datasets created by the project	VUB	>= 5000				>= 2000				>= 3000												
KPI 4.2c	Higher accuracy finer grained pollution datasets (compared with open datasets from public	CERTH,	>= 50%				>= 40%				>= 50%												
KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	HKU, Pilot	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%												
KPI 4.4	Number of experts/researchers participating and mentoring in the SOCIO-BEE platform	ECSA	4				2				2												
KPI 5	**Citizen Science application KPIs**	**CERTH**																					
KPI 5.1	Pilot deployments in different pilot sites	CERTH, Pilot	6	1	1	1	3	2	2	2	6												
KPI 5.2	# of hypothesis or what-if scenarios addressed	HOPU, Pilot	15	2	2	2	6	3	3	3	9												
KPI 5.3	#blue prints and templates available for reducing air pollution in cities	HOPU, Pilot	>= 6	1	1	1	3	2	2	2	6												
KPI 5.3b	Demonstration of spreading of use case by exchanging CS blueprints in pilots	HOPU, Pilot	>=4	1	1	1	3	1	1	1	3												
KPI 5.4	% of new citizens engaged after outreaching capabilities	ECSA	10%	10%	10%	10%	10%	10%	10%	10%	10%												
KPI 5.4a	Demonstration of scaling use case in pilots from iteration 1 to iteration 2	CERTH, Pilot	>= 40%	baseline	baseline	baseline	baseline	40%	40%	40%	40%												
KPI 6	**Legal, ethical, inclussion KPIs**	**VUB**																					
KPI 6.1	Number of studies in relation to legal and ethical requirements		>= 3	1	1	1	3	1	1	1	3												
KPI 6.1a	# audit of legal compliance of pilots per iteration	VUB	>=3	1	1	1	3	2	2	2	6												
KPI 6.1b	# audit of social values compliance per pilot per iteration	VUB	>=3	1	1	1	3	2	2	2	6												
KPI 6.2	Number of privacy-preserving organisational and technological measures implemented	VUB	>=5	1	1	1	3	1	1	1	3												
KPI 7	**Business development KPIs**	**VUB**																					
KPI 7.1	Business model canvas for 2 types of business and financing models	UNIPD	2				1				1												
KPI 7.2	Deliver a focused business plan at the end of the project to demonstrate the sustainability	HYP	2				1				1												
KPI 7.3	Preparation for post-project exploitations: IPR agreements between project partners,	UNIPD	1								1												

Figure 35. KPI monitoring extract.

The analysis of the data logs generated by the AcadeMe back-end or Google analytics for the project's website, ad hoc SQL queries formulated over the SOCIO-BEE data model and of the questionnaires above mentioned will allow the project to give answer, provide insights about some important aspects regarding the project performance, such as the following ones:

- How many users and in what roles make use of mobile app?
- How many campaigns have been arranged?
- What is the socio demographic composition of hives across pilots?
- AQ datasets per campaign, heat maps, insights gathered.
- Behaviour of citizen scientists actively collecting air quality data via wearables
- Google analytics of project web site to monitor take up of our portal and generated assets

As part of the support mechanism made available for the project, whenever issues with certain KPIs are detected, those problems will be reported and addressed by the consortium team. The support mechanism in SOCIO-BEE has been outlined at section "2.9. Help Desk: problem resolving approach and support mechanism".

For the Governance of the KPI monitoring and evaluation, responsibilities have been distributed among consortium partners, as follows:

Table 52. KPI monitoring responsibilities among consortium partners.

Organization	KPIs responsible for
BETTAIR	● Low-cost modular wearable sensor solution KPIs
CERTH	● Air pollution reduction support initiatives KPIs ● Open and sustainable decision-making KPIs
DEUSTO	● Micro-volunteering engine related KPIs
ECSA	● Communication KPIs
HKU	● Scientific Literacy KPIs
HOPU	● Citizen Science application KPIs
HYP	● AcadeMe related KPIs
Pilot owners	● Usage, acceptance, satisfaction, usefulness, usability, and accessibility
UNIPD	● Business development KPIs
VUB	● Legal, ethical, inclusion KPIs

5 Conclusions and further work

This deliverable has described the pilot plan for the second iteration of the SOCIO-BEE project. It has contributed with the following:

- Chapter 2 has provided the guidelines for the coordination of the pilots. It included details such as the pilots' coordination structure, the overall pilots' planning, the methodology for pilot execution, the engagement and cooperation community building strategy, a summary of the training materials, the technology to be tested or

ethical and legal requirements. It basically contributed with the framework upon which piloting in iteration 2 will take place.

- Chapter 3 has provided the specification of the pilots' experimentations plans. Concretely, for each pilot site, it included their high-level requirements, the stakeholders' map of the pilot, the two campaigns co-designed, the pilot execution plan and their community building plan.
- Chapter 4 has dealt with the evaluation methodology that will be applied before, during and after pilots' iteration 2. It has included, the objectives, evaluation approach, evaluation dimensions and constructs, qualitative and quantitative measures, and the assessment strategy, i.e. how to calculate the impact achieved by pilots' iteration 2. Updates to the evaluation approach from iteration 1 to iteration 2 have been pinpointed.

Hence, this deliverable has contributed with the workplans, and community engagement plans for the different pilots and with the evaluation methodology that will guide the assessment of the project in iteration 2.

Task 5.4 takes over the planning work of Task 5.3 and will prepare the pilots technical and resource deployments. Task 5.5 will execute and monitor SOCIO-BEE pilots whilst T5.6 is in charge of evaluating and interpreting the pilots' results. In conclusion, this deliverable has contributed with the pilot iteration 2's operation methodology, evaluation methodology, evaluation dimensions, KPI framework, measurement instruments and evaluation process that should guarantee an effective run and evaluation of the pilots.

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ANNEX A. Exemplary communication materials

Figure 36. SOCIO-BEE's pilot flyer in Greek.

Figure 37. SOCIO-BEE's pilot flyer in Italian.

Figure 38. SOCIO-BEE's pilot flyer in English.

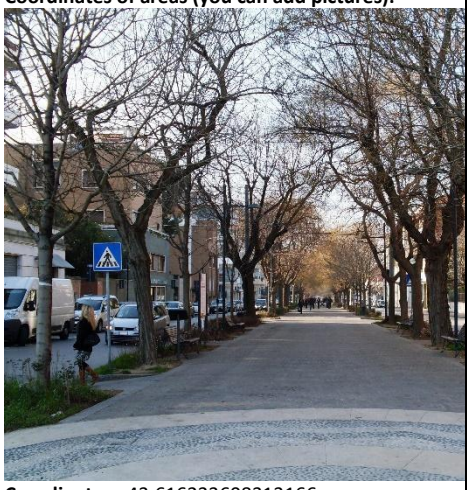
Figure 39. SOCIO-BEE's pilot flyer in Spanish.

ANNEX B. Campaign templates filled in by pilots

Campaign ANCONA 1: Evaluate the level of air pollution in the city centre, focused on the main lane used by pedestrians "Viale della Vittoria". Type I campaign, area investigation.

