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Deliverable

D5.6 - Definition and planning of pilots – 1st release

Work Package No.	**WP5**	Work Package Title	**Pilots, Integration Testing & Evaluation**
Task No.	**T5.3**	Task Title	**Pilots planning & Pilot Evaluation Framework (KPIs)**
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17/02/2023	2	DEUSTO, ANCONA, MRSI, ZARAGOZA	Contributions to section 3
24/02/2023	3	DEUSTO, ANCONA, MRSI, ZARAGOZA	Provided feedback to pilot owners and completed section 4
03/03/2023	4	CERTH, VUB, UNIPD, ECSA, ZKF, ZGZ, MRSI , ANCONA, UNIVPM and HOPU.	Received, processed and integrated contributions from all participants in Task 5.3
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10/03/2023	final	DEUSTO	Integration of feedback supplied by reviewers and preparation of final version.
03/07/2023	Revised	DEUSTO	Following the recommendations of the first review report the following modifications have been applied: • An introduction to the hive and bee metaphor has been introduced in section 2.1 to provide further context for piloting and evaluation. • All links to the KPI table have been verified to point to publicly available document. • Table with public links to PDF versions of all questionnaires designed has been included as Annex C. • Figure 2, now Figure 3 has now all the text in English. • Correction to description of workplan of Ancona, removing wrong reference to Zaragoza.

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 first version of the deliverable that is delivered right after M17 (February 2023) and will evolve during the project (update in month M27 – December 2024).

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 1 and 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 1 comprising the period April to July 2023.

Table of Contents

List of Figures

List of Tables

1   Introduction

1.1   Purpose of the document

The purpose of this document is to describe the pilot plan for iteration 1 in SOCIO-BEE, being the main output of Task 5.3. This is the first version of the deliverable that is scheduled for M17 (February 2023) – eventually delivered with 1 week delay – and will evolve during the project (update in month M27 – December 2024). This document includes the following parts:

- **Guidelines of coordination per use case**: including aspects such as the within consortium and pilot-specific coordination structure (personnel involved); overall planning of iteration 1; 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.
- **Specification of pilots' experimentation:** detailing pilot per pilot, their requirements, associated stakeholder map, the actual 2 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 1, 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 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 1 comprising the period March 2023 to July 2023.

1.2   Relationship with other deliverables

This deliverable is based on the following previously issued deliverables:

<div align="center">Table 1. Relationship of D5.6 with other deliverables.</div>

#	Title	Dissemination Level	Due Date	Relationship to D5.6
D2.8 [1]	SOCIO-BEE toolkit - 1st release	CO	M12	Detail of all the engagement tools to be used for recruitment, onboarding, experiments' execution, and evaluation.
D3.2 [2]	Report on use case definition, user requirements and technical compliance to legislation	CO	M11	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

D3.4 [3]	Technical Specifications & System Architecture - 1st release	CO	M12	A more detailed information regarding the overall architecture of the system along with all technical specifications are included in this deliverable.
D4.1 [4]	Citizen engagement services layer tool suite - 1st release	CO	M13	This deliverable provides info regarding the functionality and modules of the Citizen engagement services layer tool suite.
D5.1 [5]	SOCIO-BEE integrated platform - 1st release	CO	M16	Details about integration of the SOCIO-BEE platform and its validation are encountered here.

1.3   Deliverable Structure

The structure of this deliverables is as follows. Chapter 2 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 3 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 4 deals with the evaluation methodology that will be applied before, during and after pilots' iteration 1. 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 1.

Finally, chapter 5 concludes the deliverable and proposes future work foreseen in the frame of Task 5.3.

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 1's 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

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 to set up a new hive. S/he adds members to that hive. S/he creates a new campaign based on SOCIO-BEE toolkit element for on boarding 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 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 end of campaigns and provide feedback of their experience through mobile app. They take part in 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 easily graspable manner to enhance understanding of the effects of air pollution and remediation actions. They are invited to attend to reflection workshop to have a say regarding possible actions to be taken by the public administration.
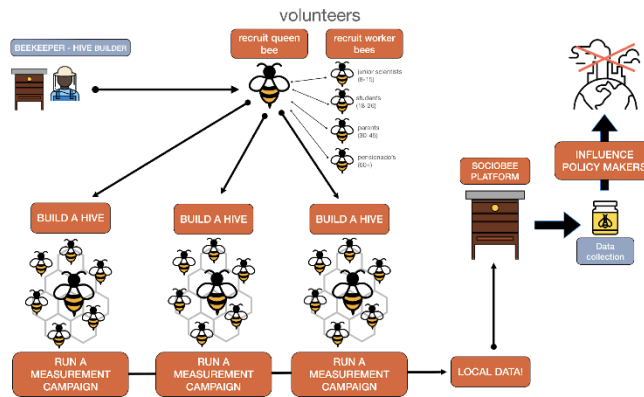
Figure 1. Bee metaphor employed by SOCIO-BEE.

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 realize 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 of the cross-pilots coordination (CERTH) and who will be responsible at each specific pilot sites. 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 M20 (August 2022), will be responsible for reporting the operation and monitoring, and, the evaluation and interpretation, respectively, of pilots' iteration 1.

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 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 1 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*". 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 realize 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.
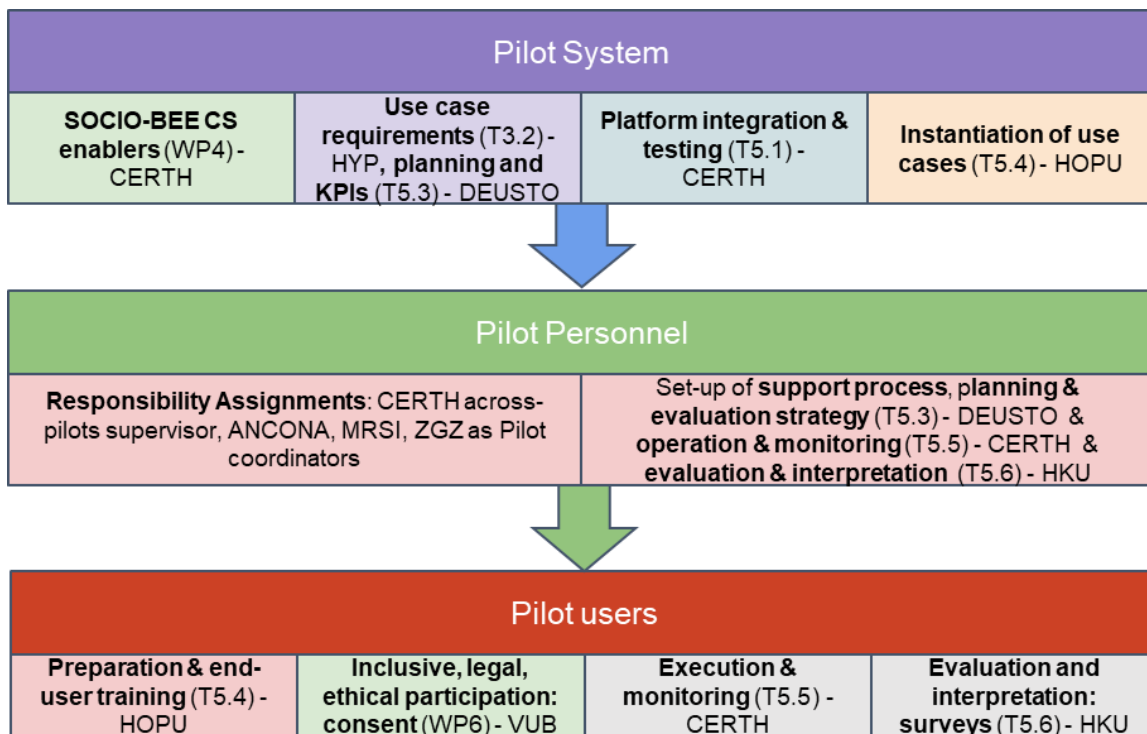
Figure 2. SOCIO-BEE pilots' coordination structure..

To achieve those objectives, the project will be **evaluated across two iterations**, divided into two evaluation stages, where:

● *Exploration stage*: performed in iteration 1, explores 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 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 1.

Since the SOCIO-BEE platform is being currently developed and the WP2's engagement toolkit has not been assessed yet, in iteration 1, hives will be promoted from the consortium, particularly pilot owners, whilst hives will be created more spontaneously for iteration 2. Consequently, two types of hives will be 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 1   is divided in sub-phases. The first sub-phase (a.k.a., the *pre-pilot sub-phase*) will be used to make sure that the SOCIO-BEE platform (i.e., wearable sensors, campaign blueprints and engagement toolkit, AcadeMe's back end and front-end, including mobile and web apps), are fully tested and mostly bug-free. In this first sub-phase, a controlled and selected reduced group of *alpha testers* will report about their experience using the 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 first 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 1 will correspond to the launching of the Pilots Iteration 1 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 published in beta testing mode on SOCIO-BEE's GitHub organization and deployed as external release of Pilots Iteration I. One single deployment of AcadeME will be shared by all pilot sites during iteration 1.

PILOT ITERATION 1 EXPLORATION		PILOT ITERATION 2 CONSOLIDATION	
PRE-PILOT	PILOT EXECUTION	PRE-PILOT	PILOT EXECUTION
April 2023 (M19)	May - July 2023 (M20 – M22)	Jan-Feb 2024 (M28-M29)	April– July 2024 (M30 – M34)
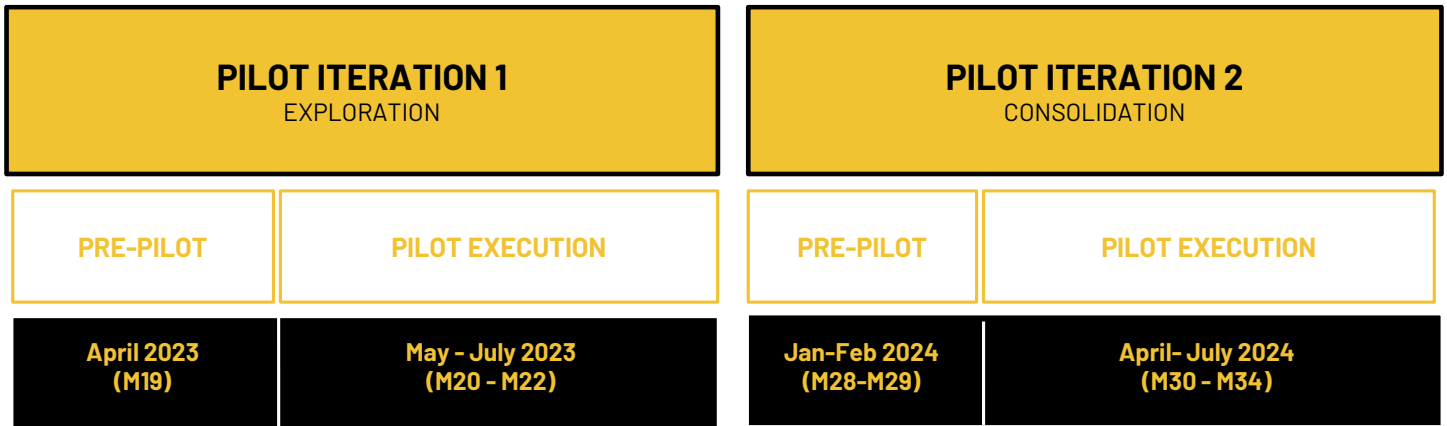
Figure 3. SOCIO-BEE pilots' evaluation across two iterations.

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 1's timespan, from April to July 2023.
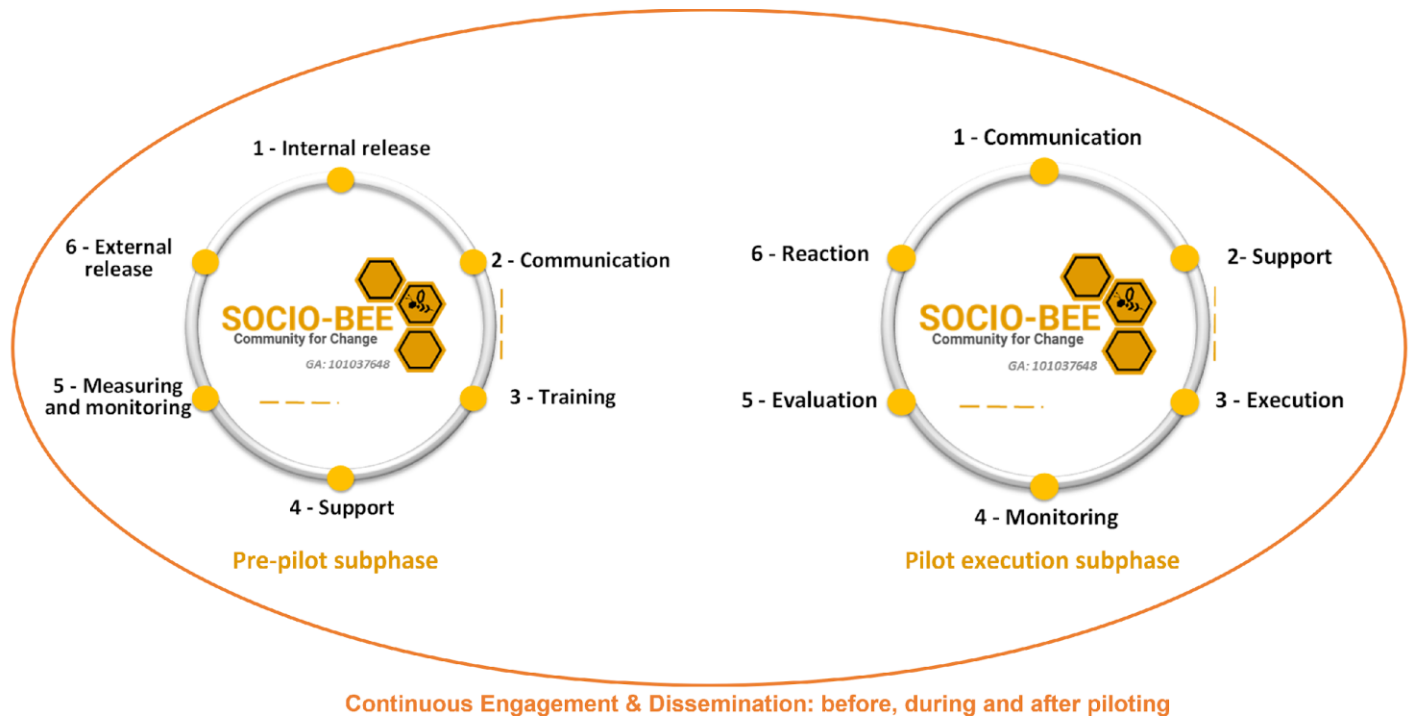
Figure 4. Action types executed within iteration 1's sub-phases.

The following two sub-sections describe the different steps in which the execution of pilots' iteration 1's sub-phases will be divided. It also includes a generic planning (indication of candidate dates) for Pilots Iteration I, comprising months M19 (April 2023) to M22 (July 2023).

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 are made available in alpha mode for partners. 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.
- *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 April and May 2023.
- *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 phase a cross-testing session involving SOCIO-BEE consortium members will be also launched by mid-April taking advantage of the face-to-face meeting planned or, alternatively, through videoconference. 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 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 M21 (June 2023) to M22 (July 2023):

- *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 May to July 2023.
- *Execution*: SOCIO-BEE framework components, namely, AcadeME mobile and web apps, wearables and toolkit are redeployed, after tuning them as a result of the pre-pilot sub-phase and are ready for massive access and execution. This activity ensures that the individual deployment per pilot site is kept operative on a 24x7 basis. The deployment of beta version of SOCIO-BEE platform must take place before May 2023.
- *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 wil be carried out in period May to July 2023.
- *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 May to July 2023.
- *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 (15 February 2023 was the set deadline), at least 2 campaigns/pilot are defined through a focus group or co-design workshop organized by pilots.
- **Alpha tester users' engagement and training**. Whilst the technology is still not fully implemented, 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 during March 2023.

- **Internal pre-testing** (face-to-face 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 mid-April so that the feedback collected can be used to refine the alpha release of SOCIO-BEE platform and turn it into beta version of the solution by end of April 2023. Before and after the cross-testing sessions, SOCIO-BEE technical partners validate that the alpha release of the platform 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.
- **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, 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 May 2023.
- **Pre-pilot sub-phase monitoring and evaluation**. Possible technical deficiencies both at the technical solution and the evaluation instruments are addressed by SOCIO-BEE members of the support and technical team. They work on this polishing in the second half of April 2023.
- **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 March and until April 2023 first versions of material are already used by pilot owners during the recruitment of alpha testers. Materials (presentations, communication kits, guidelines, and training materials) are enhanced so that they can be made available to beta testers from May 2023 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](link) has been configured, a slack channel [(SOCIO-BEE.slack.com)](link) 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 2.8 for more details). Such training will take place in April 2023.
- **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 need to be translated to pilots' local languages by 30 April 2023.

2.4.4   Pilot work plan definition

Each pilot needs to define a work plan during the whole duration of iteration 1, 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* (M19, April 2023).
- *Milestone 2 (MS) – Pilot execution sub-phase* (M20 – May 2023 to M22 – July 2023)
- *Milestone 3 (MS) – Post-Pilot execution sub-phase* (M23-24 – August to September 2023)

Some pilots might even define tasks before the official iteration 1'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.

<div align="center">**Table 2. Pilot's workplan template table.**</div>

ID	MS	Phase	When	Action	Description	Target	Comments
C1	1	Pre-pilot launch subphase	M19	Communication	Pilot X announces with two separate communication 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".	All Pilot X stakeholders: - 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.

<div align="center">**Table 3. Pilot's workplan action types.**</div>

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.

2.5   Engagement and cooperation plan for community building

The following organizational steps (see Figure 5) are required per pilot (based on cascading **SOCIO-BEE hive assembly process** from D2.8 [1]), in order to realize community building (engagement + involvement) in the pilot cases. Indicative dates per action are indicated:

- **Municipality** organizes an **artificial hive** for iteration 1 (**Task 5.4**) – January-March 2023
- **Beekeeper**/s is/are **appointed** – February 2023
- **Hive** is **created** including Queen Bee/s and Worker Bees – Feburary 2023
- **Beekeeper/s and QueenBee/s** cooperate to **specify campaign** based on **Campaign Blueprint** and **CS experiments** knowledge base from **SOCIO-BEE** (**Task 5.4**) – February 2023. Results are shown in chapter 3.
- **Experimentation** is **launched** for a period in each region (**Task 5.5**) – April-June 2023
  o Worker bees continuously perform measurements with support of SOCIO-BEE mobile app and wearable sensor.
  o 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** – July 2023
  o We will prepare dissemination outcomes, create communication campaigns with results, and so on.
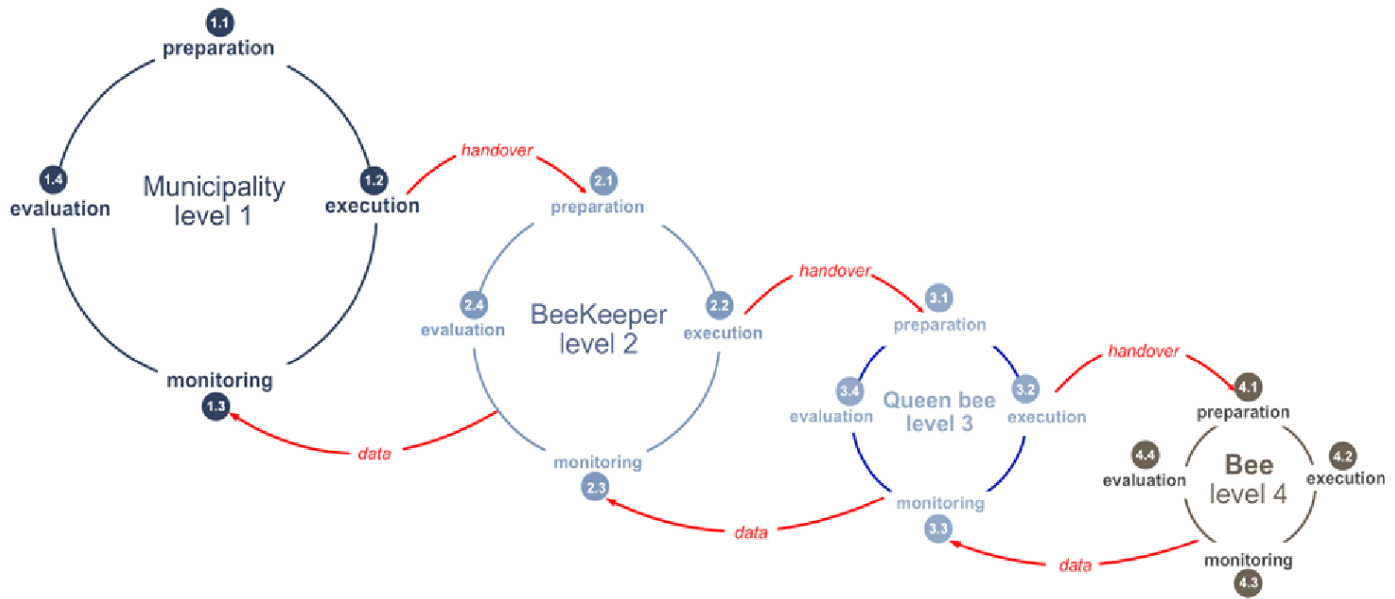
Figure 5. SOCIO-BEE's hive assembly process.

According to the results of "D2.5. SOCIO-BEE methodology for ecosystem and hive creation - 1st release" [6], 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 [7] and INTERLINK [8] 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 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*	*Use-Case Community Building*	*Evaluation, Assessment, and Monitoring*	*Use-Case Community Building*	*Evaluation, Assessment, and Monitoring*
	- Public Meetings - Training Sessions - Hackathons - Seminars - Contests	- Focus groups (to explore attitudes and opinions in depth) - Public Meetings & Hearings	- Pre-Evaluation Sessions (e.g., think aloud evaluation and heuristic evaluation) - Mid-Evaluation Sessions (e.g., interviews, open-	- Focus groups - Consensus workshops (to identify shared values and agreement)	- Administration of questionnaires during the pilots while SOCIO-BEE is in use by the CS hives running the co-designed campaigns - Focus groups

	- Briefings (to reach out to established groups) - Printed information (Factsheets, Newsletters, Leaflets, Posters, and Bulletins) - Websites - Information Repositories - Information Hotlines and Kiosks - Press and Media - Social Media - Exhibitions & Stands	- Public Workshops - World Cafes (fostering open discussion of a topic/aspect)	ended questions in questionnaires) - Post-Evaluation Sessions (e.g., interviews, open-ended questions in questionnaires)		- Consensus Workshops (to identify shared objectives and agreement)

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

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

Other materials to be used during pilots, such as **onboarding and training materials** are currently in preparation and made publicly available. Such slides include, see examples in Figure 8, the following types of contents:

- Slides for 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.

In the future, it will be necessary to design materials to disseminate the outcome of the pilots. Besides, more in depth training materials and user manuals once the tools are available will be prepared. All prepared materials and particularly the outcome of the CS experiments will be translated to pilot languages (Greek, Italian and Spanish).

Figure 8. Some screenshots taken from the on-boarding presentation for all audiences.

