SISCODE CO-DESIGN FOR SOCIETY IN INNOVATION AND SCIENCE

DELIVERABLE 3.3

PROTOTYPES

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1. Executive summary

SISCODE is exploring the use of co-creation to promote responsible research innovation (RRI) in Science, Technology and Innovation (STI) by an original approach crossing knowledge from literature, qualitative analysis and research action.

The consortium hypothesised since the beginning of the project that prototypes are essential means to move from co-design to co-production and thus, could allow to reach the classic gap between ideation and implementation. This posture is complemented by the role of Labs seen as territorial ambassadors of co-design and prototyping acting as key educators, change-makers and gap bridgers.

Since November 2018, SISCODE partners are running an experimentation taking place in 10 co-creation labs across Europe. This experimentation aims at empowering labs with new skills, cross-pollinating knowledge and better understanding how to better combine co-construction (ideation) and co-production (implementation) of solutions and policies for the integration of society in science and innovation.

A co-creation process based on experiential learning and design thinking were used to support the co-creation journey of each lab. It is divided into 4 phases: phase (1) analyse the context; phase (2) reframe the problem; phase (3) envision alternatives; phase (4) develop and prototype.

While previous deliverables (D3.1 and D3.2) describe the first phases of the journeys, this deliverable aims at describing the results of the prototyping process conducted in each of the SISCODE labs from August 2019 to October 2020.It is important to highlight that a collective effort has been made to understand the appropriate scale of prototyping and implement strategies that were feasible for each organisation and at the same time sufficiently elaborated to create an adequate sphere of influence and reach the appropriate stakeholders for designing, discussing critically and testing the concept.

A rich variety of artefacts and processes were created in different localities within specific and moving ecosystems of co-creation. Those prototypes are considered here not only as results of the process of co-design but also as intermediary objects serving for dialogues between stakeholders looking for exploring diverse representations and offering original solutions to societal challenges.

The deliverable is separated in four parts:

- It first introduces key theoretical background on prototypes and prototyping processes. Then, it highlights the specificities of how prototyping is used and considered in SISCODE's project.
- This second part particularly emphasizes the importance given in SISCODE to prototyping as a potential driver for supporting a better implementation of RRI in the STI processes. It describes how labs, supported by other members of the project, have developed their own way of prototyping to give tangibility to their initial concepts.
- Part three is dedicated to the description of activities for each of our labs. Each lab presents their overall context and challenges, then describes a blueprint and a demonstrator of their solutions. They end their narrative by informing us about their process of prototyping giving key elements about iterations and testing. The prototypes developed during SISCODE are extremely varied due to the diversity of contexts, the background of the single labs and therefore the complexity of the challenges addressed, the maturity of the solutions, the intents in terms of social changes and the innovation capacities of the local ecosystems (See Table 1). COVID-19 also affected them in many ways.
- The deliverable concludes by raising key reflections and insights about the nature of prototypes, their processes and roles in social transformations.

All the results have been gathered in a common infographic co-created in the software Miro, accessible here: https://miro.com/app/board/o9J_lfwhbJM=/. We recommend opening it while reading the individual descriptions for having a better quality of the visual contents.

This deliverable refers to the result of task T3.3. This task has been done in parallel with T3.4 and has mainly benefitted from the work of WP4 and WP6 referring to policy maker engagement and sustainability. A synthesis of the solutions described here has been integrated in each case-study (D3.4) and will serve as a basis for WP5 activities, the exploitation strategies (WP6) and dissemination activities (WP7).

Table 1: Synthesis of lab's prototypes

Labs	Territory of intervention	Challenge	Types of Solutions	Proposed Artefacts
IAAC|Fab Lab Barcelona	Barcelona Poblenou Neighbourhood	Food Leftovers and Fab Cities	Local **ecosystems** for circular solutions and biomaterial making	Remix El Barrio collective illustrated by an **exhibition, a Gitbook and a set of video tutorials** for biomaterial making
Polifactory	Lombardy region	Cerebral Palsy	New **playground** for performing physical reactivation for children.	Body-Sound, web **platforms** for kids performing 'choreographies' transformed into 'melodies'
Maker	Copenhagen City	Plastic and Fab Cities	Small-scale **ecosystems** for plastic recycling	PIPO community, their Digital **Exhibition** and Case **Catalogue**
KTP	Malopolska Region	Air pollution	New **services and processes** for co-creating with local new policies on Air Pollution	A new **blueprint** for local supports the new Air pollution **programme** of the region and a **Platform** for monitoring industrial pollution
PA4ALL	Novi Sad city	Precision Agriculture	A new national **curriculum** for agricultural high schools	A Curriculum **programme and process** and promotion of the AgroSens **Platform**
THESSAHALL	Thessaloniki City	Loneliness in Ageing	Life-long **learning programmes** to engage elderly people in research activities	Partners of Experience" **life-long learning programme** for early-stage researchers over 65 years old
CIENCIA VIVA	Lisbon's river coast	River's Access and engagement	An engaging festival with practical yearlong activities that could *show* that the river is interesting has the capacity to better populate the river.	Online **learning and engagement service** focused on boat design, building and co-creation skills, and dissemination Mock-up of the web platform that should be the hub of our service
CUBE	Voerendaal city	Quality of Life and citizen engagement	A design **tool** that helps citizens and policy makers to better collaborate, plan, evaluate and coordinate co-creation processes	A **Co-Design Canvas**, a physical conversation tool, consisting of eight stimulating cards and a set of storyboards
SCIENCE GALLERY	Ireland country	Mental health and well-being for youth	OPEN MIND programme, a co-created set of **educational modules** about Well-being for schools	The Open Mind **guide** for teacher
TRACES	Paris, Île de France Region	Intelligibility of AI	**Cultural performances** for exploring co-spectatorship among human beings and artificial agents	An illustrated **procedure** to support an audience to engage with AI in cultural events. (**service blueprint, Prezi**)

2. On prototypes and prototyping activities

"Prototypes allow us to develop ideas in a different way—by thinking with our hands. We may not have an idea completely developed, but the act of building it—putting our idea into a concrete format—allows us to push our thinking forward.

Tangible, visible representations of new behaviours serve as both encouragements to behave in new ways and as ongoing prompts or reminders of the new behaviours."

Coughlan, 2005

Prototyping is core to how designers do their work. It supports the transition from blurred, general and often abstract ideas and concepts towards tangible and concrete products and services.

To be defined in a simple way, a prototype is an early sample, model or release of a product created to test and discussed by the designers during the concept/idea stage. It is a core part of the design process (see Fig 1).

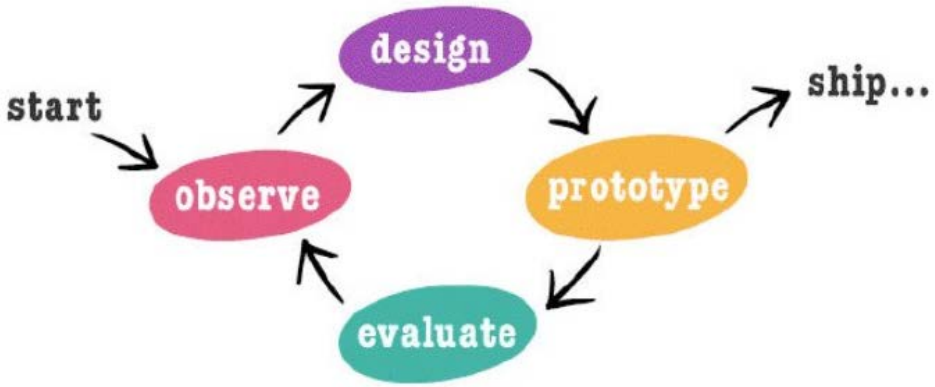

Fig 1: Prototyping in a classic design process
(From POLIMI's internal presentation - September 2019)

It is important to keep in mind that prototyping is all about trial and error. Starting from an initial idea or even single elements it is an iterative process that typically requires several stages of revisions to arrive at a functioning, implementable version.

2.1. Low-fidelity and high-fidelity prototypes

There are different degrees of prototypes that can be visual such as Sketches, Diagrams & Frameworks, Hand Made Constructions, Machined Constructions, Virtual Models, Graphics, Packaging, Spaces, Role Play, Experiences, or Video. Prototypes are generally expressed in terms of fidelity. Fidelity refers to the level of detail and functionality that is included in the prototype. Usually, this depends on the development stage the teams are working on. Low fidelity prototypes for example could be sticky notes or sketches, which are ideal for brainstorming. These quick and inexpensive quick and inexpensive preliminary versions leave room for modifications and improvement throughout the process encouraging creative thinking. On the contrary, hi-fi prototypes are often the last step of the final development or applied with solutions that cannot be tested as low fidelity prototypes. This includes for example visual design like colour, typo or functional page layout. Hi-fi prototypes can almost arrive until the final product or service. The creation of high-fidelity prototypes is usually based on an already solid idea of how the final product or service is going to be, it is used when teams need to either test it with real users or get final-design approval from stakeholders. Hi-fi prototypes may take the shape of a 3D printed plastic model with movable parts, a graphic user interface or a simulation of the service. As Gene Bertrand highlighted for the SISCODE MOOC, "*No matter if low- or high-fidelity prototype, it is important that it lets users experiment and interact with the prototype just as they would with the final product, to test the functions and scope of the product or service while offering them the opportunity to give focused feedback*".

"Just as important as the prototypes themselves are the activities and attitudes involved in the process of creating, testing, and refining them." *Couglan, 2005*

2.2. Approaches to prototyping

To analyse prototyping as a process, two approaches are generally considered; on one side is the (1) specification-driven approach, which relies heavily on data before prototyping and prototypes seek to validate specifications already established. On the opposite side is the (2) prototype-driven approach, where prototyping usually appears from an early stage of the design process and contributes to experiment and identify opportunities for the outcome

rather than to validate existing concepts. “At times, theory dictates the experimental agenda; at others, experimental discoveries drive the theoreticians” (Shrage, 1996, p. 3).

On the one hand, the perception of prototypes as the result of an innovation process is leading to a belief that periodic prototyping can drive innovation processes by producing human-centred products and services that meet real market and user needs.

“Designers that are held to periodic prototyping schedules are likely to become more prototype-driven.” (Shrage, 1996, p. 9)

On the other hand, prototyping can also become a means for communication between teams and stakeholders, acting as a boundary object that enhances dialogue and integration, leading to a cross-functional organisation of teams. ‘… conceive of the process of prototyping as “thinging,” that is, not only as a thing (an object) but as a socio-material relationship in which issues can be dealt with.’ (Tironi, 2018)

In this sense, prototyping is becoming a collective activity, which aims to involve stakeholders and users from the beginning of the design process into a practice that allows all participants equally to make sense of and reason on future scenarios, beyond testing solely features of a specific solution. In a variety of disciplines, such as art, science design and political organisations, prototypes have become part of an emerging culture based on participation, experimentation and innovation. “The experimental and open-ended qualities of prototyping have become a surrogate for new cultural experiences and processes of democratisation” (Corsín, 2014, p. 382)

In other words, prototyping is about giving people the space and time to materialise, concretise and test their ideas, it turns a vision into a tangible experience by creating objects of dialogue and designs that allow interaction with people and spaces, to evoke debates to capture the potentialities and risks involved in innovation.

Prototyping does so by manifesting interconnection between ideas, matter, theory and practices, bringing together soft and hard systems approaches. It is about learning by doing, giving tangibility and creating bridges between projects, scales and stakeholders.

3. Prototyping in SISCODE

3.1. Scope of the prototypes in SISCODE

In SISCODE, the function of prototyping is investigated specifically as a driver for supporting a better implementation of RRI in the STI processes. It has been observed in previous works (WP1 deliverables) that there is a huge gap between the ideas and values promoted by RRI and their effective development in territories while prototyping has been found as a means to bridge exactly this gap in other fields and context. Therefore, the step from ideation to implementation through prototypes is explored in the field of RRI policy making.

Furthermore, the experimentation is addressing also the aforementioned social aspect of prototyping by testing how prototypes change interactions and dynamics among stakeholders and finally, how it could help to support organisational changes, move from ideas to new realities and empowering labs with design and prototyping skills to foster the actions in local contexts.

<u>Prototypes as a mean to move from co-design to co-production</u>

Having identified the issue to move from ideation to implementation (Von Schomberg, 2013), bridging this gap has been one of the main objectives for all the partners during the experimentation.

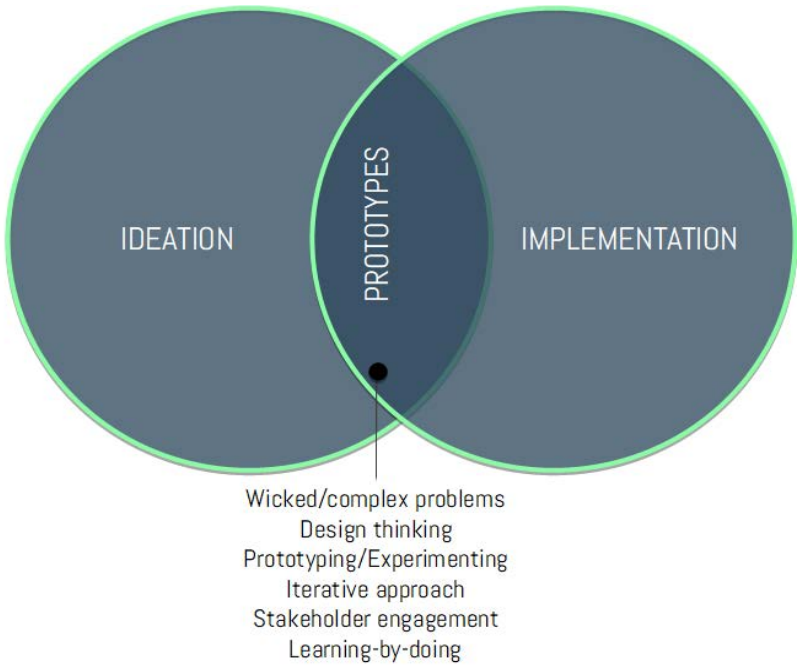

Fig 2: Prototypes an interface between ideation and implementation

(From POLIMI's internal presentation - September 2019)

The underlying assumption is that design methodologies and tools are suitable to support co-creation for the inclusion of society in science and innovation and exploit their practical orientation to bridge the gap between ideation and implementation. What differentiates design from other co-creation methodologies is the role of prototypes and their experimentation in real contexts.

Prototypes can provide support in shortening the distance between "co-construction and its outcomes as they are refracted through practicalities embedded in existing institutions and interests" (SwafS-13- 2017 topic, European Commission, 2015).

The experimentation in a real context is crucial to explore the possibilities of bridging the gap between ideal and real outputs that the application of co-creation and RRI can produce.

Labs as territorial ambassadors

In SISCODE, we defend the idea that to create new infrastructures for design both at local and global scales a bottom-up approach starting from small-scale experiments is an effective way to ensure local dialogs and frequent bi-directional exchanges around needs, uses and designs as well as existing versus future impacts to then apply them at larger scales.

Labs are seen as the ambassadors of prototyping acting as key educators, change-makers and gap bridgers. In the SISCODE experimentation, three types of labs jointly experience prototyping mixing visions and approaches from their network.

- Fab Labs support prototyping by making digital fabrication accessible and creating communities of makers.
- Living Labs create and use prototypes to define the best user's experiences.
- Science Centres and Museums co-design and use prototypes as objects to enhance knowledge transmission and critical thinking, to open innovation and debate societal controversies.

Beyond the belongings to a predominant kind of practices, labs generally build hybrid models to adopt an original approach that connects civil society, academic institutions and industrials for a better appropriation of innovation.

Prototypes in the overall process of experimentation.

As mentioned in previous deliverables (SISCODE D3.1 and D3.2, 2019), the experimentation in co-creation labs consists of 10 labs co-designing and co-producing answers and solutions to specific challenges coming from their territorial context. The methodological framework

to guide the experimentation is based on the experiential learning model of Kolb and an iterative design process of 4 steps: analysing the context, reframing the problem, envisioning alternatives and prototyping and developing.

At the end of July 2019, labs were ready to start with prototyping activities and enter in a cycle of loops of development and testing allowing to refine their solutions and give more fidelity or impacts to their concepts.

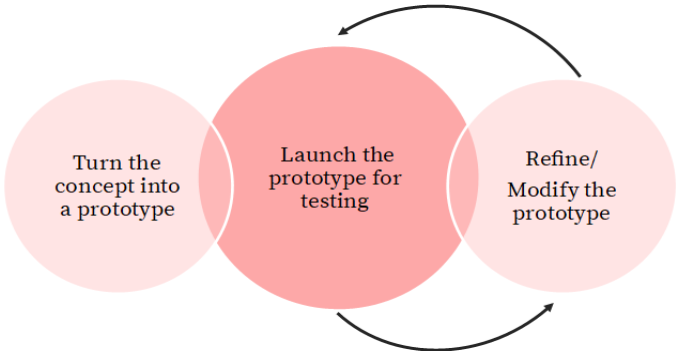

Fig 3: Prototyping process from concepts to iterations

Labs had to develop its approach to prototyping to give tangibility to the main concept created in the ideation phase. An effort has been made to understand the appropriate scale of prototyping and implement strategies that were feasible for the organisation and sufficiently elaborated to create an adequate sphere of influence and reach the relevant stakeholders for designing, discussing critically and testing the concept. The guiding questions for this activity are listed in the table below (Table 2).

Table 2: From concept to prototypes. Guidelines for strategic planning

What kind of prototypes I will do?
- Material
- Product
- (eco)Systems
- Services

What kind of techniques and tools I will use?
- Sketching techniques
- Digital Fabrication tools
- Experiential Prototyping techniques

Who will I show my prototype to?
- homogeneity, scale (number of users)
- conflicting interests, special needs
- access & availability / time / commitment

What do I expect to learn from them?
- background: their knowledge, problems, dreams & wishes
- preferences: alternatives, features
- overall experience: likes and dislikes, mood, attitude

What role do I want them to play in the design?
- teach you about the use context

- learn from you about possibilities
- collaborate in developing design ideas / solutions

Combined efforts from the labs and the supporting partners (SPI, IAAC, DDC, POLIMI) have been made to better understand the heterogeneity of what was *prototyping* in the different project contexts and to define the appropriate process to support knowledge exchanges and peer-to-peer learning.