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	**YES**	NO	NA	**Who they are?** One of our project staff.
	Do you have one or more Bears in your campaign?	**YES**	NO	NA	**Who they are?** UNIVPM, Municipality of Ancona, ARPA Marche, ASUR Marche
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	**Who they are?** Associations Leaders, if needed our staff.
	Do you have (a group of) Bees?	**YES**	NO	NA	**Who they are?** Seniors volunteers of the associations
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	**YES**	NO	NA	**Who they are?** The Press Office and Social Media Managers of Municipality, of UNIVPM, plus, if they have, social media managers of the associations
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	**NA**	**Who they are?:**
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The area we are going to investigate is one of the main meeting points of the city, where people usually meet, go for a walk and even practice jogging. We want to test the exposure to pollutants during the day, to understand the level of pollution in that area and the potential level of risk for an elder.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● Measure AQ in different time of the day (from 7 to 20 at least) ● Evaluate across the different time of the day the air quality			

	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	It's common for citizens to use this lane for social activities, walk and jogging, but it's healthy to have a long permanence in a so central traffic zone? There are suitable times during the day for those practices?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	**YES**	NO	NA	**Hypothesis:** During high traffic times (I.e. early evening during the home coming from office), would be better avoid long permanence.
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	**YES**	NO	NA	**List your specific phases (you can also use a Gantt chart):** 1) **Meeting with associations** (only the representatives, to find the best strategies to be adopted for training seniors in the usage of the socio-bee technology (Jan 24) 2) **Meeting with seniors** (both QB and WB) to explain them the technology, make a first test together and planning with the of the campaign in terms of timing (Feb 24) 3) **Distribution of the sensors** to the WB and QB for making measurements for the campaign (March 24) 4) ideally the campaign should last one month, so each user can have the sensor for one/two week. (March 24 – April 24) 5) After returning the device to the municipality, there will be a final event of **presentation of the results to the HIVE**
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	**YES**	NO	NA	**Type them down and, if possible, how you will measure them (possible metrics or KPIs – see WHY section at the end):** To ensure that the campaign is executed in time and form, there will be recurring meetings with the hive members and an online communication with the hive members with reminders and the campaign achievements (whatsapp was already used for iteration 1)
	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	**Review onboarding material and revise your planning with this information:** As soon as the platform and app are upgraded we want start working with the QB and WB. it would be desirable before a period of time in which UNIVPM and ANCONA could test the new platform.

	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	**YES**	NO	NA	**Type of involvement:** In this phase will be involved Municipality and UNVIPM with the aim to "CONSULT", "GUIDE" and "WORK WITH".
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	**YES**	NO	NA	**Type them down and, if possible, mitigation actions:** Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. Another possible and realistic risk is the "technological barrier" represented by sensors and app that could be too complicated to use for the target audience. To mitigate these risks there will be a constant help and continous communication in case of difficulties, plus campaign will be tailored according to the seniors involved, trying not to disrupt their daily routine, and trying to find seniors that typically travels the desired path in the area individuated for the campaign.
Location - WHERE	What campaign blueprint is chosen?	Campaign Blueprint 2: Pollinate an area over a longer period (type I)			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	**Coordinates of areas (you can add pictures):**  **Coordinates:** 43.616233608313166, 13.519498509580416 to 43.61506822581888, 13.532909433085944
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	**YES**	NO	NA	- **List or needs:** At list 18 sensors should be returned to the Ancona pilot - A user manual of the overall platform will be must both for trainers and users - Define precisely the minimum technological requirements (Android, and Android OS system)

	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	Apparently all the needs are still taken in consideration by the SOCIO-BEE platform.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	**In here customize the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customized. Seniors will be instructed to go to the predefined campaign area during daily hours, possibly concurrently with their daily walk.			
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Sound Free text (insights) Pictures and Videos. Questionnaires from CS activists.	Questionnaires will be produced. Videos and pictures could be not so easy due to the target group we work with.		
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Statistical analysis could be applied, to evaluate the average pollution level hourly, or during different time slots.			
	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Hourly pollution Daily pollution Heatmap of the pollution level over time			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your	**YES**	NO	NA	**Explanation:** The target area is commonly used as aggregation zone, and by citizen *of all ages* even as cardio exercise place for jogging, walking, nordic walking. Understand the level of pollutant there during the day period is a must.

	district/neighbourhood or city?				
	Is clear who will benefit from this campaign?	**YES**	NO	NA	The whole community, not only elders.
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	Reports and datasets			
	Any possible policies for which the results of this campaign could help to?	It's actual the most used zone by pedestrians of the centre of the city, so almost all the policies involving citizen's life quality concern this area, mapping the pollutants along the day time, hourly, can give a more clear picture of the situation.			
	Explain the possible societal / environmental / economic impact expected from this campaign	The societal impact comes due to the many events organized along that lane, having a clear picture of pollutant can help to choose the right time window and date period (I.e. better an event in the weekend than during work days)			

Campaign ANCONA 2: Evaluate the level of air pollution in the city centre to individuate the proper time of day for having physical exercise. Type II campaign, Source investigation.

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who they are?** The Beekeper is Paolo Recanatini from the municipality that will create the Hive in the AcadeMe platform, also with the help of the Associations of seniors diffused in the municipality
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who they are?** The municipality itself but also UNIVPM
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who they are?** - Maria Rita - Seniors #1 - Seniors #2 (?)

	Do you have (a group of) Bees?	YES	NO	NA	**Who they are?** - There is a group of seniors that can participate to the campaign.
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	YES	NO	NA	**Who they are?**
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	NA	**Who they are?:** Students at UNIVPM may be potential people to be recruited
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The purpose of this campaign within the Ancona pilot is to measure the air quality in a specific area of downtown Ancona, which presents a pedestrian street close to the port, typically suitable for taking a walk or jogging. Through the measurement that will be taken within this campaign, the aim is to understand the most suitable times of the day for engaging citizens in physical activities based on the air quality.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● Measure AQ in different time of the day (from 7 to 20 at least) ● Evaluate across the different time of the day the air quality ● Provide a coaching solutions			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	What is the effect of possible pollution source to the air quality in this area?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	YES	NO	NA	**Hypothesis:** if air quality is bad, maybe citizens should not do physical activities in specific time of the day
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	YES	NO	NA	**List your specific phases (you can also use a Gantt chart):** 1) Meeting with associations (only the representatives, to find the best strategies to be adopted for training seniors in the usage of the socio-bee technology (Jan 24) 2) Meeting with seniors (both QB and WB) to explain them the technology, make a first test together and planning with the of the campaign in terms of timing (Feb 24) 3) Distribution of the sensors to the WB and QB for making measurements for the campaign (March 24)

					4) ideally the campaign should last one month, so each user can have the sensor for one/two week. (march 24 – April 24) 5) After returning the device to the municipality, there will be a final event of presentation of the results to the HIVE
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	**Type them down and, if possible, how you will measure them (possible metrics or KPIs – see WHY section at the end): T**o ensure that the campaign is executed in time and form, there will be recurring meetings with the hive members and an online communication with the hive members with reminders and the campaign achievements (whatsapp was already used for iteration 1)
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	**Review onboarding material and revise your planning with this information**: it would preferable to start working with the QB and WB when the platform is fully ready and after a period of time in which UNIVPM and ANCONA could test the new platform.
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	**Type of involvement:** For the Bears, the aim is to involve them from the very beginning of the campaigns (Seniors' associations) by telling them what SOCIO-BEE is and what its purposes are, by trying to convince them to collaborate in the design of the campaigns and by sharing the results of the hypothesis as well as the data obtained with the purpose of serving decision makers as input to formulate policies, guidelines, recommendations, etc. on the environment.
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	NA	**Type them down and, if possible, mitigation actions:** Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. There is also the lack of interest from bears to use campaign results as inputs for new policies. And also the sensors and/or the mobile application are not working properly or are too complicated to use for the target audience. To mitigate these risks campaign will be tailored according to the seniors involved, trying not to disrupt their daily routine, and trying to find seniors that typically travels the desired path in the area individuated for the campaign.
Location - WHERE	What campaign blueprint is chosen?	**Indicate number and title**. Pollinate an area around a source of pollution over a long period of time.			