2.7 Technology to be tested: SOCIO-BEE platform

The technology that will be handed to the pilot for testing is going to be the initially integrated SOCIO-BEE platform. This will consist of a set of interconnected components working towards supporting the CS   campaigns but also summarising their results and providing insights about air pollution. Figure 9 presents the architecture of the platform. The platform integrates a set of internal and external components. Namely, in Figure 9, the blue 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 going to be 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 will be stored in the two databases. Moreover, the platform will be communicating with external data to get more accurate data about weather and pollution. Lastly, the platform, will be accessible to the users through a web interface (bears, beekeepers queen bees) and a mobile interface (working and drone bees).
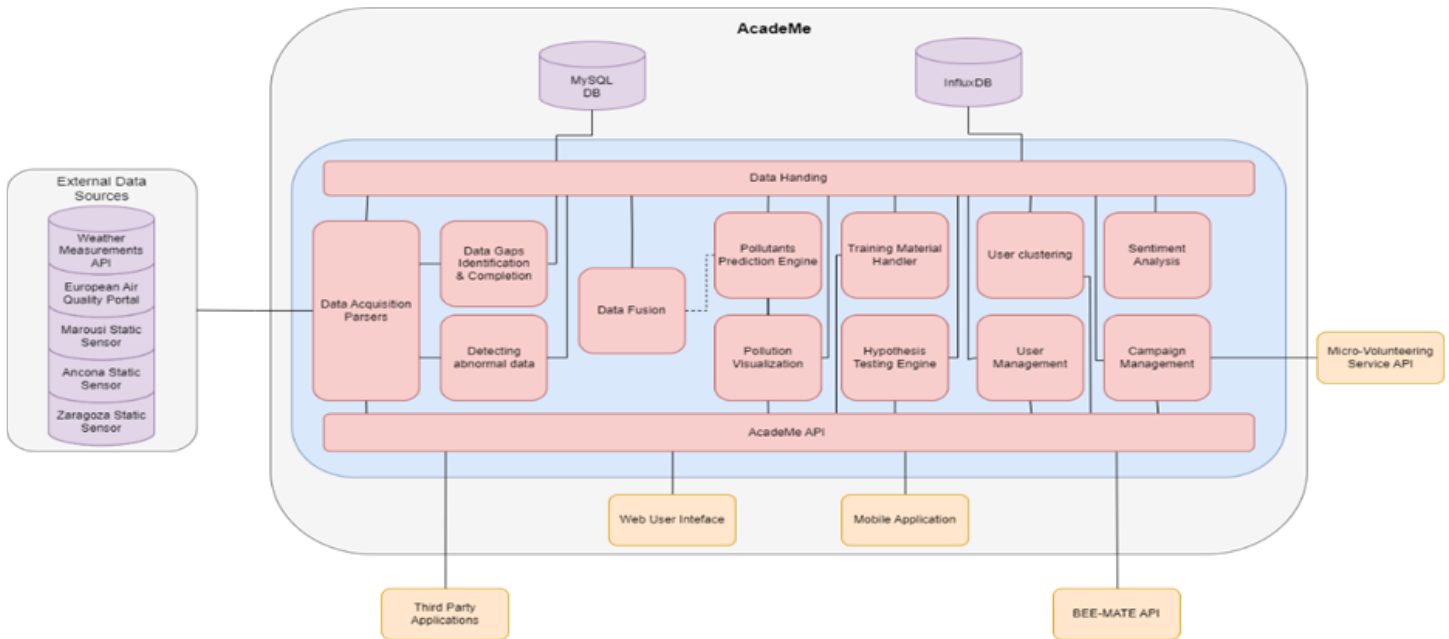
Figure 9. SOCIO-BEE's platform architecture.

Figure 10 and Figure 11 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.
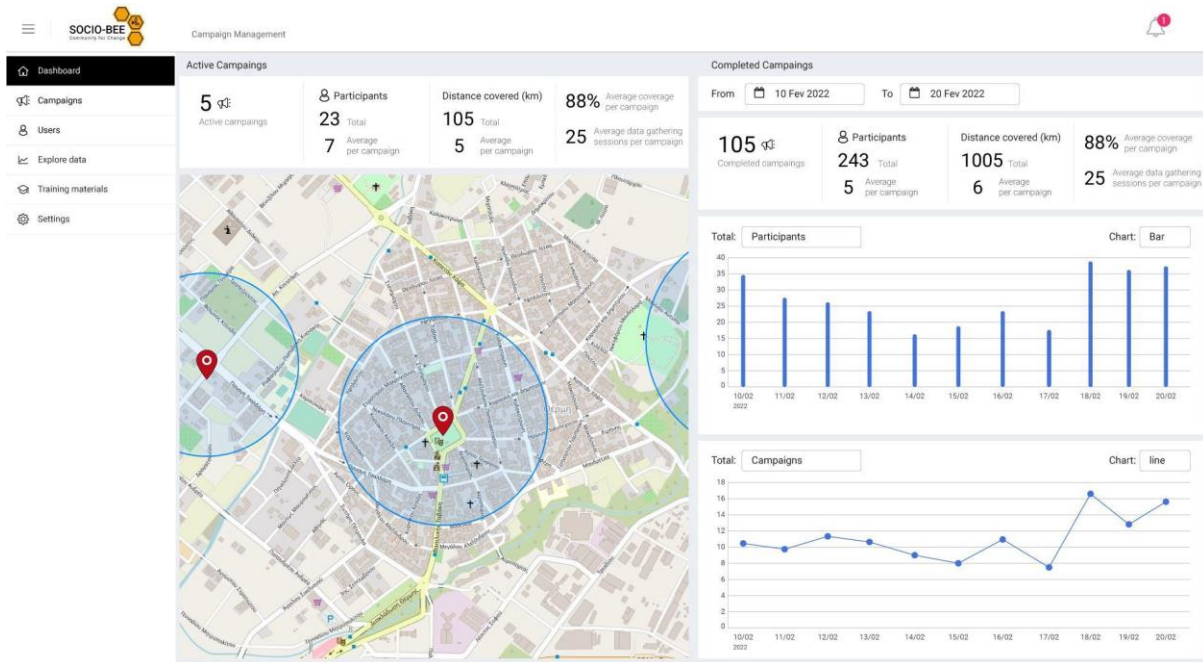
Figure 10. SOCIO-BEE's platform web front-end mock-up.

Figure 12 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.

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.
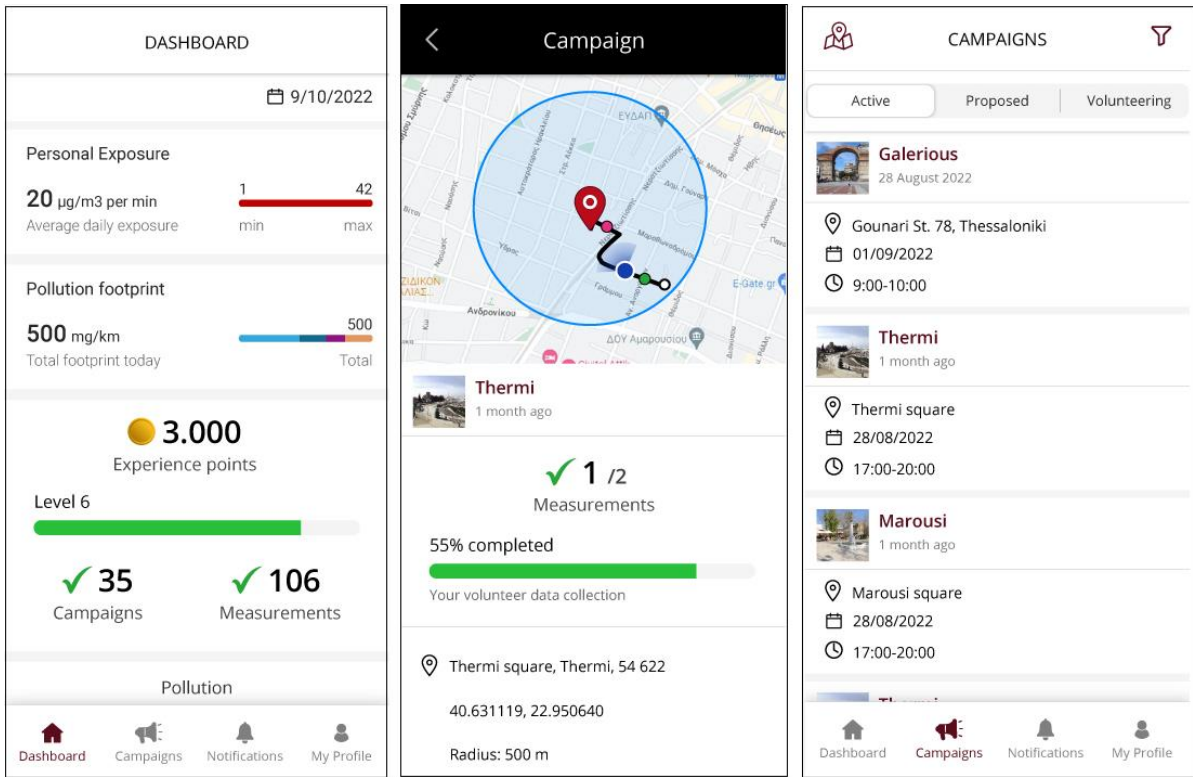
Figure 11. SOCIO-BEE's platform mobile front-end mock-up.
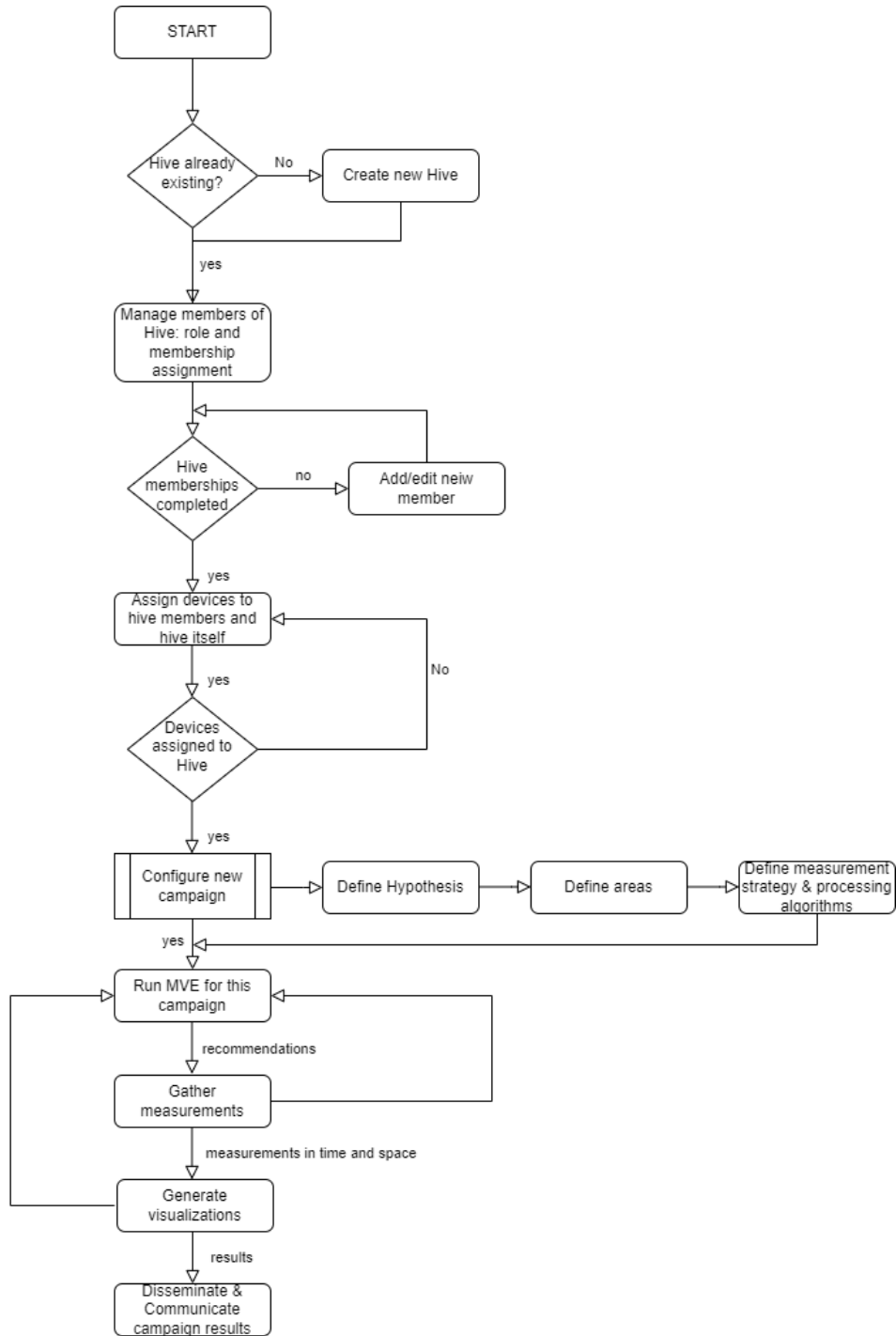
Figure 12. SOCIO-BEE's technology supported process.

2.8   Ethical and 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) 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 first wave of 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 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 will be 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. Should further waves of pilots include minors, the consent forms will be updated to reflect the specific conditions for children's consent laid down in art. 8 of the GDPR and other applicable frameworks. Consent forms will be translated by the end-users into their local language(s).

Further measures to foster privacy and data protection in the pilots will be 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 will 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 phases. 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 13):

- **1st Level of support (L1)**: SOCIO-BEE Pilot owners (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 also 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 will be created to support the PILOT participants to use the SOCIO-BEE platform.

From all these supporting assets, a specific person (pilot coordinator) for each pilot city will be 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 will collect incident details from users via all the available sources of information mentioned before (e.g., email, slack) and will properly log 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 will be used both by L1 and L2. The L1 team will classify incidents by type and filter those that require attention from the L2 support team. In addition, common issues may be 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 should be 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) will be appointed. They will be responsible for all CS campaigns and SOCIO-BEE environment configuration issues in the infrastructure. All the identified issues will be 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 will be reported through a response mail, from L1 representatives.
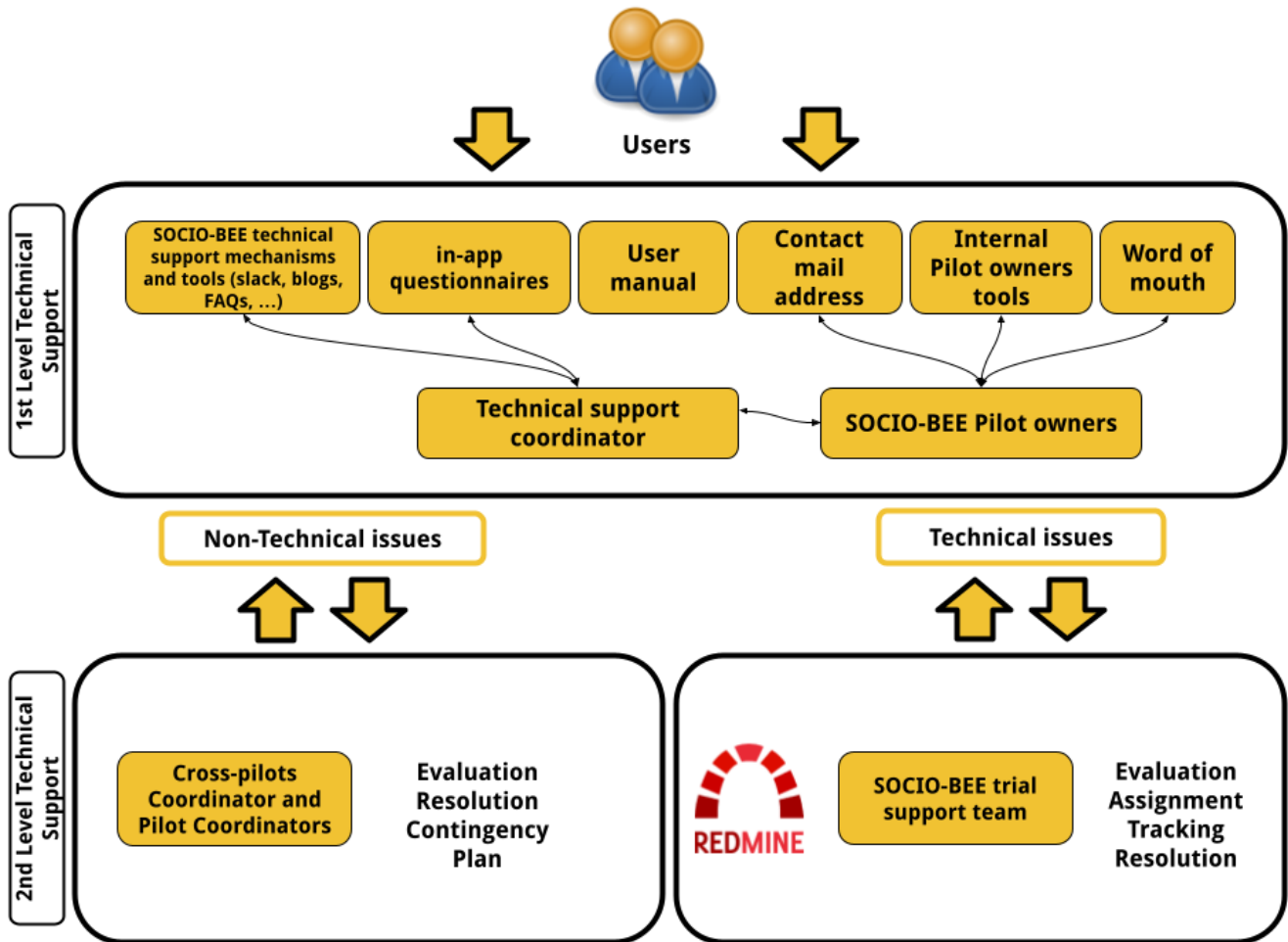
Figure 13. SOCIO-BEE's support-process.

2.10 Sensors' distribution

A production of 60 WSN devices has been planned for the first iteration of pilots, these 60 units will be distributed evenly among the pilot sites, 20 units to each pilot. The calibration process of the sensors is done in batches and has a variable duration of 1 or 2 weeks depending on environmental factors. The first batch of 10 sensors per pilot (total of 30) will be delivered during March 2023, and the second batch of 10 sensors per pilot (30 more for a total of 60) will be delivered during April 2023. These deliberately broad delivery times should account for any unexpected delays in shipping processes which are not uncommon in the current global logistics situation, and for extended calibration periods as needed.

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_final" 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)

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 help 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 or Do-it-Yourself, DiY sensors).

Besides, for the specification of actions and activities to be carried out in iteration 1 of piloting, the following schedule, and associated milestones, have been considered:

- *Milestone 1 (MS)* – Pre-pilot launch subphase (M19, April 2023).
- *Milestone 2 (MS)* – Pilot execution sub-phase (M20 – May 2023 to M22 – July 2023)
- *Milestone 3 (MS)* – Post-Pilot execution sub-phase (M23-24 – August to September 2023)

3.1   Ancona

Figure 14. Ancona city's picture.

Ancona is a city and a seaport in the Marche region in central Italy, with population of around 101,031 as of 2019. Ancona is the capital of the province of Ancona and of the region. The city is located on the Adriatic Sea, between the slopes of the two extremities of the promontory of Monte Conero, Monte Astagno and Monte Guasco.

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. This high urbanization results in an increase of various types of pollution and loss of environmental quality, which has a big impact on the quality of life in Ancona. Another factor to keep in mind is the exposure to pollen, considering both the amount of allergenic pollen and its potential chemical interaction with PM10 and PM2,5 pollution. 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. In fact, they could be discouraged to go out for a walk to avoid being in contact with pollutants and can decide to go out only by using their own vehicles, promoting a sedentary lifestyle, and bringing more pollutants to the atmosphere. The focus in this pilot aims at involving vulnerable groups (i.e., ageing people), to encourage them to adopt a healthier and safer lifestyle. In addition, 26% (still rising) of the citizens in Ancona are over 65 years old. The pilot therefore aims at involving seniors (over 65 years old), to make them more informed about the air quality in the city and to motivate them to adopt startegies for reducing air pollution. The aim of this action is to push the elderly to be active outdoors in a on-polluted and non-crowded environment, promoting a healthy lifestyle. The generated indicators will be used to help the municipality to develop and provide social assistance and define proper mobility policies. In the context of the project, Queen Bees can be citizens (elderly people) that are interested to lead actions/projects in the city, while Working bees will be Volunteers chosen by sample on the basis of specific and predefined characteristics (i.e., age range, localization, population density of the area, traffic density).

3.1.1   High level requirements of pilot

The goal is to map the levels of air pollution around the city, taking into account the elderly citizens' risks. This will be aimed by a large deployment of wearable sensors worn by volunteers. The mapping will also identify locations of critical importance for vulnerable populations that are important for aged 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 5 shows the allocation of people and associations to the different roles that stakeholders will play within the Ancona pilot and its planned campaigns.

Table 5. 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								Work in project WP's deliverables /Technological support to the Ancona municipality
Association for seniors' right (ADA)					Analyze air quality in the different areas of the city center			Collect Data, bring help and support, workshop organisation, communication & dissemination activities, bees' recruitment

Municipality of Ancona - Social Services Association for seniors' right (ADA)	**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
Università Politecnica delle Marche Municipality of Ancona ARPA Marche ASUR Marche	**Bear**	Help with communication and dissemination strategies Receive and study the final scientific reports	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 - Social Services Municipality of Ancona - Press Office Associations' members	**Worker bees**	test technology	High: Action Inform, Guide and Work with Data collection and work with	Time constraints, success in content adaptation and engagement strategy Informatio, dissemination, events, and workshops promotion	Contribute to the pilot success	Internal channels of communication of the institutions involved in the pilot (mailing list, face to face talks) Via email, phone, in person or by workshops	Pre-pilot phase	Bring experience in previous citizen science projects and scientific experiments related to air quality.

Volunteers			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**	Disseminaitoon, 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

Next, we show the summaries of the two campaigns co-designed for this pilot. For more details about the co-designed campaigns check "ANNEX B. Campaign templates filled in by pilots".

Campaign ANCONA 1: Compare air quality measurement in the city center, with the reference stations

Research questions: Taking into consideration the natural conformation of the territory and artificial factors, such as maritime and road traffic, is it sufficient to measure the air quality in the city using the two fixed stations? Are there less polluted areas in the centre than others?

Hypothesis: If the air quality in the city centre is measured at several points, instead of considering only the two available reference stations, then the spatial resolution of the AQ measurements will be enhanced, offering more reliable measurements.

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 aim of this pilot is to run a capillary mapping of the air quality in the central area of the city. Thus, the of the current campaign are the following:

1. Find critical zones.
2. Inform citizens about air pollution.

Workplan: When we talk about the Workplan, Ancona plans, firstly, to identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (March 23). Secondly, to set/codesign and share the hypothesis (definition: February 23 and redefining it if necessary: March 23 - just before the pilot starts). Thirdly, to define an area in which to

take measurements (already defined). Fourthly, to conduct the data collection journey (1st campaign from April 1 to mid-May and 2nd campaign from mid-May to end of June). Fifthly, to analyse the data collected and draw conclusions. Verify whether the hypothesis has been proved or not. (June 23rd). Sixthly, to go through a continuous evaluation. And seventhly and finally, to do a final evaluation. However, this plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, Ancona intends to carry out.

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.

Queen bees and worker bees will be incorporated as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, Ancona will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypothesis to work on. For the Bears, the aim is to involve them from the very beginning of the campaigns 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 the hypotheses (this would facilitate their later commitment once we have the results of the campaign), 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.