A set of pedagogical materials have been jointly developed by POLIMI, IAAC and Cube integrating the basic principles of prototyping, digital fabrication, service design including some examples and case studies of their application. Then, a specific learning workshop (online or in-person) has been proposed to each lab or groups of labs belonging to the same network according to their previous experience in prototyping to support them in designing their own process of prototyping.

Labs were encouraged to develop a multi-stakeholder service design experience and run a process with at least 2 cycles of iteration of developing, prototyping and evaluating.

Additionally, to improve the learning effect and better plan the testing and evaluation phase, a specific guideline of tools and methods has been created by POLIMI and disseminated to the Labs co-elaborating individual documents with suggested methods of evaluation all along the stage of prototyping for each specific project. Each evaluation activity included a description of how to set up and conduct the activity together with some specific tips and examples of applications that could support the single pilots.

After this planning phase, all Labs were able to launch their prototyping activities. The supporting activities for the labs from the consortium had then relied on two levels:

- Peer-to-peer learning activities happened during common calls with all the labs set up every second Wednesday with a duration of one hour as well as specific interventions during consortium meetings. The format for the common call sessions was to keep a general space of discussions brought by the support teams and to let the floor to two different Labs each session to showcase best practices and discuss encountered issues. For the consortium meetings, labs had the chance to present a state of the art of their journey and to test some tools dedicated to sustainability during workshops. Specific sessions have been created in collaboration with the other partners, such as the Business Modelling workshop organised by SPI and dialogues among researchers and practitioners dialogues on specific topics like prototyping or

the co-creation ecosystem model developed in WP2 (see SISCODE deliverables D2.2 and D2.3).

- Individual coaching session with members of the support team on the following topics:
    - Sustainability (SPI),
    - Policy Maker Engagement (DDC), and
    - Co-creation as a practice (IAAC + POLIMI).

The rhythm of the coaching sessions was adjusted to the needs of Labs at first and then followed by regular check-ups organised by the support team to better synchronise and support them.

With the outbreak of the COVID-19 pandemic, some adjustments have been made both to the support activities and especially the prototyping activities themselves. As most of the Labs have been closed, many of the co-creation activities such as material experimentation, workshops and usability tests have been cancelled or adapted to online formats. To be able to adjust to these changes and develop appropriate alternatives, the deadline for the prototyping activities was extended from July to November 2020 to give the possibility to some Labs severely affected by the restrictions to organise a last cycle of prototyping during the autumn period. Both the process of prototyping, as well as the nature of the prototypes itself, have been influenced by the COVID-19 situation as described in detail in the Deliverable D3.4 on the single case-studies, in chapter 4.

3.2. A diversity of prototypes in the SISCODE LABS

The prototypes developed during SISCODE are extremely varied due to the diversity of contexts, the background of the single Labs and therefore the complexity of the challenges addressed, the maturity of the solutions, the intents in terms of social changes and the innovation capacities of the local ecosystems (*See Table 3*). All the results have been gathered in a common infographic co-created in the software Miro, accessible here: https://miro.com/app/board/o9J_lfwhbJM=/. (*see Overview in Fig 4*).

Table 3: Synthesis of lab's prototypes

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KTP	Malopolska Region	Air pollution	New **services and processes** for co-creating with local new policies on Air Pollution	A new **blueprint** for local supports the new Air pollution **program** of the region and a **Platform** for monitoring industrial pollution
PA4ALL	Novi Sad city	Precision Agriculture	A new national **curriculum** for agricultural high schools	A Curriculum **program and process** + promotion of the AgroSens **Platform**
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TRACES	Paris, Île de France Region	Intelligibility of AI	**Cultural performances** for exploring co-spectatorship among human beings and artificial agents	An illustrated **procedure** to support an audience to engage with AI in cultural events. (**service blueprint, Prezi**)

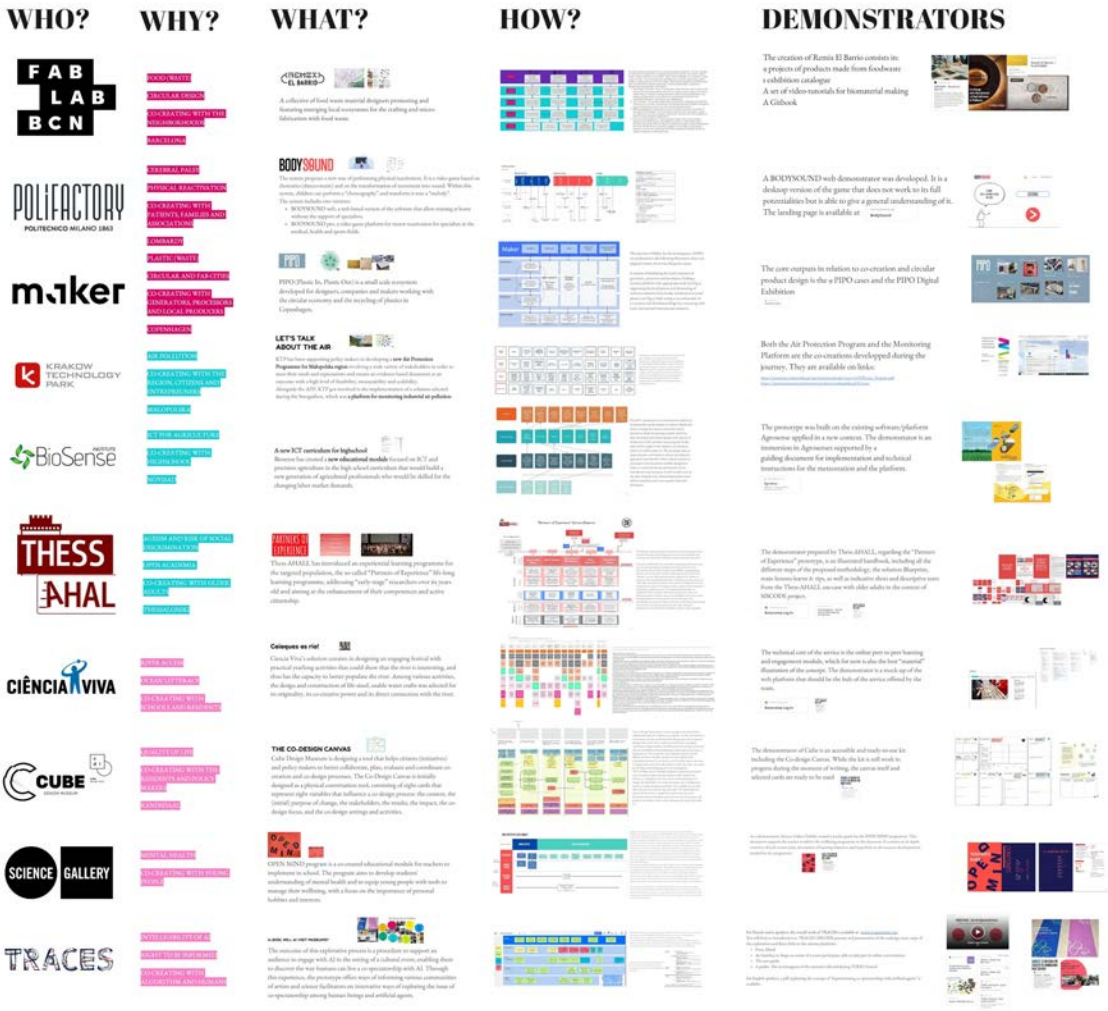


Fig 4: Overview of the infographic gathering all Lab's prototypes

4. Description of the prototypes resulting from the long-term experiments

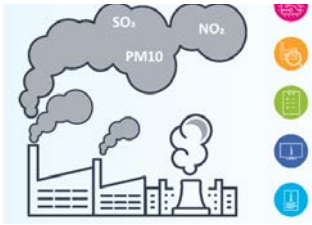
As for each deliverable of the WP3, the labs have an independent section where they elaborate on their activities. For gathering information on the prototyping activities, a template has been developed by IAAC and validated by the Polimi team (see Annexe 1). It introduces a specific terminology that has been established and discussed with the labs. In the following section, each lab will contextualise its journey, describe the blueprint of its solution, introduce a demonstrator and conclude with some insights on their process.

The prototypes will be presented in the following order:

1.IAAC| Fab Lab Barcelona

2.POLIFACTORY

3.MAKER

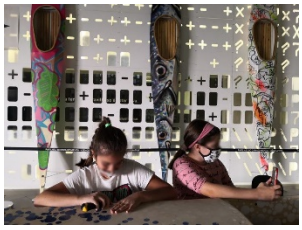


4. KTP

5.PA4ALL

6.ThessAHALL

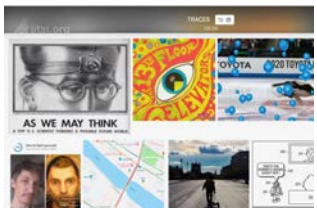
7.Ciência Viva



8. Cube Design Lab

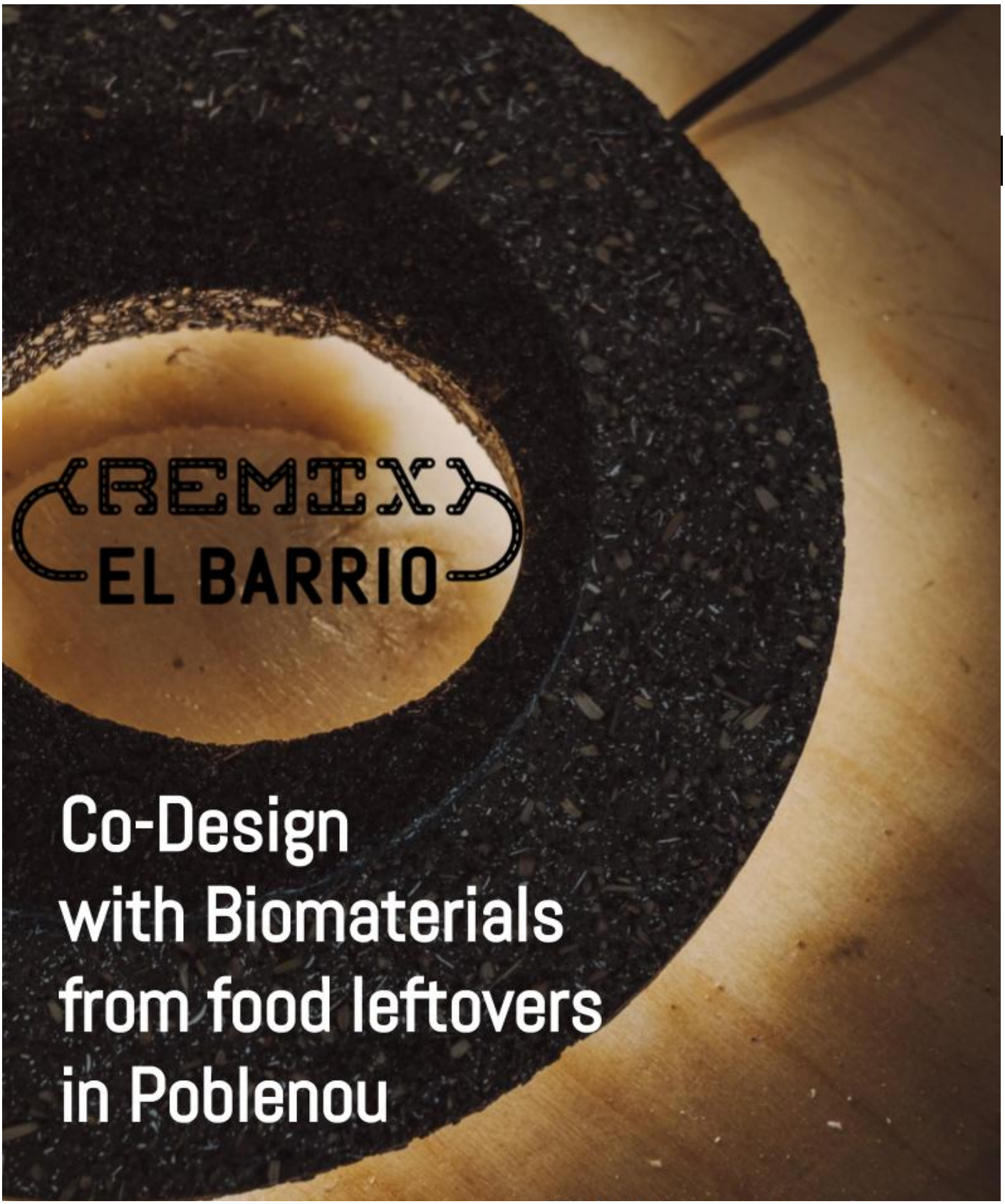
9.Science Gallery Dublin

10.Traces



4.1. Remix El Barrio by IAAC|Fab Lab Barcelona

written by Marion Real, Anastasia Pistofidou and Milena Juarez Calvo



Context and Societal Challenge

Over the last 30 years, plastic production has increased by 620%.

Every day in Catalonia, 720,000 kg of food is thrown away. This wasted food, totalling 260,000 tonnes per year[1], is equivalent to the food needs of 500,000 people for an entire year.

With the International Day of Awareness of Food Loss and Waste[2] and the new Catalan law on food waste, the need to rethink people's relationship with both food and the concept of waste at all levels is reinforced.

A variety of actors like restaurants, markets, producers, gleaners, cooperatives, associations, public administration, or neighbours are coming together to prevent food waste, to increase the use and value of food along the food chain, even more in a pandemic context.

The urgency of awakening and enhancing the value of local design to find relevant ways to collectively respond to these challenges is becoming increasingly evident.

Within this context and under the umbrella of the Fab City Agenda[3], IAAC|Fab Lab Barcelona is synergising in the neighbourhood of Poblenou in Barcelona with local communities to co-create new circular product-service systems and innovative materials from local food waste. The developed pilot gives emphasis on creating synergies at a neighbourhood level between local needs and resources, through learning-by-doing activities and supporting alternative forms of craft, based on the transformation of food waste and surplus.

By using a set of design and co-creation methodologies to support a transition towards re-valuing food surplus and bio-waste at the neighbourhood scale, the pilot has been collaborating with local restaurants, cooperatives, local associations, urban gardens, and makers' communities and engaged more specifically with three circular community projects connected to the food value chain: food waste redistribution, bio-waste-based material development and collective composting.

Remix El Barrio was born with the ambition to propose a learning and development space to foster and nurture practices based on crafting with food waste. It came with the intention of creating a 'mix of material, people and social experience.'

Composed by 9 design teams, Remix El Barrio has identified possible waste streams in Poblenou's services for the creation of new production systems. The participants were provided with materials, access to machines and experts through the Fab Lab Barcelona, online interaction spaces, weekly collective activities and individual coaching both at technical level and community engagement.

[1] March 2020: Catalan law on food waste accessible here: https://www.boe.es/eli/es-ct/l/2020/03/11/3
[2]More info: http://www.fao.org/international-day-awareness-food-loss-waste/fr/
[3]More info: https://fab.city/

Blueprint of Fab Lab Bcn's solution

From an incubation programme, Remix El Barrio is now becoming an active collective of food waste material designers (the Remixers) promoting and featuring emerging local ecosystems for the crafting and micro-fabrication with food waste at the neighbourhood scale and beyond.

The solution proposed here is not just about material innovation from food leftovers, it consists of giving solutions on how to implement local learning ecosystems that give new life to food leftovers avoiding them being tossed too early. It is about fostering and sustaining local synergies, about micro-fabricating a series of material and products and it is about inspiring and guiding communities toward a new future for social bio-design and distributed manufacturing.

The four synthetic documents have been designed to best describe the different dimensions of circular ecosystem emerging within Remix El Barrio:

- A Geographical Map has been created at the district level to show the synergies created between the designers in the makerspace, the providers and local associations (Fig 5).
- An illustrated list of the Remixers projects shows what kind of materials, products and experiences have been made with a variety of food waste (Fig 6).
- A Service Blueprint synthesised the future offers such an ecosystem could propose to local stakeholders (Fig 7).
- A policy brief destined to policy makers gives an emphasis of the future challenges and ambition of Remix El Barrio (Fig 8).

