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Wearables and drones fOr City Socio-Environmental Observations and Behavioral Change

Deliverable

D2.9 - SOCIO-BEE Toolkit final release

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| 16-03-2024 | 4.0 | Willem-Jan Renger & Evert Hoogendoorn | Final |

List of definitions & abbreviations

| Abbreviation | Description |
|--------------|---|
| AcadeMe | AcadeMe – online repository of toolkit materials to be used by all relevant stakeholders in SOCIO-BEE |
| AQ | Air Quality |
| B | Bee |
| BR | Bear |
| BK | BeeKeeper organisation |
| CO | Citizen Observatory |
| CS | Citizen Science |
| EU | European Union |
| GA | Grant Agreement |
| MVE | Micro Volunteering Engine |
| QB | Queen Bee |
| Q&A | Questions and Answers |
| SwafS | Science with and for Society |
| WP | Work Package |

Executive Summary

The central objective of the SOCIO-BEE project is to effectively engage citizens, policy makers, and other key stakeholders in initiatives that enhance air quality and encourage environmentally responsible behavior.

As a cornerstone of this initiative, all collaborators involved in Work Package 2 (WP2), along with many other partners, particularly those in the pilot cities, have devoted their efforts to jointly develop an improved version of a comprehensive and inclusive toolkit. This toolkit is designed to facilitate the implementation of citizen science activities. The present document outlines the culmination of an extensive co-creation and collaborative effort, building upon the initial framework established in Deliverable 2.8: SOCIO-BEE Toolkit First Release. In a separate Annex, the factual toolkit materials (English version) will be presented.

Since the toolkit's initial launch, there have been significant developments. The initial pilot trials conducted in Zaragoza, Ancona, and Marussia, employing the toolkit's first version, provided the consortium with valuable insights into the toolkit's application and potential areas for enhancement. These trials allowed us to test the toolkit's effectiveness in real-world conditions, assess the resilience of the formats against technological challenges, and understand how different user groups interacted with the resources provided.

As the principal evaluator of these first pilots, we gained direct experience with the toolkit's practical application and the valuable lessons from this first phase. This experience informed a series of refined design guidelines for the toolkit's subsequent iteration, which we are now introducing.

For the initial release, we created the core materials in a slide-based format in English. Time constraints necessitated that city partners adapt these materials to their local contexts and languages. At that time, we believed that such an approach would offer the necessary adaptability and flexibility for the partner cities to tailor the materials to their specific needs.

In the aftermath of our inaugural pilot, our strategies have been refined to incorporate practical insights. Initially, the tools devised were theoretically sound yet proved overly complex in actual application (actionability), drawing attention to their need for simplification and greater action-oriented focus—feedback that was echoed by our evaluators, advisory board, and was evident during the pilot's execution.

Furthermore, practical engagement revealed some gaps in our material, highlighting essentials that were overlooked and are now identified for inclusion.

The software suite supporting the measurement campaigns had not yet matured to the point where it contained integrated analysis tools for citizens to reflect on their campaign outcomes. This had to be remedied in the second release of the software suite and the toolkit.

Previously, in preparation for our initial pilot tests, we settled on using PowerPoint for its broad accessibility, facilitating collaborative support material development. This choice, however, did come at the expense of more sophisticated design possibilities. The provided English-language slide decks were designed for easy adaptation and translation by our city partners, an approach necessitated by the limited time available to co-create fully customized tools for each city.

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Considering our comprehensive experience and the constructive feedback we received, our methodology for this updated toolkit has been refined. We aim for a toolkit that is user-friendly, comprehensive, and conducive to collaboration, to ensure it is practical and easily customizable for varied citizen contexts.

Several revised design decisions informed the iterative process of creating version 2 of the toolkit, which are made available in this new deliverable.

- The PowerPoint platform was retained for its accessibility; however, we transitioned from slides to A4 handout formats to simplify printing and on-demand use.
- The initial strategy requiring city partners to adapt English base versions proved cumbersome and less necessary than anticipated. We recognized this added unnecessary workload on our partners and adjusted our strategy accordingly.
- We crafted a detailed customer journey, leveraging the “cascading model” established in the first toolkit deliverable, informed by insights from the first pilot. This journey outlines all the steps involving all relevant stakeholders, trickling down from municipality, through beekeeper to queen bees and bees, with each step being supported by a specifically designed handout with a distinct identifier.
- An online 'ticket system' was implemented to track each material and to facilitate a consortium-wide effort from the creation to the final delivery of each support item through collaborative efforts.
- We adopted a 'horse-race' metaphor for the development process of each support item, delineating clear co-creation stages:

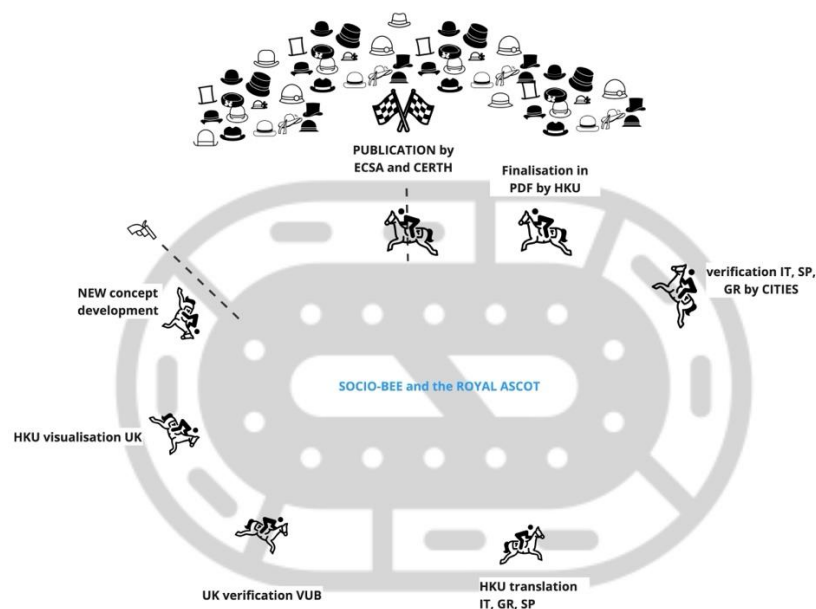


Figure 1. The Royal Ascot horse race metaphor visualizing the co-creation process.

- Stage 1: Expert input on a support material using a PowerPoint template was first. Experts ranged from technical (app or WSN) to content specialists (air pollution, behavior change, inclusion, etc.) from various partners (mainly, the co-authors of this deliverable)

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- Stage 2: Following this, the content received a visual enhancement and underwent UK language validation by a native speaker (VUB).
- Stage 3: The approved versions were then initially translated into Spanish, Italian, and Greek using DEEPL AI online tool (HKU).¹
- Stage 4: City partners then refined these AI-generated translations, correcting errors and ensuring the material's relevance and effectiveness for their specific target audiences (MAR, ZAR, ANC).
- Stage 5: The validated localized versions were sent back for a final graphical polish and quality check before being finalized in PDF format (HKU).
- Stage 6: Materials were then made available for end users through SOCIO-BEE website and the Academe (ECSA, CETH).

- A MIRO boardⁱⁱ visually mapped the progression of each item in this 'race', accessible to all involved partners.

- Progress, revisions, and validations were managed through weekly online Workgroup meetings, ensuring the smooth advancement of all materials through the process steps.

Refinement of our toolkit materials was informed by reliable mockups from CETH and HYP partners to ensure they would be seamlessly applicable upon the technical release of both mobile and web apps, anticipated in early April 2024.

We extend our heartfelt thanks to every partner for their integral role in the collaborative creation of this toolkit. Orchestrating this 'horse race' was a complex task, involving the digital transfer of 112 handouts through six distinct processing stages across Europe, each interdependent on the other. Our city partners, in particular, deserve recognition for their unwavering vigilance, prompt responses, and critical insights that significantly contributed to the success of this endeavor. Their efforts are a testament to the spirit of pan-European cooperation.

The honeybee analogy

Through an example from nature, SOCIO-BEE builds on the metaphor of bee colonies to develop effective behavioral and engagement strategies with a wide range of stakeholders (i.e., queen Bees, drone Bees, working Bees, and bears) and to co-create in Hives long-lasting solutions against urban air pollution supported by emerging new technologies such as drones or wearables. The reasoning behind this is the need to increase wider participation in citizen science initiatives.

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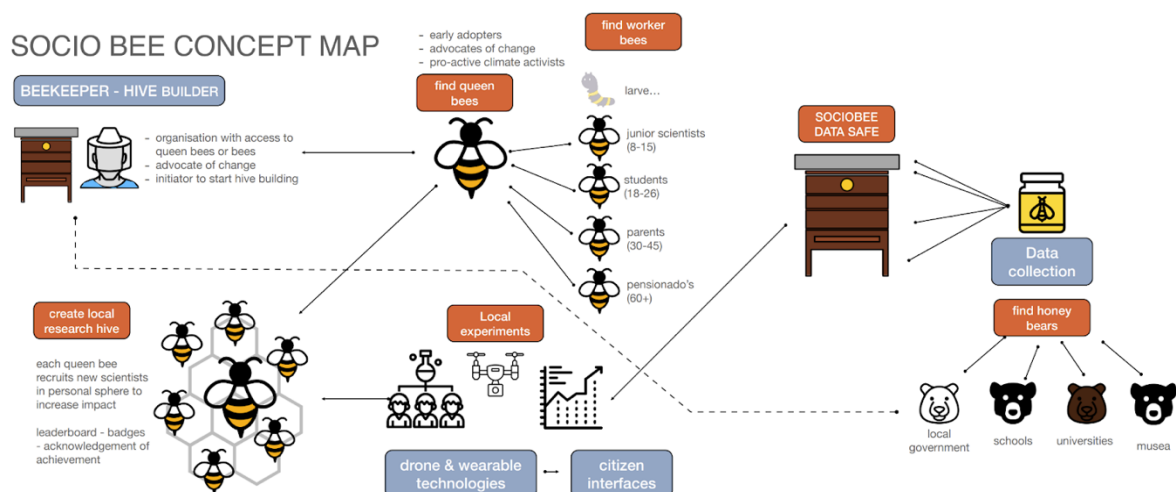


Figure 2. SOCIO-BEE concept visual

In this visual we represent the citizen science approach as a beehive metaphor. A city or NGO initiates a project. They deploy tactics to find volunteers which can identify as a queen bee (a more pro-active role) or bee to form small hives. These hives create their own measurement campaign in an area of their interest. Using a wearable sensor, apps and support materials, they are able to perform air quality measurements. They are enthused to share their results or contact policy makers or other influencers to reflect on their data and potential measurements.