Risks: Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. Secondly, not being able to get the bees to want to stay involved after the campaign ends. Thirdly, lack of interest from bears to use campaign results as inputs for new policies. And fourthly, the sensors and/or the mobile application are not working properly or are too complicated to use for the target audience.

Location: Regarding campaign blueprints, Ancona has selected the blueprint chosen to "Pollinate an area over an area in the city centre of the city (type I)". The area that will be covered by this campaign will be: Around the city center of Ancona (43.617603, 13.513020).

Figure 15. Ancona's pilot location.

Materials & Equipment: Regarding the resources needed, Ancona requires: some material to contact new potential hive's representatives, 20 devices, the AcadeMe back-end platform, the mobile app, some training materials about 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 to be used during the pilot.

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: air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activists will be gathered. To analyse these data Ancona will use traditional statistical analysis and AI techniques. The collected data will contribute to complete visualizations of the most and least polluted area in the city centre, to know the involvement of

citizens in the campaigns, and data related to the % of days when average air quality levels are below or over to a certain recommended threshold.

Reasoning: The Hive will have a clear purpose for the campaign which is to compare the air quality in the city centre and the sensibilization for acting mitigation strategies. Also, it is clear that ones who are going to be benefited by this campaign will be Bears, Queen Bees, Beekeepers, bees and all the citizens (that includes senior people).

Regarding the outcomes expected by the campaign are the following. Firstly, a dataset of air quality and a report. From the new policies that can come out because of this campaign, there can be a promotion of open-air activity and urban qualification. Data can be shown to relevant stakeholders for expanding green areas and developing strategies for traffic management and installing pollutant barriers. And finally, it can impact with an improvement of air quality locally and the inclusion of senior citizens with this type of active actions in the city activity.

Success indicator/s:

- **ANCONA1.KPI1**: # of additional AQ reference points in Ancona >= 2, this implies that 2 new virtual AQ stations are defined thanks to crowdsourced data, having reliable data corresponding to the campaign period
- **ANCONA1.KPI2**: # validations of SOCIO-BEE wearables against physical AQ stations offering results with a reliability bigger than 80% > 2

  Other alternative KPIs which may be proposed for this campaign could be:
  - # 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 ANCONA 2: Analyse the impact of green areas and of the sea on the air quality of the city

Research questions: Is air quality better in areas where there are more trees and parks?

Hypothesis: Locations near green areas should be less polluted than other city locations, despite the proximity to the main traffic arteries.

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 ADA and municipality will have the role of Queen Bee. Moreover, elders recruited from *Associations for Seniors' Rights* (ADA) 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 aim of this pilot is to run a capillary mapping of the air quality in the central area of the city. Thus, the of the current campaign are the following:

1. Find healthy zones.
2. Inform citizens about air pollution.
3. Coaching citizens about doing activities in healthy zones found.

Workplan: When we talk about the Workplan, Ancona plans, firstly, to identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (March 23). Secondly, to set/codesign and share the hypothesis (definition: March 23rd and redefining it if necessary: April 23rd - just before the pilot starts). Thirdly, to define an area in which to take measurements (already defined). Fourthly, to conduct the data collection journey (1st campaign from April 1 to mid-May and 2nd campaign from mid-May to end of June). Fifthly, to analyse the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23rd). Sixthly, to go through a continuous evaluation. And seventhly and finally, to do a final evaluation. However, this plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, Ancona intends to carry out.

In order 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.

Queen bees and worker bees will be incorporated as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, Ancona will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypothesis to work on. For the Bears, the aim is to involve them from the very beginning of the campaigns 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 the hypotheses (this would facilitate their later commitment once we have the results of the campaign), 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.

Risks: Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. Secondly, not being able to get the bees to want to stay involved after the campaign ends. Thirdly, lack of interest from bears to use campaign results as inputs for new policies. And fourthly, the sensors and/or the mobile application are not working properly or are too complicated to use for the target audience.

Location: Regarding campaign blueprints, Ancona has selected the blueprint chosen to "Pollinate an area over an area in the city centre of the city (type I)". The area that will be covered by this campaign will be: Around the city centre of Ancona (43.617603, 13.513020). See Figure 15 for more details.
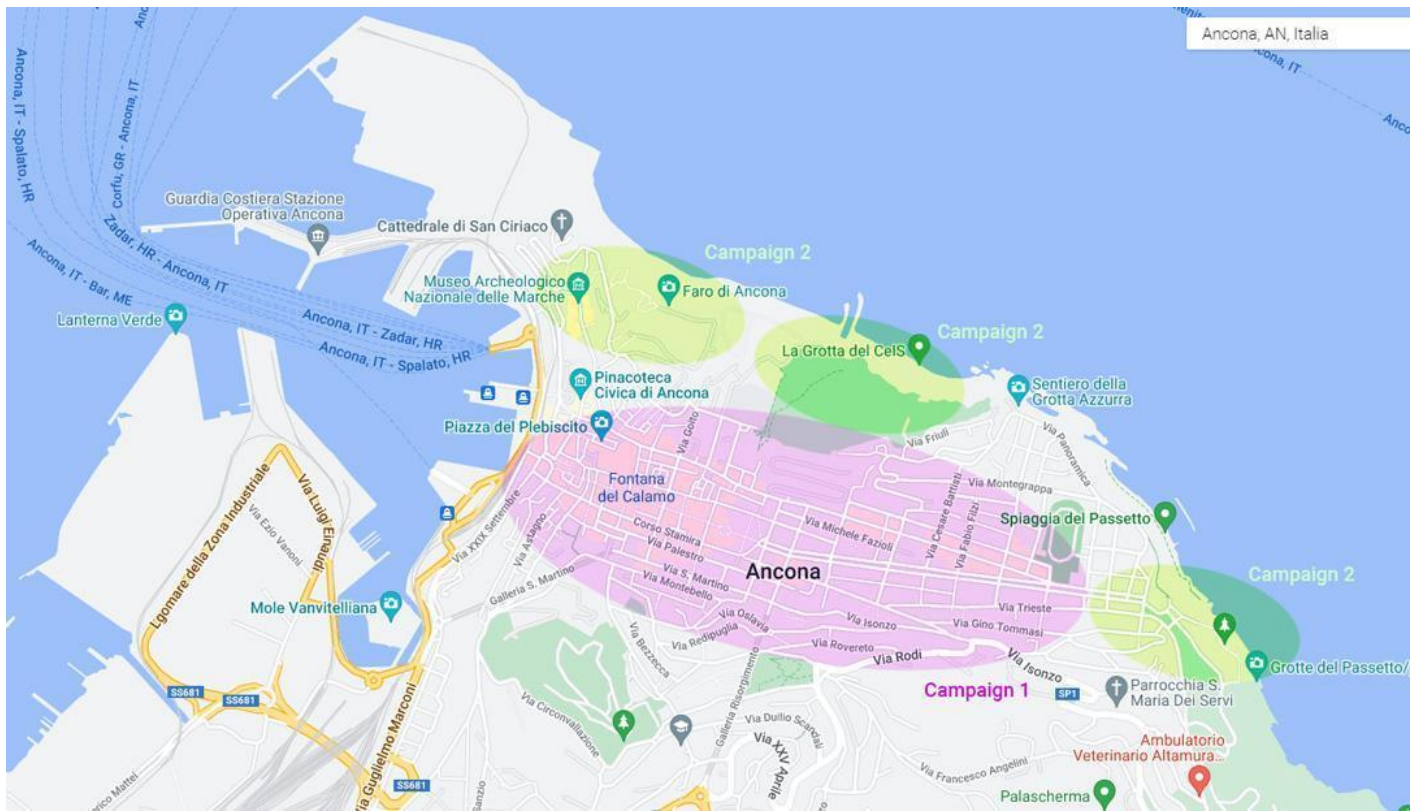
Materials & Equipment: Regarding the resources needed, Ancona requires: some material to contact new potential hive's representatives, 20 devices, the AcadeMe back-end platform, the mobile app, some training materials about air quality and citizen science, some user manuals for the mobile application and the web application, and some workshops with technology partners to learn how to use the tools to be used during the pilot.

Recommendations: Ancona considers that it would be good that Beekeepers and QBs could get an instant indication of the pollution after the measurement by the SOCIO-BEE application. In addition, they would like that QBs could see the activities performed by each WB separately and be able to contact them to activate them in case of inaction.

Methodology: air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activists will be gathered. To analyse these data Ancona will use traditional statistical analysis and AI techniques. The collected data will

contribute to the % of days when average air quality levels are below or over to a certain recommended threshold and the number of citizens actively involved in the pilot.

Reasoning: The Hive will be used for meetings among partners of the project, QB and WB, for monitoring activities, for solving potential issues encountered in the usage of the tools and devices of SOCIO-BEE. Also, it is clear that the ones who are going to be benefited by this campaign will be Bears, Queen Bees, Beekeepers, bees and all the citizens (that includes senior people).

Regarding the outcomes expected by the campaign are the following. Firstly, a dataset of air quality and a report. From the new policies that can come out because of this campaign, there can be a promotion of open-air activity and urban qualification. Data can be shown to relevant stakeholders for expanding green areas and developing strategies for traffic management and installing pollutant barriers. And finally, it can impact with an improvement of air quality locally and the inclusion of senior citizens with this type of active actions in the city activity.

Success indicator/s:

- **ANCONA2.KPI1**: # comparisons of AQ in locations near traffic arteries, where group A represents locations close to green spaces and groups B represents locations far away to green spaces >= 6
- **ANCONA2.KPI2**: # average AQ measurements in group A location are better than in B locations (TRUE/FALSE)

Other alternative KPIs which may be proposed for this campaign could be:

- o # Valid measurements taken by citizens (>300)
- o Average mean of the measurements in group A against group B (p<0.05)
- o Number of measurements taken in each zone per citizen (>100)
- o Difference of Measurements between zones (<10%). For example, if in group A we have 100 measurements, group B should be between 90-110.

3.1.4   Pilot execution plan

The actions foreseen for Ancona pilot are shown in Table 6:

<div align="center">Table 6. Ancona's workplan for iteration 1.</div>

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	Continous 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	Questionaires, 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.		
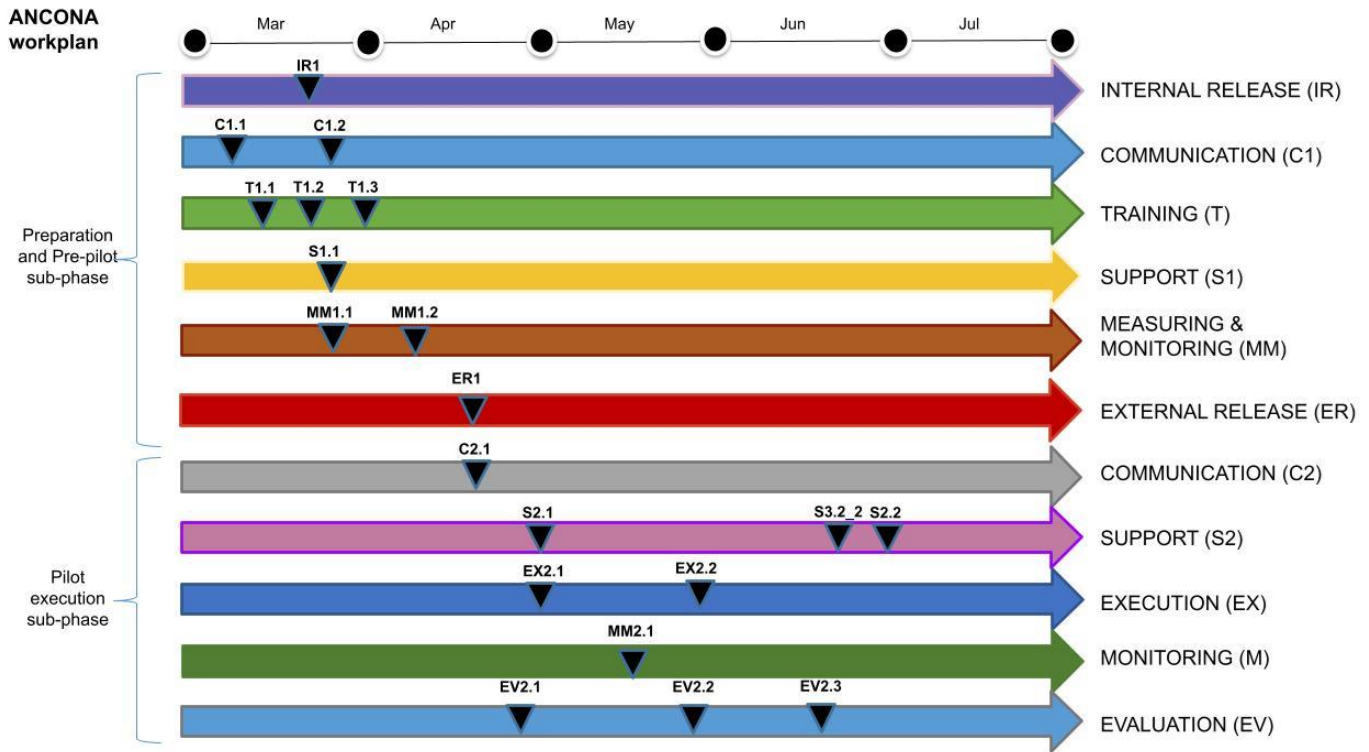
Figure 16. Ancona's workplan for iteration 1.

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).
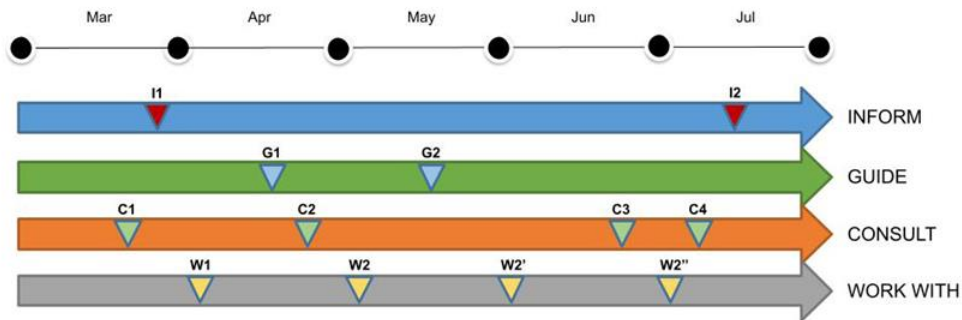
Figure 17. Ancona's community building plan for iteration 1.

Next, a table is filled in for each of the 12 activities planned for Ancona which are depicted in the timeline in Figure 17. The following code is used to define the type of activity described I (INFORM), C (CONSULT), G (GUIDE) and W (WORK WITH).

Table 7. 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 2023
Responsible	Ancona municipality

Table 8. 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 2023
Responsible	Ancona municipality and UNIVPM

Table 9. 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 10. 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
Disseminaiton 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 2023

Table 11. 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' fulfillment.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	April 2023
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 12. 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 2023
Responsible	Technical experts

Table 13. 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)
Disseminaiton 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 2023 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 14. 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 2023
Responsible	Technical experts

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 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 2023
Responsible	Technical experts

Table 16. 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' fulfillment.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	End of June 2023
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 17. 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' fulfillment.
Evaluation mechanisms	Questionnaires and Notes
Outcomes	Questionnaires and FAQ list
Location	At each hive's location
Date	Early July 2023
Responsible	Bee-keepers: UNIVPM, Municipality of Ancona

Table 18. 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
Disseminaiton 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 2023

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 main 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.
- **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 taking action 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*: Within MRSI borders there is only one Air quality station, suggesting that the available air quality data have limited spatial resolution and the validation/standardization of the SOCIO-BEE sensors have to be performed in a given location. This is an important factor that has to be taken into consideration during the co-design process of the campaigns, so that the challenge is tackled.
    2. Lack *of interest in participating in the project*: This is a critical challenge for MRSI pilot. However, it is expected that the community building activities together with the overall pilot activities planning and the gamified SOCIO-BEE approach to successfully attract the public attention and trigger the citizens' participation in the 1st pilot iteration.
    3. *Data quality issues*: The quality and reliability of data collected by citizen scientists is a big challenge when it comes to leveraging this information (results) for policy making. Seeing this, MRSI will use the 1st Iteration to gain experience on citizen science experiments and identify potential issues raised during such activities.
- **Recruitment strategy**: The recruitment strategy is divided in 3 phases:
    1. *General public*: In order to recruit the general public, MRSI will have an active presence through a series of posts in social media, local press, MRSI website, etc.

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.

● **Beekeepers**: Dr. Maria Kotzagianni and Mr. Anargyros Roussos from MRSI will be the beekeepers.
● **Queen Bees & Working Bees**: General population and members of hives.
● **Type of engagement**: Physical and digital engagement.

Figure 18. Maroussi's city's picture.

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, namely iteration 1's pre-pilot and the pilot execution sub-phase, MRSI has two main high-level requirements:

1. In order 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 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 fulfill the first high level requirement of MRSI which is having access to a *useful, attractive and with high acceptance engagement approach/tool.*

2. Employing the SOCIO-BEE approach, MRSI with the aid of alpha testers has already designed two campaigns, with the following specific requirements: 1) *identify the impact of the presence/absence of a park in the vicinity of a busy highway on local air quality* based on AQ measurements conducted by citizen scientists and 2) *develop strategies for the standardization/calibration process of the* SOCIO-BEE *sensors*. The results from these two

campaigns may lead to *communication and dissemination material*, while they may be used in the future for *policy making.*

3.2.2   Stakeholders' map of pilot

Table 19 summarizes the stakeholders' map as it is foreseen for the 1st pilot iteration. However, as the participation of some stakeholders is not yet confirmed, the information in specific cells may change during the pilot execution.

<p align="center">Table 19. Stakeholder's map for Maroussi.</p>

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)	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 / Supervision	Time con-straints	Check SOCIO-BEE technological components (sensors, platform, app, etc) Check SOCIO-BEE engagement strategies for building communities	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 Collect Data and Provide support during the campaigns
Eleutheria Stamati (MRSI) Dimitris Tsiantopoulos (MRSI)		Aid in the preparation of the training material Support pre-pilot and pilot activities Prepare, coordinate and run engagement, communication and dissemination	Low: Coordination High: Facilitation High: Action Low: Supervision		Check SOCIO-BEE technological components (sensors, platform, app, etc)			Provide support and help to Beekeepers at all stages of the pre-pilot and pilot execution phase Provide help and support to hives and all types of bees during the pilot phase Work in project WP's deliverables

		actions						Participate in communication & dissemination activities
Stella Chatzichristou (MRSI) Eleni Stauridou (MRSI)	**Queen Bees**	Recruit WBs Co-design and coordinate experimental campaigns Perform engagement and communication actions to WBs. Supervise WBs if possible.	Medium: Coordination High: Execution Low: Supervision	Time constraints, Low interest	Check engagement strategies and campaign creation function on the platform	Not necessary (They're all members of the Pilots team)	All phases of the pilot	Facilitate time and spaces to run the pilot activities
Future QBs recruited from the new hives						This group will be reached in person by the beekeepers	Pilot execution sub-phase and post-pilot phase	
Departments responsible or involved in policy making within MRSI Municipality	**Bear**	Consult on areas and activities of interest to be covered by the campaigns. Help with communication strategies. Receive and study the final scientific reports	High: Consultation	Time constraints, Bureaucracy	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
Department of local public transport in MRSI								
Department of Gender and Equality								
Staff members of MRSI Town Hall	**Worker bees**	Consist alpha and beta testers group. Use SOCIO-BEE technological	High: Consultation High: Action	Time constraints, lack of initial interest, feeling of	Contribute to the pilot success. Get informed about the air	Internal channels of communication of the institutions involved in	Pre-pilot sub-phase Pilot	Bring personal time and effort to run the experiments

		solution and provide feedback. Participate in workshops and/or training activities. Participate in CS campaigns and in data collection		disappointment after participation	quality in areas of personal interest	the pilot (mailing list, face to face talks) Communication campaigns and talks in the future hives	execution sub-phase	
Staff members of MRSI Public transport Members of volunteering groups and/or staff members of SMEs/LEs		Participate in workshops and/or training activities Participate in CS campaigns and in data collection	High: Action		Checking the pilot technology		Pilot execution sub-phase	
Department of communication in MRSI Municipality Katerina Vourlaki (journalist)	**Drone Bees**	Receive and study the final scientific reports Help with communication and dissemination activities Advice on context of communication material	Low: Supervision / Advice	Lack of time and interest,	Be aware of the pilots development to keep the local community updated and engaged	Pilot communication channels: Email, social media, newsletter, local press, dissemination events	Pilot Phase	Dissemination of the results through their communication channels

3.2.3　Campaigns co-designed

At this stage of the project, the beekeepers from Municipality of Amaroussion together with the alpha testers have co-designed two experimental campaigns. The campaigns are depicted in the following map.
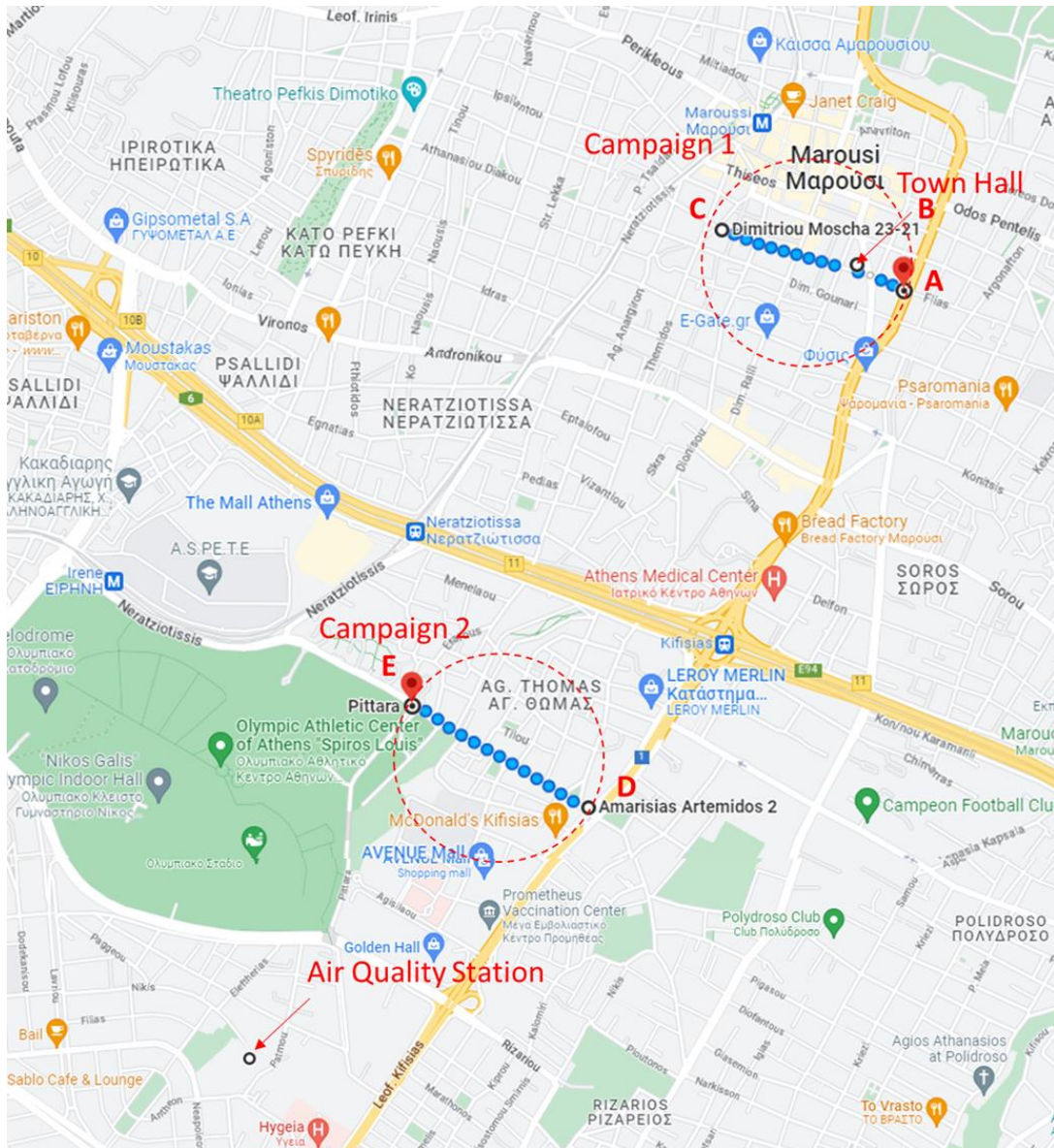
Figure 19. Maroussi's campaigns' map.