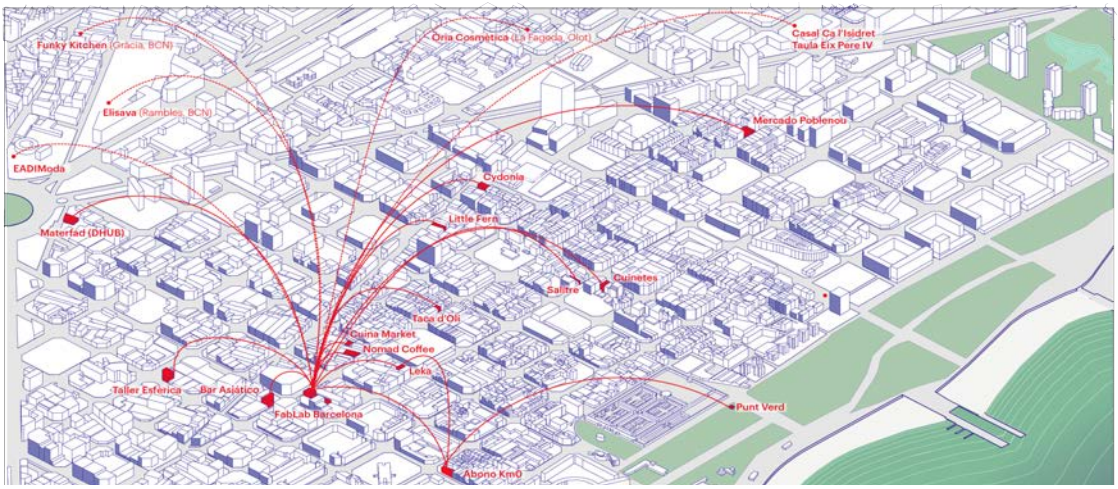


Fig 5: Representation of the ecosystem explored with all the Remixers –

Credit: Laura Freixas

Fig 6: Overview of potential applications of food waste - Credit: Anastasia Pistofidou

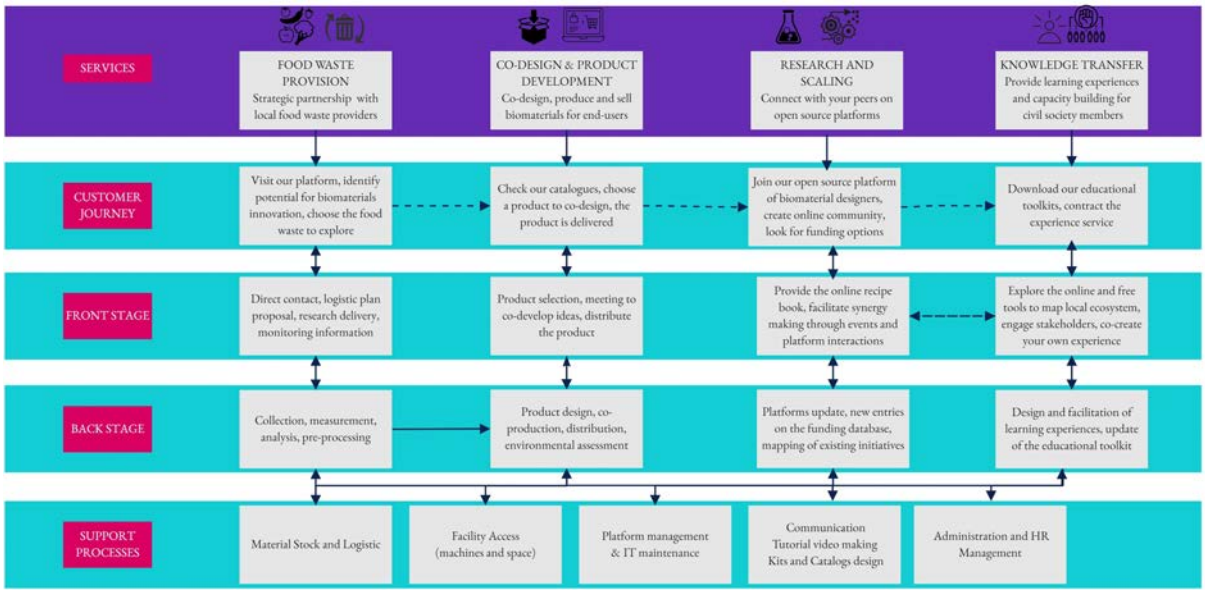


Fig 7: Service blueprint of the ecosystem - Credits: Marion Real and Milena Juarez

For promoting the development of a local food waste ecosystem, the team ideated an ideal service blueprint for a neighbourhood community who will need to collect waste, design materials and products, foster their knowledge and empower a wider range of actors. Four branches were identified that could be implemented either linearly or autonomously one from another. Each of these branches (described as columns in Fig 1.3) targeted specifically some type of stakeholders among restaurants and food stakeholders, prosumers, researchers and industries, and citizens:

- **Food Waste Provision**. Such an ecosystem starts with the need to define what are the local food ecosystems, what kind of waste could be valued and how to collect them. It involves creating new bonds with the food stakeholders and started collaborating on new actions for pushing them towards more sustainable behaviour and active local engagement.
- **Co-Production.** The second logical step is to envision, prototype and build the infrastructure to locally manufacture and distribute products between designers, local manufacturers and futures users/consumers/prosumers.
- **R&D development.** Many barriers and constraints remain on the path of biomaterial development. The innovation's actors need more space, means and platforms to create, prototype, assess the relevance and the possibility to scale such bio-designed applications.
- **Community Empowerment**. Those solutions need to be communicated, adopted and transformed for the different contexts to raise awareness in the local community. Remix El Barrio's collective through its close collaboration with Fab Lab Barcelona is actively engaged in the design of educational programmes, community workshops that make possible knowledge transfer and capacity building in a distributed way[4], connecting local makers through global platforms and academia.

This Service Blueprint helped to create a policy brief destined to all relevant stakeholders willing to engage and support Remix El Barrio in the circular transformation of local ecosystems.

[4] https://distributeddesign.eu/resources/

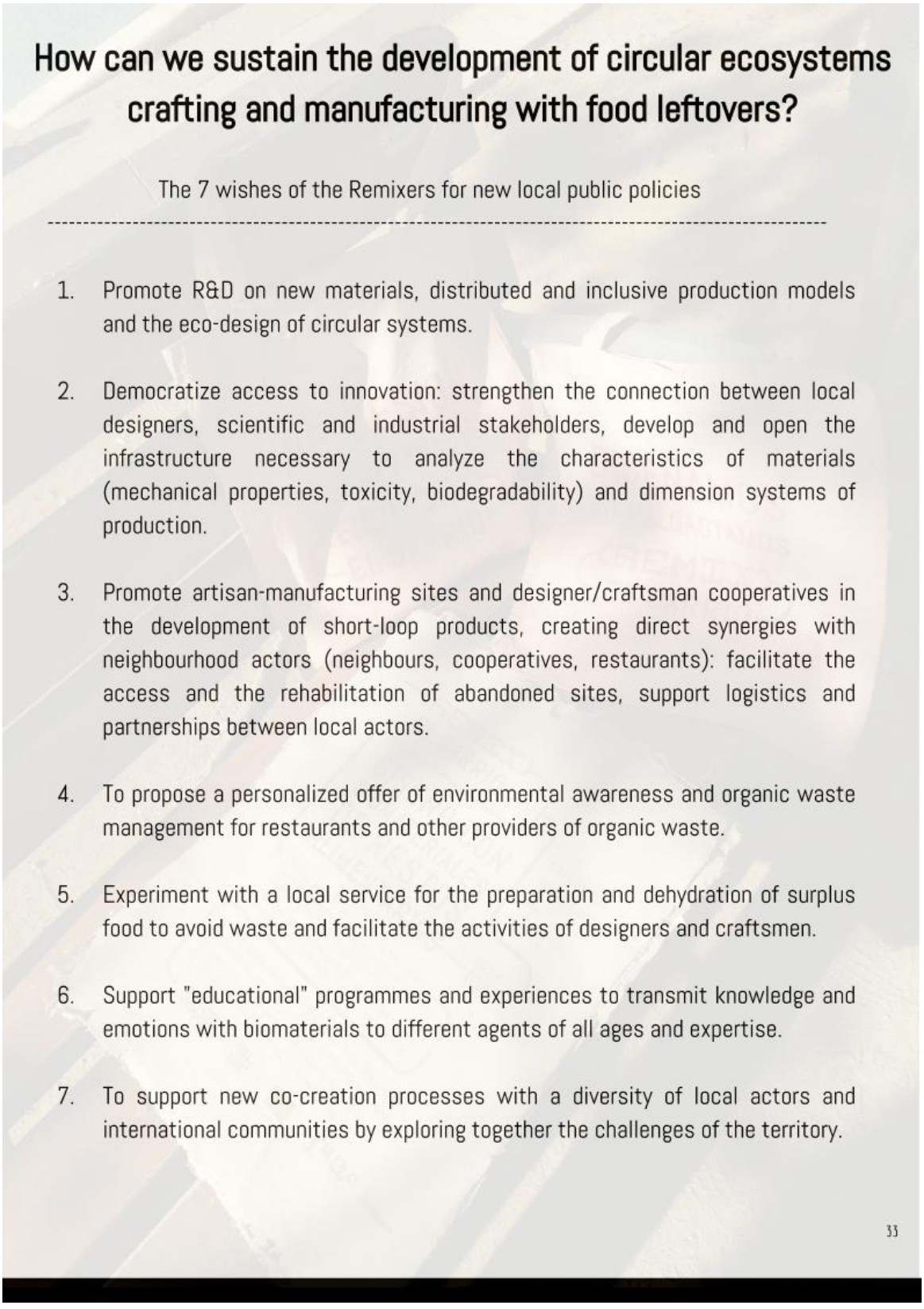


Fig 8: Policy Brief. Credit: Marion Real

Demonstrator's description

The demonstrator of IAAC|Fab Lab Barcelona Remix El Barrio, consists of a set of communication and educational materials supporting the development of local ecosystems for co-creating, crafting and micro-producing food waste.

It is composed of:

- A catalogue of the exhibition 'Remix El Barrio, co-design with biomaterials of food leftovers in Poblenou' with an activism campaign kit and a policy brief to be replicated in different places,
- A set of video tutorials explaining the process of making biomaterials for emerging DIY makers,
- A virtual open access book made with Gitbook platform[5] (only in Spanish) for researchers and practitioners, containing a written mix of materials, interactions and services to endeavour the creation of local ecosystems for crafting and eco-innovating with food surplus and waste.

About the exhibition

In the context of COVID-19, physical interactive activities were almost impossible, therefore, it has been difficult to connect with local stakeholders and give them the chance to reinitiate a short loop of making, interacting and envisioning some future lines of research and activities. The exhibition has power for fostering debates on co-creation both locally and internationally.

What to find in the exhibition?

The visitors can discover the 9 projects of the Remixers and their prototypes as well as the circular and collaborative design journey they have shared together since February 2020. They can be surprised by the power of waste, become familiar with innovative forms of local craftsmanship, and discuss the actions needed to sustain these ecosystems in the specific neighbourhood, city and beyond.

How has it been designed and by whom?

The exhibition was hosted at Leka, the ecological and Open Source restaurant located in Poblenou, using materials and resources found locally and 100% conceived and transformed by the Remixers in Fab Lab Barcelona.

[5] https://www.gitbook.com/

Place and dates

The first exhibition has been open to the public from 15 to 23 October at the Leka Restaurant, Calle Badajoz, 65, from 3 p.m. to 7 p.m. The exhibition has been launched during the Fab City Summit and actively participated in the Poblenou Urban District Open day/night event, the Foodture event (20.10-22.10) and the local EU FoodSHIFT pilot kick-offs. Future opportunities are being planned. To keep up to date, follow us on the social networks @circularbarris and @fablabbcn.

Where to find the contents?

All the description of the pilot is available in the webpage of Fab Lab Barcelona: https://fablabbcn.org/projects/siscode-remix-el-barrio.

Here are the specific links for:

- The exhibition catalogues and activism campaign kit: https://knowledge.fablabbcn.org/ or https://issuu.com/iaac
- The tutorials: https://fablabbcn.org/videos and YouTube channel
- The gitbook (ES): https://flbcn.gitbook.io/remix-el-barrio/

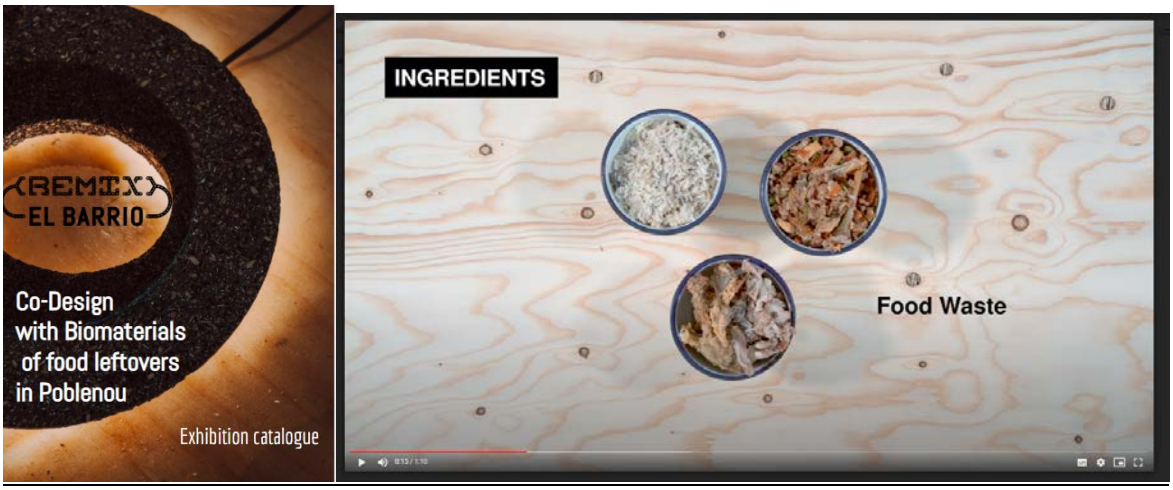


Fig 9: Cover of the catalogues and capture of a video tutorial

About the Gitbook

The book describes the narratives of the co-creation journey, introduces the 9 key design projects and pedagogical materials such as a map of interactions with business models and emergent future stories, and presents a list of tips, tools, recipes, courses and protocols to better develop educational and incubation programs.

All the content is shared with an open-source philosophy respecting the agreement of the different stakeholders involved in the project.

About the video tutorials

Tutorials are an excellent medium to transmit practical hands-on knowledge and were one of the only remaining solutions to transmit the recipes in a sustainable way during the COVID-19 crisis. Fab Lab Barcelona Communication's team has collaborated with the team of Remix El Barrio to test a new format of video with a high potential to be improved and replicated for all educational and dissemination activities offered in IAAC|Fab Lab Barcelona. A set of 4 trial videos has already been realized and more are coming in the following weeks. The videos that last a maximum 2 minutes, briefly present the type of recipe and the design team, display the tools and ingredients and review the recipes step by step from preparation, cooking and use.

Evolution and ongoing validation of your prototype

Prototypes are by nature undergoing constant redefinition and evolution. It is even more present when dealing with the eco-innovative design of multiple systems of materials, products, services and interactions. From the SISCODE's co-creation process perspective, the local team realized that their local co-creation process could be more realistically described as an innovation spiral, picking from and retro-feeding the overall distributed communities of the Fab Ecosystems (see Fig 10).

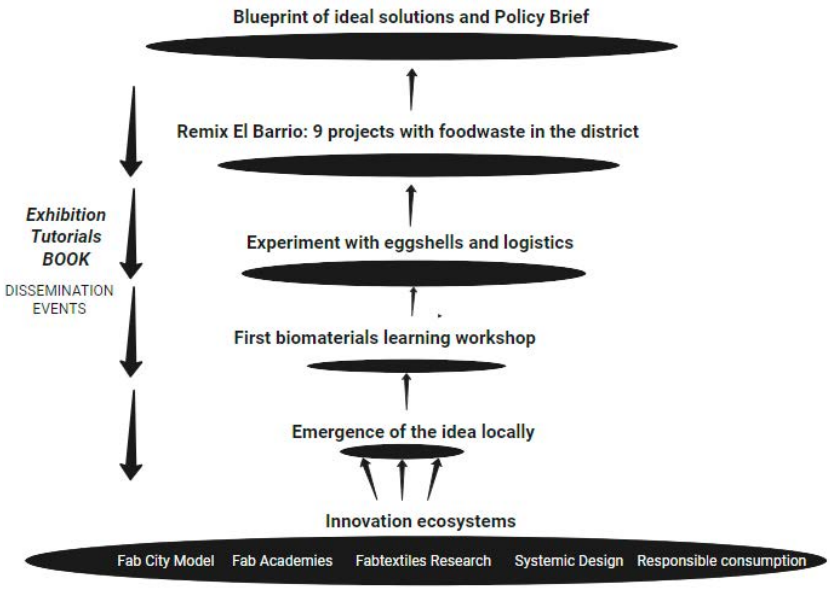


Fig 10: Fab Lab Bcn's journey as a spiral innovation process

It was about letting emerge the idea from the context and ecosystem's aspiration, applying the circular food waste concept by first developing a small 3-hour workshop with locally

collected waste as a proof of concept, then building a demonstration pilot with a specific type of waste, in this case, exploring how to make ceramic pots from eggshells with local stakeholders, to finally create an local ecosystem through an incubation program of 8 months with 9 projects where restaurants, designers and local associations co-created new materials, products and services from food waste of the neighbourhood. All the knowledge created by Remix El Barrio has then been translated to be reused, debated, criticized and improved by these learning change-maker ecosystems.

How to monitor and assess such prototypes?

Difficulties were encountered to define criteria for evaluation especially in the early stages of the process. The action research conducted allowed the project members to understand and define how to assess and monitor such a circular community project. Benefiting from reflexivity, the team has defined 5 criteria containing different types of possible KPIs and a list of dialogical expressions to define the source of tensions of co-creation management. (see Fig 11)

- The improvement of the **circularity of the system** can be analysed by means of the diversity of resource-waste that are put back into the loop as well as the diversity of ways in which they are applied in the solution. Taking a quantitative perspective, the main indicators remained the quantity of avoided waste and the quantity of (potential) products fabricated by year. According to the maturity of the project, the realisation of a Material Flow Analysis or a System Flow Map could be beneficial tools to be used.
- The transparency of **environmental impacts** and the development of eco-design capabilities can be enhanced and visualised by drawing the system process, eliciting the recipes and better investigating the origin and characteristics of ingredients. Toxicity, energy and water consumption could be measured for each step of the process in this system. According to the maturity of the project, the realisation of a Life Cycle Analysis more or less simplified as well as the use of other eco-design tools could be applied.
- Other important criteria to support and assess is how to foster **cross-pollination of knowledge**. In the Remix El Barrio case, this has been monitored observing the agility of the team to both identify the areas of knowledge they needed to explore, and their progress on each of these areas after participating in talks, intuitive, hands-on or more theoretical approaches and the personal empowerment of each individual to diverse career pathways identified by the facilitation team.
- In terms of **stakeholder engagement**, the interactions between four specific groups of stakeholders has been framed out from the journey: the Remixers as peers (design teams

participating in the programme), the lab's facilitation team, the local community stakeholders and the global distributed platforms/networks. Here the interactions were happening all along the process, following the need of the design processes with the facilitation teams active to foster interactions between the peers, the local community and other wider networks.

- Finally, one crucial aspect of the project's success is to set up some KPIs to assess the **quality and the agility of the infrastructure**. In this case, it refers first to the agility and characters of involved people but also to the respect of protocols for purchasing, loaning, accessing the machines of the lab and other places, the means for communication and sharing contents which highly depends on the local lab policy and practices.