The first deliverable from this WP, D2.1 expanded on the initial description of the different Bees presented in the GA leaving us where we currently stand with a rich set of actors each with different engagement strategies.

Table 1. Description of the different SOCIO-BEE roles adapted from D2.1

| Concept/Role | Description |
|--------------|--|
| BeeKeepers | <p>A BeeKeeper organisation can be an NGO, a museum, a university, a school, a sports club, community centre.... They are characterised by having natural access to Queen Bees or Bees. They are sympathetic to the air quality measurement cause. They are willing to kick start the Hives and provide some support and facilities. Preferably they have their own building or access to a premises to organise workshops, keep and distributes sensors, invite Queen Bees and Bees, instruct them and support them. They have qualified personnel to carry out these tasks, like teachers, educators, youth workers, activity workers in an home of the elderly etc.</p> <p>These institutions or public/private bodies will initially push Hives with effort, human resources and possibly budget to guarantee Hives future success once they become independent.</p> |
| Queen Bee | <p>Leaders of the Hives, so they participate and coordinate collective activities. They are knowledgeable participants interested in leading CS initiatives and who also aim</p> |

| | |
|-------------|---|
| | to engage others to participate. They understand the barriers that can be present in the creation of a new Hive |
| Worker Bees | Participate intensively in collective activities organised by the Hive. These Bees are aware; they have self-efficacy and have skills that allow them to work in the team. They have pro-environmental values and attitudes driving their involvement. These are typically the most active Bees in the Hive and they take up a variety of tasks. |
| Drone Bees | They are available to acquire information and being consulted. They do not actively collaborate in the campaigns but may participate in co-creation activities and receive information on their results and ponder on their consequences. Their main role is increasing and raising awareness. But they might convert to another role, like a worker bee or eventually even a Queen Bee. |
| Larvae | They do not care or are unaware of the involvement of CS in fighting against climate change. They do not participate in dissemination activities or other pro-environmental activities. However, if they receive the right honey or royal jelly (information) they can become one of the previously described Bees. |
| Bears | Bears were originally conceived to be organisations benefiting from the data acquired by the Hives through measurements. Based on progressive insights we propose to extend this definition to include individuals, being subject matter experts on both science and air pollution. We believe these SME's can be quite important in supporting Hives in the definition and evaluation phase as advisors and can play an important role in carrying the data further towards impact. Examples of Bears: professor at a university; expert working for NGO; expert working within a municipality; expert working in a company. |

Citizen Science (CS) initiatives often face many barriers. We hope to overcome these using this classification of roles and stakeholders to form an integrated network. Common barriers from T2.1 (D2.1 and D2.2) are:

- Hard to involve citizen science participants.
- Many don't see the benefit.
- Little citizen involvement in policy making.
- Available (air-pollution) data.
- Perceived low accuracy of data.
- Lack of localized data (only for a few places in the city).
- Existing (air-pollution) sensors are static.
- People have old habits and patterns that are hard to break.

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1 Introduction

Air pollution is one of the biggest drivers of biodiversity loss with a dramatic effect on human health, such that it is the number one cause of premature deaths in the EU. This is particularly severe in highly populated cities with a lot of traffic. To solve this issue, it is evermore clear that one intervention alone will not be sufficient. Now more than ever, we as humans need to work together if we want to tackle these global issues.

Toward that end, in SOCIO-BEE we will work together with local communities to build citizen science hubs (referred to as Hives) where inclusive engagement practices, as described in our engagement toolkit will be put in place to build active groups of participants working towards clean air. The overarching aim is to empower people to act whilst fostering a long-lasting wish in everyone to adopt more environmentally friendly behaviors in their day-to-day lives. We will aim to:

- Create an easy, affordable, and portable way for air-pollution data collection.
- Accommodating for different categories of citizens in different contexts.
- Empowering citizen science participants to measure air-pollution.
- Support air-pollution reduction initiatives through the development of a toolkit that once final will be made available to the citizen science community.
- Close the gap between scientists, citizens and policy makers.
- Encourage pro-environmental behavior change in the community.

Throughout the project, SOCIO-BEEs engagement toolkit, once properly evaluated and updated, will be tested in three pilot cities: Ancona, Maroussia (Athens) and Zaragoza, each with a focus on a specific target groups, older communities, daily commuters and young adults respectively. Whilst each pilot is still working in better defining whom their target groups are, this inherent diversity requires flexible engagement strategies by design. This is the underlying tenet of our bee analogy and the main purpose for this deliverable described below.

1.1 Purpose of the document

With this deliverable, we aim to deliver a final version of the SOCIO-BEE toolkit, consisting of support materials tailored to specific types of users. We follow the architecture set out in D2.1ⁱⁱⁱ, called the cascading model, where we mapped the relationship between the various levels of responsibility and dependency in the SOCIO-BEE ecosystem.

This deliverable describes the process how we moved from version 1 of the toolkit, as used in the first pilots, consisting of components, towards this version 2, consisting of actionable handouts for each major step in the SOCIO-BEE Campaign process. The toolkit consists of 20 separate handouts, delivered in four languages, (English, Spanish, Italian and Greek) and occasionally tailored to a specific subgroup of users.