Campaign 1 is in the vicinity of the Town hall and Campaign 2 is relatively close to the Air Quality Station. The results from the 2 campaigns will be combined in order to extract valuable information about the air quality in the area.

Campaign MRSI 1: Test the effect of high number of cars passing through MRSI particularly during rush hours and make an estimation of the air quality around the MRSI Town Hall

Research questions: Do emissions from private cars contribute to air pollution? And if yes, to which extent?

Hypothesis: If traffic is increased in Kifissias Avenue during rush hours on weekdays, then the concentration of air pollutants should change considerably during the day in closer areas to that avenue.

Stakeholders: Maroussi will have Maria Kotzagianni and Dimitris Tsiantopoulos as Beekeepers to create or assign a hive for a potential campaign. Technical Services Division of Municipality of Amaroussion will work as Bears in the campaigns. Stella Chatzichristou (MRSI) will have the role of Queen Bee. Moreover, Giannis Stoufis (MRSI), Maria Katsari (MRSI), Panagiota Tsonopoulou (MRSI), Eleni Stauridou (MRSI) and Ares Fasoulas (MRSI) will have a role as Bees. Communication Department of Municipality of Amaroussion and Katerina Vourlaki, in her position as a journalist will be the Drone Bees, helping to disseminate the outcomes of the campaign.

Goal: The Municipality of Amaroussion is located in the northeastern part of Attica Region and it is considered to be an important financial and business centre of Athens. It has 70,5K inhabitants, 3.500 companies, 3 of the country's largest shopping malls, 2 Ministries' premises, 2 Embassies, 4 Consulates, several maternity hospitals and medical centres of Attica, while it is crossed by two main highways. This is translated into a high number of people commuting from and to Maroussi on a daily basis reaching approximately 1.000.000 cars passing through this area on weekdays. As expected, this results in elevated air pollution especially during the rush hours. Thus, the objectives of the current campaign are the following:

1. Recruit and raise awareness of employees of MRSI to participate in a citizen science project related to air pollution.
2. Build hives with high emphasis on inclusiveness and gender equality.
3. Collect preliminary air pollution measurements to be potentially used for policy making.

Workplan: When we talk about the Work Plan, Maroussi plans (if there are not unexpected delays or a better fit the overall planning of the pilot iteration), first, to recruit alpha testers (Queen Bee and Working Bees aforementioned). Secondly, to carry out 3 meetings or workshops to test SOCIO-BEE components and get feedback from alpha testers (beginning of March, middle of April and end of April in line with the delivery of components from technical partners. The meetings or workshops may be shifted accordingly). Thirdly, to prepare activities to enrol more citizens (employees of MRSI) probably via an in-person events. Fourthly, to build a hive, design campaigns in more detail, assign roles and perform workshops. Fifthly, to carry out measurements and collect data. Sixthly, to monitor progress. And seventhly, to perform evaluation of hive's performance.

Queen bees and worker bees will be incorporated during the pre-pilot test as alpha testers. On the other hand, during the pilot sub-phase QBs are envisioned to be the initially recruited alpha testers, now acting as beta testers, while the WBs, also acting as beta testers, will be incorporated during the communication event. For the Bears, they will be involved during the pre-pilot sub-phase and the engagement activities will be of type INFORM and CONSULT. It is foreseen to carry out interviews with Bear's representatives to inform them about the SOCIO-BEE project and its capabilities and consult them about areas of interest and/or other open questions that may be addressed by the project (input for campaigns design).

Risks: Some risks are anticipated, first, not having enough participants and possibly mitigated by performing an additional information event workshop. And second, not gender equality ensured and possibly mitigated by approaching the Department of Gender Equality of Municipality of Amaroussion.

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 the town hall, with the following coordinates: 38.053080061906435, 23.808415757670467.

Materials & Equipment: Regarding the resources needed, Maroussi requires firstly, some material to contact potential hive's representatives; secondly, 20 devices, the app and the platform working properly; thirdly, some communication material such as brochures, leaflets, banners, stickers or online material to call people to participate; and finally, some training materials.

Recommendations: MRSI, points out 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. Additionally, MRSI thinks that it is crucial for the end user to be able to get an indication of the pollution instantly after the measurement.

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. Thus, the circle area of diameter 600 meters long extending from **Location A**: Kifissias Avenue (38.051849802184904, 23.809991074635818), to   **Location B**: Town hall (38.053080061906435, 23.808415757670467) and ending at **Location C**: (38.05341316323043, 23.80400886452207) will be covered. While doing this, air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activists will be gathered. To analyse these data some statistical analysis and *wherever feasible*, will be performed per day per location spot (e.g., 3 different time stamps at specific time slots during the day), same time same location spot different day, and average per location spot. Therefore, MRSI is expecting, at the end of this campaign, to have a clear air quality distribution at different distances from Kifissias Avenue and at various distances around Town hall. 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 reasoning of this campaign is as follows: Blueprint 1 is useful for MRSI employees because they will be informed about the air quality in the vicinity and around their workplace; and Blueprint 2 is useful because it may help MRSI employees to understand that using private cars has a great impact on the environment and significantly deteriorates the AQ, which may lead to behavioural change in their everyday commuting habits. This will benefit all involved parties by being informed about air quality in areas affecting them. In addition, there are other outcomes from this campaign, the air quality measurements or the sound records, or some policies such as the creation of pocket parks, namely urban open irregular pieces of public or private land at very small scale accessible to the general public and without the need for large-scale redevelopment in highly polluted areas or if necessary planting of trees in the area of study. And finally, this campaign can also have a societal impact in inclusivity and equal participation in such actions, and an environmental impact if some actions or policies are made on SOCIO-BEE results and thus, resulting in an air quality improvement.

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

- **MRSI1.KPI1**: # capture of aggregated AQ measurements in locations in increasing distances (at least 3 increasing distances) to reference point locations (A, B, C) (>= 12)
- **MRSI1.KPI2**: # reports of AQ propagation from reference locations (A, B, C), considering proximity to highway (>= 3)
  Other alternative KPIs that might be considered are:

○   1 of complete, coherent datasets for emission/dispersion models validation (>= 1)
○   10 of hourly averages estimated within one same week of measurements.
○   1 week of measurements

Campaign MRSI 2: Test the effect of a green park on air quality in areas close to main highways with elevated traffic during rush hours measured by lower precision wearable sensors carried by CS activists

Research questions: Can portable sensors be validated / standardised by campaigns carried out by citizens? What is the air quality in areas/neighbourhoods that have both parks and main highways within their borders?

Hypothesis: If there is a park (green area) in the vicinity of Kifissias Avenue, then the air quality there is expected to be better despite the heavy traffic even during rush hours.

Stakeholders: Maroussi will have Anargyros Roussos, Maria Kotzagianni and Eleutheria Stamati as Beekeepers to create or assign a hive for a potential campaign. The Urban Planning Division of Municipality of Amaroussion will work as Bears in the campaigns. Eleni Stauridou (MRSI) will have the role of Queen Bee. Moreover, Giannis Stoufis (MRSI), Maria Katsari (MRSI), Panagiota Tsonopoulou (MRSI), Stella Chatzichristou (MRSI) and Ares Fasoulas (MRSI) will have a role as Bees. Communication Department of Municipality of Amaroussion and Katerina Vourlaki, in her position of a journalist will be the Drone Bees, helping to disseminate the outcomes of the campaign. Finally, the intention of MRSI is to reach NGOs and SMEs to potentially recruit them in the 1st iteration as hives.

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 of AQ by standardised sensors and a considerable amount of collected data for statistical analysis and safe conclusion extraction. So, the aim of this particular campaign of this pilot is to design tasks around the Air Quality Station in order for the SOCIO-BEE sensors to be validated/standardised, providing reliability to the measurements, whilst still allowing us to test the effects of green areas close to heavy traffic roads on air quality improvement.

Thus, the objectives of the campaign will be the following:

1.   Recruit and raise awareness of employees of MRSI to participate in a citizen science project related to air pollution.
2.   Collect data that are reliable and accurate for policy making.

Workplan: Maroussi's plans (if there are not unexpected delays or a better fit the overall planning of the pilot iteration), first, to recruit alpha testers (Queen Bee and Working Bees aforementioned) (already done in February23). Second, to carry out 3 meetings or workshops to test SOCIO-BEE components and get feedback from alpha testers (beginning of March, middle of April and end of April in line with the delivery of components from technical partners. The meetings or workshops may be shifted accordingly). Third, to prepare activities to enrol more citizens (employees of MRSI) probably via an in-person event (approx. 1h duration May23). Fourth, to build a hive, design campaigns in more detail, assign roles and perform workshops (May23). Fifth, to carry out measurements and collect data (May23). Sixth, to monitor progress (May23). Seventh, to perform evaluation of hive's performance (May23).

Queen bees and worker bees will be incorporated during the pre-pilot test as alpha testers. On the other hand, during the pilot execution sub-phase QBs are envisioned to be the original alpha testers, now acting as beta testers, while the WBs will be incorporated during the communication event (May23). For the Bears, they will be involved during the pre-pilot phase and the engagement activities 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 its capabilities and consult them about areas of interest and/or other open questions that may be addressed by the project (input for campaigns design).

Risks: Some risks are anticipated, first, not having enough participants and possibly mitigated by performing an additional information event workshop. And second, not enough time of sensors collocated to the air quality station and possibly mitigated by the Beekeepers being responsible for successfully concluding the experiment.

Location: Regarding campaign blueprints, MRSI has selected the blueprint "*Pollinate a specific area in a short period of time (Type I)*". MRSI will also try to design campaigns to cover the needs of scenarios 6 (Walking routes sensing at noise level), 7 (Using stationary sensors in public spaces) and if possible also 9 (Letting citizens build and experiment with sensors - DIY approach). 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: firstly, some material to contact potential hive's representatives; secondly, 20 devices (April-May23), the app and the platform working properly (April-May23); thirdly, some communication material such as brochures, leaflets or online material to call people to participate; and fourthly and finally, some training material.

Recommendations: MRSI 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, MRSI thinks that it is crucial for the end user to be able to get an indication of the pollution instantly after their measurement.

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 of 600m long extending from **Location D**: Kifissias Avenue (38.03758453483845, 23.79914731615933) and ending at **Location E**: Park Spyros Louis (38.040333040913914, 23.79305541053046) will be covered. The diameter of the circle is 600m long, similar to campaign 1. **The main difference here is that the area covered during Campaign 2 includes partially a big park (green area) with surface area 4 km²**. This will help them compare the results with Campaign 1 and evaluate the **impact of a green area** on air quality. While doing this, air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activists will be gathered. To analyse these data and *wherever feasible,* some statistical analysis will be performed per day per location spot (e.g., 3 different time stamps per day), same time same location spot different day, and average per location spot.

Furthermore, MRSI is expecting at the end of this campaign to have, first, each sensor spending sufficient time in the location of the Air quality station for calibration purposes. This will be used as a decision-making supporting metric to ensure data reliability (KPI4). Second, a clear Air quality distribution at different locations between Kifissias Avenue and the Spyros Louis park and at the location of the Air Quality Station. 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. And third and final, a comparative study between campaign 1 and 2 to highlight the importance of green areas in the urban environment for communication and dissemination purposes.

Reasoning: The reasoning of this campaign is that Blueprint 2 may help MRSI bears and employees to realise the importance of green spaces in improving air quality locally, while all involved parties will benefit by being informed about air quality in areas affecting them.

In addition, there are other outcomes from this campaign as there are the air quality measurements, pictures and videos, sound records, potentially valuable information for communication and dissemination purposes focusing on role of green spaces in urban environment, and potentially some conclusions on best calibration practices for CS projects to be published in conferences or scientific journals. This campaign also has an impact in policies regarding the creation of pocket parks in highly polluted areas or if necessary planting of trees in the area of study. Finally, these policies are based on the SOCIO-BEE results, there will be improvement of air quality locally.

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 in locations at different distances (at least 3 distances) from reference locations (D, E) and closest reference air station, from green and highway locations (>= 12)
- **MRSI2.KPI2**: # report of AQ propagation from reference locations (D, E) and closest AQ station, considering proximity to highway or green spaces (>= 1)

3.2.4   Pilot execution plan

The actions foreseen for MRSI's pre-pilot phase and 1st pilot iteration are listed below. Please note that MRSI aims to create three hives during the 1st Pilot Iteration. The hives to be established could be either public bodies, and/or SME(s) / LE (s) and/or NGO (s) and/or Volunteering Group(s). 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 first pilot iteration is designed to be 1 to 2 weeks to engage as many as possible citizens, due to restraints originating from the limited number of available technical equipment.

Table 20. Maroussi's workplan for iteration 1.

ID	MS	Phase	When	Action	Description	Target	Comments
C1.1	1	Pre-pilot launch subphase	February 2023 (CW7)	Communication	Announcement of SOCIO-BEE pilot and purpose (press release, social media posts) among alpha testers	Alpha testers: MRSI employees	This was done with word-of-mouth.

C1.3	1	Preparation of pre-pilot and pilot subphase	February 2023 (CW8 & 9)	Communication	Communication with potential new hive's representatives	Communities, Public Bodies, Companies	Goal: Pick and contact at least: 5 companies, 1 department from Mun. and 1 vol.community via email, phone or in person.
S3.2	1	Preparation of pre-pilot and pilot subphase	February 2023 (CW8 & 9)	Support	Enhance pilot documentation, materials and FAQ	All end users	Goal: Finalise/Translate Material (Brochures, Website, Presentations, Training, consent forms, etc)
C1.2	1	Preparation of pre-pilot and pilot subphase	February - March 2023 (CW8 - 10)	Communication	Meeting/Workshop with potential hive representatives informing about SOCIO-BEE purpose and activities, privacy procedures and policies	Communities, Public Bodies, Companies	Goal: Creation of at least 2 more hives
Pre - pilot sub-phase							
C1.2'	2	Pre-pilot launch subphase	February 2023 (CW7)	Internal release	Workshop with potential alpha testers informing about purpose, privacy procedures and policies	Alpha testers: MRSI employees	Outcome: 1) at least 5 people willing to participate (5 signed consent forms) and 2) 2 campaign blueprints for the pilot phase Hive-Mun
MM2.7	2	Pre-pilot launch subphase	February - March 2023 (CW8 - 10)	Consult	Interviews with Bears	Representatives from departments related to policy making	Goal: Interview at least 3 bears

MM2.1	2	Pre-pilot launch subphase	April 2023 (CW14)	Internal release	Guidelines with usage scenario for Pilot case produced	Alpha testers: MRSI employees	
MM2.2	2	Pre-pilot launch subphase	April - May 2023 (CW16 - 18)	Training	Cross-testing workshop	Alpha testers: MRSI employees	Alpha testers training on Sensors, App, Platform, Campaign design, Presentation material
MM2.3	2	Pre-pilot launch subphase	April 2023 (CW16 - 17)	Training	Internal testing workshop	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Beekeepers training on: Sensors, App, Platform, Campaign design, Presentation material, Training material
T2.1	2	Pre-pilot launch subphase	March 2023 (CW11)	Training	Training of pilot owner representatives about SOCIO-BEE support system	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	
T2.2	2	Pre-pilot launch subphase	March - April 2023 (CW16 - 17)	Training	Physical and/or online workshop about SOCIO-BEE platform and Pilot public services	Alpha testers: MRSI employees	
IR1	2	Pre-pilot launch subphase	March - April 2023 (CW16 - 17)	Training	Deployment of SOCIO-BEE platform, toolkit, knowledge base and instantiation of test campaigns in Pilot	Alpha testers: MRSI employees	Outcome: Input provided by alpha testers
MM2.4	2	Pre-pilot launch subphase	April - May 2023 (CW16 - 18)	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	March - April 2023 (CW 12, 14 & 17)	Evaluation	Verification pilot associated logs and questionnaires are correctly gathered	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Outcome: at least 5 questionnaires and some indicative datasets collected
EV3.1	2	Pre-pilot launch subphase	March - April 2023 (CW13 & 17)	Evaluation	Monthly review of progress of pre-pilot: analysis of KPIs, logs and questionnaires to check that measurement mechanisms are working and can feed KPIS	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	
ER2	4	Still open	May - December 2023 (CW18 - 52)	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 1 - Pilot-execution sub-phase with 3 intervals: 8-21.05.2023, 29.05-11.06.2023 and 19.06-2.07.2023							
Horizontal Activities							
C3.1	3a	Pilot-execution subphase	April 2023 (CW15 - 17)	Communication	Announcement of pilot public start	General Public	Actions: Press release/newsletter mailing list of Municipality, posts on social media and municipality official page, publication in local press
S2.1	3a	Pilot-execution subphase	May - June 2023 (CW18 - 26)	Support	Address in a timely manner (within 2 business days) issues related to usage of SOCIO-BEE assets	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Provide support to end-users

EX3.1	3a	Pilot-execution subphase	May - June 2023 (CW18 - 26)	Execution	Engaging material to prepare quiz/gamified description of challenge to be addressed by users online	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	
MM2.6	3a	Pilot-execution subphase	May - June 2023 (CW18, 21 & 24)	Measuring & Monitoring	Calibration of sensors, co-location activities	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Calibrate sensors /co-location with AQ station in case gathered data from citizens are insufficient/poor quality/unreliable etc.
Type A: Hive(s) - Municipality							
C1.2''	3b	Pilot-execution subphase	May 2023	Communication (CW19)	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: recruitement of 10 or more bees
MM2.8	3b	Pilot-execution subphase	May 2023	Training (CW19 & 20)	Profile questionnaires, Pre-evaluation questionnaires and other	MRSI employees	Action: collect questionnaires
C3.2	3b	Pilot-execution subphase	May 2023	Training (CW19)	Public training presentation for interested MRSI employees	MRSI employees	Goal: Educate participants
MM2.1	3b	Pilot-execution subphase	May 2023	Training (CW19)	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 (strongly related to Alpha testers suggestions)

EX3.2	3b	Pilot-execution subphase	May 2023	Execution (CW19)	Workshop with MRSI employees to organise challenge / contest about improving co-designed citizen science experiments	MRSI employees	
EV3.1	3b	Post-execution subphase	May 2023	Evaluation (CW21)	Monthly(Hive's) performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Monitor progress and take mitigation measures if required
R3	3b	Pilot-execution subphase	May 2023	Reaction (CW19)	Monthly 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	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 2023	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 5 or more bees
MM2.8''	3c	Pilot-execution subphase	May - June 2023	Training (CW22 & 23)	Profile questionnaires, Pre-evaluation questionnaires and other	Volunteers	Action: collect questionnaires
C3.2''	3c	Pilot-execution subphase	May 2023	Training (CW22)	Public training presentation for interested volunteers	Volunteers	Goal: Educate participants

MM2.1	3c	Pilot-execution subphase	May 2023	Training (CW22)	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 subphase	May 2023	Execution (CW22)	Workshop with volunteers to organise challenge / contest about improving co-designed citizen science experiments	Volunteers	
EV3.1''	3c	Post-execution subphase	June 2023	Evaluation (CW24)	Monthly(Hive's) performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Monitor progress and take mitigation measures if required
R3_2	3c	Pilot-execution subphase	May 2023	Reaction (CW22)	Monthly 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	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) - SME(s) / LE(s) Group							
C1.2''''	3c	Pilot-execution subphase	June 2023	Communication (CW25)	Workshop with potential end users informing about purpose, privacy procedures and policies	SME employees	Action: 1h presentation to SME employees about AQ, SOCIO-BEE, recruitment of users, membership assignment Goal: recruitment of 5 or more bees
MM2.8''	3c	Pilot-execution	June 2023	Training (CW25 & 26)	Profile questionnaires, Pre-evaluation	SME employees	Action: collect questionnaires

		subphase			questionnaires and other		
C3.2''	3c	Pilot-execution subphase	June 2023	Training (CW25)	Public training presentation for interested volunteers	SME employees	Goal: Educate participants
MM2.1''	3c	Pilot-execution subphase	June 2023	Training (CW25)	Guidelines with usage scenario for Pilot case produced	SME employees	Goals: 1) Selection of 1 or more scenarios, 2) creation of 2 or more campaigns
EX3.2''	3c	Pilot-execution subphase	June 2023	Execution (CW25)	Workshop with SME employees to organise challenge / contest about improving co-designed citizen science experiments	SME employees	
EV3.1'''	3c	Post-execution subphase	July 2023	Evaluation (CW27)	Monthly(Hive's) performance review of progress of pilot: analysis of KPIs, logs and questionnaires	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	Goal: Monitor progress and take mitigation measures if required
R3''	3c	Pilot-execution subphase	June 2023	Reaction (CW25)	Monthly 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	Action: Review the campaigns' progress. If required, organise video conference, 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 2023	Support (CW26- 27)	Enhance pilot documentation, materials and FAQ	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	

S2.2	4	Post-execution subphase	June - July 2023	Support (CW26-28)	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 2023	Evaluation (CW26-28)	Generation of final evaluation report	Beekeepers: M. Kotzagianni, A.Roussos, E. Stamati, D. Tsiantopoulos	
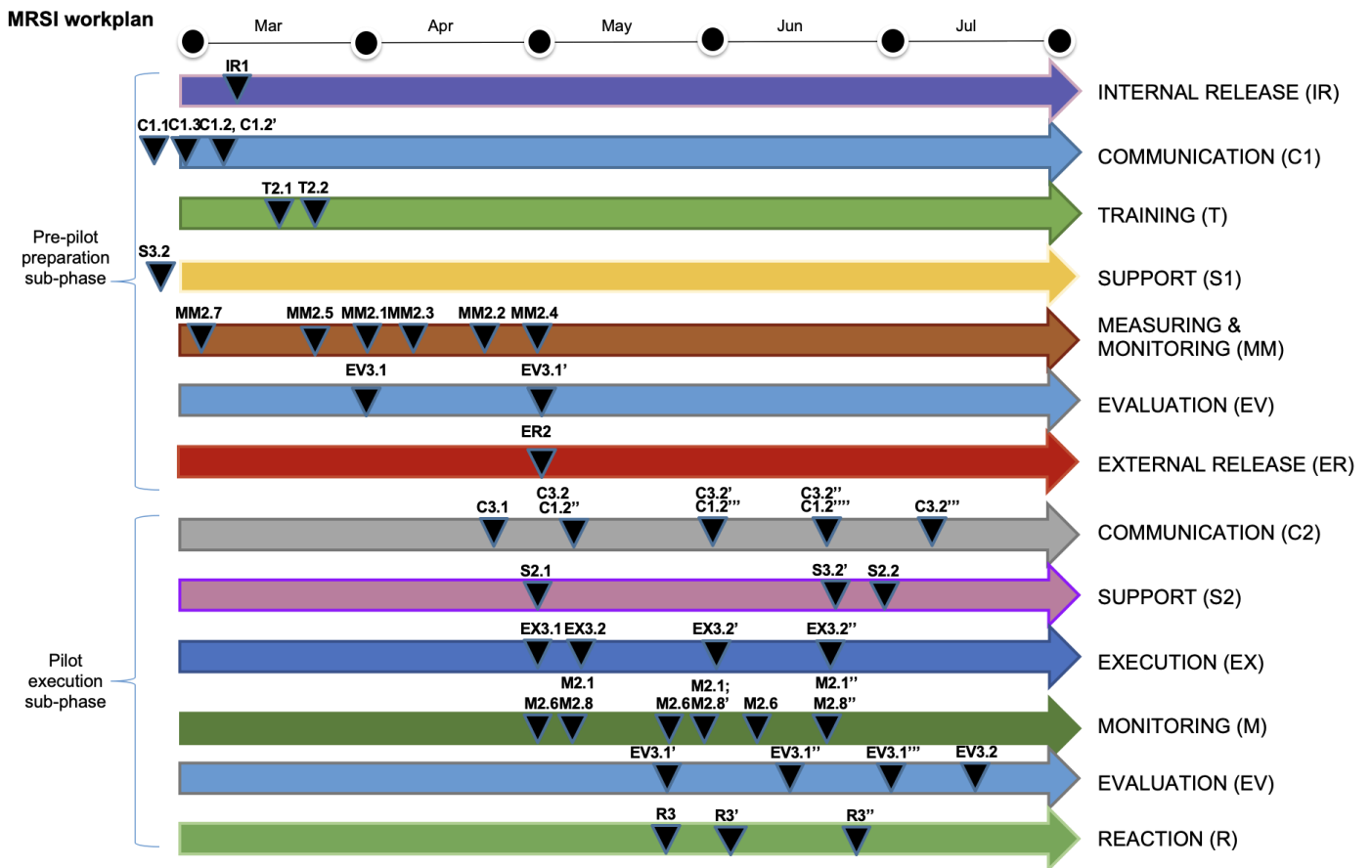
Figure 20. Maroussi's workplan for iteration 1.