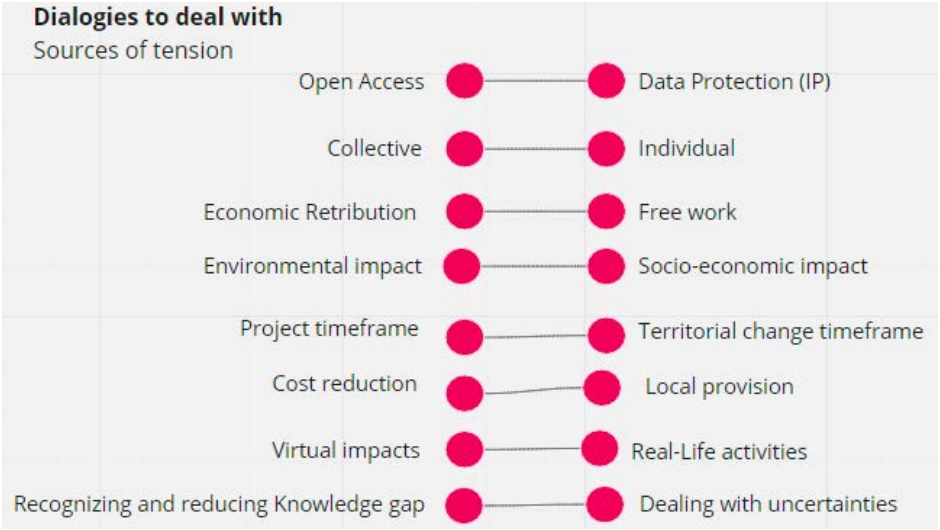


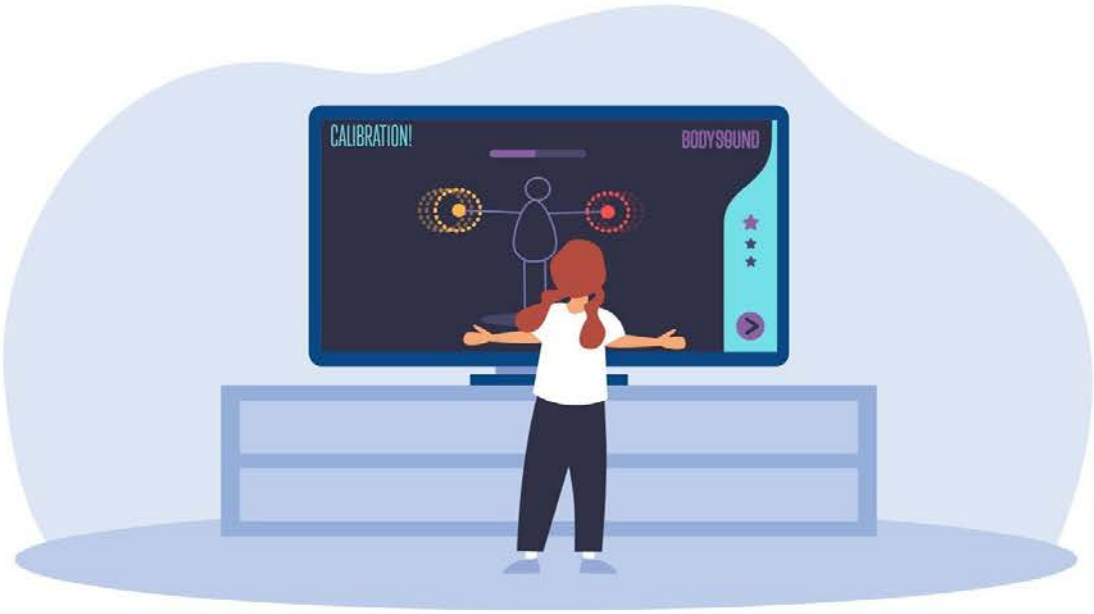
Fig 11: Co-creation Management's dialogic and source of tension

What about the next steps?

The content needs to be disseminated to act as a source of inspiration for other localities and designers to support the wider development of the field of circular and biodesign. Further investigations need to be done to move forward with the emerging prototypes such as conducting further research on the quality of the materials, environmental performance and compostability test or cost analysis. Meanwhile, local development support needs to be associated with the project in order to make it more effective and to better pursue the path initiated with this journey.

4.2. BodySound by Polifactory

written by Carla Sedini, Laura Cipriani, Mirko Gelsomini, Stefano Maffei, Massimo Bianchini



BODYSOUND

Context and Societal Challenge

Italy, since 1997, has opted for the decentralisation of the healthcare system, giving regions more autonomy to shift towards a 'public-private' model. Lombardy is one of the most populated European regions and has one of the most advanced healthcare systems in Italy and Europe. In 2014, Lombardy Region published the White Paper on the development of the social and health system in Lombardy, followed by the issue of the law about reorganisation "Evolution of the Lombardy socio-economic system" (August 2015).

Within this panorama, Italian and especially Milanese makerspaces and creative communities are particularly active in projects related to healthcare. Italian fablabs collaborate and operate on these issues together with patient associations, policy makers and RRI experts in several European projects, such as FabCare and MakeToCare[6] (Polifactory); Made4You, Hackability Milano (OpenDot); OpenCare (WeMake); Ubora (Fab Lab Pisa), etc.

For SISCODE, Polifactory's journey focused on the disease of Cerebral Palsy (CP) one of the most common physical disabilities in childhood. The idea of focusing on a so-called rare condition was developed for several reasons:

- Often rare diseases and conditions are not sustained by the public welfare system
- Rehabilitation and cure processes and environments are often unfriendly
- Collaborations between makerspaces/fablabs and innovative users in the medical field are very important to avoid users 'drop out' of the innovation process before having realized a prototype because of the lack of skills, budget, etc.

FightTheStroke (FTS) was identified as the patients and caregiver association to collaborate with. Thanks to this partnership, Polifactory could operate with and for young stroke survivors with a disability related to Infantile Cerebral Palsy as well as interacting with their families; The contact with families and therapists has been crucial to better know the issue and co-create new activities for supporting a better physical reactivation for those children.

The main output of the Polifactory's journey is the BODYSOUND System, a video game which is creating playful situations that stimulate the physical reactivation of children with dance and music activities.

[6] https://www.polifactory.polimi.it/polifactory/maketocare/

Blueprint: final description of your solution

BODYSOUND System proposes a new way of performing physical reactivation. It is a video game based on choreutics (dance+music) and on the transformation of movement into sound. Within this system, children can perform a “choreography” and transform it into a ‘melody’.

BODYSOUND System was conceived especially for children with motor difficulties but it is suitable for everyone.

The BODYSOUND software, through a body-tracking system, is able to calibrate the exercises on the basis of the child's mobility, monitor praxis and motor coordination, training times and frequency of its use, while recording the movements and comparing their accuracy and speed of execution.

The video game is based on a system of sound and visual movement guides that the child, through his avatar, will have to follow to create a melody, collect points and access new game levels. In the basic configuration of the software, the child can choose three themes, which correspond to different workouts in terms of speed, type of movements and overall game experience: warm-up, technical gestures, relaxation.

The BODYSOUND training system can support the acquisition of body consciousness, the development of basic motor patterns, a better visual-motor coordination and body balance. But it can also allow the child to acquire specialised motor gestures (technical gestures) that pertain to specific sports disciplines, support motor enhancement, and develop the ability to interpret rhythm.

The system includes two versions:

- BODYSOUND web, a web-based version of the software that allow training at home without the support of specialists
- BODYSOUND pro, a video game platform for motor reactivation for specialists in the medical, health and sports fields

BODYSOUND experience is composed by a series of exercises, defined as sequences of movements that contain one or more repetitions of the same action (in series or circuit)

aimed at reactivating the limbs. The table 4 summed up the main characteristics and features already developed of BODYSOUND.

Table 4: BODYSOUND features

BODYSOUND is a system composed by
a video game to carry out motor reactivation exercises
a video game platform for motor reactivation
a system for carrying out motor reactivation exercises through play
BODYSOUND is for
children with motor difficulties (and their caregivers)
specialists in the medical, health and sports fields
all children
BODYSOUND is aimed at
supporting motor enhancement
supporting the development of basic motor schemes
supporting the development of coordination and balance
developing visual motor coordination
acquiring specialized motor gestures (technical gestures) that pertain to specific sport activities
supporting the ability to interpret the rhythm
...and it does through:
• a series of exercises / movement sequences *ad hoc* designed • a system of "live" movement guides • sound feedbacks (to be valued) • three different visual themes • display of an avatar • a scoring system
BODYSOUND is able to
calibrate the exercises based on the child's mobility
upload personalised exercises after registration by therapists
record the execution of the exercises
monitor playing frequency

In SISCODE, the first solution - BODYSOUND web - has been fully developed; however, it will need some refinements and improvements. BODYSOUND web is aimed at home-training and can be used on any device with an internet connection equipped with a webcam (PC or tablet). It does not require installation but only the registration of a user profile. This version is released with a finite number of exercises which may vary due to the software updates. The solution is addressed both to patients and caregivers.

The second solution - BODYSOUND pro - will be developed beyond the lifespan of the SISCODE project. BODYSOUND pro is aimed at providing training sessions to be carried out at schools or sport centres as identified during a service co-design workshop in the development phase. The system integrates everything necessary (computer, Kinect, projector…) to set up a space dedicated to the activity to make it accessible to more users. This configuration allows the user to load custom movement sequences which are converted into exercise / game models. The solution is addressed to specialists in the medical, health and sports fields.

In Table 5 the main system components and software features of BODYSOUND web and BODYSOUND pro are reported.

Table 5: Comparison of BODYSOUND web and pro software

	BODYSOUND web	***BODYSOUND pro***
System components	● web-based software ● resources for installation and use (guidelines)	● software ● control dashboard for operators ● computer, Kinect, projector, remote control, sound system, ● accessories for the configuration of the playing field (spacers, etc.)
Software features	● child / user profile → caregiver profile ● 3 music / exercise themes ● initial calibration ● rewards system	● management dashboard (installation, maintenance, ...) ● user profiles and aggregated data ● multiplayer up to 4 players ● 3 music / exercise themes ● initial calibration ● rewards system

In the image below (Fig 11), the system map of both solutions is presented.

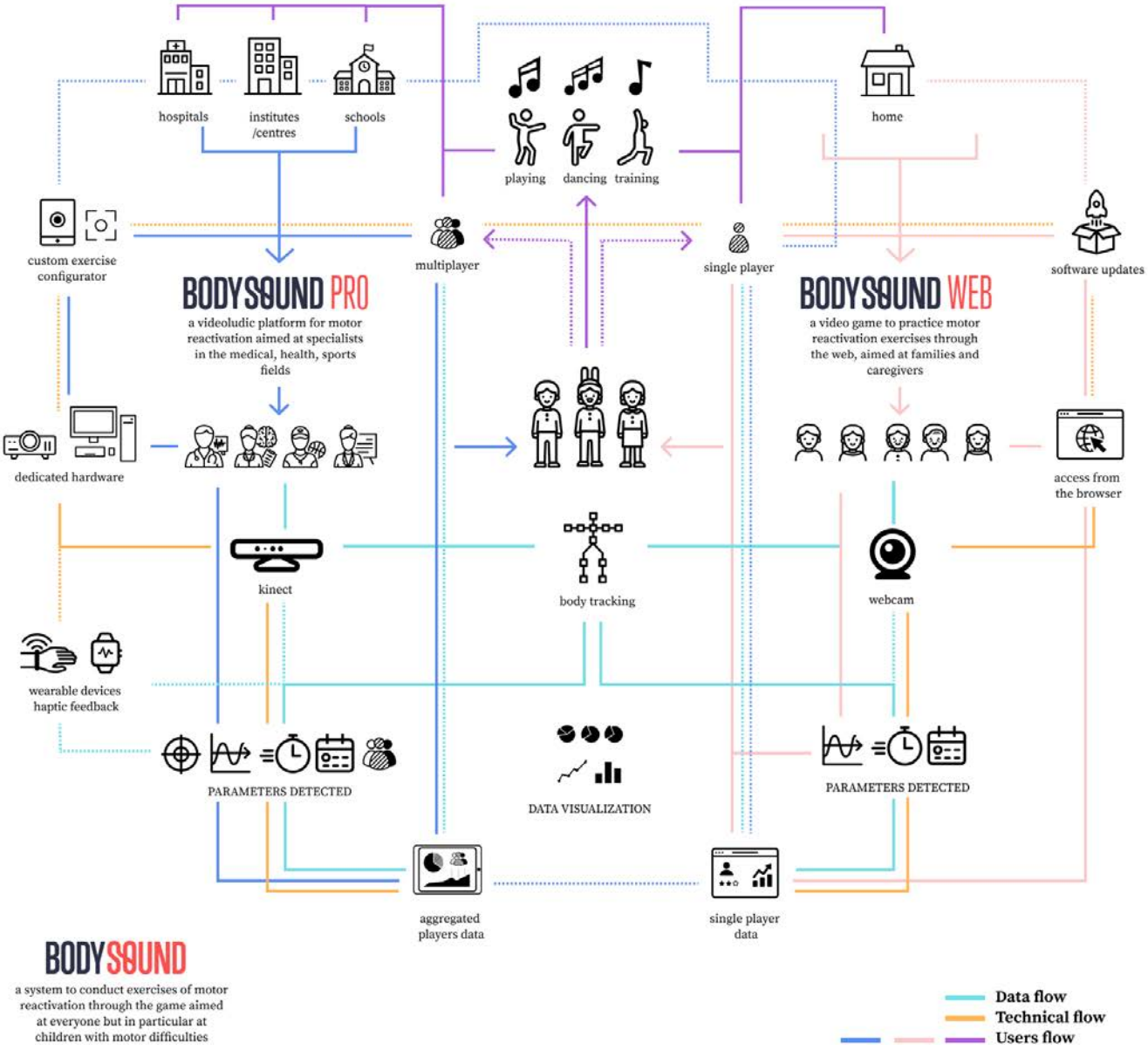


Fig.11: BODYSOUND pro and BODYSOUND web system map

Evolution and ongoing validation of your prototypes

About prototyping

Quick and dirty prototyping is an excellent tool to anticipate results and effects even during the early stages of work, especially if the development process includes co-design moments. In fact, these typologies of prototypes are useful to create evidence to be used during co-design sessions: generating ideas and new questions is an easier task when it is possible to

have an interaction with prototypes. Often dividing the solution into parts, omitting some parts or synthesising others that are not interesting in the early stages of development, and prototyping them separately is very helpful. Prototyping from the initial stages of software development allowed the team to release several versions ready to be tested, even if incomplete, and to be able to readjust the solution based on tests feedback and co-design results.

About testing

The testing phase was developed alongside the whole prototyping process and it involved several actors: the designers/developers, the therapists and -obviously- the children. These testing phases will be presented according to the actors involved. It is important to stress the fact that the tests were often carried out simultaneously with all three typologies of actors.

Internal tests

The prototype was continuously tested by the team members in order to have, at least, a weekly confrontation, refinement and test of the more technical aspects of the solution.

Tests with therapists

Therapists were involved in the testing of BODYSOUND both during the initial confrontation where information was collected on limitations and movements specific for children affected by CP. A very quick test was also possible in the occasion of the co-design service workshop. Then, due to the pandemic, they have been involved in the test of the BODYSOUND recording platform; so they could test the part of the platform dedicated to therapists recording some movements that were then used to create BODYSOUND exercises.

Tests with children and families

Children were involved in tests carried out both online and offline.

Online tests. The first online tests were mainly focused on the verification of graphics and sounds, and they involved only FightTheStroke member children who had already participated in the laboratory activities.

Offline tests. The offline tests were carried out after the development of the basic functions of the BODYSOUND system software, and the first test sessions children and families from FightTheStroke began.

The goal of this activity was to test:

- the level of children's enjoyment of the overall experience.

- the effectiveness of the graphical interface and the recognition of the avatar by children of different age groups
- the effectiveness of the sound-player association
- the maximum number of players

In order to obtain this series of feedback, the team has chosen to let the children approach the game without any preliminary explanations and without specific movement exercises in order to observe what could be the spontaneous reactions to the instrument and the free play interactions.

Two sessions were carried out with two different sound experiences.

The first one allowed to 'play' a song, known by the children, where a series of tracks and voices were associated to the main song corresponding to each person entering the playground; the second one associated a series of musical instruments to each player allowing them to compose a melody created *ad hoc* by the BODYSOUND system.

The sessions were attended by three FightTheStroke children and their families.

After collecting feedback from children and families, it was decided to move from a two-dimensional avatar display to a three-dimensional one to facilitate spatial perception even for very young children.

It has been verified that the melodies created by the users during the sessions not using already-known songs were less distracting children from the core exercise and have more relevant results, especially if they were associated with individual movements.

The offline tests were organised during summer 2020 and they were conducted at the summer camps held in a kindergarten and a primary school. Therefore, it was possible to enlarge the internal users' base, testing the prototype also with children that did not present particular physical impairments.

BODYSOUND web was tested with about 50 children divided into smaller groups. The main tested features were the functioning of the prototype, the playfulness of the game and the general satisfaction of the children involved.

Main indicators

To sum up, the indicators used to revise and test BODYSOUND prototypes, were:

- Software responsiveness, accuracy of the detection of movements, accuracy of the detection of the body schema and its movements, pleasantness of the graphics, duration and type of exercises and feedback on the sounds.
- Ergonomic of the software and classic code debugging.
- Relevance of the solution for the initial challenge
- Other evidence derives from users' feedback after tests (collective and very 'easy' interviews).

Further steps

At the present moment, in order to 'validate' BODYSOUND solution, additional effort would be needed to stabilise the system, validate the data to be collected and their accuracy, refine the quality of the chosen exercises with therapists, confirm and eventually improve the pleasantness of the gameplay with children.

Demonstrator's description

A BODYSOUND web demonstrator was developed within the timeframe of the SISCODE pilot. As it has been described in the previous chapters, it is a desktop version of the game that does not work to its full potentialities but is able to give a general understanding of it.