	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	**Coordinates of areas (you can add pictures):** 
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	NA	**List or needs:** - At list 18 sensors should be returned to the Ancona pilot - A user manual of the overall platform will be definitely necessary both for trainers and users - Define precisely the minimum technological requirements (Android, and Android OS system)
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?				
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	**In here customize the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customized. Seniors will be instructed to go to the predefined campaign area during daily hours, possibly concurrently with their daily walk.			
	What data variables should be gathered in the crowdsourcing produced by the hive?	**Air Quality** Sound Free text (insights) **Pictures and Videos.** Questionnaires from CS activists.			NB: WE ARE WORKING WITH SENIORS, THEREFORE PICTURES AND VIDEOS MAY BE NOT THE BEST OPTION
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Statistical analysis could be applied, to evaluate the average pollution level hourly, or during different time slots.			

	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Hourly pollution Daily pollution Heatmap of the pollution level over time			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	YES	NO	NA	**Explanation: to understand the best timeframe for doing physical activities in the predesigned area**
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who? Citizens and municipality**
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	By implementing and enforcing policies targeted at improving air quality, cities can create an environment that supports and encourages outdoor activities like jogging and walking, promoting both physical health and overall well-being.			
	Any possible policies for which the results of this campaign could help to?	Policies aimed at raising awareness about air quality issues can lead to better-informed citizens who might choose quieter, less polluted routes for their jogging or walking routines.			
	Explain the possible societal / environmental / economic impact expected from this campaign	Policies advocating for more parks, greenways, or pedestrian-friendly areas can provide safe and clean spaces for exercise. These areas often have better air quality due to more trees and vegetation that help filter pollutants.			

Campaign ANCONA 3: Combination of #1 and #2 to evaluate the differences and comparisons with the reference station

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	**NO**	NA	**Who they are?** This is an evalutation campaign, strictly correlated to the others

	Do you have one or more Bears in your campaign?	**YES**	NO	NA	**Who they are?** UNIVPM, Municipality of Ancona, ARPA Marche, ASUR Marche
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	**Who they are?** Associations Leaders, if needed even our staff.
	Do you have (a group of) Bees?	**YES**	NO	NA	**Who they are?** Volunteers of the associations
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	**YES**	NO	NA	**Who they are?** The Press Office and Social Media Managers of Municipality, of UNIVPM, plus, if they have, social media managers of the associations
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	**NO**	NA	**Who they are?** Not at the moment
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	This is an important phase of the whole pilot. We want compare the data collected in iterations 1 and 2 and with data from local monitoring stations, evaluate them and start to have a clear and realistic picture of the city.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● Compare data gained in #1 and #2 ● Evaluate them ● Compare with local stations data ● Find correspondences			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Are the actual local stations enough to monitor the pollutant levels? It's the picture of the city still realistic? There are time windows during day useful for outside activities?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	**YES**	NO	NA	**Hypothesis:** The city needs at least one more station positioned in the centre of the city, to gain more realistic data
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	**YES**	NO	NA	**List your specific phases (you can also use a Gantt chart):** **1) First week of may:** Internal meeting between UNIVPM and Municipality for check the data collection **2) Between second and third**

					week of may: Comparison and evaluation of data gathered **3) End of may start july:** Meeting with association to discuss results
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	**YES**	NO	NA	**Type them down and, if possible, how you will measure them (possible metrics or KPIs – see WHY section at the end):** The activities are listed above, what we need to ensure is to keep the timing
	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	**Review onboarding material and revise your planning with this information:** In this phase we will do when data will be well ordered and compared, to discuss the results we will find
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	**YES**	NO	NA	**Type of involvement:** This will be a WORK WITH and GUIDE
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	**NA**	**Type them down and, if possible, mitigation actions:**
Location - WHERE	What campaign blueprint is chosen?	**Indicate number and title**. This is an elaboration phase, not concerning the on-field campaigns.			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	**NA**	**Coordinates of areas (you can add pictures):**

					
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	**NA**	**List or needs:** We should still have potentially all the infrastructures needed
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?				
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	**In here customize the Blueprint to your campaign**. Not a pollination campaign, it's about gather and correlate results.			
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Sound Free text (insights) Pictures and Videos. Questionnaires from CS activists.			Indicate here the concrete list of measurements that will be taken.
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.				

	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Hourly pollution Daily pollution Heatmap of the pollution level over time			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	**YES**	NO	NA	**Explanation:** We want to verify if the actual monitoring is enough and exhaustive
	Is clear who will benefit from this campaign?	**YES**	NO	NA	**Why? and Who?** The whole community
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	Dataset and reports			
	Any possible policies for which the results of this campaign could help to?				
	Explain the possible societal / environmental / economic impact expected from this campaign	The impact could be very important, in case we find out that is needed a more capillar net of monitoring stations from the local authorities.			

Campaign ANCONA 4: Evaluate green areas in the city of Ancona (also using the drone); type I, area investigation

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who they are?** The Beekeper is Paolo Recanatini from the municipality that will create the Hive in the AcadeMe platform, also with the help of UNIVPM

	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who they are?** The municipality itself but also UNIVPM
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who they are?** - Nicole Morresi
	Do you have (a group of) Bees?	YES	NO	NA	**Who they are?** - Possibly group of students @UNIVPM.
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	YES	NO	NA	**Who they are?**
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	NA	**Who they are?:**
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The purpose of this campaign within the Ancona pilot is to measure the air quality in specific area of the city where there are parks and green areas. The aim is to compare the data of green areas with the one collected from campaign #1, #2 and #3 to evaluate the impact of green area in the air quality of the city-			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● Measure AQ in different time of the day (from 7 to 20) ● Evaluate the AQ with reference to the city center ● Use the drone in places that citizens cannot reach in green areas ● Compare the measurement with the reference stations			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	What is the effect of possible pollution source to the air quality in this area?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	YES	NO	NA	**Hypothesis:** if there is a green area, air quality should improve in that area
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen	YES	NO	NA	**List your specific phases (you can also use a Gantt chart):** 1) Training with ID2MOVE for the platform 2) Execution of the campaign 3) evaluation of results

	science experiment, evaluation, etc.?				
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	**Type them down and, if possible, how you will measure them (possible metrics or KPIs – see WHY section at the end):** - Do the same # of points tested on the ground and in the air
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	**Since the pilot is foreseen to be executed with seniors, it would be difficult to make seniors use a drone. Therefore, this campaign will be executed by one drone expert, and together with WB that can reach parks in the city.**
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	**Type of involvement:** at the end of the campaign for communicating results
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	NA	**Type them down and, if possible, mitigation actions:**
Location - WHERE	What campaign blueprint is chosen?	**Indicate number and title**. Pollinate an area over a small period of time.			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	**Coordinates of areas (you can add pictures):**

					 43.613266, 13.509560
	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	NA	**List or needs:** The drone was already purchased by UNIVPM; 4/5 WSN will be needed
Materials & equipment - WHICH	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	To implement the campaign, instructions will be needed to incorporate the WSN onto the drone, along with the integration between the drone and the sociobee system.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	**In here customize the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customized. A campaign will be planned in Apr/May 2024, and will be conducted for a short period (1 week up to 10 days).			
	What data variables should be gathered in the crowdsourcing produced by the hive?	**Air Quality** Sound Free text (insights) **Pictures and Videos.** Questionnaires from CS activists.			GPS coordinates, altitude coordinates of the drone, pictures from the drone
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Statistical analysis could be applied, to evaluate the average pollution level hourly, or during different time slots.			