3.2.5   Community building plan

Figure 21 shows the community building plan for Maroussi.
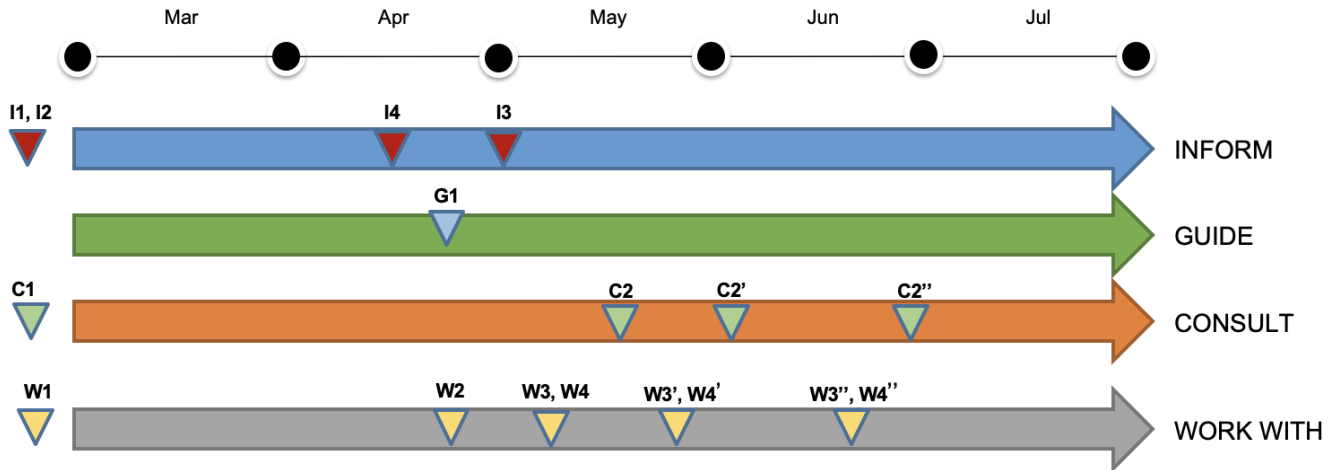
Figure 21. Maroussi's community building plan for iteration 1.

During the pre-pilot phase and the 1st 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 local SME(s)/LE(s) 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 21. Maroussi's I1 engagement activity description.

I1	INFORM - Introduction to SOCIO-BEE project to potential Alpha testers
Objective	Enrol at least 5 Alpha testers
Phase	Pre-pilot execution sub-phase
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	-
Outcomes	Express of interest
Location	MRSI Town Hall
Date	February 2023
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 22. Maroussi's I2 engagement activity description.

I2	**INFORM-First communication with potential new hive's representatives and if interested meeting/workshop**
Objective	Establish at least 2 more hives
Phase	Pre-pilot execution sub-phase
Target artefacts	SOCIO-BEE overall concept
Target groups	Communities, Public Bodies, Companies
Dissemination materials	Material needs to be prepared emphasising on added value for stakeholders to participate in SOCIO-BEE 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 2023
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	First version of SOCIO-BEE leaflet and a figure describing the concept of the project
Evaluation mechanisms	Attendees' List and Notes
Outcomes	Enrol 5 Alpha testers and 2 campaigns co-created
Location	Town hall
Date	February 2023
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
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 and 3 interviews
Location	Town hall and/or wherever needed
Date	February-March 2023
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 2023
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-May 2023
Responsible	Technical experts

Table 27. Maroussi's I3 engagement activity description.

I3	INFORM - External Release of SOCIO-BEE
Objective	Inform general public about the SOCIO-BEE project
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) and presentations
Evaluation mechanisms	-
Outcomes	Visibility of SOCIO-BEE project and new participants
Location	Probably at MRSI Town Hall
Date	April-December 2023

Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

Table 28. Maroussi's I4 engagement activity description.

I4	INFORM - 1st Iteration Official Launch
Objective	Inform public about the start of 1st 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	April 2023
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	3 Groups (1 from each hive)

Dissemination materials	Presentation material and questionnaires
Evaluation mechanisms	Questionnaires
Outcomes	3 Hives with at least 5 Bees each
Location	At each hive's premises
Date	May - June 2023
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	May - June 2023
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 1 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	May - June 2023
Responsible	Bee-keepers: Maria Kotzagianni, Anargyros Roussos

3.3   Zaragoza

Figure 22. Zaragoza city's view.

This pilot exhibits the following features:
- **Target population**: In the first iteration, the target audience will be the staff of the three institutions that make up the Zaragoza task force. The dedicated staff coming from the three institutions have experience in conducting citizen science sessions and participatory processes, as well as strong technological skills. In the second iteration the target audience will be students (11-16 years old).
- **Goal**: raising environmental awareness and encouraging environmentally friendly behaviour by using technology to engage students
- **Challenge**:
    1.   Keep participants involved when the campaigns end.
    2.   React quickly to contingencies due to mobile application or sensor malfunctions.
- **Recruitment strategy**: Through the contacts that eTOPIA has with different schools thanks to the eTOPIA kids program.
- **Beekeepers**: Zaragoza City of Knowledge Foundation - Ibercivis Foundation - Zaragoza Municipality
- **Queen Bees**: staff from ZGZ, ZKF, Ibercivis and in the second project iteration the teachers will play the role of QB.
- **Working Bees**: students in iteration 2, staff of three Zaragoza participating institutions
- **Drone Bees**: General public, 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 will be used to test the air quality measurement technology and the digital tools provided by the project -mobile application and platform for the creation and registration of citizen science projects- among young people aged 8

to 16, as well as the engagement strategies for the creation of communities (hives) among this age group, derived from the toolkit developed in work package 2.

The pilot, developed in two iterations, will have the initial participation of the staff of the three institutions involved in its development and will be responsible, in its first iteration, for testing the correct functioning of the technologies provided, carrying out 2 campaigns related to air quality in the city. The result of this first iteration will serve as feedback to introduce the necessary adjustments or improvements, either technical or in terms of methodological approach to broaden the target audience.

The two campaigns programmed in iteration 1 ("*Testing the effect of forested areas in CO2 absorption*" and *"Analysing the impact of low emission zones on improving air quality"*) will serve as a test to check in depth the functioning of the technological tools and their possibilities. This will allow us to have a much more adequate approach to conduct a second iteration with campaigns perfectly tailored for our core target audience, namely, children.

Data will be collected both scientifically, the measurements obtained by the sensors, and on the level of engagement with the project to verify both the effectiveness of the technology developed and the project's engagement and behaviour change strategies.

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)						Analyze the behavioural change about air quality between the community			Work in project WP's deliverables

Carlos López (ZGZ Municipality)							(hive) members			Collect Data, bring help and support, workshop organisation, communication & dissemination activities, bees recruitment
Marina Abadía (ZGZ Municipality) Elena Giner (Etopia Center of Art & Technology) Francisco Sanz (Ibercivis Foundation)	**Queen Bee**	Facilitate time and spaces to run the pilot activities Supervision of pilot activities	Low: Facilitation / Supervision		Time constraints	Analize the behavioural change about air quality between the community (hive) members	They're all reponsibles of the institutions involved in the pilot	All phases of the pilot	Facilitate time and spaces to run the pilot activities
Zaragoza City of Knowledge Foundation Municipality of Zaragoza Ibercivis Foundation LIA Open Innovation Labs (Zaragoza)	**Bear**	Help with communication and dissemination strategies Recieve and study the final scientific reports	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 converstions)	All phases of the pilot	Facilitate spaces and channels for communication and dissemination of the project and its results

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			
Representatives of Ibercaja	**Drone Bee**	Receive and study the final scientific reports	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
Representatives of Hiberus		Help with communication and dissemination activities							
Representatives of the Water and Environment documentation center		Advice							
Teachers of the pilot second									

iteration									
Represe ntatives of INIT						Face to face conversation			
Represe ntatives of Zaragoza Universit y						Project dissemination events			

3.3.3 Campaigns co-designed

Campaign ZARAGOZA 1: Test the effect of forested areas in CO2 absorption.

Research Question/s: Do densely wooded areas have better air quality than less wooded areas?

Hypothesis: Given the capacity of trees to absorb carbon dioxide, a densely forested area should show lower carbon dioxide levels than in areas where trees are not present.

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: 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 logistics and communications hub in the northeast of the Iberian Peninsula, which is why it supports a significant amount of road traffic. Another geographical feature to take into consideration is its location in the Ebro Valley, where it is subjected to continuous air streams and gives it, under normal conditions, a good quality of its air. The impact of these two issues, in principle antagonistic, is an unbeatable starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, together with the involvement of the institutions that will develop it, their facilities and their extensive experience in similar projects of citizen science.

Thus, the objectives of the campaign will be the following.

1. To recruit and involve new citizens who wish to become active participants in the SOCIO-BEE approach (e.g., QB, WB).
2. To test and provide a SOCIO-BEE toolkit for active participants that empowers them to involve more worker bees and other interested stakeholders (i.e., Honey Bears) in pursuing air pollution reduction actions through experimentation and evidence-based research.
3. To run co-creations sessions and collaboration activities for assembling environmental action groups targeting air quality improvement in Zaragoza areas.

Workplan: Zaragoza plans, firstly, to identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (february 23). Secondly, to set/codesign and share the hypothesis (definition: Feb 2023 and redefining it if necessary: March 2023 - just before the pilot starts). Thirdly, to define an area in which to take measurements (first week of March). Fourthly, to conduct the data collection journey (1st campaign from March 1 to mid-April and 2nd campaign from mid-April to end of May). Fifthly, to analyse the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23rd). Sixthly, to go through a continuous evaluation. And seventhly and finally, to do a final evaluation. However, this plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, Zaragoza intends to carry out. In essence, they will carry out two campaigns in the first iteration, with two different hypotheses and in two different areas of the city. Zaragoza intends to carry out the campaigns during the months of April and May (1 month for each campaign). After each campaign they will evaluate the results.

In order 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.

Queen bees and worker bees will be incorporated as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, Zaragoza will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypothesis to work on. For the Bears, the aim is to involve them from the very beginning of the campaigns 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 the hypotheses (this would facilitate their later commitment once we have the results of the campaign), 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.

Risks: Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. Secondly, not being able to get the bees to want to stay involved after the campaign ends. Thirdly, lack of interest from bears to use campaign results as inputs for new policies. And fourthly, the sensors and/or the mobile application are not working properly or are too complicated to use for the target audience.

Location: Regarding campaign blueprints, Zaragoza has selected the blueprint "*Pollinate an area over a longer period (type I)*". The area that will be covered by this campaign will be Area 1 (41.65925187996686, -0.9072107854596443) and Area 2 (41.66107541051995, -0.9046948734086837)

Figure 23. Zaragoza's campaign one zone (SIGPAC Aragon Image).

Materials & Equipment: Regarding the resources needed, Zaragoza requires: 20 wearable sensing devices, the AcadeMe backend platform, the mobile app, some training materials about 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 to be used during the pilot.

Recommendations: Zaragoza likes to point out that at this stage they are not able to identify yet, which functionality SOCIO-BEE tools should provide to Beekeepers, QBs and WBs taking part of the campaign. They need to start the project and see how it works.

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: The Hive will have a clear purpose for the campaign which is to compare the air quality in heavily populated areas with vegetation against low populated ones. Also, it is clear that ones who are going to be benefited by this campaign will be Bears, Queen Bees, Beekeepers, bees and citizens. Regarding the outcomes expected by the campaign are the following. Firstly, to improve urban planning of trees and the delimitation of low emission zones in other countries and, secondly, the City Council working to adapt to European regulations on greenhouse gas emissions. From the new policies that can come out because of this campaign, there can be an increase of urban trees and green areas. It could also help the project called "El Bosque de los Zaragozanos", which is a collaborative initiative promoted by Zaragoza City Council,

which in the coming years will modify the city and its surroundings to create new natural spaces and enhance the health of citizens. And finally, it can impact with better green zones planification.

Success indicator/s:

- ZGZ1.KPI1: # capture of aggregated AQ measurements in locations in Area 1 and 2 with increasing distances (at least 6 increasing distances) to green spaces in Area1 and 2 (>= 12)

- ZGZ1.KPI2: # reports of AQ propagation from centre of Area 1 and Area 2 considering proximity to green area (>= 3)

Campaign ZARAGOZA 2: Analyse the impact of low emission zones on improving air quality

Research Questions: Can the collection of air quality data from the public provide scientific evidence to help better plan low-emission zones in cities with high levels of road traffic?

Hypothesis: Low-emission zones designed by municipalities should have better air quality than traffic-free zones in cities with high traffic density

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, while the first iteration, they do not plan to add any group other than the ones we have indicated. 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: 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 logistics and communications hub in the northeast of the Iberian Peninsula, which is why it supports a significant amount of road traffic. Another geographical feature to take into consideration is its location in the Ebro Valley, where it is subjected to continuous air streams and gives it, under normal conditions, a good quality of its air. The impact of these two issues, in principle antagonistic, is an unbeatable starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, together with the involvement of the institutions that will develop it, their facilities and their extensive experience in similar projects of citizen science.

Thus, the objectives of the campaign will be the following.

1. To recruit and involve new citizens who wish to become active participants in the SOCIO-BEE approach (e.g., QB, WB).

2. o test and provide a SOCIO-BEE toolkit for active participants that empowers them to involve more worker bees and other interested stakeholders (i.e., Honey Bears) in pursuing air pollution reduction actions through experimentation and evidence-based research.

3. To run co-creations sessions and collaboration activities for assembling environmental action groups targeting air quality improvement in Zaragoza areas.

Workplan: Zaragoza plans, firstly, to identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (February 23). Secondly, to set/codesign and share the hypothesis (definition: february23 and redefining it if necessary: March 23 - just before the pilot starts). Thirdly, to define an area in which to take measurements (first week of March). Fourthly, to conduct the data collection journey (1st campaign from March 1 to mid-April and 2nd campaign from mid-April to end of May). Fifthly, to analyse the data collected and draw conclusions. Verify whether the hypothesis has been proved or not. (June 23rd). Sixthly, to go through a continuous evaluation. And seventhly and finally, to do a final evaluation. However, this plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, Zaragoza intends to carry out. In essence, they will carry out two campaigns in the first iteration, with two different hypotheses and in two different areas of the city. Zaragoza intends to carry out the campaigns during the months of April and May (1 month for each campaign). After each campaign they will evaluate the results.

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.

Queen bees and worker bees will be incorporated as soon as we have the necessary tools to start the experiment. In the specific case of the QBs, Zaragoza will be meeting with them before starting the campaigns to jointly design the content as well as to formulate the hypotheses to work on. For the Bears, the aim is to involve them from the very beginning of the campaigns 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 the hypotheses (this would facilitate their later commitment once we have the results of the campaign), 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.

Risks: Some risks are anticipated, firstly, not getting a minimum number of bees to create a hive. Secondly, not being able to get the bees to want to stay involved after the campaign ends. Thirdly, lack of interest from bears to use campaign results as inputs for new policies. And fourthly, the sensors and/or the mobile application not working properly or are too complicated to use for the target audience.

Location: Regarding campaign blueprints, Zaragoza has chosen to pollinate an area over a longer period (type I). The area that will be covered by this campaign will have the centre coordinate of: 41.65625797162715, -0.8788008276381808.

Figure 24. Zaragoza's campaign 2 zone (SIGPAC Aragon Image).

Materials & Equipment: Regarding the resources   needed, Zaragoza requires: 20 devices, the AcadeMe back-end, the mobile app, some training materials about 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 to be used during the pilot.

Recommendations: Zaragoza likes to point out that at this stage they are not able to identify yet, which functionality SOCIO-BEE tools should provide to Beekeepers, QBs and WBs taking part of the campaign. They need to start the project and see how it works.

Methodology: air quality data, sound, free text (insights), pictures and videos, and questionnaires from CS activistis will be gathered. To analyse 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: the Hive will have a clear purpose for the campaign which is to compare restricted areas for road traffic marked by the municipality vs. free traffic areas. Also it is clear that ones who are going to be benefited by this campaign will be Bears, Queen Bees, Beekeepers, bees and citizens. Regarding the outcomes expected by the campaign are the following. First, to improve urban planning of trees and the delimitation of low emission zones in other countries and, second, the City Council working to adapt to European regulations on greenhouse gas emissions. From the new policies that can come out because of this campaign, there can be influencing better planning of low emission zones. And finally, it can impact with a better definition of the low emission zone

Success indicator/s:

- **ZGZ2.KPI1**: # capture of aggregated AQ measurements in several point across low emissions zones in Zaragoza (>= 12)
- **ZGZ2.KPI2**: # comparison of aggregated AQ measurements between low emission zone and representative common zone in Zaragoza, to demonstrate whether AQ in the former is better than in the latter (>= 3)

3.3.4   Pilot execution plan

Table 33. Zaragoza's workplan for iteration 1.

Pre-pilot launch subphase	MS	Phase	When	Action	Description	Target	Comments
C1.1	1	Pre-pilot launch subphase	Feb23	Communication	Internal announcement of the SOCIO-BEE pilot project and its objective.	Staff ZGZ, ZKF	Informal meeting addressed to the staff of the Zaragoza City Council and the Zaragoza City of Knowledge Foundation that will be involved in the execution of the first iteration of the pilot.The meeting is merely informative as the necessary materials are not yet available to hold a hands-on meeting.
T1.1	1	Pre-pilot launch subphase	Feb23	Training	Recap with a small group of alpha testers on the tools that integrate the SOCIO-BEE platform in order to draw a plan for the implementation of test campaigns in the pilot.	Staff ZGZ, ZKF, IBER	Session to design the campaigns to be carried out in the first iteration of the pilot. Broadly speaking, the objectives of the meeting were: Filling out the role definition forms (queen bees, workeerbees, beekeepers, bears, drones ....), definition of the hypotheses to be verified during the execution of the campaigns. Filling out the work plan and the community building plan.
IR1.1	1	Pre-pilot launch subphase	Mar23	Internal release	The pilot officially kicks off	Staff ZGZ, ZKF, IBER	Testers with an active role in the campaigns and other potentially interested agents from within and outside the eTOPIA community.

C1.2	1	Pre-pilot launch subphase	Mar23	Communication	Communication of the start of the pilot to the entire group of alpha testers.	Staff ZGZ, ZKF, IBER	Informal meeting with the full group of alpha testers who will be running the project. eTOPIA's social networks will be used to communicate the start of the project.
T1.2	1	Pre-pilot launch subphase	Mar23	Training	Workshop1: Objective 1: training session with alpha testers informing about purpose, procedures and hypotheses for the compaigns. Objective 2: brainstorming to improve the hypotheses to be validated during the campaign.	Staff ZGZ, ZKF, IBER	Meeting with the full group of alpha testers who will be running the project. One representative from each of the three organizations (ZGZ, ZKF and IBER) is responsible for bringing their group of alpha testers to the meeting. The guidelines for the pilot will be given and the way of working will be explained. Feedback and proposals from the participants will also be collected. These meetings will be recurrent in order to monitor the execution of the pilot, implement improvements and react quickly to any bugs.
S1.2	1	Pre-pilot launch subphase	Mar23	Support	Training of pilot testers about SOCIO-BEE support system (preferably online)	Staff ZGZ, ZKF, IBER	
T1.3	1	Pre-pilot launch subphase	Mar23	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.	Staff ZGZ, ZKF, IBER	
MM1.1	1	Pre-pilot launch subphase	Mar23	Measuring & Monitoring	Guidelines about questionnaire issued to gather feedback from alpha testers		
MM1.2	2	Pre-pilot launch subphase	Mar23	Measuring & Monitoring	Verification and analysis of information collected during the pre-pilot phase		Identification of new actions to be undertaken to improve the testing experience and maximize

							the results of the process.
ER2	2	Pilot-execution subphase	Apr23	External release	External release of SOCIO-BEE platform and citizen science campaigns, knowledge base and toolkit		
C2.1	3	Pilot-execution subphase	Apr23	Communication	Announcement of pilot public start		
EX2.1	3	Pilot-execution subphase	Apr23	Execution	Execution of the first campaign to validate hypothesis 1		
M2.1	3	Pilot-execution subphase	Apr23	Measuring & Monitoring	Continuous monitoring of the execution of the first campaign. Checking that the measurements are correctly taken, that the data are correctly stored and that the questionnaires are completed.		In case any failure is detected, the support protocol designed to solve it will be used (mailing address and report to the technical team).
EV2.1	3	Pilot-execution subphase	Apr23	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	3	Pilot-execution subphase	May23	Execution	Execution of the second campaign to validate hypothesis 2		This part will require participatory sessions to share the results obtained during the campaign.
M2.2	3	Pilot-execution subphase	May23	Measuring & Monitoring	Continuous monitoring of the execution of the first campaign. Checking that the measurements are correctly taken, that the data are correctly stored and that the questionnaires are completed.		It will not be addressed only to the members who have actively participated in the data collection, but the session will be open to other agents with less involvement during the campaign but who may still be interested in the results.