It is accessible via the BODYSOUND webpage (https://www.bodysound.org/site/). The website is constituted by four main sections and a contact page:

- **Homepage** (Fig 12) where a general description is provided,
- The **project page** where more detailed information also about the project (Fig 13), the System map, and the game are reported,
- The **BODYSOUND page** where the whole BODYSOUND system (Fig.14), *BODYSOUND pro*, and *BODYSOUND web* are described
- From the BODYSOUND page or from the menu, it is possible to access the **BODYSOUND demo**, composed by the following subsections; registration (Fig 15a), privacy policy page , the game (*BODYSOUND web*) (Fig 15b); this section is going to be fully presented above,
- **Contacts**

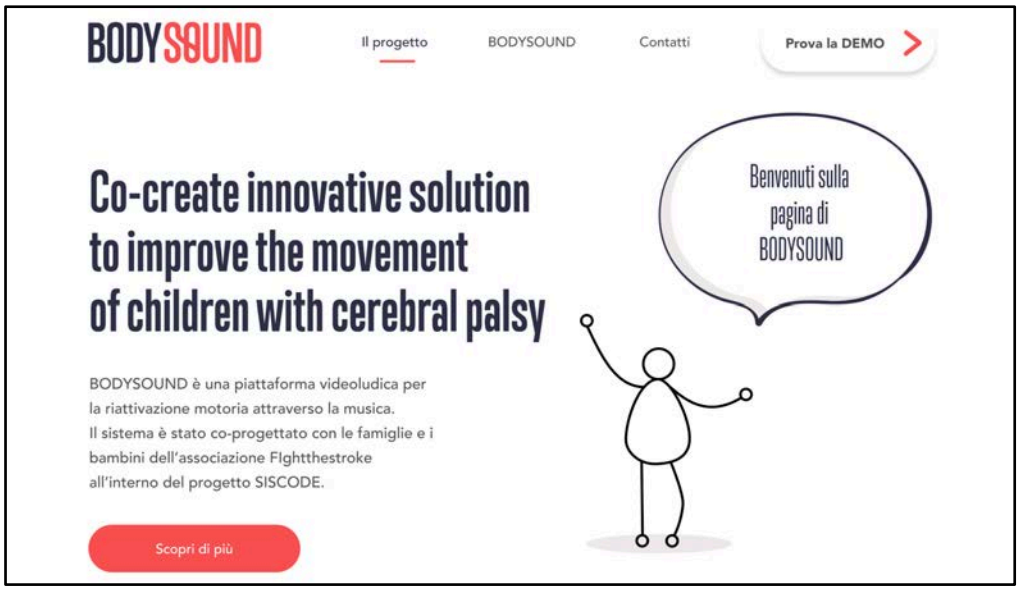


Fig 12: BODYSOUND homepage

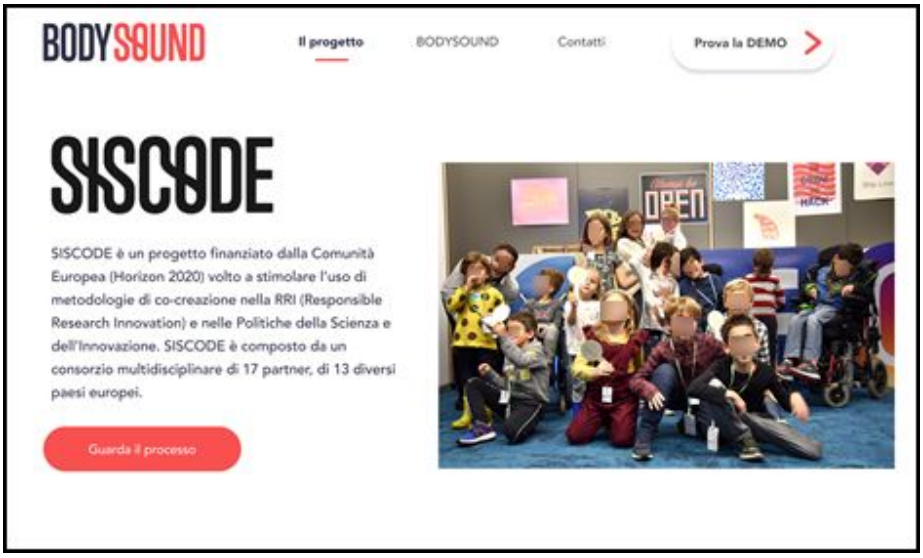


Fig 13: BODYSOUND project description

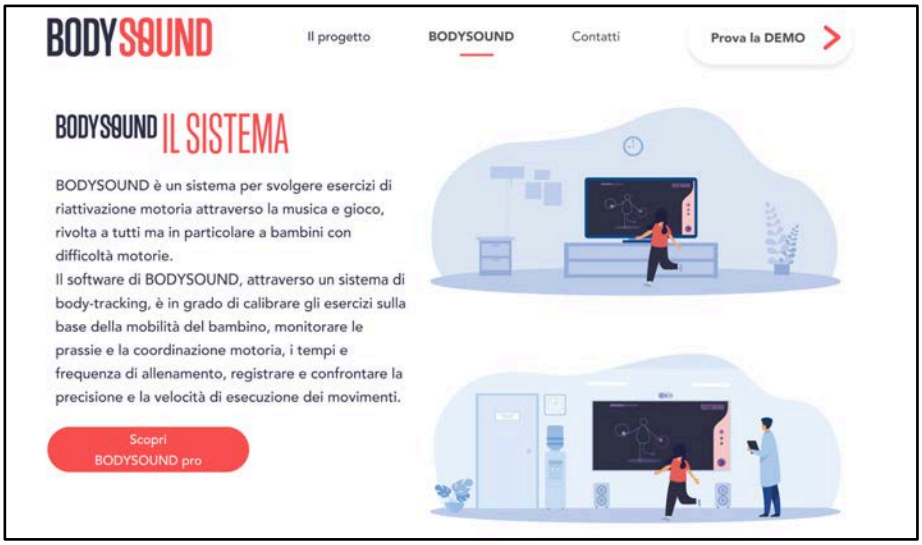


Fig 14: BODYSOUND system

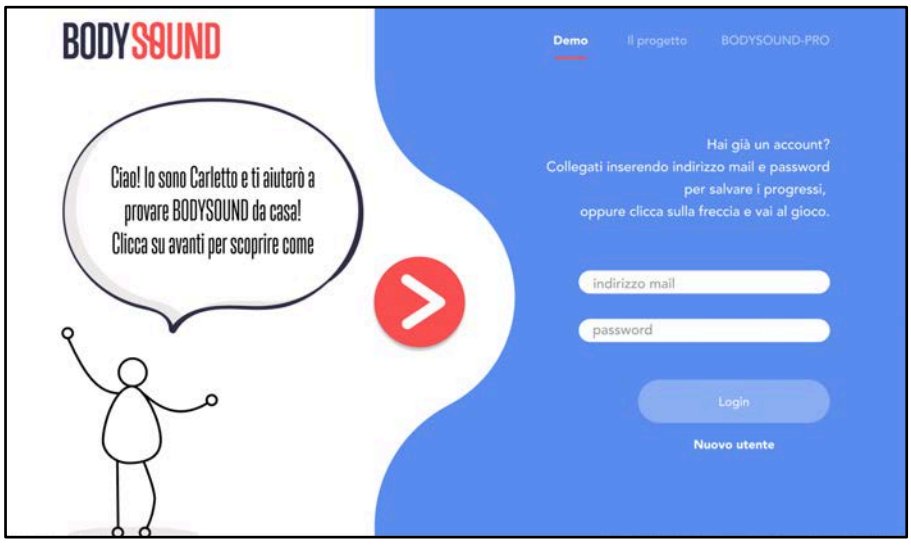


Fig 15a: BODYSOUND demo. Registration page.

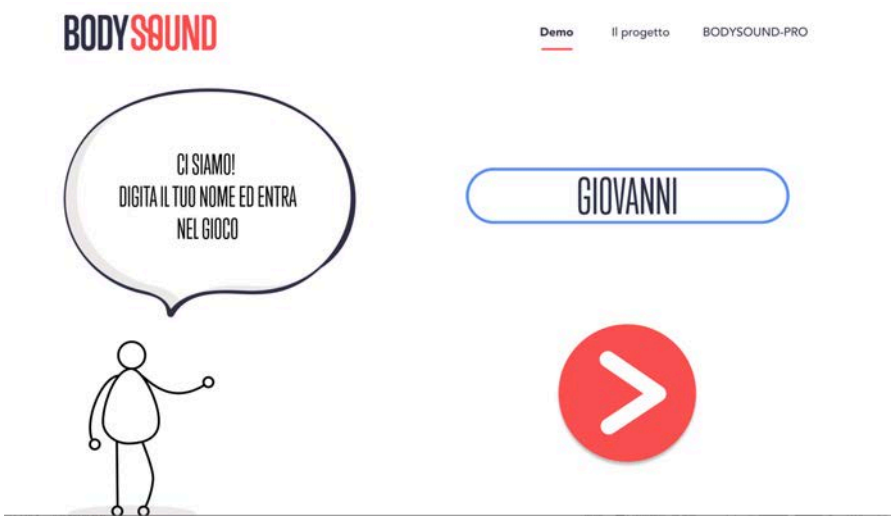


Fig 15b: BODYSOUND demo. The game.

The landing page of the BODYSOUND demo is available at https://www.bodysound.org/play/.

After inserting the user's name and before starting the game, the user will have to choose the music to play with (Fig 16a) and calibrate the game according to his/her body (Fig 16b). Then, the game (Fig 16c) will start.[7]

Fig 16a: BODYSOUND demo. Choosing the music.

[7] In the demo now available online there is only one music and one cycle of exercises.

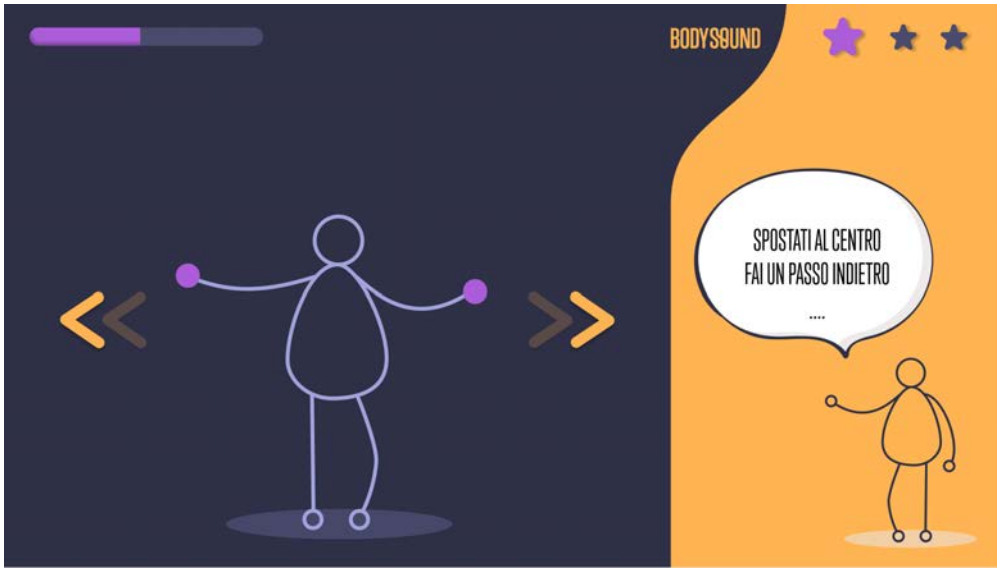


Fig 16b: BODYSOUND demo. Calibration.

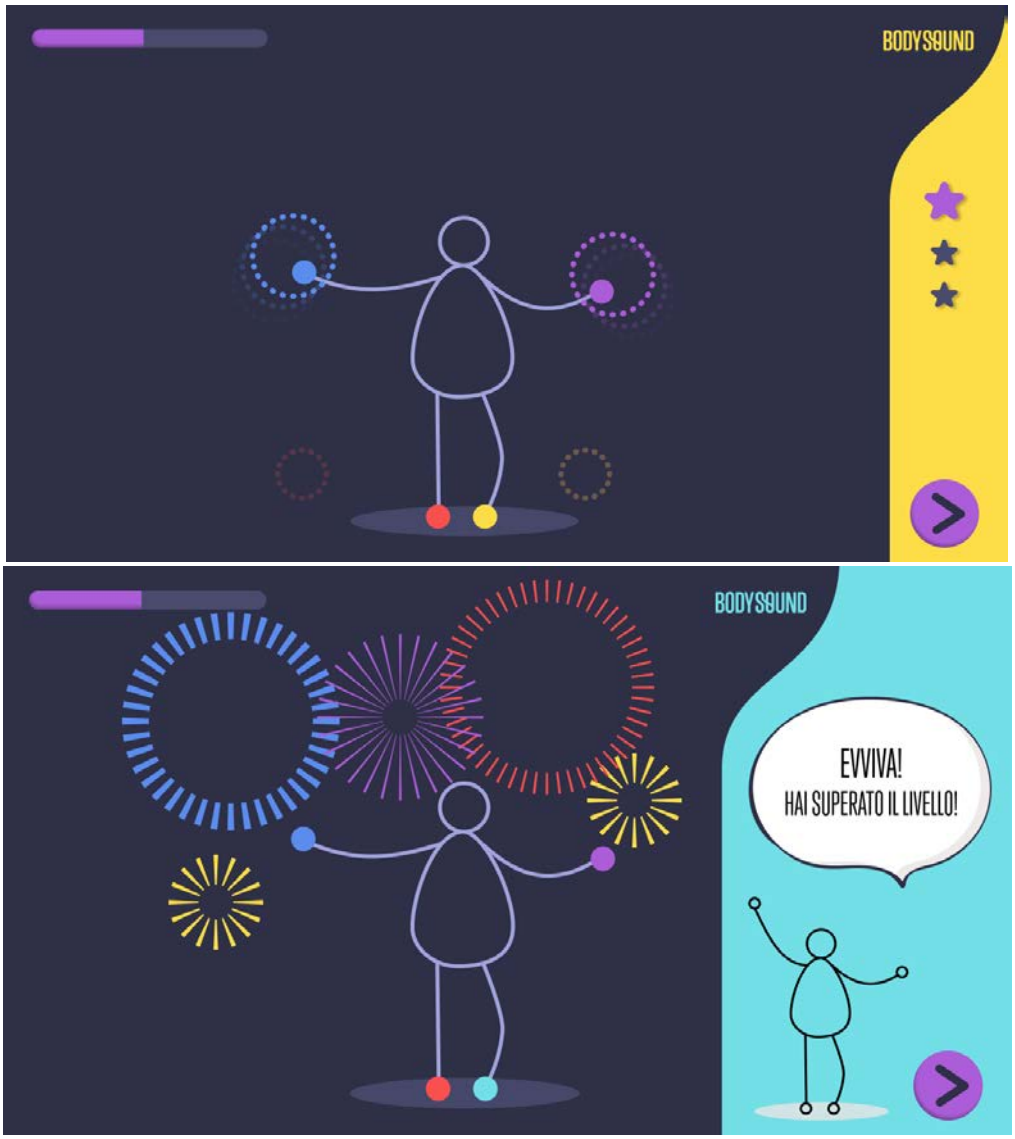


Fig 16c - BODYSOUND demo. The game.

In addition to that, some functionalities of the BODYSOUND pro (the therapists' platform) were already developed and tested. In the images below it is possible to see the process of a therapist registering a cycle of exercises (Fig 17).

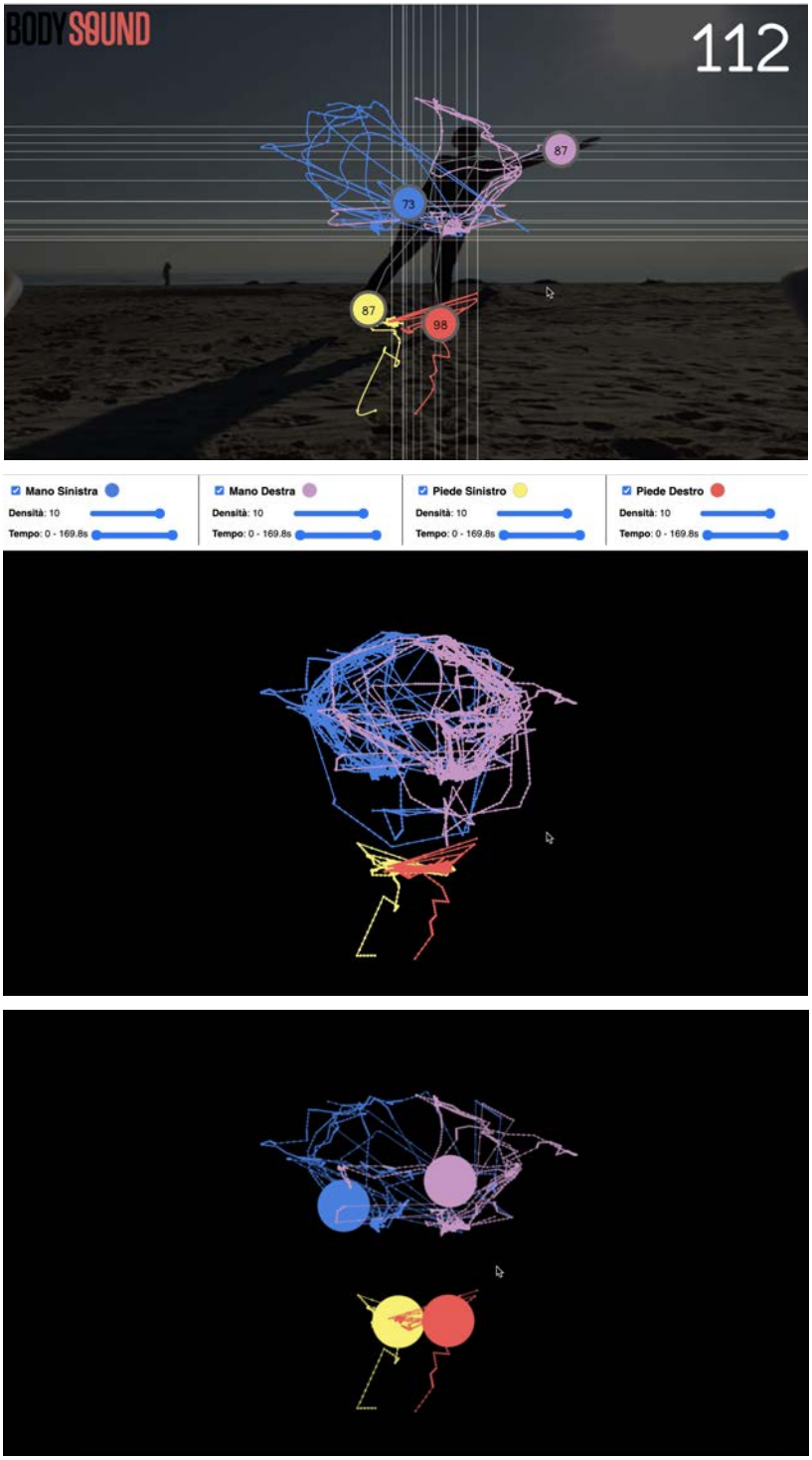


Fig 17: BODYSOUND pro. Therapists platform.

4.3. Plastic In Plastic Out (PIPO), by Maker / Viadukten

written by Asger Nørregård Rasmussen

maker

Context and Societal Challenge

The political landscape in Denmark and in Copenhagen is undergoing a transition towards raised awareness and a focus on development and implementation of the circular economy, better resource management and optimisation.

In this context, Maker's pilot decided to incubate the **Fab City initiative and approach[8] in the city of Copenhagen**. The ambition of Fab City[9] is to pave the way for locally productive and globally connected cities that foster circularity, social cohesion and well-being. In the framework of the SISCODE pilot this envisioned the development of **circular production systems by adopting an ecosystemic approach:** for small-scale systems of local designers and producers and by paying attention to effective technical solutions with a high potential for scaling.

With the SISCODE pilot co-design and prototyping have focused on community capacity building resource and knowledge sharing, and the creation of a new dynamic for developing the small-scale model for local production and circular economy.