	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Heatmap of the pollution level over time			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	YES	NO	NA	**Explanation: to explore the added value of using drones in air quality measure in the city**
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** Citizens and municipality
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	**explore the added value of using drones in air quality measure in the city**			
	Any possible policies for which the results of this campaign could help to?	Understand the impact of pollution in the city and also of the green areas			
	Explain the possible societal / environmental / economic impact expected from this campaign				

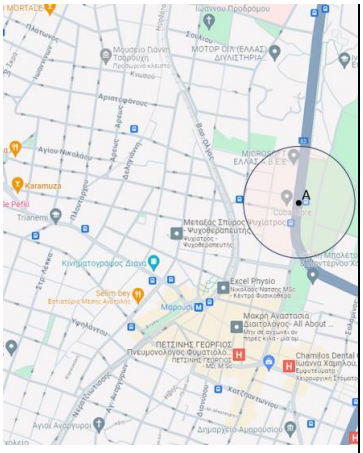
Campaign MRSI 1:

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	**YES**	NO	NA	Anargyros Roussos, Maria Kotzagianni and Eleutheria Stamati

	Do you have one or more Bears in your campaign?	**YES**	NO	NA	The Urban Planning Division of Municipality of Amaroussion
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	Ms Theodorakopoulou (President of Friends of Forest Syggrou)
	Do you have (a group of) Bees?	**YES**	NO	NA	Members of the volunteering group Friends of Forest Syggrou
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	**YES**	NO	NA	The responsible person of the social media accounts of Friends of Forest Syggrou and the Communication Department of Municipality of Amaroussion
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	**NO**	NA	**Who they are?:**
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The aim of the pilot in the context of this campaign is to leverage citizen science as a tool for actively engaging the community in assessing air quality within and around Forest Syggrou. The pilot seeks to not only collect and evaluate air quality data but also to cultivate a strong participatory approach, encouraging citizens, NGOs, and SMEs to join in pro-environmental activities.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	The objectives of this campaign will be the following: 1. Recruit and raise awareness of citizens to participate in a citizen science project related to air pollution. 2. Validate already available and novel components and services of the SOCIO-BEE toolkit putting emphasis on the processing and analysis of the results in order to close the citizen science loop. 3. Test the impact of green areas close to heavy traffic roads on air quality and collect preliminary air pollution measurements to be potentially used for policy making.			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	How does the presence of a green park and in particular of Forest Syggrou influence the air quality in areas adjacent to high-traffic streets particularly during peak rush hours and in locations within the forest?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	**YES**	NO	NA	**Hypothesis:** If monitoring air quality within a green park situated adjacent to a high-traffic highway, WSNs will indicate better air quality levels within the forested interior compared to the border areas, particularly during rush hours, suggesting that the green park

					serves as a mitigating factor against the air quality deterioration caused by the high traffic.
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	**YES**	NO	NA	1. MRSI plans to carry out in person meetings with volunteers of this hive to firstly educate and train them on the new features of the SOCIO-BEE solution. 2. The Queen Bee under the supervision of the Beekeepers will co-design the campaign and specify its details together with the Worker Bees. 3. The volunteers will then be responsible to collect the air quality data and at a later stage to proceed with the interpretation of the results in order to answer their research question. 4. Communicate all these activities in order to: 1) keep volunteers engaged, interested and updated, 2) acknowledge their efforts and contribution to society and to their local community and 3) attract the attention of the general public in order to enrol more participants.
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	●

	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	**QB:** Prior to the pilot initiation **WBs**: Prior and during the pilot execution phase
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	**YES**	NO	NA	**Type of involvement:** We will involve the Bears prior and during the pilot execution by the following engagement activities: INFORM and CONSULT
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	**YES**	NO	NA	Also in this campaign, some risks are anticipated. First, not having enough participants can be a major barrier to successful campaign execution. However, this can be mitigated by performing additional posts on social media channels and/or participating to event(s) or workshop(s). Secondly, being unable to process the results and extract valuable conclusions can be a very big challenge for the volunteers, while the accuracy of the acquired air quality data may raise some doubts for the whole approach. These issues are expected to be addressed prior to the initiation of the 2nd pilot iteration.
Location - WHERE	What campaign blueprint is chosen?	"Pollinate a specific area in a short period of time (Type I)".			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	**YES**	NO	NA	The area covered will be around Location A, with the following coordinates: (38.059220197880244, 23.80883386623799).

					
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	**YES**	NO	NA	**List or needs:** ● REducational, information and training material to contact hive's representatives and old and new members of the hive ● Several devices (depending on the number of worker bees), the SOCIO-BEE app and the AcadeMe platform working properly ● Communication material such as brochures, leaflets or online material to communicate the progress of the activities via various digital channels ● Instructions or guidebook on how to process the acquired data.
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	MRSI considers that it would be good that Beekeepers and QBs can see the activities performed by each WB separately in order to be able to contact them and activate them in case of inaction. MRSI also thinks that it would be very important for the Worker Bees to know their exposure to air pollution at the time of the measurement as this is expected to trigger further their interest and motivation.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	In order to pollinate cells in a campaign's surface, MRSI suggests doing it at different distances from a main highway (pollution distribution) over a short period of time (Type II). Thus, a circular area of diameter extending around **Location A**: Kifissias Avenue (38.059220197880244, 23.80883386623799) is foreseen. This area is selected in such a manner so it covers both parts of the Kifissias avenue and parts of Forest Syggrou (green area). This will help the volunteers compare the air quality results from the two areas and evaluate the impact of the green area at higher spatial resolution. Additionally, sound samples, free texts (insights),			

		pictures, videos, and questionnaires from CS activists will be gathered to shed light on other aspects of the air pollution issue and on the execution of a pilot campaign. The collected data are expected to contribute to the visualisation of the results through heatmaps and depending on the volume of collected data also have a temporal profile of the air quality for these areas (KPI 3).			
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Free text (insights) Pictures and Videos. Questionnaires from CS activists.			Air Quality measurements Possibly photos from Hive's meetings and measurements Comments and insights from WBs Questionnaires
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	This is still unclear.			
	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	A complete data set of air quality data to be presented in a report with heatmaps on different periods.			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	**YES**	NO	NA	**Explanation**: . This campaign is integral for the district as it aims to tackle a critical issue: understanding how green spaces, specifically Forest Syggrou, impact air quality in areas adjacent to high-traffic streets. This endeavor is crucial as it will provide valuable insights into the effectiveness of green spaces in mitigating air quality deterioration caused by heavy traffic.
	Is clear who will benefit from this campaign?	**YES**	NO	NA	This campaign's outcomes have the potential to benefit various stakeholders by providing crucial insights into the relationship between green spaces and air quality, ultimately contributing to informed decision-making and potentially enhancing the city's environmental conditions.