EV2.2	3	Pilot-execution subphase	May23	Evaluation	Campaign 2: share the results - verify the hypothesis		
EV2.3	3	Post-execution subphase	Jun23	Evaluation	Preparation of the final evaluation report on the outcome of the campaigns: analysis of key performance indicators, records and questionnaires.		
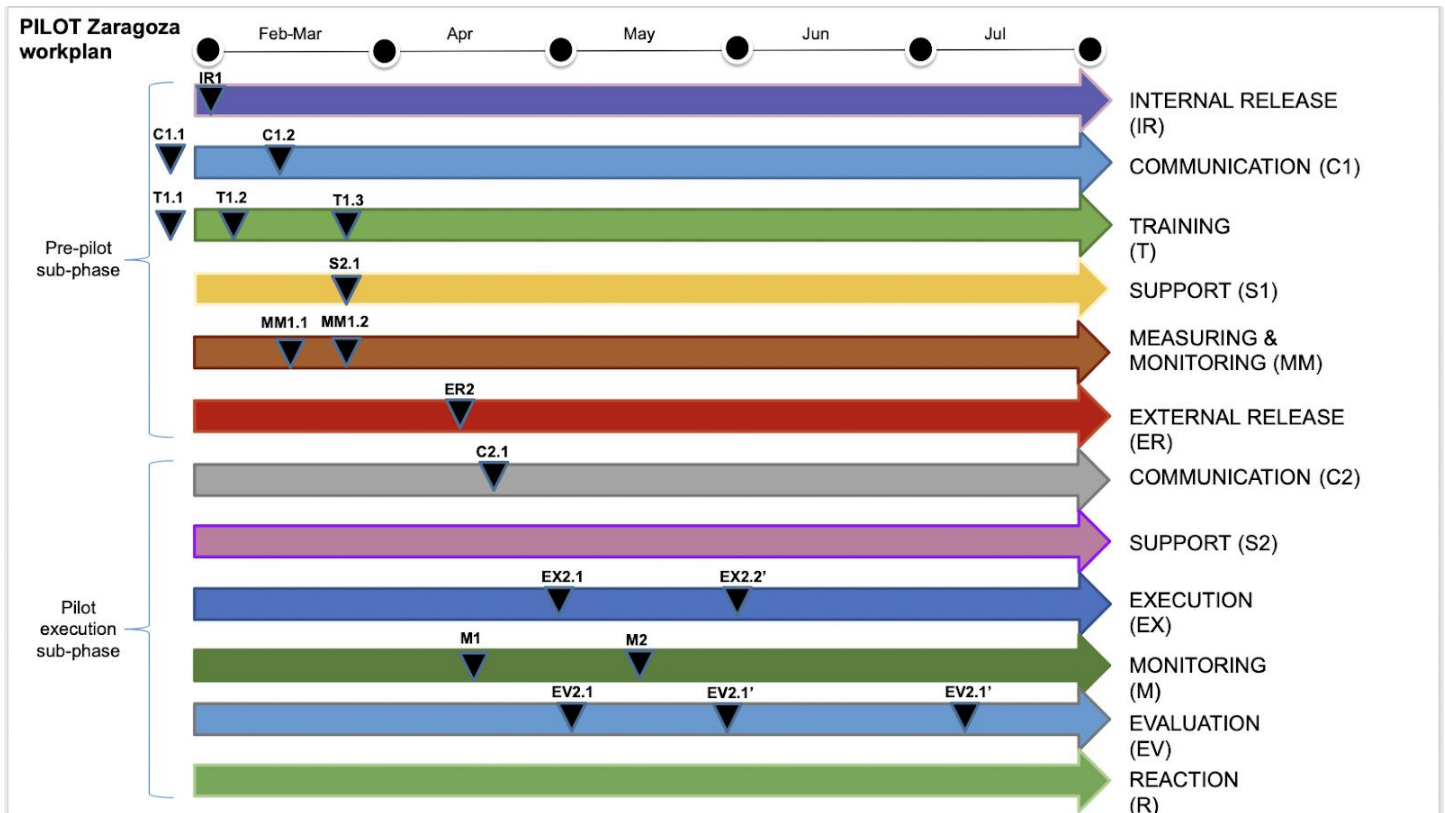
Figure 25. Zaragoza's workplan for iteration 1.

3.3.5   Community building plan

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.
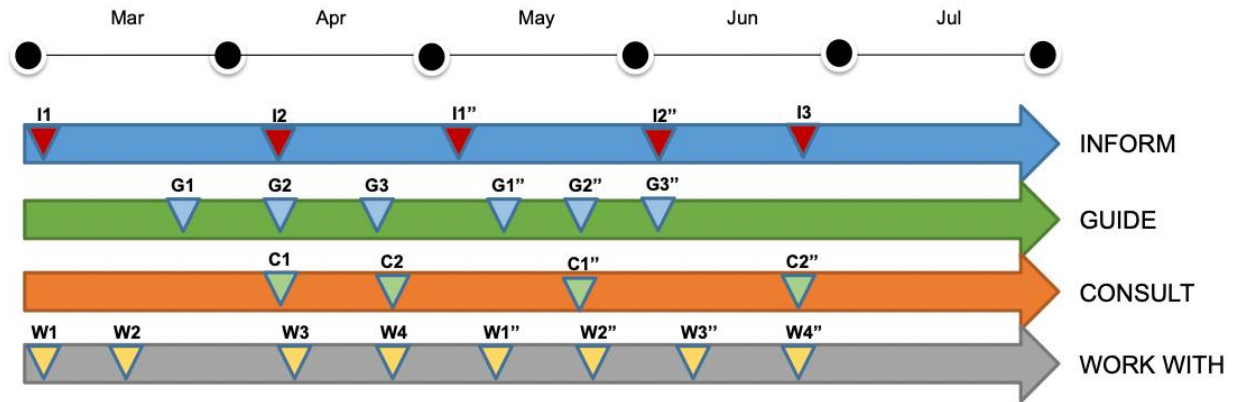
Figure 26. Zaragoza's community building plan for iteration 1.

Some of the activities planned to be carried out during the first iteration of the Zaragoza pilot are described below. As shown in the tables, there are some activities programmed for a pre-pilot phase, others for the pre-pilot phase and others that will be carried out in the execution phase of the pilot. It is in this execution phase where, it is expected, more activities will be carried out as it comprises the two campaigns that we have planned to launch from our pilot.

Table 34. Zaragoza's I1 engagement activity description.

I1	INFORM - Pilot preparation meeting
Objective	Meeting between the pilot coordinators and the ZGZ Pilot team to set a baseline. Set the guidelines of the pilot and its chronogram.
Phase	BEFORE PRE-PILOT (MAR)
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	A fully agreed chronogram and the distribution of task between the team members
Location	Etopia Center for Art and Technology

Date	March 2023

Table 35. Zaragoza's W2 engagement activity description.

W2	WORK WITH - Campaigns design meeting
Objective	Design the two pilot iteration campaigns
Phase	PRE-PILOT SUBPHASE
Target artefacts	SOCIO-BEE campaigns templates
Target groups	Pilot team members
Disseminaiton materials	N/A
Evaluation mechanisms	A review meeting after the pilot activities start
Outcomes	2 documents filled in with all the information about the campaigns: scientific question, hypothesis, measurement and data collection methodology, expected results
Location	Etopia Center for Art and Technology
Date	February 2023

Table 36. Pilot's G2 engagement activity description PRE-PILOT PHASE (March).

G2	GUIDE - 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 (APR)
Target artefacts	SOCIO-BEE toolkit for engagement items (didactic material about CS)
Target groups	Testers Team
Disseminaiton materials	email

Evaluation mechanisms	Number of attendees
Outcomes	A testers team aligned with the objectives of the pilot
Location	Etopia Center for Art and Technology
Date	April 2023

Table 37. Zaragoza's I1 engagement activity description.

I1	**INFORM - Internal Release**
Objective	Hands on learning session for the pilot team about the pilot technology
Phase	PRE-PILOT PHASE (APR)
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	sensors, web platform, mobile app, training materials
Disseminaiton materials	N/A
Evaluation mechanisms	Number of attendees
Outcomes	A tester team full understanding about the technology to be used in the campaigns
Location	Etopia Center for Art and Technology
Date	April 2023

Table 38. Zaragoza's G3 engagement activity description.

G3	**GUIDE - Training session (workshop) about the experiments and campaigns**
Objective	Work with the testers team to introduce the scientific and data collection methodology of the pilot through the technology provided by the project.
Phase	PRE-PILOT PHASE (APR)

Target artefacts	sensors, web platform, mobile app, training materials
Target groups	Testers Team
Disseminaiton materials	SOCIO-BEE general presentation SENSORS + MOBILE APP Collaborative Environment (Interlink project)
Evaluation mechanisms	Number of attendees
Outcomes	A tester team full understanding about the technology to be used in the campaigns
Location	Etopia Center for Art and Technology
Date	April 2023

Table 39. Zaragoza's W4 engagement activity description.

W4	WORK WITH - Kicking off the first campaign.
Objective	• Collaborative session with the entire group of alpha 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. • Finishing the last details before going out to take the measurements on the street.
Phase	PILOT-EXECUTION
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	Pilot team members (ZGZ, ZKF, IBER)
Disseminaiton 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	Etopia Center for Art and Technology
Date	April 2023 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 40. Zaragoza's W1'' engagement activity description.

W1"	WORK WITH - Measurement taking campaign 1
Objective	• Taking measurements in the area of zone 1
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	Institutions staff - public servants - researchers - makers - activists - teachers
Disseminaiton materials	Brochure, email
Evaluation mechanisms	- Attendee's list - short survey
Outcomes	Brochure, email
Location	Etopia Center for Art and Technology
Date	Beginning of april

Table 41. Zaragoza's C1'' engagement activity description.

C1"	CONSULT - Follow-up meeting on campaign 1 measurements.
Objective	• Weekly follow-up meetings will be held to confirm that everything is going as expected. • These meetings will also serve to share doubts, lessons learned, suggestions, etc… • Follow-up meetings with the team of testers will be weekly. They may be in online or face-to-face format at the convenience of the participants.
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE toolkit for engagement items
Target groups	Pilot team members (ZGZ, ZKF, IBER)
Disseminaiton materials	- Collaborative environment (project INTERLINK)

Evaluation mechanisms	- Attendee's list - short survey - Collaborative environment (project INTERLINK)
Outcomes	To be sure that campaigns are being executed as planned.
Location	Etopia Center for Art and Technology
Date	April 2023 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 42. Zaragoza's C2'' engagement activity description.

C2''	CONSULT - Closing and evaluation meeting of the first campaign (internal)
Objective	• Define a strategy to visualize the data collected. • Analyze the data to verify if the hypothesis is true or not.
Phase	PILOT EXECUTION
Target artefacts	
Target groups	TESTERS TEAM
Disseminaiton materials	- Attendee's list and short survey - Photos and questionnaires filled in
Evaluation mechanisms	- Attendee's list - short survey
Outcomes	Make conclusions about how the pilot interaction went.
Location	Etopia Center for Art and Technology
Date	April 2023

Table 43. Zaragoza's I3 engagement activity description.

I3	INFORM - Communication of results to the public (campaign 1)
Objective	• Presentation of the results in eTOPIA. • Participants will report the results of the experiment and share their experience with the rest of the audience.

	• The presentation will be open to the general public although those who have participated in the campaign will have a more relevant role in the event.
Phase	PILOT EXECUTION
Target artefacts	SOCIO-BEE general presentation SENSORS + MOBILE APP + WEB (VIDEO? -> to be confirmed)
Target groups	GENERAL PUBLIC
Disseminaiton materials	- Attendee's list and short survey - Photos and questionnaires filled in
Evaluation mechanisms	- Attendee's list - short survey
Outcomes	conclusions, feedback and dissemination of results
Location	Etopia Center for Art and Technology
Date	April 2023

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.

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. 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.

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.

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.

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.

SOCIO-BEE adopts an 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-without SOCIO-BEE phase
  - POST-with SOCIO-BEE 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 SOCIO-BEE approach, tools and co-designed experiments; 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.
- The PRE-without SOCIO-BEE phase tackles the establishment of a baseline before SOCIO-BEE approach is adopted to foster CS experiments mediated evidence gaining for decision-making by beta testers within interaction 1. It is executed during the first 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 alpha release of SOCIO-BEE platform which will be made available as beta release to beta testers in pilot execution sub-phase of iteration 1. After the execution of this latter sub-phase (pilot-execution sub-phase), i.e. end of iteration 1, release 1 of the SOCIO-BEE platform will be produced.
- The POST-with SOCIO-BEE Phase encompasses the two pilot iterations: *Exploration* (1) and *Consolidation* (2). It will concretely cover the *pilot-execution sub-phase* of iteration 1 and the two sub-phases of iteration 2. However, in the pre-pilot execution phase of iteration 2, alpha testers will again be involved to help finetuning release 1 of the SOCIO-BEE platforms which will be used in iteration 2 to deliver SOCIO-BEE's release 2.
- 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: **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-Without SOCIO-BEE and POST-With SOCIO-BEE and b) differences between end-user stakeholders participating in PRE-Without SOCIO-BEE and in

POST-With SOCIO-BEE. 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.

Figure 27 shows the pilots evaluation process planned for iteration 1. Departing from the alpha version of the platform, the pre-pilot execution subphase will be executed, with the help of alpha testers, delivering the beta release of the solution of SOCIO-BEE. From the beta release, the pilot execution subphase will be carried out delivering release 1 of the platform. As observed in Figure 27, 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 test*s [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.
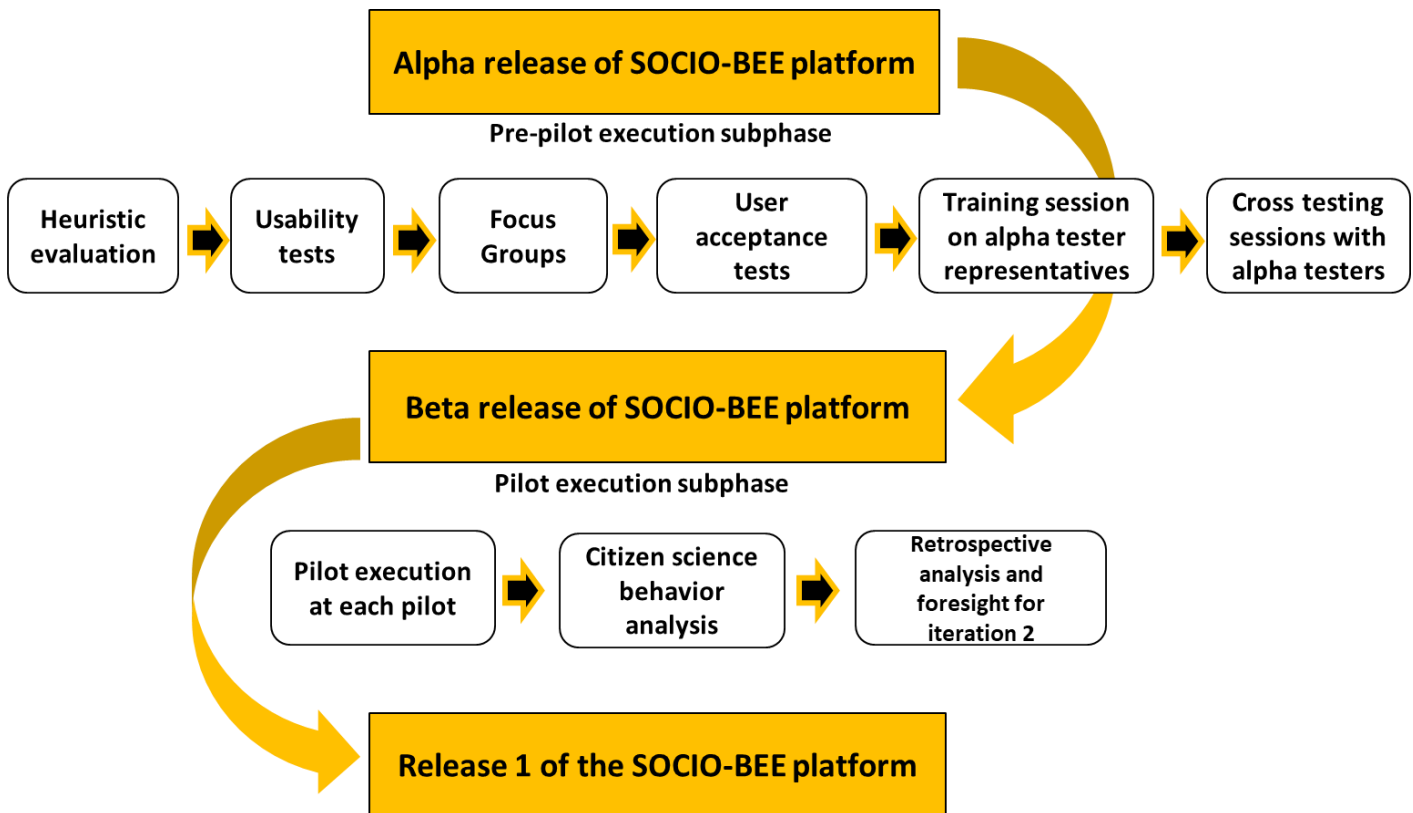
Figure 27. SOCIO-BEE's pilots' evaluation process.

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.

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

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 Mastersheet. Such spreadsheet contains the following tabs:

- *KPIs management*: this KPI tab/view indicates (see Figure 28) 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 29) how per each month of iteration 1 independent columns for each of the 3 pilots and the global value achieved in that month in iteration 1 for every KPI is included.
- *KPIs distribution per pilot*: this view distributes (see Figure 30) the load of contributing for each KPI among the 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.

KPI	Description	Responsible	Objective	Justification	Iteration 1				Iteration 2				TOTAL
					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 & back-end manager (CERTH)	500-1000	Satisfaction questionnaire. In all co-design workshops organized by pilots, they should make participants complete this satisfaction and demographic questionnaire	100	100	100	300	200	200	200	600	1200
KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	Pilot owners	>= 70%	Evaluation questionnaire (POST campaign). Questions 25 and 26. The indicated questions ask about awareness. Notice that it is important to measure awaress BEFORE campaign execution and AFTER campaign execution	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%
KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	WP4	1	We need to publish publicly SOCIO-BEE toolkit, probaby in Zenodo or better repository. Source code in GitHub repository				1				1	1
KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	WP4	>=3	We need to make available the platform twice in eu-citizen.science. 3 releases, iteration 1, iteration 2 and final				1				2	3
KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	WP4	>= 2	This means that 2 releases of the platform have to be produced. 1 release per iteration. They should correspond to v1.0 and v2.0 tags in GitHub repos.				1				1	2
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 personal wearables and drones	Bettair, ID2M	1	In iteration 1 by end of July 2023 this should have happened in the three pilots. By 2024 final versions should be available. Videos demonstrating it could be provided.				1				1	2
KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device demonstrating versatility of the solution	Bettair	3	3 interchangeable sensor modules				1				2	3
KPI2.3	Number of wearable deviced produced	Bettair	226	60 at the end of iteration 1				60				166	226
KPI 3	**Citizen Science platform KPIs**	**CERTH**											

Figure 28. Snapshot of "KPIs management" tab of KPIs master sheet.

KPI	Description	Objective	Iteration 1 Ancona	Marousi	Zaragoza	Global	Iteration 2 Ancona	Marousi	Zaragoza	Global	TOTAL	It.1 May 2023 Ancona	Marousi	Zaragoza	Global	It.1 June 2023 Ancona	Marousi	Zaragoza	Global
KPI 1	**Air pollution reduction support initiatives KPIs**																		
KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	500-1000	100	100	100	300	200	200	200	600	1200								
KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%								
KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	1				1				1	1								
KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	>=3				1				2	3								
KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	>= 2				1				1	2								
KPI 2	**Low-cost modular wearable sensor solution KPIs**																		
KPI 2.1	Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into personal wearables and drones	1				1				1	2								
KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device demonstrating versatility of the solution	3				1				2	3								
KPI2.3	Number of wearable deviced produced	226				60				166	226								
KPI 3	**Citizen Science platform KPIs**																		
KPI 3.1	% of EU citizens use the micro volunteering app to gather evidence	>= 95%				80%				95%	95%								
KPI 3.2	Technology acceptance rate	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 80%	>= 80%	>= 80%	>= 80%	>= 80%								
KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	>= 90%	>= 80%	>= 80%	>= 80%	>= 80%	>= 90%	>= 90%	>= 90%	>= 90%	>= 90%								
KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%								
KPI 3.3a	Level of usability and accessibility of pilot artefacts	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%								
KPI 4	**Open and sustainable decision-making KPIs**																		
KPI 4.1	Availability of open science repository in Zenodo connected with SOCIO-BEE platform	1				1				1	1								
KPI 4.2	# of datasets with at least 5 pollutants per pilot case	>=6	1	1	1	3	2	2	2	6	9								
KPI 4.2a	Publication of open datasets generated in two iterations of pilots	>=6	1	1	1	3	2	2	2	6	9								
KPI 4.2b	Access to the open science datasets created by the project	>= 5000				>= 2000				>= 3000	>= 5000								
KPI 4.2c	Higher accuracy finer grained pollution datasets (compared with open datasets from public stations)	>= 50%				>= 40%				>= 50%	>= 50%								
KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	>= 70%	>= 60%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%	>= 70%								
KPI 4.4	Number of experts/researchers participating and mentoring in the SOCIO-BEE platform	4				2				2	4								
KPI 5	**Citizen Science application KPIs**																		
KPI 5.1	Pilot deployments in different pilot sites	6	1	1	1	3	2	2	2	6	9								
KPI 5.2	# of hypothesis or what-if scenarios addressed	15	2	2	2	6	3	3	3	9	15								
KPI 5.3	#blue prints and templates available for reducing air pollution in pilots	>= 6	1	1	1	3	2	2	2	6	9								
KPI 5.4	Demonstration of spreading of use case by exchanging CS blueprints in pilots	>=4	1	1	1	3	1	1	1	3	6								
KPI 5.5	% of new citizens engaged after outreaching capabilities	16%	baseline	baseline	baseline	baseline	16%	16%	16%	16%	16%								
KPI 5.6	Demonstration of scaling use case in pilots from iteration 1 to iteration 2	>= 40%	baseline	baseline	baseline	baseline	40%	40%	40%	40%	40%								
KPI 6	**Legal, ethical, inclussion KPIs**																		
KPI 6.1	Number of studies in relation to legal and ethical requirements	>= 3	1	1	1	3	1	1	1	3	6								
KPI 6.1a	# audit of legal compliance of pilots per iteration	>=3	1	1	1	3	2	2	2	6	9								
KPI 6.1b	# audit of social values compliance per pilot per iteration	>=3	1	1	1	3	2	2	2	6	9								
KPI 6.2	Number of privacy-preserving organisational and technological measures implemented during the project lifecycle	>=5	1	1	1	3	1	1	1	3	6								
KPI 7	**Business development KPIs**																		
KPI 7.1	Business model canvas for 2 types of business and financing models	2				1				1	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				1				1	2								
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								1	1								

Figure 29. Snapshot of "KPIs monitoring" tab of KPIs master sheet.