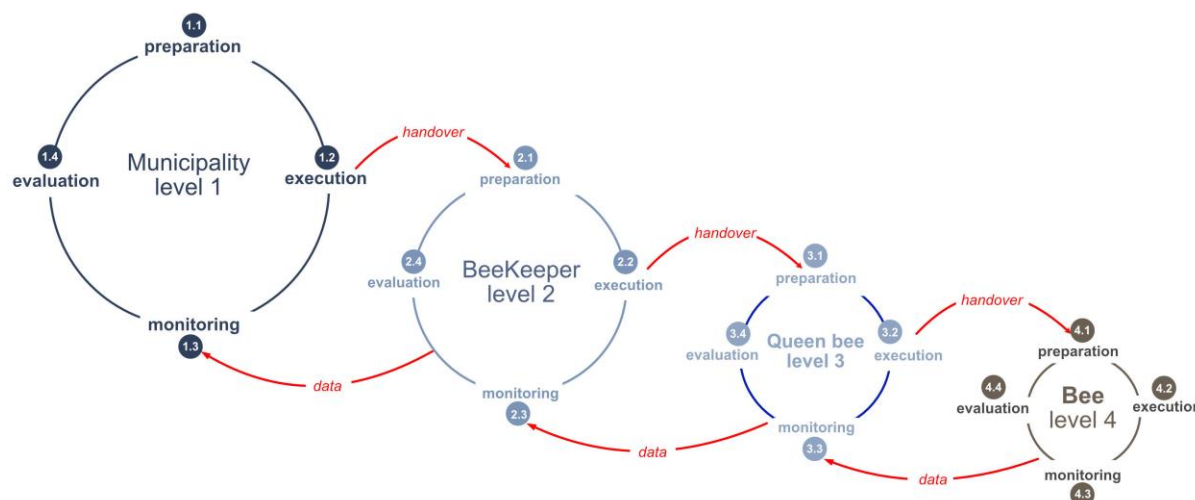


Figure 3. Cascading process model for SOCIO-BEE citizen science experiments.

1.2 Relationship with other deliverables

This document is a culmination of efforts from numerous preceding works, especially the first release of the Toolkit (D2.8) and the Evaluation and Interpretation of Pilot Results (D5.12). The technical specifications (D4.2, D4.4, D4.6, D4.8, and D4.10) also played a crucial role, informing the toolkit's development through collaborative interactions with CERTH and HYP partners. By utilizing technical mockups, we bridged the gap between the architectural framework and the practical needs of end-users.

Beyond these tangible deliverables, it was the online collaborative processes that truly propelled our progress. In our last in-person gathering, we established a workgroup model, committing to weekly meetings that would run concurrently with the general plenary sessions. These sessions were dedicated to the synchronization and meticulous review of all support materials, ensuring that every piece of content not only met our standards but also resonated with the practical needs of our users.

The following table summarises the main features of Toolkit version 1.

Table 1 Index of toolkit first release

| | Index of Toolkit Version 1 | | | | | Description |
|---|---|-----|----|----|---|--|
| | Toolkit version 1 consisted of documents and partly converted training materials for Queen Bees. The training materials were collected in one Slide deck, offered in English, for local adaptation and translation. | | | | | |
| | | Mun | BK | QB | B | |
| 1 | A. How to: organize a CS project | | X | X | | Short description how to organize a CS project |
| 2 | B. How to: check on inclusion | | X | X | | Questionnaire how to reflect on inclusion |

| | | | | | | |
|----|--|---|---|---|---|--|
| 3 | C. How to: measure engagement | | | X | | Document describing how measure engagement |
| 4 | D. How to: involve stakeholders map | X | X | | | Flowchart how to involve stakeholders in a SOCIO-BEE project setup |
| 5 | E. How to: involve BeeKeepers | X | | | | Document how to find and identify beekeepers. |
| 6 | F. How to: involve Bears | | X | X | | Document how to find and identify bears. |
| 7 | G. How to: data protection and ethics | | X | | | Document how to handle data protection and ethics |
| 8 | H. How to: write a Hive manifesto | | | X | X | Slides how to create a Hive manifesto |
| 9 | I. How to: communicate | | X | X | | Slides how to communicate campaign outcomes |
| 10 | J. How to: know about Air pollution (AcadeMe) manual | | | X | X | Slides how to understand air pollution |
| 11 | K. How to: organize a workshop | | | X | | Document how to organize various kinds of workshops |
| 12 | L. How to: campaign | | | X | | Document how to setup and configure a campaign |

The analogous features of the second release are described in detail in Section 3- “The SOCIO-BEE Toolkit inventory”.

As can be seen in comparison between the above table and section 3, the toolkit has been substantially expanded as well as reworked in terms of formatting, inclusivity, actionability and usefulness. In revising the toolkit, we developed 20 handouts, while substantially reworking the existing tools in the process. So, while we weren't starting from scratch, a significant portion—about 50% - needed to be newly created.

2 The Toolkit co-creation process

2.1 To PowerPoint or not to PowerPoint...

Since the release of the first toolkit, and its subsequent use in the first pilots, we started to work on a thorough revision, based on expert feedback, reviewer feedback and pilot evaluation (D5.12).

The first toolkit was intended to support the execution of the pilots, focusing our efforts on the end users specifically. We decided on using PowerPoint as shared editing tool for several reasons. Accessibility for all partners to modify and edit source file material; some (though limited) visual design possibilities; and possibility of future modifications, also by future users. More advanced graphical design software (like InDesign or Affinity Publisher) would facilitate more attractive and advance graphic design but on the other hand hinder the co-creation process substantially and limit inclusion to a large extend.