The key objective was to meet the need for sourcing locally **produced recycled plastic sheets.** This need was identified because of a growing interest in designing and producing with recycled plastics. The desk research carried out at the beginning of the co-creation journey showed that there was no Danish production of high quality recycled plastic sheets for product design etc. At the same time, a growing number of designers and makers were buying plastic sheets from the UK-company SMILE plastics. Considering this, Maker's challenge addresses the lack of local and economically accessible facilities, technologies, incitement and know-how to enhance the local recycling of plastic waste in Copenhagen. The challenge meets a need for circular systemic innovation and holistic production models for recycling plastics that take the whole model chain - from local generators of waste plastic to end-buyers of locally produced goods - that is economically viable and scalable.

By co-designing '**Plastic In, Plastic Out' - (PIPO), Maker aimed at empowering and supporting local communities to re-circulate materials and engage in the circular economy through a distributed ecosystemic approach**. The project has involved mainly Maker, Von Plast, Circular Design Studio, local designers and makers, Aalborg University Copenhagen, Plastic Change, GreenKayak, Naboskab, and municipal civil servants.

[8] https://fab.city/#fabcity-challenge
[9] https://blog.fab.city/fab-city-prototypes-designing-and-making-for-the-real-world-e97e9b04857

Blueprint: Description of PIPO

PIPO is a small-scale ecosystem developed for designers, companies and makers working within the circular economy, material recycling and the plastic recycling sector.

PIPO Ecosystem Model

The PIPO Ecosystem model is based on a core layer of actors (generators, processors, producers, resellers and end-buyers) that form the PIPO Design and Recycling Community. Over the course of SISCODE, Maker has focused on facilitating the interaction between three of the five stakeholder groups displayed in the model: generators, processors and producers (Fig 18).

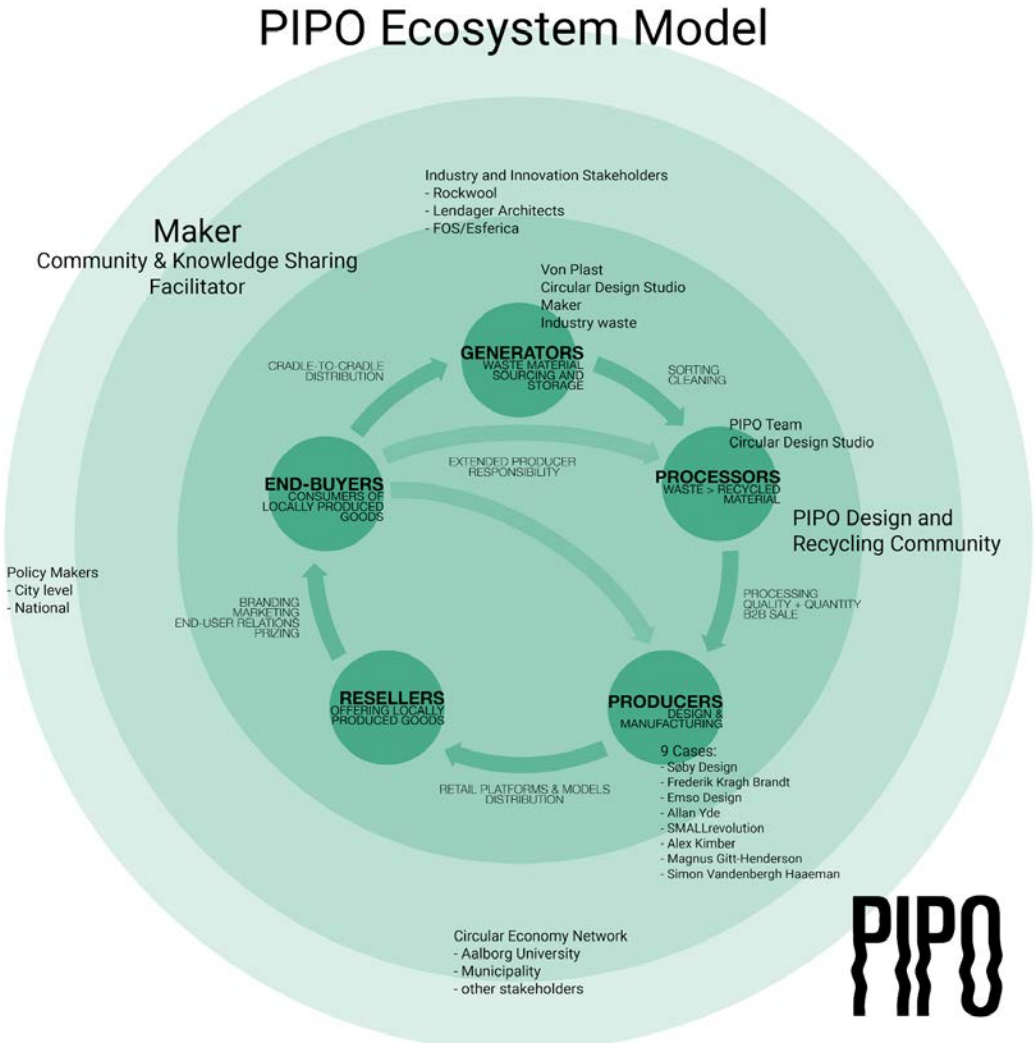


Fig 18: PIPO ecosystem Mode

Open Access Resources and Tools

Within this ecosystem, a set of tools (life cycle assessment demonstration, stakeholder mapping, resource flows, cases and more) supports the community providing evidence of the benefits of recycling plastics as well as the possibility for building capacity and managing resources.

Among various tools created during the co-creation journey, the Life Cycle Assessment (LCA) tool developed in collaboration with students from Aalborg University Copenhagen, is presented here (Fig 19). This tool was key in gaining a better understanding of the environmental impacts of recycled plastics and improving the eco-design of the emerging proposal.

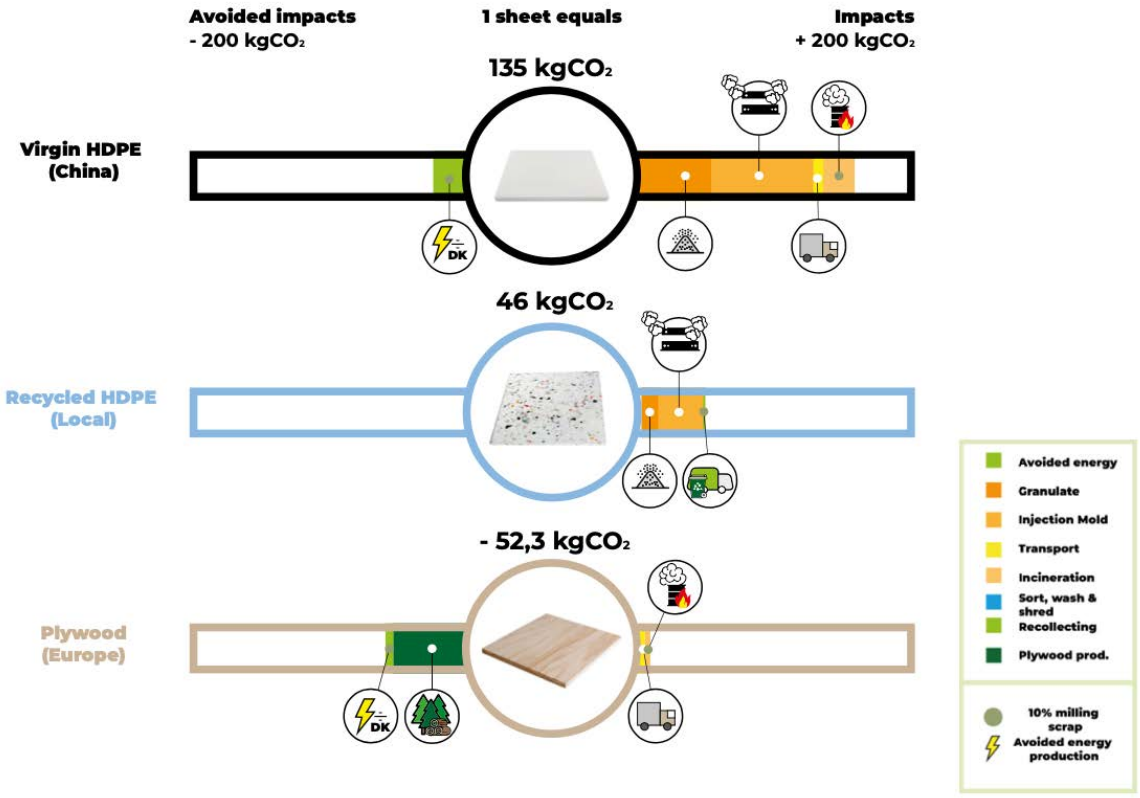


Fig 19: LCA & Infographic
in collaboration with Mikkel Barfod Boll and Félix Elkær Nicot, AAU

In makerspaces, fablabs and other fabrication entities, plywood is a commonly used material for furniture making, product design and prototyping. At the same time there is a rise of interest in cases working with the recycled plastic - ie. recycled plastic sheets. The triangulation in the LCA therefore focuses on plywood (FSC), virgin plastic and recycled plastic. This choice is purposely made considering all the 3 materials are well-used within the

maker- and design community and in most cases of use, they have the same functionalities and capabilities.

The LCA shows how virgin plastics should be replaced with locally produced recycled alternatives. However, recycled plastic sheets, compared to FSC-marked birch plywood[10], still have a much higher carbon footprint. Thus, recirculating plastic and recycling to new materials holds a large potential for finding more sustainable alternatives to virgin plastics.

Technical solution to producing recycled plastic sheets

As part of the co-creation journey and physical prototyping, Maker and the core group of stakeholders have experimented, tested and developed various solutions for plastic recycling. The goal of this prototyping activity was to develop sheet moulds and processes for producing sheets up to 25mm with a tolerance of +/- 1 mm. The team succeeded in developing solutions to make sheets of recycled plastics of thickness that go from 2mm to 25mm, establishing best practices on working with various plastic fractions. Design and recycling community actors have been using them to work but most importantly to give feedback on the usability and quality of PIPO sheets.

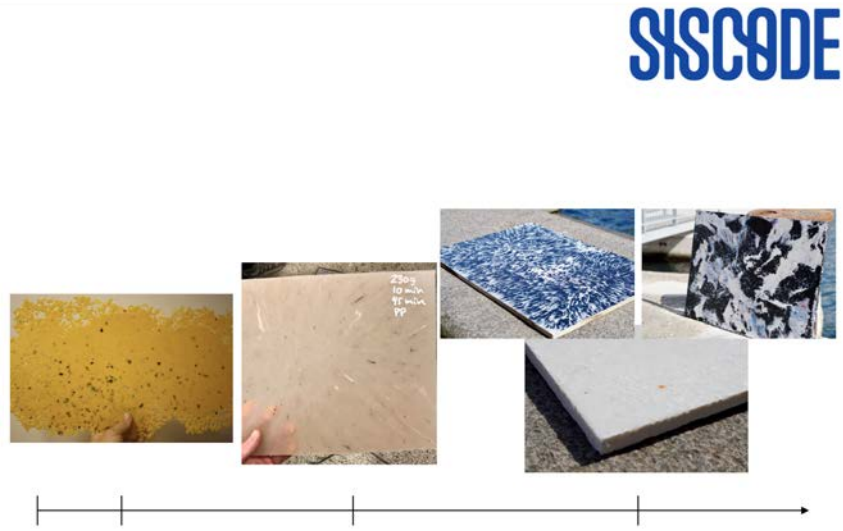


Fig 20: Evolution of the plastic sheet developed by Maker's ecosystem.

A feedback guide to design recycled plastic sheets has also been developed. It consisted of questions related to quality, functionality and price. The overall feedback on the materials was good (see Appendix 4, Case Feedback, PIPO), and especially when related to high quality, great functionality, prices higher than or same as 1m^2 birch plywood.

[10] https://fsc.org/en/fsc-labels

PIPO also includes a prototype gallery and case exhibition that serves to inspire, co-design and develop new circular products and materials locally in Copenhagen. This is the core object of Makers' demonstrator as described below.

Maker's role:

Maker has acted as a facilitator and community actor in the PIPO ecosystem. This role is important to ensure engagement and knowledge sharing via activities, online platforms and events. During the development of PIPO Maker has helped to facilitate the relationship and interconnection among generators, processors and producers, and ensure sharing of open innovation aspects, open access resources and capacity building.

The activities of Maker for the development of PIPO are synthesized in the following illustration, that is an adapted version of a service blueprint canvas (see Fig 21).

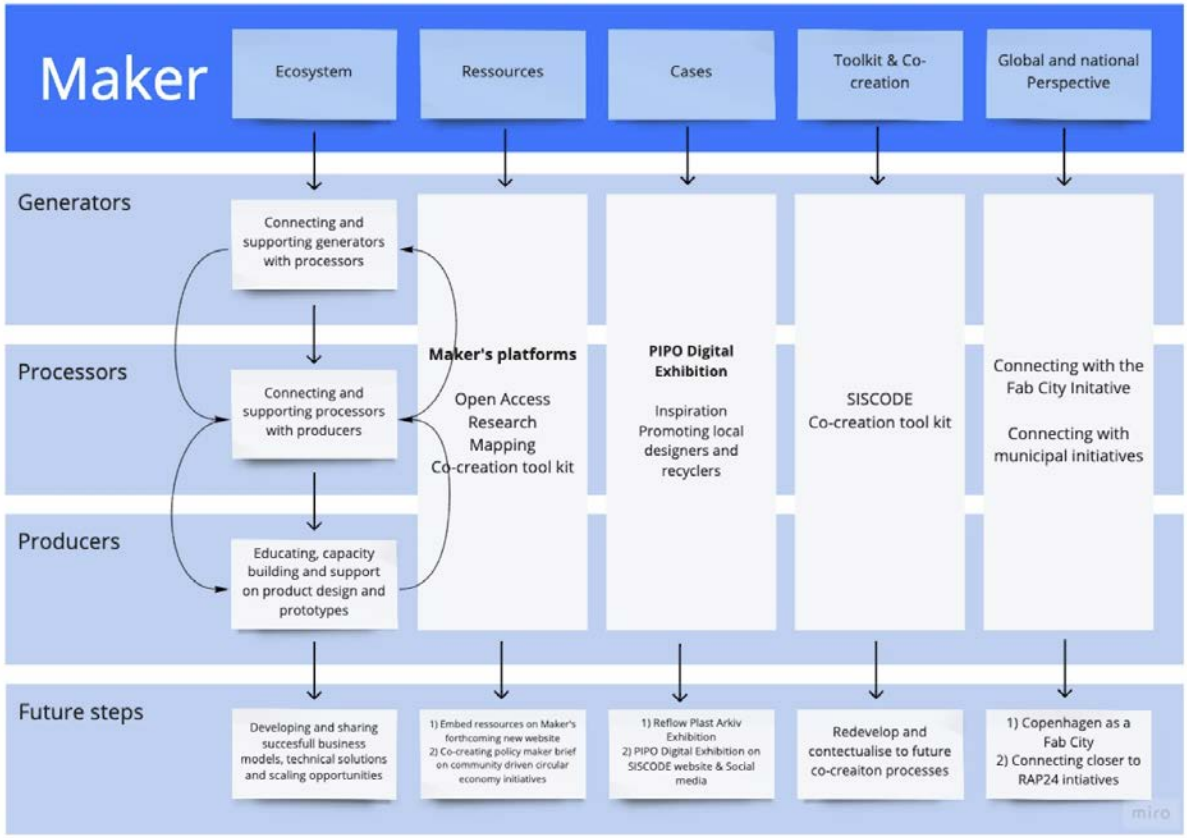


Fig 21: Service Blueprint of Maker for PIPO development - from MIRO

It consists of facilitating the local ecosystem of generators, processors and producers (see Fig 2), feeding a resource platform with appropriate tools (see Fig.3), supporting the development and showcasing of technical solutions from locally transformed recycled plastics (see Fig.4) while acting as an ambassador of co-creation and distributed design by connecting with local, national and international initiatives.

Demonstrator's description

The demonstrator is built around 3 elements: two of them are exhibitions and the third is a policy brief. A positive externality that has resulted from the co-creation journey is the growing community of designers and makers working within the circular economy that has also supported Maker to validate the sheet prototypes and to receive valuable feedback.

PIPO Digital Exhibition and Case Catalogue (booklet)

The PIPO Digital Exhibition (Fig 22, appendix 1, PIPO Digital Exhibition) had the purpose of disseminating the results of PIPO, but also helped promote local companies, makers and designers working with circular economy processes in product design. The digital exhibition serves as an inspiration to others interested in physical entrepreneurship with a focus on circular economy. The PIPO Digital Exhibition exhibits 9 cases that range from a lamp made from recycled plastics to full size conference table built from FSC marked plywood and recycled plastics and includes art objects and installations.

Reflow - Plast Arkiv Exhibition

Reflow[11], is a H2020 EU-funded project that '[...]aims to develop circular and regenerative cities through enabling active citizen involvement and systemic change to re-think the current approach to material flows in cities. The project utilises Fab Labs and maker spaces as catalysts for change in urban and peri-urban environments.' (Reflow, 2020)
As part of the project, the Danish consortium is hosting an exhibition at Spinderihallerne in the city of Vejle. Maker will contribute to the exhibition with three PIPO cases, which will be exhibited for 2 weeks. This opportunity both connects SISCODE to another H2020-project, but most importantly serves as a disseminating platform for showcasing and exhibiting PIPO results.
The overall output of PIPO Digital Exhibition and Reflow Plast Arkiv Exhibition is to disseminate results, promote community cases and inspire others to work with the circular economy within product design. Additional outputs are also the connection of local community cases to potential resellers and end-buyers, and therefore as the initial step to connect the design and recycling community to potential markets.