KPI	Description	Objective	Iteration 1 Ancona	Marousi	Zaragoza	Iteration 2 Ancona	Marousi	Zaragoza	TOTAL
KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	500-1000	100	100	100	200	200	200	900
KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	>= 70%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
KPI 3.2	Technology acceptance rate	>= 60%	>= 70%	>= 70%	>= 70%	>= 80%	>= 80%	>= 80%	>= 80%
KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	>= 90%	>= 80%	>= 80%	>= 80%	>= 90%	>= 90%	>= 90%	>= 90%
KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	>= 70%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
KPI 3.3a	Level of usability and accessibility of pilot artefacts	>= 70%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
KPI 4.2	# of datasets with at least 5 pollutants per pilot case	>=6	1	1	1	2	2	2	9
KPI 4.3	Accessibility and adoption rate of the intelligence supporting tools	>= 70%	>= 60%	>= 60%	>= 60%	>= 70%	>= 70%	>= 70%	>= 70%
KPI 5.1	Pilot deployments in different pilot sites	6	1	1	1	2	2	2	9
KPI 5.2	# of hypothesis or what-if scenarios addressed	15	2	2	2	3	3	3	15
KPI 5.3	#blue prints and templates available for reducing air pollution in cities	>= 6	1	1	1	2	2	2	9
KPI 5.4	Demonstration of spreading of use case by exchanging CS blueprints in pilots	>=4	1	1	1	1	1	1	6
KPI 5.5	% of new citizens engaged after outreaching capabilities	16%	baseline	baseline	baseline	16%	16%	16%	16%
KPI 5.6	Demonstration of scaling use case in pilots from iteration 1 to iteration 2	>= 40%	baseline	baseline	baseline	40%	40%	40%	40%
KPI 6.1a	# audit of legal compliance of pilots per iteration	>=3	1	1	1	2	2	2	3
KPI 6.1b	# audit of social values compliance per pilot per iteration	>=3	1	1	1	2	2	2	3
KPI 8.1	# Queen Bees recruited by pilot and iteration	>= 3	1	1	1	1	1	1	6
KPI 8.2	# Bears involved by pilot and iteration	>= 3	1	1	1	1	1	1	6
KPI 8.3	# Working Bees involved by pilot and iteration	>= 20	20	20	20	20	20	20	120
KPI 8.4	# Societal groups involved	>= 3	1	1	1	1	1	1	6
KPI 8.5	% Women participation	>=50%	50%	50%	50%	50%	50%	50%	50%
KPI 8.6	% Inclusivity rate target	>= 85%	50%	50%	50%	85%	85%	85%	85%
KPI 8.7	# Citizens actively collecting air quality data via wearables	>=200	50	50	50	100	100	100	450
KPI 8.8	# Citizens actively collecting multimedia data of air quality pollution sources	>=200	50	50	50	100	100	100	450
KPI 8.9	# Citizens using microvolunteering app to gather measurements	>=450	100	100	100	200	200	200	900
KPI 9.3	"Word of mouth" communication campaigns per pilot	>=2	1	1	1	2	2	2	9
KPI 9.6	Cities using SOCIO-BEE	>=3	1	1	1	1	1	1	3
KPI 9.9	Interest in the project by local populations (downloads materials)	>=1000	150	150	150	300	300	300	1350
KPI 12.1	Increased interest or engagement in science	>= 80%	baseline	baseline	baseline	>= 80%	>= 80%	>= 80%	>= 80%
KPI 12.2	Intention to be involved in new citizen science projects	>= 75%	baseline	baseline	baseline	>= 75%	>= 75%	>= 75%	>= 75%
KPI 12.3	Improved participant understanding of science	>= 50%	baseline	baseline	baseline	>= 50%	>= 50%	>= 50%	>= 50%
KPI 12.4	Better participant attitudes toward science	>= 75%	baseline	baseline	baseline	>= 75%	>= 75%	>= 75%	>= 75%
KPI 12.5	Increased participant interest in science as a career	>= 35%	baseline	baseline	baseline	>= 35%	>= 35%	>= 35%	>= 35%
KPI 13.1	Total # of workshops/webinars by end of project	>=5	1	1	1	2	2	2	9
KPI 13.2	# of Attendees per workshop (average)	>= 30	20	20	20	30	30	30	30
KPI 13.7	# articles in local newspapers	>= 6	1	1	1	2	2	2	9
KPI 13.16	# of videos produced for project purposes	>=2	0	0	0	1	1	1	3

Figure 30. 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 can 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 Mastersheet. As indicated in the KPI mastersheet 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 (>=226)
  - 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 (>=6)
  - 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 Mastersheet, most of these KPIs can be solved by issuing SQL queries to the Data Model that holds the logic of SOCIO-BEE platform:

- o KPI 1.1 – Total number of EU citizens involved in the co-design process (surveyed or interviewed) (Objective: in range 500-100)
- o KPI 3.1 – % of EU citizens use the micro volunteering app to gather evidence (>= 95%)
- o KPI 4.4 – Number of experts/researchers participating and mentoring in the SOCIO-BEE platform (>=4)
- o KPI 5.1 – Pilot deployments in different pilot sites (>=6)
- o KPI 5.2 – Number of hypothesis or what-if scenarios addressed (>=15)
- o KPI 5.4 – Demonstration of spreading of use case by exchanging CS blueprints in pilots (>=4)
- o KPI 8.1 – Queen Bees recruited by pilot and iteration (>=3)
- o KPI 8.2 – Bears involved by pilot and iteration (>=3)
- o KPI 8.3 – Working Bees involved by pilot and iteration (>=20)
- o KPI 8.4 – Societal groups involved (>=3)
- o KPI 8.5 – Women participation (>=50%)
- o KPI 8.6 – Inclusivity rate target (>=85%)
- o KPI 8.7 – Citizens actively collecting air quality data via wearables (>=200)
- o KPI 8.8 – Citizens actively collecting multimedia data to identify air quality pollution sources (>=200)
- o KPI 8.9 – Citizens using the micro volunteering app who have gathered at least one measurement (>=450)
- o KPI 8.10 – National institutions reached by the project (>=10)
- o KPI9.6 – Cities using SOCIO-BEE (>=3)
- o KPI9.12 – Relevant financing institutions involved in the seminars (>=3)
- o KPI10.1 – Visualizations of AcadeMe tutorial video (>= 1000)
- o KPI10.2 – Accesses to SOCIO-BEE AcadeMe portal (>= 3000)
- o KPI11.1 – User willing to follow recommendations (>= 70%)
- o KPI13.1 – Total # of workshops/webinars by end of project (>=5)
- o KPI13.2 – Number of Attendees per workshop (>= 30)
- o KPI13.3 – # of Events by end of project (>=1)
- o KPI13.4 – # of Attendees for the final event (>= 50)
- o KPI13.5 – total # of project presence in events (national & international) (>= 15)
- o KPI13.8 – Access to project website (>= 100)
- o KPI13.9 – Numbers of participant visits to project Web sites (>= 5000)
- o KPI13.10 – total # of visits (sessions) by end of project (>= 10000)
- o KPI13.11 – AVG Duration (time spent) per session in minutes (>= 3)
- o KPI13.12 – Total # of followers (Facebook, Twitter, LinkedIn) by end of project (>= 1800)
- o KPI13.13 – Total # of Newsletters by end of project (>= 6)
- o 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:
  - o KPI 3.2 – Technology acceptance rate (>=80%)
    - ▪ KPI 3.2a – User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform (>= 90%)
  - o 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%)
  - o KPI 4.3 – Accessibility and adoption rate of the intelligence supporting tools (>= 70%)
  - o KPI 8.11 – Positive feedback from relevant institutions (>= 50%)
  - o KPI9.9 – Interest in the project by local populations - downloads of materials (>=1000)

- **Value provided**.. This dimension serves to asses 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 Mastersheet, 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:

  - o K1.2 – % of EU citizens who feel more aware of air pollutions issues after being involved in SOCIO-BEE (Objective:>= 70%)
  - o KPI4.2 – Number of relevant datasets from pollutant types analysed, at least 5 pollutants 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%)
  - o KPI 5.5 – % of new participating citizens engaged because of SOCIO-BEE outreaching capabilities after initial campaigns (>=16%)
  - o KPI 5.6 – Demonstration of scaling use case in pilots from iteration 1 to iteration 2 (=40%)
  - o 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)
  - o KPI9.1 – White book with recommendations on how CS can impulse citizen engagement and their pro-environmental behavioural change (>=1)
  - o KPI9.4 – Meeting with European Institutions regarding the management of citizen initiatives (>=2)

- o KPI9.5 – Proof of Value outside the consortium uses of SOCIO-BEE artefacts (>=2)
- o KPI9.7 – Institutional toolkit sent to local authorities (>=3000)
- o KPI9.8 – CO2 emission reduction related to citizens involved in the project (-15%)
- o KPI 9.10 – Improving social and open innovation capacity - new initiatives (>=6)
- o KPI9.11 – Impact on employment - new employments (>=6)
- o KPI12.1 – Increased interest or engagement in science (>= 80%)
- o KPI12.2 – Intention to be involved in new citizen science projects (>= 75%)
- o KPI12.3 – Improved participant understanding of science (>= 50%)
- o KPI12.4 – Better participant attitudes toward science (>= 75%)
- o KPI12.5 – Increased participant interest in science as a career (>= 35%)
- o KPI13.6 – total # of publications (conferences & journals) (>= 8)
- o KPI13.7 – Articles in local newspapers (>= 6)
- o KPI13.15 – total # of brochures by end of project (>= 2)
- o KPI13.16 – total # of videos produced for project purposes (>=2)

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

In summary, we will consider that **iteration 1's piloting is successful iff** the following three **conditions associated to its evaluation dimensions** are met:

- ● **Usage**:
  - ○ **availability and compliance** - a legally compliant SOCIO-BEE platform is delivered in time, i.e. before iteration 1's pilot execution sub-phase is started in May 2023.
  - ○ **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 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.

4.5   Qualitative and quantitative measures for evaluation

Table 44 depicts the evaluation dimensions and constructs that will be assessed in the pilots and what mechanism will be used to measure those dimensions.

Table 44. 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 Cognitive walkthrough 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, in order 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 fine tune 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

- 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

- 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

In order to organize the planning and then operation of the pilots, pilot owners have been provided with Table 45 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 1. 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 mastersheet 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 1 and the rest of the project.

- A set of questionnaires, including the above mentioned questionnaires which are further elaborated in Table 46, 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 45. 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 46	
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 46 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 1. You may access the contents of the onboarding questionnaires by clicking on their associated links in column "resource location".

Table 46. 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 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-ZapP2s7O1fVIyB1PZAvKTmgIbRa6Kw/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)	The purpose of this questionnaire is to give ALPHA testers during the pre-pilot execution sub-phase of iteration 1 to provide FEEDBACK	It should be filled in by an alpha tester every time that s/he tests one of the	PDF publicly accessible

		regarding the SOCIO-BEE platform. This feedback will be used by the technical team to finetune the SOCIO.BEE technical solution.	components of the SOCIO-BEE platform.	
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 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 analysisñ.	PDF publicly accessible

By the start of iteration 1's pilot execution sub-phase in May 2023, the earlier mentioned master KPI sheet will be shared with pilots and their fulfilment distributed among pilots and project partners where monthly, from May to July 2023, 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 31 you can see an extract of the monitoring table contents. Notice, on the right hand side, how the columns associated to "May 2023" would be repeated for the June and July 2023 months. More details about the contents of this KPIs master sheet were given in section Evaluation dimensions' KPIs.

KPI	Description	Objective	Iteration 1 Ancona	Iteration 1 Marousi	Iteration 1 Zaragoza	Iteration 1 Global	Iteration 2 Ancona	Iteration 2 Marousi	Iteration 2 Zaragoza	Iteration 2 Global	TOTAL	May 2023 Ancona	May 2023 Marousi	May 2023 Zaragoza	May 2023 Global
KPI 1	**Air pollution reduction support initiatives KPIs**														
KPI 1.1	# EU citizens involved in the design process (surveyed or interviewed)	500-1000	100	100	100		200	200	200		900				
KPI 1.2	% of EU citizens more aware of air pollutions issues through SOCIO-BEE	>= 70%	>= 60%	>= 60%	>= 60%		>= 70%	>= 70%	>= 70%		>= 70%				
KPI 1.3	Availability of integrated, ready-to-use CS co-creation platform and the engagement toolkit	1				1				1	1				
KPI 1.3a	SOCIO-BEE platform open source releases at https://eu-citizen.science/	>=3				1				2	3				
KPI 1.3b	Publication in GitHub repository of SOCIO-BEE platform and toolkits	>= 2				1				1	2				
KPI 2	**Low-cost modular wearable sensor solution KPIs**														
KPI 2.1	Integrated, ready-to-use SOCIO-BEE compatible low-cost sensing devices integrated into personal wearables and drones	1				1				1	2				
KPI 2.2	Availability of interchangeable and attachable sensor modules to SOCIO-BEE wearable device demonstrating versatility of the solution	3				1				2	3				
KPI2.3	Number of wearable deviced produced	226				60				166	226				
KPI 3	**Citizen Science platform KPIs**														
KPI 3.1	% of EU citizens use the micro volunteering app to gather evidence	>= 95%				80%				95%	95%				
KPI 3.2	Technology acceptance rate	>= 60%	>= 70%	>= 70%	>= 70%		>= 80%	>= 80%	>= 80%		>= 80%				
KPI 3.2a	User's appreciation (satisfaction) of the SOCIO-BEE (AcadeMe) platform	>= 90%	>= 80%	>= 80%	>= 80%		>= 90%	>= 90%	>= 90%		>= 90%				
KPI 3.3	Perceived usability scorerelated to how the solution fits in their everyday life	>= 70%	>= 60%	>= 60%	>= 60%		>= 70%	>= 70%	>= 70%		>= 70%				
KPI 3.3a	Level of usability and accessibility of pilot artefacts	>= 70%	>= 60%	>= 60%	>= 60%		>= 70%	>= 70%	>= 70%		>= 70%				
KPI 4	**Open and sustainable decision-making KPIs**														
KPI 4.1	Availability of open science repository in Zenodo connected with SOCIO-BEE platform	1													
KPI 4.2	# of datasets with at least 5 pollutants per pilot case	>=6	1	1	1		2	2	2		9				
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 4.3	Accessibility and adoption rate of the intelligence supporting tools	>= 70%	>= 60%	>= 60%	>= 60%		>= 70%	>= 70%	>= 70%		>= 70%				
KPI 4.4	Number of experts/researchers participating and mentoring in the SOCIO-BEE platform	4													
KPI 5	**Citizen Science application KPIs**														
KPI 5.1	Pilot deployments in different pilot sites	6	1	1	1		2	2	2		9				
KPI 5.2	# of hypothesis or what-if scenarios addressed	15	2	2	2		3	3	3		15				
KPI 5.3	#blue prints and templates available for reducing air pollution in cities	>= 6	1	1	1		2	2	2		9				
KPI 5.4	Demonstration of spreading of use case by exchanging CS blueprints in pilots	>=4	1	1	1		1	1	1		6				

Figure 31. 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 47. 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 and is an output of Task 5.3. This is the first version of the deliverable and will evolve during the project (update in month M27 – December 2024). 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 1 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 1. 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 1.

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 1.

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 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 32. SOCIO-BEE's pilot flyer in Greek.

GA No: 101037648

Figure 33. SOCIO-BEE's pilot flyer in Italian.

Figure 34. SOCIO-BEE's pilot flyer in English.

Figure 35. SOCIO-BEE's pilot flyer in Spanish.

ANNEX B. Campaign templates filled in by pilots

Campaign ANCONA 1: Compare air quality measurement in the city centre, with the reference stations

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	**YES**	NO	NA	**Site associations**
	Do you have one or more Bears in your campaign?	**YES**	NO	NA	**Municipality. UNIVPM and ARPAM**
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	**Seniors recruited from Association for elderlies' Right (ADA) and municipality**
	Do you have (a group of) Bees?	**YES**	NO	NA	**Elders recruited from associations and volunteers**
	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	**UNIVPM Social media, Municipality Press Office and Communication Office**
	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?	Capillar mapping of the air quality in the central area of the city.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	• Find critical zones • Inform citizens about air pollution			

	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Taking into consideration the natural conformation of the territory and artificial factors, such as maritime and road traffic, is it sufficient to measure the air quality in the city using the two fixed stations? Are there in the center less polluted than others?			
	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 air quality in the city center should be measured at several points by increasing the spatial resolution of the measurements, instead of considering only the two reference stations.
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.? comp	**YES**	NO	NA	• 1) Identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (march 23) • 2) Set/Codesign and share the hypothesis (definition: february 23 and redefining it if necessary: march 23 - just before the pilot starts) • 3) Define an area in which to take measurements (already defined) • 4) Conduct the data collection journey. • 4.1) 1st campaign from April 1 to mid-May • 4.2) 2nd campaign from mid-MAy to end of June • 5) Analyze the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23rd) • 6) Continuous evaluation • 7) Final evaluation • This plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, we intend to carry out**.**

		YES	NO	NA	
	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	- meetings with the hive members - Online communication with the hive members with reminders and the campaign achievements - Reach a minimum number of participants
	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	QBs: we will be meeting with them before starting the campaigns to jointly design the content as well as to agree on the hypotheses formulated WB: we will incorporate them as soon as we have the necessary tools to explain the experiment. .
	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 could involve them from the 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 getting a minimum number of bees to create a hive. • Not being able to get the bees to want to stay involved after and during the campaign. • Lack of interest from bears to use campaign results as inputs for new policies. • The sensors and/or the mobile application not working properly or are too complicated to use for our target audience.

Location - WHERE	What campaign blueprint is chosen?	Pollinate an area over an area in the city center of the city (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 : Around the city centre of Ancona (43.617603, 13.513020)
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:** - Material to contact new potential hive's representatives · 20 devices - - Properly working app and platform· - Communication material (brochures, leaflets, online material to call people to participate) - Training material**.**
	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?	- QBs and WBs: ANCONA finds it very crucial that end-users will get an indication of the pollution instantly after their measurement , in the SOCIO-BEE application. - Beekeepers and QBs should be informed about the data collected by WBs. .			
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. Pollinize the overall area of the city centre (horizontally) - capillar pollinization (type I, exploring a physical area).			
	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.			Air Quality Questionnaires from CS activisist Optional: pictures and videos, depending on technical scholarization of seniors

	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.	- Traditional statistical analysis and AI techniques			
	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?	- Involved citizens in the campaigns - % of days when average air quality levels are below/over the recommended threshold - Visualize KPIs for the most and less polluted area in the city centre			
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:** the Hive should be more aware about the air quality in the city centre and be sensibilized for acting mitigation strategies.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** All the community will benefit, even if the target are seniors.
	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 of air quality and the report			
	Any possible policies for which the results of this campaign could help to?	Promotion of open air activity and urban qualification. Data can be showed to relevant stakeholders for expanding green areas and develop strategies for traffic management and install pollutant barriers			
	Explain the possible societal / environmental / economic impact expected from this campaign	Environmental impact: If actions/policies are made based on SOCIO-BEE results, there will be improvement of AQ locally. Societal impact: include seniors, that often are left apart, in active actions in the city activity			

Campaign ANCONA 2: Analyze the impact of green areas and of the sea on the air quality of the city

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	**YES**	NO	NA	**Site associations**
	Do you have one or more Bears in your campaign?	**YES**	NO	NA	**Municipality. UNIVPM and ARPAM**
	Do you have Queen Bees for the campaign?	**YES**	NO	NA	**Seniors recruited from ADA and municipality**
	Do you have (a group of) Bees?	**YES**	NO	NA	**Elders recruited from associations for seniors' right (ADA) and volunteers**
	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	**UNIVPM Social media, Municipality Press Office and Communication Office**
	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?	Increase urban life quality for elders and promote open-air activities.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	• Find healthy zones • Inform citizens about air pollution • Coaching citizens about doing activities in healthy zones found			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Is air quality better in areas where there are more trees and parks?			

		YES	NO	NA	**Hypothesis:** Green areas and area in the sea proximity should be less polluted than others, despite the proximity to the main traffic arteries.
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove.	**YES**	NO	NA	
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) Identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (february23) 2) Set/Codesign and share the hypothesis (definition: March 23rd and redefining it if necessary: April 23rd - just before the pilot starts) 3) Define with the hive area in which to take measurements (already defined) 4) Conduct the data collection journey. 4.1) 1st campaign from March 1 to mid-April 4.2) 2nd campaign from mid-April to end of May 5) analyse the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23) 6) Continuous evaluation 7) Final evaluation This plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, we intend to carry out.

		YES	NO	NA	
	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	- Meetings with the hive members - Online communication with the hive members with reminders and the campaign achievements - Reach a minimum number of participants
	Do you know when to incorporate the queen bee and worker bees in your hive?	**YES**	NO	NA	QBs: we will be meeting with them before starting the campaigns to jointly design the content as well as to agree on the hypotheses formulated WB: we will incorporate them as soon as we have the necessary tools to explain the experiment.
	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 could involve them from the beginning of the campaigns. 1.- By telling them what SOCIO-BEE is and what its purposes are. 2.-Convince them to collaborate with new hypothesis and campaigns 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 getting a minimum number of bees to create a hive. ● Not being able to get the bees to want to stay involved after and during the campaign. ● Lack of interest from bears to use campaign results as inputs for new policies. ● The sensors and/or the mobile application not working properly or are too complicated to use for the target audience.

	What campaign blueprint is chosen?	Pollinate an area over an area in the city centre of the city (type I)		
Location - WHERE	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 : Around the city centre of Ancona (43.617603, 13.513020)

	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:** - Material to contact new potential hive's representatives . 20 devices - - Properly working AcadeMe back-end platform and mobile app. - Communication material (brochures, leaflets, online material to call people to participate) - Training material**.**
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?	- QBs and WBs: ANCONA finds it very crucial that end-users will get an indication of the pollution instantly after their measurement , in the SOCIO-BEE application. - Beekeepers and QBs should be informed about the data collected by WBs. .			

	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. Pollinize the overall are of the city centre (horizontally) - capillar pollinization (type I, exploring a physical area).	
Methodology - HOW	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.	Air Quality Questionnaires from CS activists

		Optional: pictures and videos, depending on technical scholarization of seniors
	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.	- Traditional statistical analysis and AI techniques
	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?	% of days in which air quality level are below/under the reccommened threshold number of citizens actively involved in the pilot

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:** the Hive will be used for meeting among partners of the project, QB and WB, for monitoring activities, for solving potential issues encountered in the usage of the tools and devices of SOCIO-BEE.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** All the community will benefit, even if the target are seniors.
	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 of air quality and the report			
	Any possible policies for which the results of this campaign could help to?	Promotion of open air activity and urban qualification. Data can be showed to relevant stakeholders for expanding green areas and develop strategies for traffic management and install pollutant barriers			
	Explain the possible societal / environmental / economic impact expected from this campaign	Environmental impact: If actions/policies are made based on SOCIO-BEE results, there will be improvement of AQ locally. Societal impact: include seniors, that often are left apart, in active actions in the city activity			

GA No: 101037648

Campaign MRSI 1: Test the effect of high number of cars passing through MRSI particularly during rush hours and make an estimation of the air quality around the MRSI Town Hall

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES[1]	NO	NA	**Who are they?** · Maria Kotzagianni · Dimitris Tsiantopoulos
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who are they?** · Technical Services Division of Municipality of Amaroussion
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who are they?** · Stella Chatzichristou - MRSI
	Do you have (a group of) Bees?	YES	NO	NA	**Who are they?** · Giannis Stoufis - MRSI · Maria Katsari - MRSI · Panagiota Tsonopoulou - MRSI · Eleni Stauridou - MRSI · Ares Fasoulas - MRSI
	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 are they?** · Communication Department of Municipality of Amaroussion · Katerina Vourlaki, journalist

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[1] Option selected by pilot appears highlighted in yellow

		YES	NO	NA	
	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 are they?** · NGOs and vol. groups · SMEs and LEs MRSI will reach these bodies in the upcoming months to potentially recruit them in the 1st iteration as hives.
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	The Municipality of Amaroussion is located in the northeastern part of Attica Region and it is considered to be an important financial and business centre of Athens. It has 70,5K inhabitants, 3.500 companies, 3 of the country's largest shopping malls, 2 Ministries' premises, 2 Embassies, 4 Consulates,several maternity hospitals and medical centres of Attica, while it is crossed by two main highways. This is translated into a high number of people communiting from and to Maroussi on a daily basis reaching 1.000.000 cars passing through this area on weekdays and as expected, this leads to elevated air pollution especially during the rush hours.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	· Recruit and raise awareness of employees of MRSI to participate in a citizen science project related to air pollution. · Build hives with high emphasis on inclusiveness and gender equality. · Get 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?	Do emissions from private cars contribute to air pollution? And if yes, to which extent?			
	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:** Given the high number of cars passing through MRSI it is expected that air pollution is higher during rush hours on weekdays in the vicinity of main highways, correct?

| 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.? | <mark>YES</mark> | NO | NA | **List your specific phases (you can also use a Gantt chart):**

1. Recruit Alpha testers (Queen Bee and Working Bees aforementioned) (already done CW:7)

2. Carry out 3 meetings/workshops to test SOCIO-BEE components and get feedback from Alpha testers (beginning of March, middle of April and end of April in line with the delivery of components from technical partners. The meetings/ workshops may be shifted accordingly.)