Initially we focused on slide format for creation of materials. But feedback from practical use in the pilots pointed to a preference for handout capabilities. To use the best of both worlds, we adopted a modified 'slide' format to mimic A4 format, which meant we could keep PowerPoint as our base tool, leading to printable handouts in PDF format.

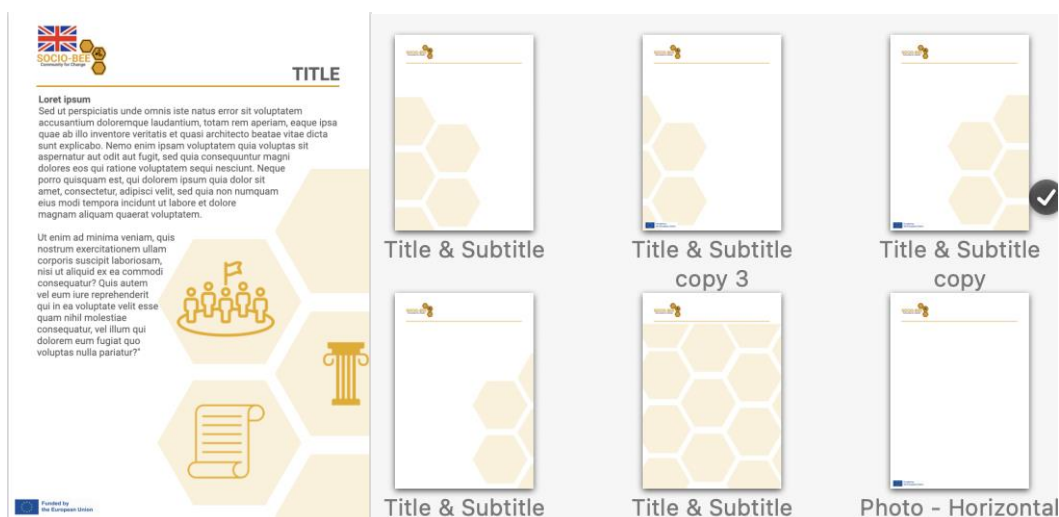


Figure 4. Empty templates to create handouts, in PowerPoint, using an A4 modifier in formatting.

2.2 From cascading model to user journey

The second phase of our revision process entailed a thorough reassessment of the support materials' nature, necessity, and purpose. During the initial pilot, due to the developmental stage of our technological framework, we were unable to close the 'citizen science loop.'

For citizen science, it is important that citizens familiarize themselves with the scientific process. They have to understand the various steps in the scientific process, from initial hypothesis and prediction, through data collection and storage, to data analysis, reflection on their prediction and hypothesis and drawing conclusions on their experiments. In our case, experiments are called campaigns and consist of group activities, in which citizens collect air pollution data within a set time frame and set spatial boundaries to take stock of air pollution in a delimited area in their environment.

Due to the complexities of building all technical components and integrating them for pilot one, some functionalities were not yet ready for field operations. This included the functionalities providing citizens with data access and visual feedback on their measurements. As a result, in the first pilot not all citizens could interpret their measurement results from their campaigns. With some prototypical tools, and with substantial effort of Queen Bees, this ‘loop’ could be closed for some campaigns. But his method was not inclusive and accessible to all volunteers. Therefore, most participants could not close the circular nature of the scientific process, in returning to their original hypothesis and reflecting on the campaign outcomes. We call this ‘closing the citizen science loop’. This is therefore a critical component of our second pilots; the ability to test and verify the SOCIO-BEE concept to its full extend, including the ability for all citizens to ‘close the loop’ and analyze, reflect, and conclude on their campaigns to foster their follow-up actions and intended behavior change.

The first pilot’s objective was to evaluate citizens’ capabilities in initiating campaigns and conducting field measurements, along with rigorously testing each technical component. This included the Wireless Sensor Node (WSN), its integration with the mobile and web apps, and the underlying micro-volunteering engine (MVE).

A significant gap identified in the first pilot was the absence of technical features that allowed for the visualization and interpretation of campaign results, leading to a lack of corresponding support components in the toolkit (Those barriers were reported in the Redmine application for SOCIO-BEE issues and on the deliverable D2.6). Furthermore, we recognized the necessity for enhanced support in guiding citizens on how to conduct scientific inquiries. Although initial materials introduced the subject of air pollution, it became clear that citizens required more comprehensive assistance in grasping the parallel between the bee-hive metaphor and their roles as citizen scientists.

In order to identify all possible missing links, we started to construct a very detailed customer journey, based on the cascading model developed in D2.1 see figure 3.

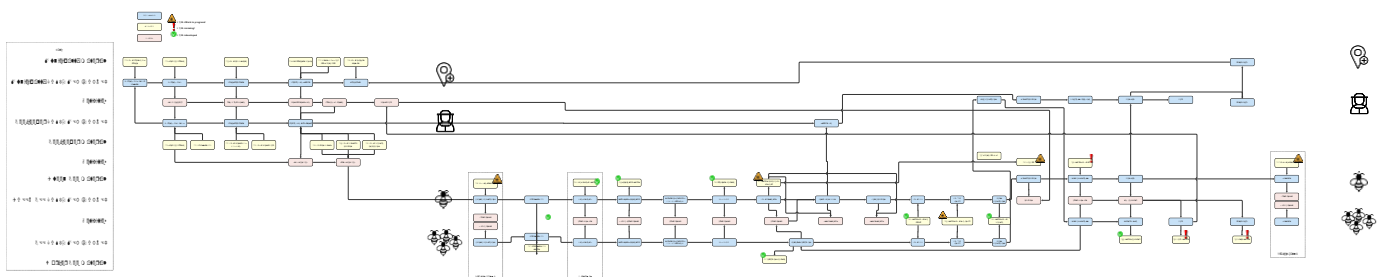


Figure 5. A detailed customer journey model from initiation to campaign impact.