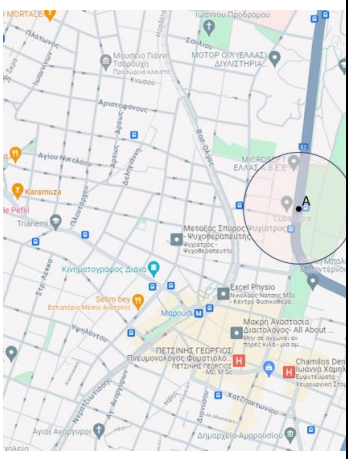
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	The campaign outcomes include valuable datasets, reports, and engagement models that can aid other communities, researchers, policymakers, and environmental advocates in understanding the impact of green spaces on air quality and replicating it in other areas within MRSI.
	Any possible policies for which the results of this campaign could help to?	The results from this campaign could influence policies related to urban planning, green space allocation, and transportation management. They might advocate for policies promoting the creation of green areas and pocket parks near high-traffic zones.
	Explain the possible societal / environmental / economic impact expected from this campaign	• Societal: Engaging citizens in scientific endeavours fosters a sense of community involvement and awareness. It educates people about the relationship between green spaces, air quality, and health, encouraging proactive participation in environmental initiatives. • Environmental Impact: Understanding how green spaces affect air quality near high-traffic zones can highlight the importance of urban greenery in mitigating pollution. This knowledge might prompt efforts to expand green areas, enhance biodiversity, and improve overall urban environmental quality.

Campaign MRSI 2:

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	**YES**	NO	NA	Anargyros Roussos, Maria Kotzagianni and Eleutheria Stamati
	Do you have one or more Bears in your campaign?	**YES**	NO	NA	The Urban Planning Division of Municipality of Amaroussion
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	Ms Theodorakopoulou (President of Friends of Forest Syggrou)
	Do you have (a group of) Bees?	**YES**	NO	NA	Members of the volunteering group Friends of Forest Syggrou

	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	**YES**	NO	NA	The responsible person of the social media accounts of Friends of Forest Syggrou and the Communication Department of Municipality of Amaroussion
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	**NO**	NA	**Who they are?:**
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The aim of the pilot in the context of this campaign is to leverage citizen science as a tool for actively engaging the community in assessing air quality within and around Forest Syggrou. The pilot seeks to not only collect and evaluate air quality data but also to cultivate a strong participatory approach, encouraging citizens, NGOs, and SMEs to join in pro-environmental activities.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	The objectives of this campaign will be the following: 1. Recruit and raise awareness of citizens to participate in a citizen science project related to air pollution. 2. Validate already available and novel components and services of the SOCIO-BEE toolkit putting emphasis on the processing and analysis of the results in order to close the citizen science loop. 3. Test the impact of green areas close to heavy traffic roads on air quality and collect preliminary air pollution measurements to be potentially used for policy making.			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	How does the presence of a green park and in particular of Forest Syggrou influence the air quality in areas adjacent to high-traffic streets particularly during peak rush hours and in locations within the forest?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	**YES**	NO	NA	**Hypothesis:** If monitoring air quality within a green park situated adjacent to a high-traffic highway, WSNs will indicate better air quality levels within the forested interior compared to the border areas, particularly during rush hours, suggesting that the green park serves as a mitigating factor against the air quality deterioration caused by the high traffic.
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	**YES**	NO	NA	1. MRSI plans to carry out in person meetings with volunteers of this hive to firstly educate and train them on the new features of the SOCIO-BEE solution. 2. The Queen Bee under the supervision of the Beekeepers will co-design the campaign and specify

					its details together with the Worker Bees. 3. The volunteers will then be responsible to collect the air quality data and at a later stage to proceed with the interpretation of the results in order to answer their research question. 4. Communicate all these activities in order to: 1) keep volunteers engaged, interested and updated, 2) acknowledge their efforts and contribution to society and to their local community and 3) attract the attention of the general public in order to enrol more participants.
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	●
	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	**QB:** Prior to the pilot initiation **WBs**: Prior and during the pilot execution phase
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	**YES**	NO	NA	**Type of involvement:** We will involve the Bears prior and during the pilot execution by the following engagement activities: INFORM and CONSULT

	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	**YES**	NO	NA	Also in this campaign, some risks are anticipated. First, not having enough participants can be a major barrier to successful campaign execution. However, this can be mitigated by performing additional posts on social media channels and/or participating to event(s) or workshop(s). Secondly, being unable to process the results and extract valuable conclusions can be a very big challenge for the volunteers, while the accuracy of the acquired air quality data may raise some doubts for the whole approach. These issues are expected to be addressed prior to the initiation of the 2nd pilot iteration.
Location - WHERE	What campaign blueprint is chosen?	"Pollinate a specific area in a short period of time (Type I)".			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	**YES**	NO	NA	The area covered will be around Location A, with the following coordinates: (38.059220197880244, 23.80883386623799). 
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	**YES**	NO	NA	**List or needs:** ● REducational, information and training material to contact hive's representatives and old and new members of the hive ● Several devices (depending on the number of worker bees), the SOCIO-BEE app and the

					AcadeMe platform working properly • Communication material such as brochures, leaflets or online material to communicate the progress of the activities via various digital channels • Instructions or guidebook on how to process the acquired data.
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	MRSI considers that it would be good that Beekeepers and QBs can see the activities performed by each WB separately in order to be able to contact them and activate them in case of inaction. MRSI also thinks that it would be very important for the Worker Bees to know their exposure to air pollution at the time of the measurement as this is expected to trigger further their interest and motivation.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	In order to pollinate cells in a campaign's surface, MRSI suggests doing it at different distances from a main highway (pollution distribution) over a short period of time (Type II). Thus, a circular area of diameter extending around **Location A**: Kifissias Avenue (38.059220197880244, 23.80883386623799) is foreseen. This area is selected in such a manner so it covers both parts of the Kifissias avenue and parts of Forest Syggrou (green area). This will help the volunteers compare the air quality results from the two areas and evaluate the impact of the green area at higher spatial resolution. Additionally, sound samples, free texts (insights), pictures, videos, and questionnaires from CS activists will be gathered to shed light on other aspects of the air pollution issue and on the execution of a pilot campaign. The collected data are expected to contribute to the visualisation of the results through heatmaps and depending on the volume of collected data also have a temporal profile of the air quality for these areas (KPI 3).		
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Free text (insights) Pictures and Videos. Questionnaires from CS activists.	Air Quality measurements Possibly photos from Hive's meetings and measurements Comments and insights from WBs Questionnaires		
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	This is still unclear.			