3. Prepare activities to enrol more citizens (employees of MRSI) probably via an in person event (approx. 1h duration CW:18)

4. Build hive/Design campaigns in more detail/Assign roles/Perform workshops (CW:19)

5. Carry out measurements/ collect data (CW:19-20)

6. Monitor progress (CW:19-20)

7. Perform evaluation of hive's performance ((CW:21-22)

The plan may change due to unexpected delays or in order to better fit the overall planning of the pilot iteration 1. |
| | 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)? | <mark>YES</mark> | NO | NA | **Type them down and, if possible, how you will measure them (possible metrics or KPIs – see WHY section at the end):**
· KPI1: Gender equality: from consent forms check if gender equality is ensured
· KPI2: Min number of Participants:10 reached via communication event (CW:18) |

	Do you know when to incorporate the queen bee and worker bees in your hive?	<mark>YES</mark>	NO	NA	**Pre-pilot phase** QBS and WBs are already approached (alpha testers). **Pilot phase** QBs are envisioned to be the Alpha testers WBs will be incorporated during the communication event (CW:18)
	Do you know when to involve Bears and for what purpose? [DLdIGdA1] Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	<mark>YES</mark>	NO	NA	**Type of involvement:** Bears will be involved during the pre-pilot phase and the engagement activities will be INFORM and CONSULT. It is foreseen to carry out interviews with Bear's representatives to inform them about the SOCIO-BEE project and its capabilities and consult them about areas of interest and/or other open questions that may be addressed by the project (input for campaigns design).
	Have you anticipated and listed any potential risks and possible mitigation actions to execute this campaign in the assigned period. Propose workarounds if needed.	<mark>YES</mark>	NO	NA	**Type them down and, if possible, mitigation actions:** · Not enough participants o Perform additional information event workshop · Not gender equality ensured o Approach Department of Gender Equality of Municipality of Amaroussion
Location - WHERE	What campaign blueprint is chosen?				**Indicate number and title**. You may define a new one if necessary. · Campaign Blueprint 1: Pollinate a specific area in a short period of time (Type I) · MRSI will try also to design campaigns to cover the needs of scenarios 6 and scenario 9
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	<mark>YES</mark>	NO	NA	**Coordinates of areas (you can add pictures):** Around town hall (38.053080061906435, 23.808415757670467)

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?)	<mark>YES</mark>	NO	NA	**List or needs:** · Material to contact new potential hive's representatives · 20 devices (CW17 or CW18 latest) · Properly working app and platform (CW17 or CW18 latest) · Communication material (brochures, leaflets, online material to call people to participate) · Training material.
	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 the SOCIO-BEE platform?	· Beekeepers and QBs: It would be good if they could see the activities performed by each WB separately and be able to contact them to activate them in case of inaction. · QBs and WBs: MRSI finds it very crucial for the end user to be able to get an indication of the pollution instantly after their measurement.			
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.	**Here customise the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customised. **Close to Campaign Blueprint 3:** Pollinize an area at different distances (vertically) from a main highway (pollution distribution) over a short period of time (Type II) **Location** Instead of an area of interest will be a line of interest. The line will start from Location A: Kifissias Avenue (38.051849802184904, 23.809991074635818), will pass in from of Location B: Town hall (38.053080061906435, 23.808415757670467) and will end at Location C: (38.05341316323043, 23.80400886452207). The line is 600m long.			

	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. Air Quality Sound Questionnaires from CS activists.
	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.	1. AQ Statistical analysis per day per location spot (eg 3 different time stamps per day) 2. AQ Statistical analysis same time same location spot different day 3. Average AQ per location spot	
	What visualisation 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 visualisations and/or decision-making supporting metrics should be generated as a result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	MRSI is expecting at the end of this campaign to have a clear Air quality distribution at different distances from Kifissias Avenue and at various distances around Town hall. 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. KPI3: Min number of measurements for campaign 1: 50	

Reasoning - WHY (outcomes, replication and policy- making)	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:** CAMP1 - Blueprint 1 is useful for MRSI employees because they will be informed about the air quality in the vicinity and around their workplace. CAMP1 - Blueprint 2 is useful because it may help MRSI employees to understand that using private cars has a great impact on the environment and significantly deteriorates the AQ, which may lead to behavioural change in their everyday commuting habits.

		YES	NO	NA	
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** All involved parties by being informed about air quality in areas affecting them.
	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?	AQ measurements Sound records			
	Any possible policies for which the results of this campaign could help to?	Creation of pocket parks, namely urban open irregular pieces of public or private land at very small scale accessible to the general public and without the need for large-scale redevelopment in highly polluted areas			
	Explain the possible societal / environmental / economic impact expected from this campaign	Societal impact: Inclusivity and equal participation in such actions Environmental impact: If actions/policies are made based on SOCIO-BEE results, there will be improvement of AQ locally.			

Campaign MRSI 2: Test the effect of a green park on air quality in areas close to main highways with elevated traffic during rush hours measured by lower precision wearable sensors carried by CS activists

		YES	NO	NA	
Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who are they?** · Anargyros Roussos · Maria Kotzagianni · Eleutheria Stamati
	Do you have one or more Bears in your campaign?	YES	NO	NA	**Who are they?** · Urban Planning Division of Municipality of Amaroussion
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who are they?** · Eleni Stauridou - MRSI

	Do you have (a group of) Bees?	YES	NO	NA	**Who are they?** · Giannis Stoufis - MRSI · Maria Katsari - MRSI · Panagiota Tsonopoulou - MRSI · Stella Chatzichristou - MRSI · Ares Fasoulas - MRSI
	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 are they?** · Communication Department of Municipality of Amaroussion · Katerina Vourlaki, journalist
	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 are they?** · NGOs and vol. groups · SMEs and LEs MRSI will reach these bodies in the upcoming months to potentially recruit them in the 1st iteration as hives.
Goal - WHAT	What is the aim of your pilot (city/neighbourhood) in the context of this campaign?	Municipality of Amaroussion is for the first time participating in a citizen science project with focus on air quality for behavioural and policy change. This requires among others active citizen engagement, data of AQ by standardised sensors and considerable amount of collected data for statistical analysis and safe conclusion extraction. So the aim of this particular campaign of this pilot is to design tasks around the Air Quality Station in order the SOCIO-BEE sensors to be validated/standardised, providing reliability to the measurements.			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	· Recruit and raise awareness of employees of MRSI to participate in a citizen science project related to air pollution. · Collect data that are reliable and accurate for policy making.			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	RQ 1: Can portable sensors be validated / standardised by campaigns carried out by citizens? RQ2: In areas/neighbourhoods that have both parks and main highways within their borders, how is the air quality?			

		YES	NO	NA	
	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 1:** Seeing the challenges arising from the accuracy and reliability of citizen science data, are campaigns for sensor validation performed by citizens considered to be credible? **Hypothesis 2:** The presence of a park is of paramount importance as it improves the air quality significantly, correct? This hypothesis will be tested combining the results of the two campaigns.
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. Recruit Alpha testers (Queen Bee and Working Bees aforementioned) (already done CW:7) 2. Carry out 3 meetings/workshops to test SOCIO-BEE components and get feedback from Alpha testers (beginning of March, middle of April and end of April in line with the delivery of components from technical partners. The meetings/ workshops may be shifted accordingly.) 3. Prepare activities to enrol more citizens (employees of MRSI) probably via an in person event (approx. 1h duration CW:18) 4. Build hive/Design campaigns in more detail with some of them in the vicinity of the Air Quality Station/Assign roles/Perform workshops (CW:19) 5. Carry out measurements/collect data (CW:19-20) 6. Monitor progress (CW:19-20) 7. Perform evaluation of hive's performance (CW:21-22) The plan may change due to unexpected delays or in order to better fit the overall planning of the pilot iteration 1.

	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):** ● KPI2: Min number of Participants:10 reached via communication event (CW:18) (Also mentioned in campaign 1) ● KPI4: Sum of hours of sensors spent in the vicinity of Air Quality Station for sensor calibration purposes: 12 hours per sensor.
	Do you know when to incorporate the queen bee and worker bees in your hive?	YES	NO	NA	**Pre-pilot phase** QBS and WBs are already approached (alpha testers). **Pilot phase** QBs are envisioned to be the Alpha testers WBs will be incorporated during the communication event (CW:18).
	Do you know when to involve Bears and for what purpose? [DLdIGdA1] Consider the four types of engagement activities suggested by SOCIO-BEE: INFORM, CONSULT, GUIDE and WORK WITH.	YES	NO	NA	**Type of involvement:** Bears will be involved during the pre-pilot phase and the engagement activities will be INFORM and CONSULT. It is foreseen to carry out interviews with Bear's representatives to inform them about the SOCIO-BEE project and its capabilities and consult them about areas of interest and/or other open questions that may be addressed by the project (input for campaigns design).

	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:**
					● Not enough participants
					  ○ Perform additional information event workshop
					● Not enough time of sensors collocated to the air quality station
					  ○ Bee-keepers will be responsible for concluding successfully the experiment.

Location - WHERE	What campaign blueprint is chosen?	**Indicate number and title**. You may define a new one if necessary. · Campaign Blueprint 1: Pollinate a specific area in a short period of time (Type I) · MRSI will try also to design campaigns to cover the needs of scenarios 6, 7 and if possible also 9			
	Has a clear decision been made on where in the city you will be taking measurements for this campaign (areas covered)?	<mark>YES</mark>	NO	NA	**Coordinates of areas (you can add pictures):** Around Air Quality Station (38.030837 23.787372)
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?)	<mark>YES</mark>	NO	NA	**List or needs:** · Material to contact new potential hive's representatives · 20 devices (CW17 or CW18 latest) · Properly working app and platform (CW17 or CW18 latest) · Communication material (brochures, leaflets, online material to call people to participate) · Training material.
	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 the SOCIO-BEE platform?	· Beekeepers and QBs: It would be good if they could see the activities performed by each WB separately and be able to contact them to activate them in case of inaction. · Beekeepers: It would be very important to know the exact time spent of each sensor in the vicinity of the air quality station <u>per individual sensor for validation purposes</u> · QBs and WBs: MRSI finds it very crucial for the end user to be able to get an indication of the pollution instantly after their measurement.			

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 customise the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customised.	
		Close to Campaign Blueprint 3:	
		Pollinize an area at different distances (vertically) from a main highway (pollution distribution) over a short period of time (Type II)	
		Location	
		Instead of an area of interest will be a line of interest.	
		The line will start from Location D: Kifissias Avenue (38.03758453483845, 23.79914731615933) and will end at Location E: Park Spyros Louis (38.040333040913914, 23.79305541053046).	
		The line is 600m long, similar to campaign 1.	
		The main difference here is that in Location E there is a big park of total area: 975 acres. This will help us compare the results with campaign 1 and evaluate the impact of the forest on air quality.	
	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. Air Quality Pictures and Videos. Sound Questionnaires from CS activists.
	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.	1. AQ Statistical analysis per day per location spot (eg 3 different time stamps per day) 2. AQ Statistical analysis same time same location spot different day 3. Average AQ per location spot	

	What visualisation 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 visualisations and/or decision-making supporting metrics should be generated as a result of the experimentation in this campaign to prove your hypothesis or consider the campaign as a success or failure?	MRSI is expecting at the end of this campaign to have: 1) Each sensor spends sufficient time in the location of the Air quality station for calibration purposes. This will be used as a decision-making supporting metric to ensure data reliability (KPI4). 2) A clear Air quality distribution at different locations between Kifissias Avenue and the Spyros Louis park and at the location of the Air Quality Station. 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. 3) A comparative study between campaign 1 and 2 to highlight the importance of green areas in the urban environment for communication and dissemination purposes. KPI5: Min No of measurements for campaign 2: 50			
Reasoning - WHY (outcomes, replication, and policy - making)	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:** CAMP2 - Blueprint 1 is useful for MRSI bears as they will be able to rely on CS data for future policy making. CAMP2 - Blueprint 2 is useful because it may help MRSI bears and employees to realise the importance of green spaces in improving air quality locally.
	Is clear who will benefit from this campaign?	YES	NO	NA	**Why? and Who?** All involved parties by being informed about air quality in areas affecting them.
	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?	AQ measurements Pictures and Videos Sound records Potentially valuable information for communication and dissemination purposes focusing on role of green spaces in urban environment Potentially some conclusions on best calibration practices for CS projects to be published in conferences or scientific journals			

	Any possible policies for which the results of this campaign could help to?	Creation of pocket parks in highly polluted areas If necessary planting of trees in the area of study
	Explain the possible societal / environmental / economic impact expected from this campaign.	Environmental impact: If actions/policies are based on SOCIO-BEE results, there will be improvement of AQ locally.

Campaign ZARAGOZA 1: Test the effect of forested areas in CO2 absorption

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who are they?** - 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 are they?** - ZKF - ZGZ - IBER - LIA CESAR LABS
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who are they?** ZGZ: Marina Abadía, Elena Giner ZKF: Daniel Sarasa IBER: Fran Sanz
	Do you have (a group of) Bees?	YES	NO	NA	**Who are they?** - 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 are they?** Representatives/Staff from Ibercaja, Unizar, Hiberus, Init, Water and Environment documentation center and teachers from some of the schools will be participating in the second iteration (Juan de Lanuza School, Santo Domingo School)

	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 first 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 logistics and communications hub in the northeast of the Iberian Peninsula, which is why it supports a significant amount of road traffic. Another geographical feature to take into consideration is its location in the Ebro Valley, where it is subjected to continuous air streams and gives it, under normal conditions, a good quality of its air. The impact of these two issues, in principle antagonistic, is an unbeatable starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, together with the involvement of the institutions that will develop it, their facilities and their extensive experience in similar projects of citizen science. **Hypotesis: Analyse air quality in densely forested areas and compare the results with areas where tree density is lower or non-existent.**
	List the specific objectives (separated by bullet points) that will be followed in this campaign.				- Recruit and involve new citizens who wish to become active participants in the SOCIO-BEE approach (QB, WB, etc...) - Test and provide a SOCIO-BEE toolkit for active participants that empowers them to involve more worker bees and other interested stakeholders (i.e., Honey Bears) in pursuing air pollution reduction actions through experimentation and evidence-based research. - Run co-creations sessions and collaboration activities for assembling environmental action groups targeting air quality improvement in Zaragoza areas
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?				Do densely wooded areas have better air quality than less wooded areas?
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove?	YES	NO	NA	Given the capacity of trees to absorb carbon dioxide, a densely forested area should show lower carbon dioxide levels than in areas where trees are not present.

GA No: 101037648

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.?	<mark>YES</mark>	NO	NA	**List your specific phases (you can also use a Gantt chart): *** 1) Identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (february23) 2) Set/Codesign and share the hypothesis (definition: february23 and redefining it if necessary: march 23 - just before the pilot starts) 3) Define an area in which to take measurements (first week of March) 4) Conduct the data collection journey. 4.1) 1st campaign from March 1 to mid-April 4.2) 2nd campaign from mid-April to end of May 5) analyse the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23rd) 6) Continuous evaluation 7) Final evaluation This plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, we intend to carry out. In essence, we will carry out two campaigns in the first iteration, with two different hypotheses and in two different areas of the city. We intend to carry out the campaigns during the months of April and May (1 month for each campaign). After each campaign we will evaluate the 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)?	<mark>YES</mark>	NO	NA	- Recurring meetings with the hive members - Online communication with the hive members with reminders and the campaign achievements
	Do you know when to incorporate the queen bee and worker bees in your hive?	<mark>YES</mark>	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 getting a minimum number of bees to create a hive. - Not being able to get the bees to want to stay involved after the campaign ends. - Lack of interest from bears to use campaign results as inputs for new policies. - The sensors and/or the mobile application do not work properly or are too complicated to use for our target audience.
Location - WHERE	What campaign blueprint is chosen?	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	center coordinate Zona 1: 41.65925187996686, -0.9072107854596443 center coordinate Zona 2:41.66107541051995, -0.9046948734086837
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:** 20 devices Online platform Mobile App Training documentation about air quality Training 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?	At this stage of the project we are not able to provide a right answer. We need to start the project and see how it works.			

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 custom** parameters **ise the Blueprint to your campaign**. From the earlier chosen blueprint specify the with which it will be customised.			
	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 measurements and repeat them in time and space until have scientific relevant data, according to the platform and devices standards.			
	What visualisation 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 visualisations and/or decision-making supporting metrics should be generated as a 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	**Explanation:** Compare the air quality in heavily populated areas with vegetation against low populated ones
	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?	Improve urban planning of trees and the delimitation of low emission zones in other countries The City Council works to adapt to European regulations on greenhouse gas emissions			

	Any possible policies for which the results of this campaign could help to?	Increase urban trees and green areas. It could also help the project called"El Bosque de los Zaragozanos", is a collaborative initiative promoted by Zaragoza City Council, which in the coming years will modify the city and its surroundings to create new natural spaces and enhance the health of citizens.
	Explain the possible societal / environmental / economic impact expected from this campaign	Better green zones planification

Campaign ZARAGOZA 2: Analyse the impact of low emission zones on improving air quality

Bees and Bears - WHO	Do you have a Beekeeper creating or assigning a hive for a potential campaign?	YES	NO	NA	**Who are they?** - 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 are they?** - ZKF - ZGZ - IBER - LIA CESAR LABS
	Do you have Queen Bees for the campaign?	YES	NO	NA	**Who are they?** ZGZ: Marina Abadía, Elena Giner ZKF: Daniel Sarasa IBER: Fran Sanz
	Do you have (a group of) Bees?	YES	NO	NA	**Who are they?** - 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 are they?** Representatives/Staff from Ibercaja, Unizar, Hiberus, Init, Water and Environment documentation center and teachers from some of the schools will be participating in the second iteration (Juan de Lanuza School, Santo Domingo School)
	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 first 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 logistics and communications hub in the northeast of the Iberian Peninsula, which is why it supports a significant amount of road traffic. Another geographical feature to take into consideration is its location in the Ebro Valley, where it is subjected to continuous air streams and gives it, under normal conditions, a good quality of its air. The impact of these two issues, in principle antagonistic, is an unbeatable starting point for Zaragoza as a city to develop one of the SOCIO-BEE pilots, together with the involvement of the institutions that will develop it, their facilities and their extensive experience in similar projects of citizen science. **Provide scientific evidence for the improvement of the planning of the low emission area for road traffic in the city of Zaragoza.**			
	List the specific objectives (separated by bullet points) that will be followed in this campaign.	- Recruit and involve new citizens who wish to become active participants in the SOCIO-BEE approach (QB, WB, etc...) - Test and provide a SOCIO-BEE toolkit for active participants that empowers them to involve more worker bees and other interested stakeholders (i.e., Honey Bears) in pursuing air pollution reduction actions through experimentation and evidence-based research. - Run co-creations sessions and collaboration activities for assembling environmental action groups targeting air quality improvement in Zaragoza areas			
	What is the Research Question/s of your campaign or what would you like to explore following the scientific process?	Can the collection of air quality data from the public provide scientific evidence to help better plan low-emission zones in cities with high levels of road traffic?			
	Can you also formulate a hypothesis from the research question? If yes, what is the scientific hypothesis you want to prove?	<mark>YES</mark>	NO	NA	Do low-emission zones designed by municipalities have better air quality than traffic-free zones in cities with high traffic density?
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.?	<mark>YES</mark>	NO	NA	**List your specific phases (you can also use a Gantt chart):** 1) Identify the target groups (QBs, WBs, etc.) and let them know what we expect from them. (february23) 2) Set/Codesign and share the hypothesis (definition: february23 and redefining it if necessary: march 23 - just before the pilot starts) 3) Define an area in which to take measurements (first week of March) 4) Conduct the data collection journey. 4.1) 1st campaign from March 1 to mid-April 4.2) 2nd campaign from mid-April to end of May 5) analyse the data collected and draw conclusions. Verify whether or not the hypothesis has been proved or not. (June 23) 6) Continuous evaluation 7) Final evaluation * This plan is not intended to be definitive. It is a mere draft of what, at this stage of the project, without having received any material yet, we intend to carry out. In essence, we will carry out two campaigns in the first iteration, with two different hypotheses and in two different areas of the city. We intend to carry out the campaigns during the months of April and May (1 month for each campaign). After each campaign we will evaluate the 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	- Recurring meetings with the hive members - Online communication with the hive members with reminders and the campaign achievements
	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 getting a minimum number of bees to create a hive. ● Not being able to get the bees to want to stay involved after the campaign ends. ● Lack of interest from bears to use campaign results as inputs for new policies. ● The sensors and/or the mobile application do not work properly or are too complicated to use for our 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	center coordinate: 41.65625797162715, -0.8788008276381808

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: ● 20 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?	At this stage of the project we are not able to provide a right answer. We need to start the project and see how it works.			
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 customise the Blueprint to your campaign**. From the earlier chosen blueprint specify the parameters with which it will be customised.			
	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 measurements and repeat them in time and space until have scientific relevant data, according to the platform and devices standards.			
	What visualisation 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 visualisations and/or decision-making supporting metrics should be generated as a 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	**Explanation:** H2: compare restricted areas for road traffic marked by the municipality vs. free traffic areas

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?				● Improve urban planning of trees and the delimitation of low emission zones in other countries ● The City Council works to adapt to European regulations on greenhouse gas emissions
Any possible policies for which the results of this campaign could help to?				H2: influence better planning of low emission zones
Explain the possible societal / environmental / economic impact expected from this campaign				A better definition of the low emission zone

ANNEX C. List of Questionaires 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)	The purpose of this questionnaire is to give ALPHA testers during the pre-pilot execution sub-phase of iteration 1 to provide	It should be filled in by an alpha tester every time that s/he tests one of the	[PDF publicly accessible](#)

		FEEDBACK regarding the SOCIO-BEE platform. This feedback will be used by the technical team to finetune the SOCIO.BEE technical solution.	components of the SOCIO-BEE platform.	
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 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 analysisñ. | [PDF publicly accessible](#) |