[11] https://reflowproject.eu/

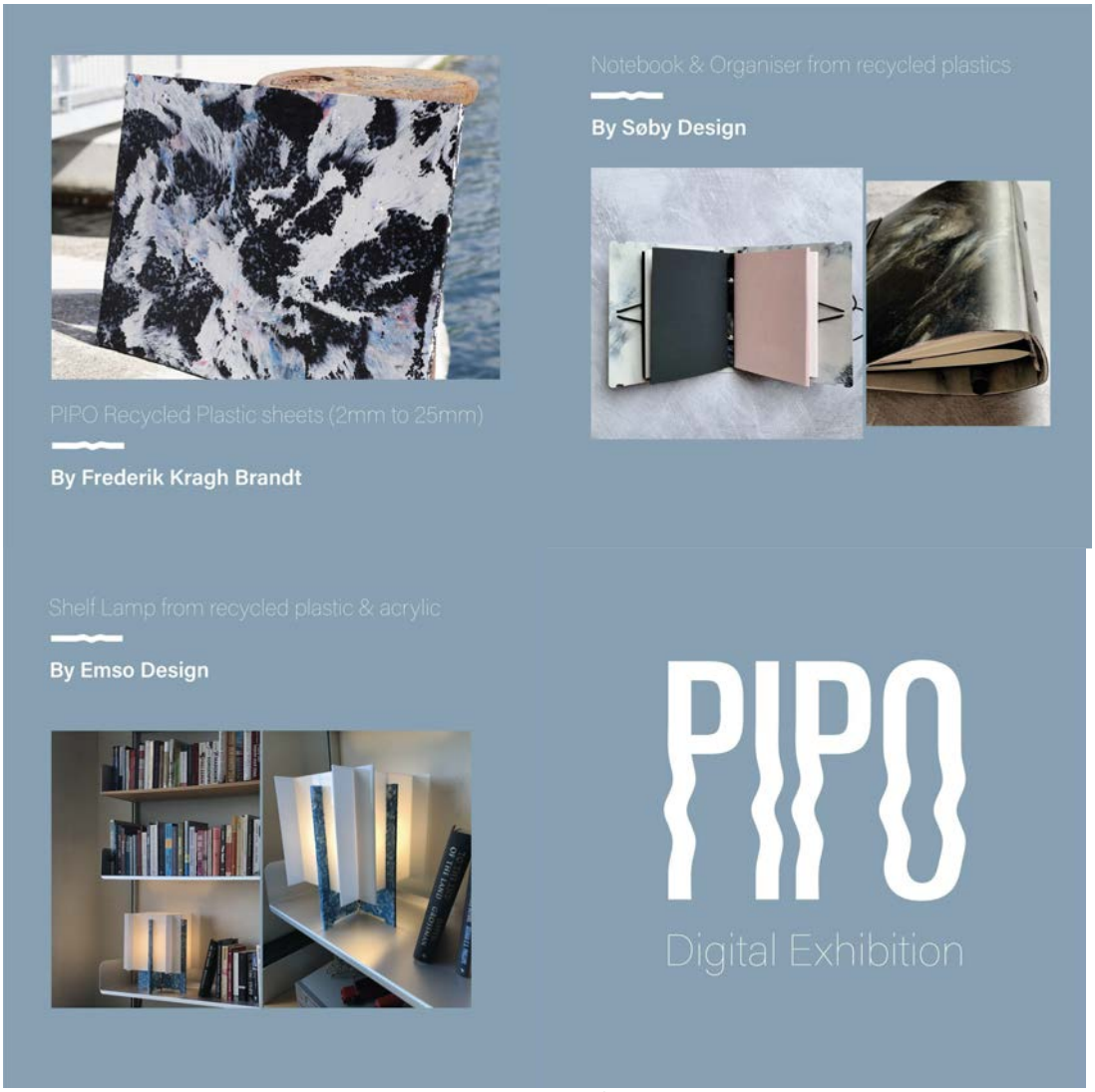


Fig 22: Three of nine PIPO Cases

Local Policy Maker Brief on community driven circular economy initiatives

The third part of the demonstrator consists of a policy brief for the Copenhagen stakeholders. The brief, w\currently under development, is a shared co-production between WP3 and WP4 and builds on the knowledge and resources produced during Maker's co-creation journey. The overall objective of the Policy brief is to envision and debate the circular economy in Copenhagen, circular economy community building, and to highlight the potentials of the transition towards better recycling and recirculation of materials in the city. The Policy Maker Brief is directly related to objectives and agendas described in the Resource and Waste Management Plan 2024 (Rap24) of Copenhagen and anchor community-driven initiatives to larger political agendas.

Evolution and ongoing validation of your prototypes

To synthesize, Maker has exceeded the expectations of its co-creation journey:

Table 6: Outcomes of the Maker's journey

Initial Desired Outcomes	Delivered Outcomes
5-10 community concepts/prototypes/cases	8 cases/prototypes
3 PIPO prototypes	More than 3 different sheet prototypes (sheets, moulds/cassettes, products (conference table, sheets, tray))
Collaborative Blueprint - ecosystem	PIPO Ecosystem
Infrastructural prototype	Yes, but mostly on 3 stakeholder groups (Generators, Processors, Producers)

During the process of development and prototyping the initial idea has undergone several iterations. Maker core team has worked closely with the industry and innovation community to prototype recycled plastic sheets. It has also developed 8 cases as well as educational activities for the community to engage in plastic recycling and ensure knowledge transfer. During this phase, the technical documentation on plastic types (fractions), sheet production, mould making, digital manufacturing, and material specifications have been produced both through internal and external prototyping activities like training courses, workshops and meet -ups.

Fig 23: Maker's community making

Hands-on prototyping has been an essential method throughout the co-creation journey to ensure a practical approach for knowledge transfer and co-development of the solution.

Prototype iterations on the technical solution include designing and producing low-cost steel moulds for the sheet press to reach the result with a material tolerance as low as +/- 1mm.

As part of these activities and during SISCODE, Maker has experienced a growing interest in design for and with the circular economy - in this case mostly with recycled plastic. This has led to core design collaborations and essentially 9 different cases of application for recycled plastic products and concepts.

What are the plans to make the prototype sustainable and how?

Scaling the ecosystem model

The core idea behind the sustainability strategy is focused on developing and working with a community of local plastic recyclers to push towards a local circular model and ecosystem for small to medium size entrepreneurs and makers working with the circular economy in Copenhagen. The community and ecosystem model targets the ongoing environmental crisis regarding plastic waste at a national and global level.

Scaling up the technical solution

From a technical point of view, the concept could be scaled by increasing the sheet sizes and producing them in larger quantities collaborating with other companies. Currently the team is exploring various possibilities and potential solutions to scale up the solution.

What steps does the strategy foresee?

The strategy for the technical aspects of scaling the solution will be secondary in respect to the work on scaling up and re-developing the community and ecosystem model. This decision is supported by key policy makers and stakeholders that are aware of the difficulties faced in the past when scaling up 'maker-solutions' to an industry level.

In this line, Maker has identified relevant potential partners for the scaling of the technical solution and developing a larger sheet press. The potential partners in this concern are Circular Design Studio, Rockwool Innovation, Lendager Architects, and FOS /Esferica from Spain. This choice is rooted in the local demand for and interest in recycled plastic sheets as a commercial material.

Additionally, Maker wants to empower the community through events, open access blueprints and solutions to engage further with existing initiatives both on a local and citizen level. In order to re-develop the PIPO-project from an action research approach, learnings, models and knowledge from PIPO will be utilised in other European projects and future

proposals. SISCODE and PIPO have pushed the objective of Maker in the direction of the circular economy, which is now part of the core activities in the association.

The actions foreseen include:

- Community events (Open lab days, Maker Meetups, training courses, events)
- Knowledge sharing and transfer within PIPO ecosystem and globally
- Connecting small-scale initiatives to larger agendas, and promoting Fab City in Copenhagen
- Promoting community-driven-circular initiatives and cases - e.g. Reflow Plast Arkiv Exhibition
- New Maker-website incorporating PIPO (resources, capacity building, research results)
- Circular Initiatives Policy Maker Brief

References and Appendices

All the information and outcomes will be available in internal management tools (see the appendices) and accessible on @maker and the SISCODE website: https://siscodeproject.eu/maker/ .

'Cirkulær København: Resource- og Affaldsplan 2024', Københavns Kommune 2019

Link: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1990

'Fab City Whitepaper: Locally productive, globally connected self-sufficient cities', Tomas Diez et. al.

Link: https://fab.city/uploads/whitepaper.pdf

'Danmark Uden Affald: genanvend mere - forbrænd mindre', Miljøstyrelsen MST 2011. Link: https://mst.dk/media/mst/Attachments/MST_Faktaark_1_WEB.pdf

'KBH 2025 Klimaplanen', Københavns Kommune 2012. Link: https://kk.sites.itera.dk/apps/kk_pub2/index.asp?mode=detalje&id=1035

Appendix 1: PIPO Digital Exhibition (Case Booklet). Link: https://3.basecamp.com/4017473/buckets/7749026/uploads/3164464077

Appendix 2: PIPO Technical Informations on cases and prototypes. Undersøgelsesdesign (Study Design) by Frederik Kragh Brandt 2019-2020. Link: https://docs.google.com/document/d/176eCUiEbv5nDqvn4gS6lwVvnDWT2KoU--p77e240QuY/edit

Appendix 3: PIPO Prototyping, Technical Document by Frederik Fragh Brandt and Asger Nørregård Rasmussen. Link: https://docs.google.com/document/d/1PSiXXFT7PHfR3HoLN4QpJYWFATdgjYnCzQzlSaDSa90/edit

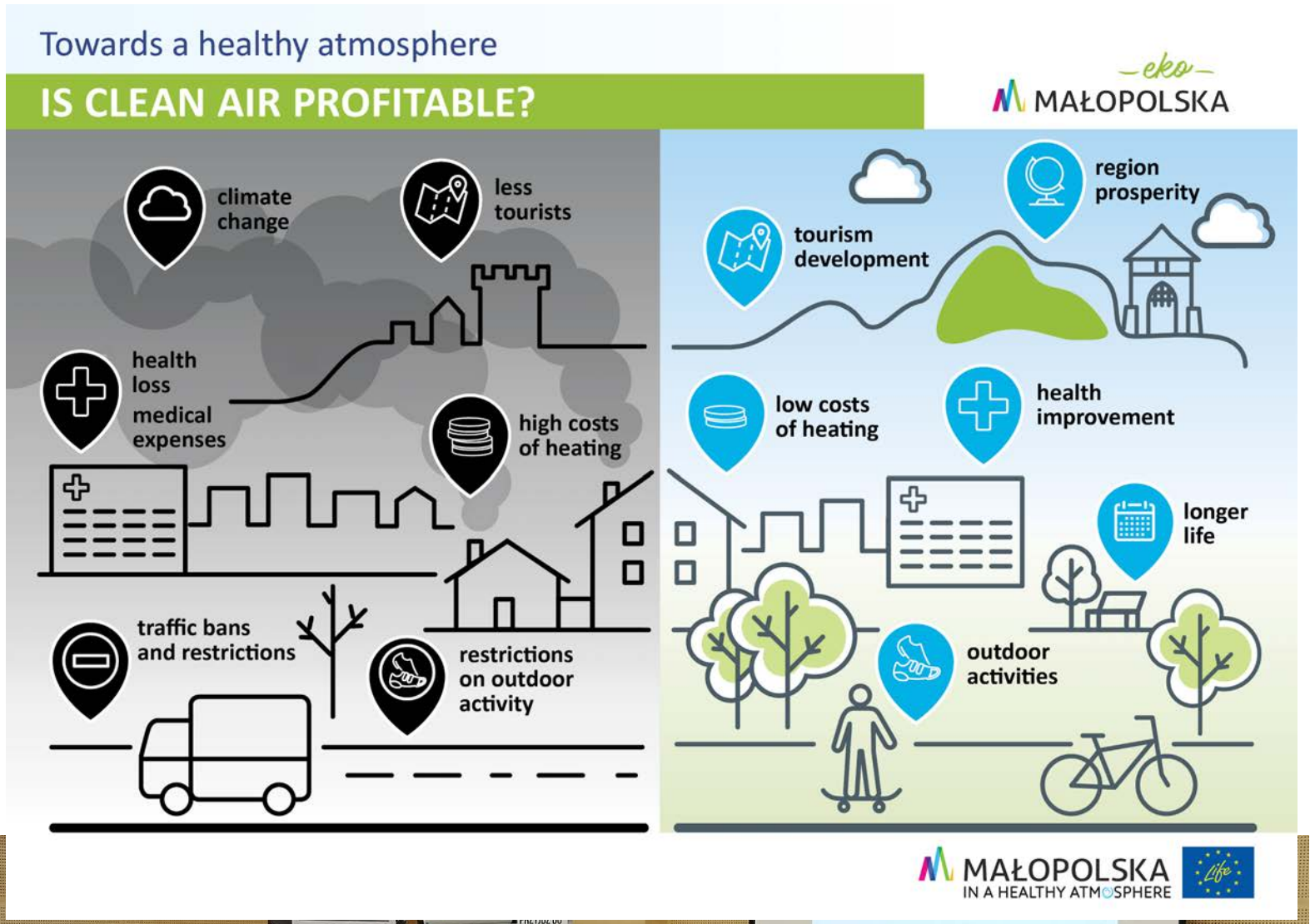
Appendix 4: Case Feedback, PIPO. Link: https://docs.google.com/document/d/1sDjwAbYUp0OJTqREZ-rxnMlh041Ma5Qk0mkDJ6xc1Dg/edit#heading=h.l6h2kq7q48j1

Appendix 5: Resources by student group from Aalborg University Copenhagen

Link (Basecamp): https://3.basecamp.com/4017473/buckets/7749026/vaults/1703531388

4.4. LET'S TALK ABOUT THE AIR by KRAKOW TECHNOLOGY PARK (KTP)

written by Agnieszka Włodarczyk, Monika Machowska, Aleksandra Gabriel



Context and Societal Challenge

A problem in Krakow is air quality. The city has been rated amongst the most polluted in the world in a World Health Organization (WHO) study. There is a high concentration of dust in the air and smog sensed by inhabitants (according to responses in the survey), that is leading to exponential numbers of fatal chronic illnesses situated in lower respiratory tracts.

KTP's challenge within the SISCODE project is to improve the quality of the air in Krakow by motivating citizens to change their ecological attitudes, transport and heating habits and support decision makers with relevant tools and instruments for better co-creation of local new policies with a user centred approach.

To realise the challenge, KTP has been involved in the creation of a new Air Protection Programme (APP) for the Małopolska region supporting policy makers in developing the programme involving a wide variety of stakeholders in order to meet their needs and expectations and ensure an evidence-based document as an outcome with a high level of feasibility, measurability and scalability.

Alongside the APP, KTP got involved in the implementation of a solution selected during a Smogathon, a hackathon with a specific focus on solutions for air pollution, whose winner was a platform for the monitoring of industrial air pollution. It resulted from the fact that one of the main areas in the field of air quality improvement is limiting industrial emissions to the environment and undertaking environmental education of residents. From the residents' perspective, designing an efficient platform for monitoring industrial pollution will allow them to gain reliable knowledge concerning their geographical area to react quickly and adequately to incidents related to uncontrolled industrial emissions. For entrepreneurs, it will facilitate the process of monitoring pollution by simplifying the reporting process and unifying the method of recording data related to pollution permits.

The decision to tackle this specific challenge was preceded by a series of consultation meetings with the public administration both at the municipal- and the regional level, relevant city-based public institutions responsible for transport and mobility, NGOs and activists.

Blueprint: final description of your solution

In this section the solution developed by Krakow Technology Park within the SISCODE journey is presented. The blueprint consists of two solutions: The Air Protection Programme for Malopolska Region by 2023 and the platform for monitoring of the industrial air pollution. They both create the joint approach to improve quality of air in the Malopolska region by setting and implementing the ambitious plan with long and short term activities and clearly set responsibilities approved by varied groups of stakeholders representing quadruple helix: business, academia, NGOs & inhabitants and administration in consultation process.

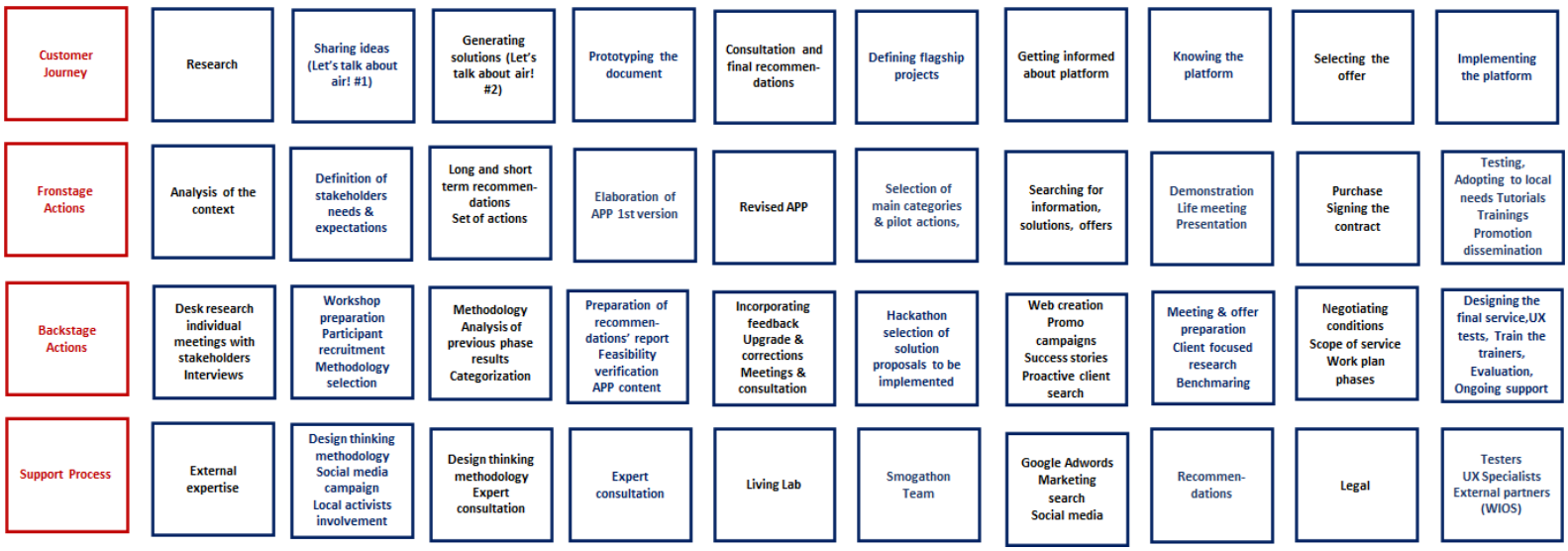


Fig 24: The blueprint presenting two solutions developed by KTP
the APP and platform for monitoring of the industrial air pollution

The Blueprint presented in Fig 24 is based on the effective KTP co-creation journey showing the interrelation between the two prototypes and emphasizing a new set of expertise and services that can shape the future interventions of KTP in its leading position as a BSO who supporting policy makers in co-creation and implementation of regional binding acts as the Air Protection Programme.