	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	A complete data set of air quality data to be presented in a report with heatmaps on different periods.			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	**YES**	NO	NA	**Explanation**: . This campaign is integral for the district as it aims to tackle a critical issue: understanding how green spaces, specifically Forest Syggrou, impact air quality in areas adjacent to high-traffic streets. This endeavor is crucial as it will provide valuable insights into the effectiveness of green spaces in mitigating air quality deterioration caused by heavy traffic.
	Is clear who will benefit from this campaign?	**YES**	NO	NA	This campaign's outcomes have the potential to benefit various stakeholders by providing crucial insights into the relationship between green spaces and air quality, ultimately contributing to informed decision-making and potentially enhancing the city's environmental conditions.
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	The campaign outcomes include valuable datasets, reports, and engagement models that can aid other communities, researchers, policymakers, and environmental advocates in understanding the impact of green spaces on air quality and replicating it in other areas within MRSI.			
	Any possible policies for which the results of this campaign could help to?	The results from this campaign could influence policies related to urban planning, green space allocation, and transportation management. They might advocate for policies promoting the creation of green areas and pocket parks near high-traffic zones.			
	Explain the possible societal / environmental / economic impact expected from this campaign	• Societal: Engaging citizens in scientific endeavours fosters a sense of community involvement and awareness. It educates people about the relationship between green spaces, air quality, and health, encouraging proactive participation in environmental initiatives. • Environmental Impact: Understanding how green spaces affect air quality near high-traffic zones can highlight the importance of urban greenery in mitigating pollution. This knowledge might prompt efforts to expand green areas, enhance biodiversity, and improve overall urban environmental quality.			

Campaign ZARAGOZA 1: Zaragoza Staff

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who they are?** - ZKF:Pilar Martín y Guillermo Malón - ZGZ:Ana Jimenez y Carlos Lopez IBER: Daniel Lisbona
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who they are?** - ZKF - ZGZ - IBER - LIA CESAR LABS
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who they are?** ZGZ: Marina Abadía, Elena Giner ZKF: Daniel Sarasa IBER: Fran Sanz
	Do you have (a group of) Bees?	YES	NO	NA	**Who they are?** - Staff ZKF - Staff ZGZ - Staff IBERCIVIS - Staff LIA LABS
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	YES	NO	NA	**Who they are?** Representatives/Staff from Ibercaja, Unizar, Hiberus, Init, Water and Environment documentation center.
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	NA	**Who they are?:** In this second iteration we do not plan to add any group other than the ones we have indicated. However, if during the execution of the campaigns we detect any new group interested in participating, we will try to incorporate them whenever possible and if not, we will incorporate them in the second iteration.
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	Due to its strategic location, Zaragoza -in the middle of a wide area that includes Madrid, Barcelona, the north of the country and the Mediterranean area- is an important logistic and communications hub in the northeast of the Iberian Peninsula, which is why it supports an important amount of road traffic. Another geographical characteristic to take into account is its location in the Ebro Valley, where it is subject to continuous air currents and which gives it, under normal conditions, good air quality. The impact of these two issues, in principle antagonistic, is an excellent starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, along with the involvement of the institutions that will develop it, its facilities and its extensive experience in similar citizen science projects. Involve citizens and young people in air quality issues and cause behavioural changes.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	To test that the technology works correctly in order to be able to offer good technical support to the rest of the hives.			

	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Can data collection by people/citizens change their habits to improve air quality?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	YES	NO	NA	**Hypothesis:** Can the scientific experimentation with the project's technology help to raise awareness of air quality on citizens?
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	YES	NO	NA	1) Prepilot (testing app, web, sensors..) 2) Pilot (long campaigns with static sensors and short but intense campaigns with staff.) 3) Conclusion Pilot (sharing of the results of the staff)
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	- Training and technical support to the different hives of the project. - Regular meetings with hive members - Online communication with hive members with reminders and campaign achievements - Collecting, analysing and issuing conclusions of the campaigns. - Continued evaluations of the technology, app and platform of the project. - Overall reporting of all campaigns conducted in the Pilot
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	As far as WBs are concerned, we will incorporate them as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, we will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypotheses to work on.
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	We aim to involve them from the very beginning of the campaigns. 1.- By telling them what socio-bee is and what its purposes are. 2.- Trying to convince them to collaborate in the design of the campaigns and the hypotheses (this would facilitate their later commitment once we have the results of the campaign). 3.- Sharing the results of the hypothesis as well as the data obtained with the purpose of serving decision makers as input to formulate policies, guidelines, recommendations, etc. on the environment

	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	NA	• Sensors and/or the mobile application not working properly or problems being too complicated to solve internally at ZGZ. • To carry out this campaign we require the voluntary participation of our colleagues, so a possible risk may be the lack of time due to the workload of each one.
Location - WHERE	What campaign blueprint is chosen?	Pollinate an area around a source of pollution over a longer period (type II)			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	Area around Etopia.
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	NA	List or needs: • Devices • Online platform • Mobile App • Didactic documentation about air quality • Didactic documentation about Citizen science • User manuals for the mobile application and the web application. • Workshops with technology partners to learn how to use the tools to be used during the pilot.
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	It is necessary to implement all the issues noted in redmine after the experience of the first interaction. Special emphasis should be placed on data visualization to close the loop.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	**In here customize the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customized.			
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Sound Free text (insights) Pictures and Videos. Questionnaires from CS activists.			Indicate here the concrete list of measurements that will be taken.

	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Set an area grid for taking measurements and repeat the process in time and space until having scientific relevant data, according to the platform and devices standards.			
	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Complete visualisations of the state of air quality in the studied areas.			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	YES	NO	NA	To test the usefulness of scientific experimentation with the project's technology in helping to change the behaviour of its participants with respect to air quality, in our case children and young people.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** Bears, Queen Bees, Beekeepers, bees and citizens.
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	The data collection, the conclusions drawn by the hive, will be used to help change their habits. All the hypotheses obtained will be shared to make the conclusions known.			
	Any possible policies for which the results of this campaign could help to?	Low emission zones Influence on the quality of the urban tree stock, for a better greening of the city. Encourage the use of public transport, low-emission vehicles or the use of bicycles.			
	Explain the possible societal / environmental / economic impact expected from this campaign	Involve citizens in air quality issues and cause behavioural changes. promoting sustainable mobility			

Campaign ZARAGOZA 2: School

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who they are?** - ZKF:Pilar Martín y Guillermo Malón - ZGZ:Ana Jimenez y Carlos Lopez IBER: Daniel Lisbona
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who they are?** - ZKF - ZGZ - IBER - LIA CESAR LABS
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who they are?** - Schools: Director or teacher
	Do you have (a group of) Bees?	YES	NO	NA	**Who they are?** - Students and teachers
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	YES	NO	NA	**Who they are?** Parents' and students' associations School Associations / Foundations
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	NA	**Who they are?:** In this second iteration we do not plan to add any group other than the ones we have indicated. However, if during the execution of the campaigns we detect any new group interested in participating, we will try to incorporate them whenever possible.
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	Due to its strategic location, Zaragoza -in the middle of a wide area that includes Madrid, Barcelona, the north of the country and the Mediterranean area- is an important logistic and communications hub in the northeast of the Iberian Peninsula, which is why it supports an important amount of road traffic. Another geographical characteristic to take into account is its location in the Ebro Valley, where it is subject to continuous air currents and which gives it, under normal conditions, good air quality. The impact of these two issues, in principle antagonistic, is an excellent starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, along with the involvement of the institutions that will develop it, its facilities and its extensive experience in similar citizen science projects. Involve citizens and young people in air quality issues and cause behavioural changes.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● Active participation of young people in the analysis of Zaragoza's air quality. ● Analize, draw and display conclusions about air quality in Zaragoza. ● Facilitate an analysis of air quality after a process of co-creation and community work done by the participants. ● Test the improvements done in the technology of the project (software and hardware), based on the experience of the pilots in their campaigns in their first iteration			