[The full size version can be found [here](#)^{iv}]

As can be seen in figure 5, this process is quite elaborate.

The color coding in this schematic focused on three entities. Blue boxes identify ‘knowledge elements’ users would need to perform a certain activity. Pink identifies whether it is an individual or group activity. Yellow refers to a particular handout with a unique identifier.

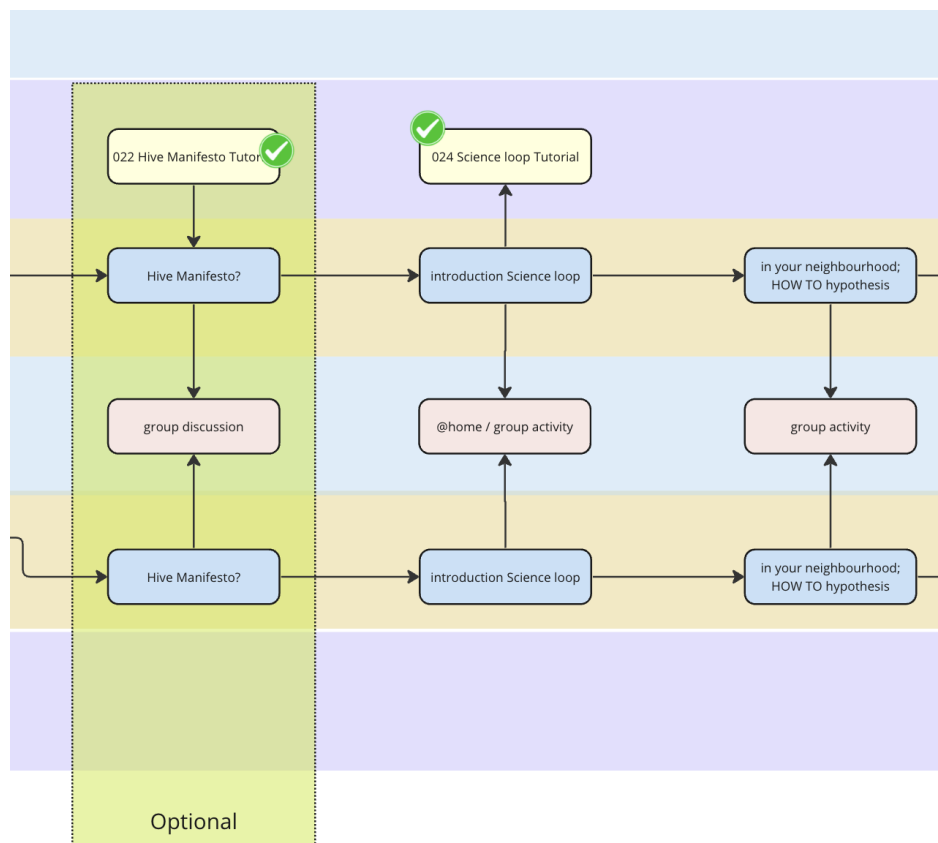


Figure 6. Close up of part of the detailed customer journey model showing process steps, activity type and handout specification.

Based on this schematic, we could now start to revisit our toolkit 1 ‘components’ and redesign them following our new design guidelines.

1. A4 handout based instead of slide based.
2. Actionable, inclusive, multilingual materials, visually supportive where possible.
3. Much shorter and accessible in language, bridging the gap from academic rigor to end-user friendly.

With our shortlist of all handouts needed completed we had to devise a co-creation process to enable all partners to contribute, revise and verify the materials before the start of pilot 2.

2.3 The horse race metaphor.

Managing the production and revision pipeline for the toolkit was a considerable challenge. We faced the task of refining 28 handouts, with an average of 10 pages. Post-evaluation of the first pilot, we shifted our approach. We acknowledged that requiring city partners to translate and tailor materials themselves was less crucial than initially believed and too burdensome, as they were already tasked with recruiting and training volunteers and overseeing the campaigns. Consequently, we chose to supply them with pre-translated and ready-to-use handouts.

In revising the toolkit, we developed 20 handouts, while substantially reworking the existing tools in the process. So while we weren't starting from scratch, a significant portion—about 90%—needed to be newly created. These new creations were driven by fresh insights, technological advancements, new features, and the recognition of previous omissions. Thus, we had to rework or create from the

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ground up roughly 280 pages of content, which, when translated into four languages, amounted to 1,120 pages. These pages had to navigate through a truly collaborative process, involving various partners working within tight timeframes to produce the highest quality toolkit possible. This necessitated several streamlined steps to efficiently move materials among partners.

To manage the complex scope of our project and the numerous items involved, we implemented a Miro board accessible to all project partners.