	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Can data collection by young people at school or in their free time change their habits to improve air quality?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	YES	NO	NA	**Hypothesis:** Can the scientific experimentation carried out in schools with the project's technology help to raise awareness of air quality on yountgsters and teenageers?
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	YES	NO	NA	1) Prepilot (testing app, web, sensors..) 2) Pilot (long campaigns with static sensors and short but intense campaigns with young people.) 3) Conclusion Pilot (sharing of the results of the young people at a big social event)
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	- Regular meetings with hive members - Online communication with hive members with reminders and campaign achievements - Collecting, analysing and issuing conclusions of the campaigns - Overall reporting of all campaigns conducted in the Pilot
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	As far as WBs are concerned, we will incorporate them as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, we will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypotheses to work on.
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	We aim to involve them from the very beginning of the campaigns. 1.- By telling them what socio-bee is and what its purposes are. 2.- Trying to convince them to collaborate in the design of the campaigns and the hypotheses (this would facilitate their later commitment once we have the results of the campaign). 3.- Sharing the results of the hypothesis as well as the data obtained with the purpose of serving decision makers as input to formulate policies, guidelines, recommendations, etc. on the environment
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	NA	• Failure to involve a minimum number of schools to reach a reasonable number of participants. • Low level of interest from participants to continue being

					part of the hives once the pilot phase is over. ● The sensors and/or the mobile application are either not working properly or are too complicated to use for the target audience. ● Data obtained from measurements are not accessible or not easily understood by the participants. ● Resistance on the part of participants to fill out too many questionnaires.
Location - WHERE	What campaign blueprint is chosen?	Pollinate an area around a source of pollution over a longer period (type II)			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	Depends on the availability of the chosen schools.
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	NA	List or needs: ● Devices ● Online platform ● Mobile App ● Didactic documentation about air quality ● Didactic documentation about Citizen science ● User manuals for the mobile application and the web application. ● Workshops with technology partners to learn how to use the tools to be used during the pilot.
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	It is necessary to implement all the issues noted in redmine after the experience of the first interaction. Special emphasis should be placed on data visualisation to close the loop.			
Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	The more specific Blueprint will be determined by the participating schools once they define the hypothesis to be achieved.			

	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Sound Free text (insights) Pictures and Videos. Questionnaires from CS activists.			Indicate here the concrete list of measurements that will be taken.
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Set an area grid for taking measurements and repeat the process in time and space until having scientific relevant data, according to the platform and devices standards.			
	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Complete visualisations of the state of air quality in the studied areas.			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	YES	NO	NA	To test the usefulness of scientific experimentation with the project's technology in helping to change the behaviour of its participants with respect to air quality, in our case children and young people.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** Bears, Queen Bees, Beekeepers, bees and citizens.
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	The data collection, the conclusions drawn by the hive, will be used to help change their habits. All the hypotheses obtained will be shared to make the conclusions known.			
	Any possible policies for which the results of this campaign could help to?	Low emission zones,especially areas near schools. Influence on the quality of the urban tree stock, for a better greening of the city. Encourage the use of public transport, low-emission vehicles or the use of bicycles.			
	Explain the possible societal / environmental / economic impact expected from this campaign	Involve in particular young people and citizens in air quality issues, bring about behavioural changes and promoting sustainable mobility			

Campaign ZARAGOZA 3: Zaragoza Air Quality Community hive

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who they are?** - ZKF:Pilar Martín y Guillermo Malón - ZGZ:Ana Jimenez y Carlos Lopez IBER: Daniel Lisbona
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who they are?** - ZKF - ZGZ - IBER - LIA CESAR LABS
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who they are?** ZGZ: Marina Abadía, Elena Giner ZKF: Daniel Sarasa IBER: Fran Sanz Schools: Director
	Do you have (a group of) Bees?	YES	NO	NA	**Who they are?** - Citizens - People with interests in air quality
	Do you have Social Collectives, journalists, influencers, or other society representatives suitable for the role of Drone Bees, helping you disseminate the outcomes of the campaign?	YES	NO	NA	**Who they are?** Representatives/Staff from Ibercaja, Unizar, Hiberus, Init, Water and Environment documentation center and teachers/students from some of the schools will be participating in the second iteration.
	Do you plan to involve any other social groups, public and private agents and/or individuals involved in the campaign with a different role?	YES	NO	NA	**Who they are?:** In this second iteration we do not plan to add any group other than the ones we have indicated. However, if during the execution of the campaigns we detect any new group interested in participating, we will try to incorporate them whenever possible and if not, we will incorporate them in the second iteration.
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	Due to its strategic location, Zaragoza -in the middle of a wide area that includes Madrid, Barcelona, the north of the country and the Mediterranean area- is an important logistic and communications hub in the northeast of the Iberian Peninsula, which is why it supports an important amount of road traffic. Another geographical characteristic to take into account is its location in the Ebro Valley, where it is subject to continuous air currents and which gives it, under normal conditions, good air quality. The impact of these two issues, in principle antagonistic, is an excellent starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, along with the involvement of the institutions that will develop it, its facilities and its extensive experience in similar citizen science projects. Involve citizens and young people in air quality issues and cause behavioural changes.			

	List the specific objectives (separated by bullet points) that will be followed in this campaign.	● The implementation of engagement strategies for the assembly of an organic community, as well as the use of the project's technology to obtain air quality data, its work and subsequent visualisation. This hive will serve to attract talent and expertise to the project to explore possible new uses and integrations of SOCIO-BEE'S technology in other areas of interest to citizens.			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Can data collection by people with interests in air quality in their free time change their habits to improve air quality?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	YES	NO	NA	**Hypothesis:** Can the scientific experimentation carried out in schools, Etopia and sensor static with the project's technology help to raise awareness of air quality on citizens?
Workplan - WHEN	Do you have a planning with clear phases, tasks, and milestones to be achieved during the campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, etc.?	YES	NO	NA	1) Prepilot (testing app, web, sensors..) 2) Pilot (long campaigns with static sensors and short but intense campaigns with young people.) 3) Conclusion Pilot (sharing of the results of the hive at a big social event)
	Is there a list of activities that you will carry out to ensure that the campaign is executed in time and form (Validation and indicators of success)?	YES	NO	NA	- Regular meetings with hive members - Online communication with hive members with reminders and campaign achievements - Collecting, analysing and issuing conclusions of the campaigns - Overall reporting of all campaigns conducted in the Pilot
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	As far as WBs are concerned, we will incorporate them as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, we will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypotheses to work on.
	Do you know when to involve Bears and for what purpose? Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	We aim to involve them from the very beginning of the campaigns. 1.- By telling them what socio-bee is and what its purposes are. 2.- Trying to convince them to collaborate in the design of the campaigns and the hypotheses (this would facilitate their later commitment once we have the results of the campaign). 3.- Sharing the results of the hypothesis as well as the data obtained with the purpose of serving decision makers as input to formulate

					policies, guidelines, recommendations, etc. on the environment
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	YES	NO	NA	• Not achieving a minimum number of people to create a hive. • Not getting the bees to want to continue to participate after the end of the campaign. Thirdly, the lack of interest of the bees to use the results of the campaign as input for new policies. • The sensors and/or the mobile app do not work properly or are too complicated to use for the target audience.
Location - WHERE	What campaign blueprint is chosen?	Pollinate an area around a source of pollution over a longer period (type II)			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	YES	NO	NA	Area near Etopia
Materials & equipment - WHICH	Can you list your needs regarding infrastructure (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)	YES	NO	NA	List or needs: • Devices • Online platform • Mobile App • Didactic documentation about air quality • Didactic documentation about Citizen science • User manuals for the mobile application and the web application. • Workshops with technology partners to learn how to use the tools to be used during the pilot.
	Which functionalities should SOCIO-BEE tools provide to Beekeepers, Queen Bees, and Worker Bees taking part in the campaign? Is there something that you need for your campaign that was not considered in SOCIO-BEE platform?	It is necessary to implement all the issues noted in redmine after the experience of the first interaction. Special emphasis should be placed on data visualization to close the loop.			

Methodology - HOW	What strategy will you use to pollinate cells in a campaign's surface (e.g. pollinate an area over a time period)? Choose and feed with parameters the best fitting blueprint.	Area surrounding Etopia will be pollinated with static sensors, which will assist in the calibration of the portable devices. And short campaigns will be conducted around Etopia.			
	What data variables should be gathered in the crowdsourcing produced by the hive?	Air Quality Sound Free text (insights) Pictures and Videos. Questionnaires from CS activists.			Indicate here the concrete list of measurements that will be taken.
	What analytical methods will you apply to process measurements? You will be receiving support from WP4 and WP5 partners on this. Check with them if you have questions.	Set an area grid for taking measurements and repeat the process in time and space until having scientific relevant data, according to the platform and devices standards.			
	What visualization and KPIs do you want to obtain to support the decision-making process around AQ in your pilot with this campaign? In other words, what visualizations and/or decision-making supporting metrics should be generated as result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	Complete visualisations of the state of air quality in the studied areas.			
Reasoning - WHY (outcomes, replication, and policymaking)	Does the Hive have a clear purpose for the campaign that can serve to its community? Why is this campaign necessary for your district/neighbourhood or city?	YES	NO	NA	To test the usefulness of scientific experimentation with the project's technology in helping to change the behaviour of its participants with respect to air quality.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** Bears, Queen Bees, Beekeepers, bees and citizens.
	What will be the outcomes of this campaign that can be used for others? What is in it for your community, e.g. datasets, reports, videos?	The data collection, the conclusions drawn by the hive, will be used to help change their habits. All the hypotheses obtained will be shared to make the conclusions known.			

	Any possible policies for which the results of this campaign could help to?	Low emission zones Influence on the quality of the urban tree stock, for a better greening of the city. Encourage the use of public transport, low-emission vehicles or the use of bicycles.
	Explain the possible societal / environmental / economic impact expected from this campaign	Involve citizens in air quality issues and cause behavioural changes. promoting sustainable mobility

ANNEX C. List of Questionnaires used in the project

The following table contains public links to PDF versions of the questionnaires used in the project.

#	Title	Description	Usage	Resource location
1	Profiling (ONBOARDING)	The purpose of this questionnaire is to be able to profile candidate participants in the campaigns, to identify what role would be most suitable for each of them.	Only to be used whenever participants have been identified but roles in the Hive are not known a priori. It should be executed, if needed, before a campaign can be organized	PDF publicly accessible
2	Inclusion checklist (ONBOARDING)	This checklist should be passed before Hives for a campaign are configured. It will allow us to bear in mind inclusion, gender balance and accessibility when approaching the community or configuring the hives	It is recommended to go once over it before we complete the planning of engagement activities. It should be passed again before deciding the Hive composition for each Hive	Available at https://docs.google.com/forms/d/e/1FAIpQLSd0U4Fl5puxTM2I_Df-ZapP2s7O1fVIyB1PZAvKTmglbRa6Kw/viewform
3	SOCIO-BEE - Pilot Users' Demographics and Activity Satisfaction Questionnaire (EVALUATION)	The purpose of this questionnaire is known who attends to SOCIO-BEE events and to know their opinion/feedback about the activities celebrated	This questionnaire should be filled in by every participant in every community building activity organized within a pilot. It is a short questionnaire. It should not take longer than 3'. They should be submitted together with consent forms since pictures and some demographic data is gathered in those events..	PDF publicly accessible
4	SOCIO-BEE Alpha Questionnaire (EVALUATION) (OPTIONAL)	The purpose of this questionnaire is to give ALPHA testers during the pre-pilot execution sub-phase of iteration 1 to provide FEEDBACK regarding the SOCIO-BEE platform. This feedback will be used by the technical team to finetune the SOCIO.BEE technical solution.	It should be filled in by an alpha tester every time that s/he tests one of the components of the SOCIO-BEE platform.	PDF publicly accessible
5	User Acceptance test for SOCIO-BEE platform (EVALUATION)	The purpose of this spreadsheet is to allow a tester to go through every single functionality of the SOCIO-BEE platform and indicate whether it is functional or not. In case that it is not functional, it should indicate what is wrong, so that developers react and adapt the component.	This template should be completed every time new updates of the SOCIO-BEE platform wants to be released. It includes an exhaustive list of all the features that SOCIO-BEE platform will be enabling and that should be operative before users may use the	Document available in nextcloud: PILOTS' GUIDELINES spreadsheet (tab User Acceptance test)

			platform. It will be applied several times before ALPHA release is launched for alpha testers to check SOCIO-BEE platform in pre-pilot execution sub-phase and also in the process where ALPHA releases is enhanced into BETA release which will be used by BETA testers during pilot execution sub-phase.	
6	PRE SOCIO-BEE Citizen Science Activists Evaluation Questionnaire (EVALUATION)	This questionnaire is filled in ONCE, for *ex-ante analysis*, by those participants about to start a campaign to provide info regarding their expectations, that will be then after the campaign be compared with answers to the same questions after having completed the campaign.	Once per campaign participant BEFORE they start participating in the campaign. If they have not signed previously a consent form, they should sign it. It is a short questionnaire which should be answered in fewer than 5'.	PDF publicly accessible
7	POST SOCIO-BEE Citizen Science Activists Evaluation Questionnaire (EVALUATION)	This questionnaire is filled in ONCE per campaign participant to enable *ex-post evaluation analysis*, once the campaign has concluded. It is a long questionnaire, because it requires feedback from participants in several dimensions (Acceptance, Interests and attitudes, Satisfaction, Accessibility, Inclusiveness, Awareness, Usability) measured in the project KPIs.	Once per campaign participant AFTER they start participating in the campaign. If they have not signed previously a consent form, they should sign it. This evaluation questionnaire is longer than the PRE evaluation questionnaire. It is important for KPI collection and to perform ex-post analysis.	PDF publicly accessible