This Miro board features a Customer Journey (as seen in figure 1), which provides all partners with a clear view of every stage involved in initiating and completing a citizen science project in the SOCIO-BEE style, from inception to impact. It also displays the 'horse race' visual, offering insight into the sequence and intricacies of the co-creation process. Additionally, the board includes a ticket system to track progress. In this setup, each column represents a stage in the process, while the rows correspond to the handouts. Every handout is assigned a number and has a designated owner responsible for it at each stage of the process, ensuring clarity and accountability throughout.

| | | | | | |
|---|---|---|--|--|--|
| Material is discussed in plenary meeting. If all stakeholders agree: move to localisation. If not: move back to work in progress. | Owner: Daniel Copy is localised within format | Owner: Paolo Copy is localised within format | Owner: Maria Copy is localised within format | Material is final in English; Spanish; Italian; Greek. | Owner: Babis Material is hosted on the website |
| done (English and content check) | review Spanish | review Italian | Review Greek | Done | hosted |
| 001 How to organise a CS project Owner: Diego C. & Perle | | | | 001 How to organise a CS project Owner: Daniel 001 How to organise a CS project Owner: Nicc 001 How to organise a CS project Owner: Maria | final PDF's can be found in the NEXTCLOUD in folder 999 Certified Materials (PDF) |
| 002 SocioBee Narrative Owner: Evert H | | | | 002 SocioBee Narrative Concept GR Owner: Maria 002 SocioBee Narrative Concept ESP Owner: Daniel 002 SocioBee Narrative Concept IT Owner: Nicole | final PDF's can be found in the NEXTCLOUD in folder 999 Certified Materials (PDF) |
| same as 020 | | | | 002 Air pollution GR Owner: Maria final PDF! | final PDF's can be found in the NEXTCLOUD in folder 999 Certified Materials (PDF) |
| 004 how to communicate Owner: Diego C & Perle | | | | 004 how to communicate Owner: Daniel 004 how to communicate Owner: maria 004 how to communicate Owner: Nicole | final PDF's can be found in the NEXTCLOUD in folder 999 Certified Materials (PDF) |
| 005 How to identify QB's; WB's; Hives analysis Owner: Diego | 005 How to identify QB's; WB's; Hives analysis Owner: Daniel | 005 How to identify QB's; WB's; Hives analysis Owner: Nicole | 005 How to identify QB's; WB's; Hives analysis Owner: Maria | | |

Figure 7. Snapshot of the Miro Board, with the color-coded ticket system, monitoring the progression of each handout in four languages, with each ticket owned by a partner organization representative.

During our 5th plenary meeting in Brussels (October 2023), it was decided to establish working groups, with one specifically dedicated to the toolkit creation process. In our weekly workgroup sessions, we meticulously reviewed each ticket and cross-referenced it with the file repository on our Next Cloud Server. This careful and labor-intensive method was adopted because we believe it to be the most

effective way to align closely with the end-user requirements, with pilot cities actively participating in the specification and correction of all materials.

Managing this 'horse race'—the digital circulation of 80 handouts through six interdependent stages across Europe—was an intricate endeavor. Our city partners merit particular acclaim for their constant alertness, timely responses, and critical feedback, which were all vital to the project's success and are reflective of true pan-European collaboration. As the coordinator of this task, the success hinged on the cooperation of each partner involved, and their dedication was crucial to achieving our collective goal.

2.4 Publication and dissemination of materials.

The toolkit materials will soon be accessible on the SOCIO-BEE project's website. With the help of our communication partner ECSA, we've established a dedicated area for all the resources. To cater to the different user groups, such as Queen Bees and Bees, the materials are organized in line with our bee metaphor. This structure allows users to find the appropriate materials from their unique user perspective. Additionally, the materials are categorized into four language groups to accommodate linguistic diversity.

This approach guarantees that SOCIO-BEE volunteers have tailored access to the necessary resources according to their role, and it also broadens the availability of these materials beyond the confines of the SOCIO-BEE pilot initiatives, offering valuable resources to the broader community interested in citizen science and air quality issues.

3 The SOCIO-BEE Toolkit inventory

The SOCIO-BEE toolkit in its final appearance consists of actionable handouts, intrinsically connected to the mobile app, web app and the WSN to form an integrated solution to support citizens in executing air pollution measurement campaigns.

In line with the first deliverable (D2.8), we provided a short inventory of the handouts in the toolkit and their function.

Table 2. Toolkit index second release

| | | Mun | BK | QB | B | |
|---|---------------------------------------|-----|----|----|---|---|
| 1 | How to organize a CS project* | X | X | | | Aimed at BeeKeepers and Queen Bees, this tutorial provides a helicopter view on the various phases of a CS project in preparation of setting up such a project. |
| 2 | How: The SOCIO-BEE metaphor narrative | X | X | | | This infographic explains the SOCIO-BEE metaphor and concept as whole, aimed at municipalities and beekeepers primarily. |

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| | | | | | | |
|----|--|---|---|---|---|---|
| 3 | Data Protection and ethics* | X | X | | | Aimed at BeeKeepers, Queen Bees this tutorial aims to make this complex subject actionable for Hives to operate in a responsible and safe manner. |
| 4 | How to: Inclusion* | X | X | | | Aimed at BeeKeepers, this online tool/questionnaire and coinciding background reading supports in providing inclusive design parameters for the proper conduct of a CS project. |
| 5 | How to communicate a CS Project* | X | X | | | Aimed at Queen Bees and Bees, this tutorial advises on the importance of public communication of results and how to go about that. |
| 6 | How to identify Roles in a CS Project * | X | X | X | X | Aimed at Municipalities and BeeKeepers this tutorial supports these stakeholders in how to identify and engage these types of volunteers in the SOCIO-BEE metaphor. |
| 7 | How to use the Academe? | | | X | X | Aimed at Queen Bees and Bees, this tutorial explains how to use the web app to create campaigns, monitor them and analyze campaign results. |
| 8 | How to understand: Air Pollution 101* (children) | | | X | X | Aimed at Queen Bees and Bees, this tutorial introduces the subject of air pollution to citizens, introducing a taxonomy of the key pollutants and the invisible nature of the problem. |
| 9 | How to understand: Air Pollution 101* (adults) | | | X | X | Aimed at Queen Bees and Bees, this tutorial introduces the subject of air pollution to citizens, introducing a taxonomy of the key 10 pollutants and the invisible nature of the problem. |
| 11 | How to install the mobile app | | | X | X | before a hive can start a campaign, all Bees have the get the mobile app installed and running on their phone. |

| | | | | | | |
|----|------------------------------|--|---|---|---|---|
| 12 | How to use the mobile app? | | X | X | X | Aimed at Beekeepers, Queen Bees and Bees, this tutorial explains how to use the mobile app to join a campaign, and perform correct measurements (using suggested data measurement locations from the micro-volunteering engine by DEUSTO) |
| 13 | How to: Hive manifesto* | | X | X | X | Aimed at Beekeepers, Queen Bees, and Bees, this tutorial supports an activity to create a manifesto for each individual Hive to collectively define certain rules of conduct, values, or ambitions to support the group dynamic process or provide (social)safety standards. |
| 14 | How to: do the Science Loop? | | | X | X | Aimed at Queen Bees and Bees, this tutorial explains the steps and provide some tools to explain the scientific process parallel to the beehive metaphor, to make citizens aware of their role as citizen scientists. It supports group activities on coming up with an hypothesis and a prediction for their campaign. |
| 15 | How to: Design a campaign | | X | X | | This document guides you through the process of setting up and maintaining a campaign. For that it references to many other manuals and materials on this page. |
| 16 | How to measure in a campaign | | | X | X | To take good measurements you need to know how the sensor and the app works, but you also need to know how to treat the sensor well. |
| 17 | How to monitor a campaign | | X | X | | Aimed at Beekeepers and Queen Bees, this tutorial aims to enable them to use the relevant features of the online platform to monitor the progress of a running campaign. |

| | | | | | | |
|----|--|--|---|---|---|---|
| 18 | How to interpret Campaign results lvl1 | | | X | X | Aimed at Queen Bees and Bees, this tutorial supports a Hive in analyzing their campaign results based on <u>heatmaps</u> as part of the online app and reflect on the hypothesis and predictions made at the start of a campaign, closing the citizen science loop. |
| 19 | How to interpret Campaign results lvl2 | | | X | X | Aimed at Queen Bees and Bees, this tutorial supports a Hive in analyzing their campaign results in a more advanced manner using exported CSV data sets. |
| 20 | How to measure engagement* | | X | X | | Aimed at Beekeepers and Queen Bees, this tutorial supports them in monitoring campaigns in progress and provides pointers how to measure engagement of bees, identifying various types of engagement. |

Separate annexes contain all actual handouts in UK, as well as the Inclusion Toolkit Support Text as a stand-alone tool for future EU projects.

In addition to tool #4, How to: inclusion, a separate tool is developed with is far more elaborate. An Inclusion toolkit for EU projects is not readily available. The team at DEUSTO, lead by María López Belloso (Phd), developed a reflective tool (questionnaire) with supported documentation that can act as stand-alone tool outside our SOCIO-BEE toolkit. The supportive document explaining and underpinning this tool is included in this deliverable as a separate Annex 3.

4 Conclusion

In refining the second iteration of the toolkit, we absorbed the valuable insights gained from the initial pilot tests. This led us to establish a new development methodology, which placed a greater emphasis on co-creation and incorporated direct feedback from pilot city users, who played a pivotal role in steering the development direction. Our 'cascading model' was used to visualize a linear user-centered journey, mapping out the path from city stakeholders to individual citizens. Each step identified actionable steps and identified what scaffolding materials that stakeholder would need. It helped to pinpoint specific needs and identify potential enhancements compared to the first draft of the toolkit.

Our innovative 'horse race' logistical system was then introduced to manage the progression from expert input to final user support. This system leveraged the diverse expertise within the consortium to validate each phase of development. A significant hurdle we overcame was synchronizing the development timelines of the technology and the corresponding support materials. By collaborating closely with our technological partners and utilizing accurate mockups, we were able to align the support materials with the upcoming functionalities of the tech tools, ensuring their effectiveness upon release.

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Although we had 12 components developed for the first release of the toolkit (See Table 1: index of toolkit first release) these were revised thoroughly and expanded by another 8 components to build the revised and final version of the SOCIOBEE toolkit.

Throughout this intricate co-creation process, we emphasized the importance of ownership for each specialist within the consortium, allowing their expertise to significantly enhance the quality of the toolkit materials. This collective effort ensures that when the technology is ready to go live, the supporting materials are not only in place but are finely tuned to meet the needs of end-users.

References

ⁱ <https://www.deepl.com/nl/translator>

ⁱⁱ https://miro.com/app/board/uXjVNV5OyPg=/?share_link_id=323850067884

ⁱⁱⁱ Deliverable D2.1 - Profiling instrument CS Bees and Bears identification.R1

^{iv} <https://miro.com/app/board/uXjVNV5OyPg=/?moveToWidget=3458764585873216365&cot=10>