Demonstrator's description

KTP has selected two specific demonstrators respectively corresponding to (1) the Air Protection Programme and (2) the Monitoring pollution platform.

1) The Air Protection Programme

In relation to the Air Protection Programme, the demonstrator is the regional policy created by Marshal Office of Małopolska Region to improve quality of air in the region by 2023.

Here you may find the document: https://powietrze.malopolska.pl/wp-content/uploads/2020/10/POP2020_Program.pdf

An English synthesis will be available soon and updated in the SISCODE website and the MIRO of the deliverable.

It is a strategic, legislative document which has been approved and ratified by the Regional Authorities in September 2020. It defines the main areas of responsibilities, lists restrictions addressed to households and industries, identifies the catalogue of potential instruments and incentives that will support the modernisation and transformation of heating systems and reduction of emission from transport. The document is illustrated in Fig 25, 26, 27 and 28.

Fig 25: The Air Protection Programme - the cover of legislative document

Fig 26: The Air Protection Programme - the action plan

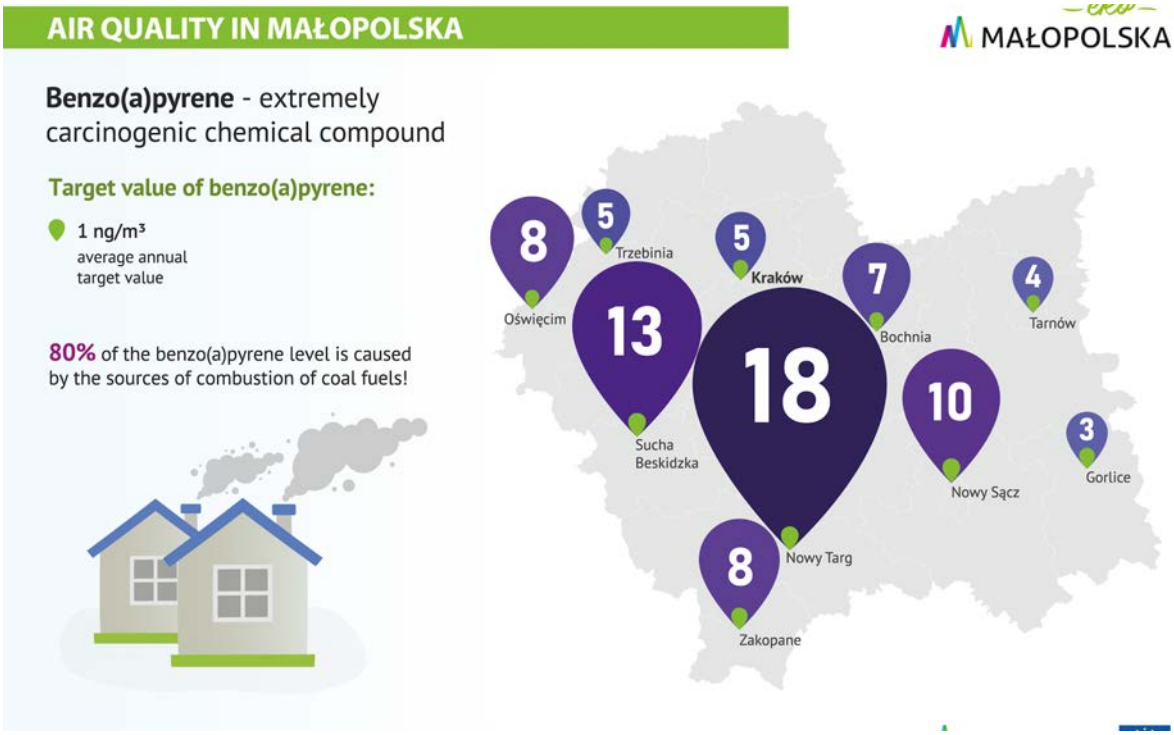


Fig 27: The Air Protection Programme - Air Quality and Benzo(a)pyrene

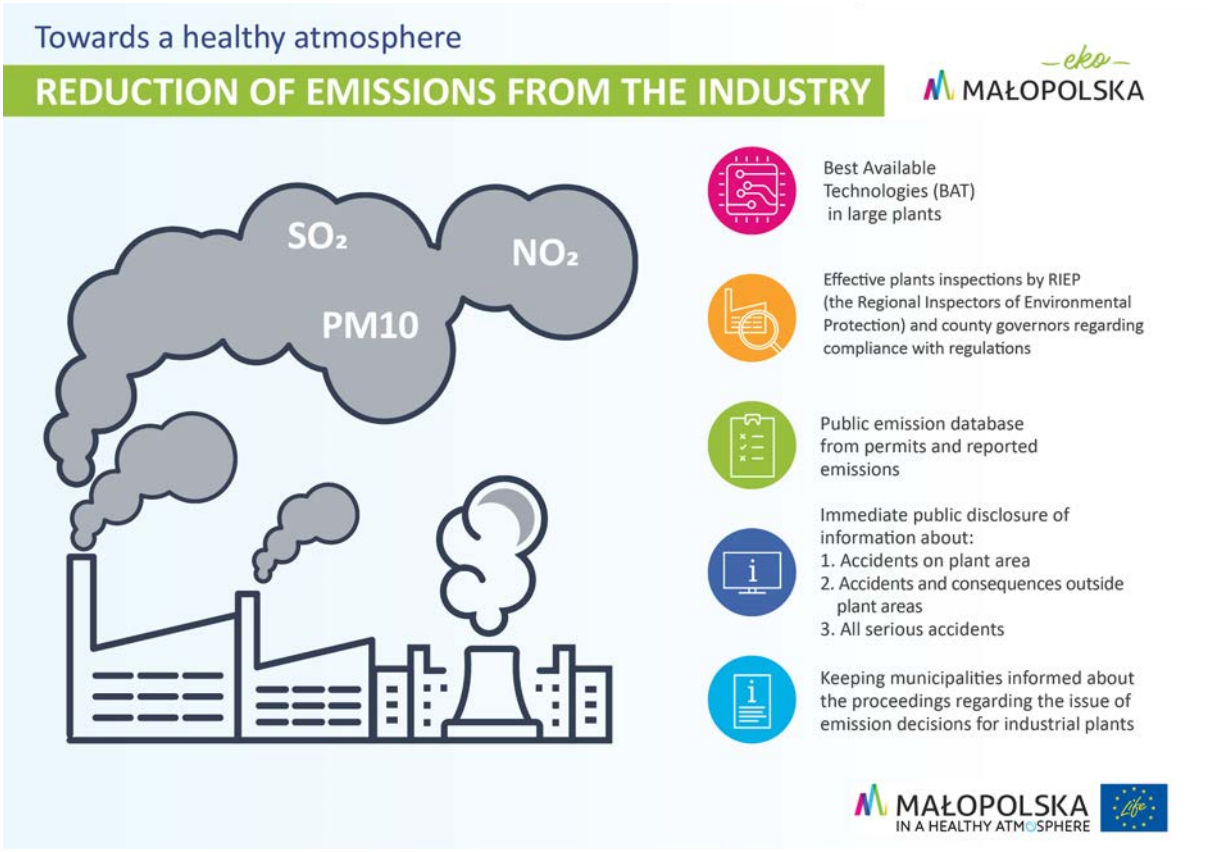


Fig 28: The Air Protection Programme - action plan to fight industrial pollution

2) The industrial pollution monitoring platform

In relation to monitoring of industrial air pollution, the demonstrator is a digital platform available at https://zanieczyszczenia-przemyslowe.powietrze.malopolska.pl/#/zones. The internet platform is addressing for citizens to both educate and raise their awareness on the air pollution and to deliver the relevant information on industrial pollution in their neighbourhood and to companies to support them in registering and reporting industrial emissions and maintaining transparency in evidencing the specific incidents. The platform will be also a useful tool for administration and controlling institutions as Regional Inspectorate of Environmental Protection.

The platform for industrial pollution prototyped and implemented within the SISCODE project is a pilot demonstrator and covers only the area of one county. The pilot is carried out in the Skawina commune, after prior recognition of the interest and potential of other communes in the Kraków agglomeration.

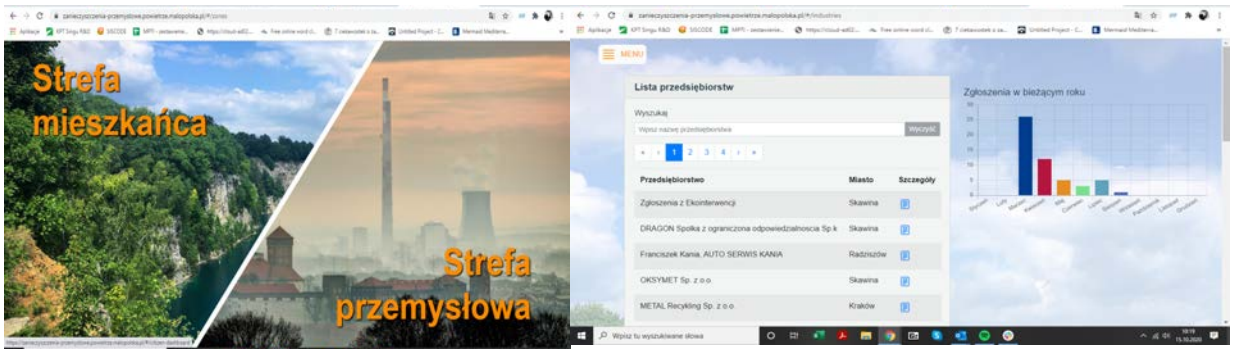


Fig 29: Presentation of the Platform for Monitoring of Industrial Pollutions

It was important to initiate the process of monitoring industrial pollution on a micro scale and test the platform in a small community and limited number of companies (24 thousand inhabitants and nearly 50 companies). The reason for that was to eliminate the mistakes and inconsistencies and improve functionality and usability of the platform. The lessons learnt during the implementation of the internet platform and the feedback collected during the interview with inhabitants and companies, will support the process of scaling up the demonstrator and introducing a final platform for monitoring industrial pollution for the Małopolska region.

Evolution and ongoing validation of your prototypes

(1) The Air Protection Programme

In relation to the Air Protection Programme, it took almost 11 months to develop an ambitious programme. Many people, many environments were involved in this work. The co-creation process had three loops. The inhabitants of Małopolska region, companies, academia, administration, NGOs and a varied group of producers and associations were given the chance to express their threats and list their expectations during the open, transparent and neutral consultation process. The public consultations lasted over seven months with six consultations meetings organised in five major cities of Małopolska region. Parallel to the meetings organised on site and streamed sessions (if the number of participants had to be limited due to coronavirus restrictions), the consultation process was also carried out in the

traditional written form by submitting concerns, comments and recommendations. Several thousand comments were submitted.

The new APP is ambitious and certainly the co-creation process was difficult and complex. It required a lot of negotiation and diplomatic skills, openness and transparency to introduce the legislation that will be approved and accepted by a varied group of stakeholders. It was very important to understand the perspective of inhabitants of big and small cities, large companies and small family businesses, activists and farmers or food producers to create the ambitious but realistic plan. The indicators for successful implementation of the APP will be monitored and verified and the programme will be subject to periodic evaluations.

(2) The industrial pollution monitoring platform

In relation to monitoring of industrial pollution, the prototyping phase consisted of 3 loops. In the first loop the platform was validated by the volunteers from KTP, who shared their opinions and gave some comments and recommendations on how to improve the platform. The second loop of the platform validation was organised with external testers recruited by KTP according to predefined methodology and interview structure. KTP interviewed 20 individuals and 5 companies. They all were located in Skawina. To achieve wider evaluation of the pilot and attract new testers the questionnaire has been created and placed on the internet platform. The feedback collected during the interviews as well as the comments and recommendations expressed in the questionnaires were analysed, discussed and introduced if relevant and possible in the timeline of the pilot project.

As mentioned before, the platform for monitoring industrial pollution prototyped and implemented within the SISCODE project is a pilot and covers only the area of one county. The success will be noted when the final internet platform for monitoring industrial pollution for all Małopolska region will take into consideration lessons learnt during the pilot phase.

4.5. ICT for Agricultural schools by PA4ALL

written by Isidora Stojacic

PA4ALL: ICT for Agricultural high schools in the Republic of Serbia

There are over 3.4 million hectares of land processed in Serbia and 631.552 farms. The average land size per farm is quite small, with most of the farms in the range from 2 to 5 ha. Although its high potential in the local economy, the agricultural sector faced many difficulties: most of the farmers struggled to be sustainable and the new generations did not demonstrate many interests to follow such careers. ICT has been identified as a potential solution to reach this gap. The introduction of ICT subjects in agriculture courses, together with the inclusion of younger generations, could increase the awareness of the relationship between technology and agriculture in order to increase the productivity of the field and at the same time, make agriculture more attractive for younger generations. Additionally, agriculture is mostly still traditional in Serbia, and far behind other EU countries in the use of ICT tools, therefore, the BioSense Institute (PA4ALL) as precursor is acting for disseminating precision agriculture tools and its benefits to the community. One of the most relevant solutions to reach the gap consists in introducing the youngest agriculture producers with these concepts.

Thus, the project aims to improve the curriculum in high schools specialised in agriculture with a new educational module and change the adoption of ICT in schools on a larger scale, for the students of the age bracket between 14 and 18 years old.

PA4ALL introduced precision agriculture tools in high schools specialised in agriculture by presenting its benefits and encouraging high school students as well as teachers and school principals to uptake new trends and innovations. After applying co-creation tools with relevant stakeholders, PA4ALL decided to install one meteostation in one school in Novi Sad. This meteostation, connected to the BioSense internal platform – AgroSens, was able to inform students about various meteorological parameters useful for agricultural fields.

By using co-creation tools among relevant stakeholders, PA4ALL has created a new educational module focused on ICT and precision agriculture in the high school curriculum which would build a new generation of agricultural professionals skilled for the changing labour market demands. Another important objective of the journey was to find a way to break the stereotypes that both sides, farmers and ICT experts, have towards precision agriculture.

Blueprint: A new curriculum and education service

PA4ALL's proposal is a set of documents which can be presented to policy makers in order to display the need to change the current curriculum and to describe in detail the learning module which has been developed and tested together with schools. It details each of the activities composing the model, what will be taught to the students, the duration, what tools will be used, etc. The prototype aims at improving the curriculum in high schools specialised in agriculture, therefore what is demonstrated as a prototype in this document is carefully designed brief which contains all relevant information for the prototype's description and execution. It will consider each of the steps along the way, demonstrating what topics will be included in each class together with their description.

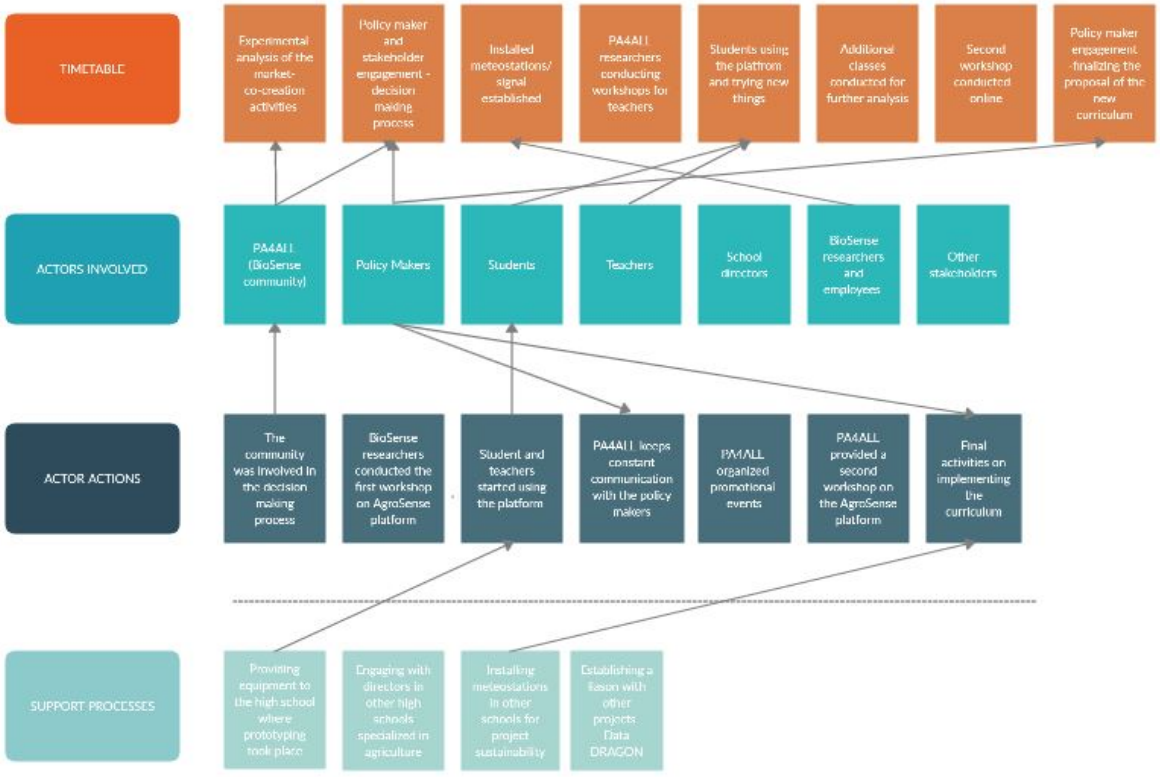


Fig 30: Service Blueprint of the intervention with schools proposed

The module is constructed by equipping the high schools with specific precision agriculture tools - in our case meteostations and credentials for the AgroSens platform. Since, the platform itself has been designed for agriculture producers, youngsters from the agriculture school were already familiar with most of the concepts in the platform, the teaching materials are also based on these modules, within the platform:

1. The Map of the fields which was sketched out with the satellite imaging system - the youngsters/teens had an opportunity to set the fields in the map on their own, for which they were observing the parameters, in this case the school property fields

2. The parcels, crop type and agriculture production type on the parcels and other information currently active and archived

3. Costs, amount spent on inputs, such as pesticides, seeds, water supply, nutrients, among others, and calculate how to optimally use the money in order to achieve cost optimisation in the future

4. Services - Drone Service which could be ordered within the platform and agriculture extension services communication (however, these were not used by the school youngsters and were not included in the designed curriculum)

5. Pest images which can be uploaded to the platform and it provides information on the pest, using a refined algorithm. The youngsters were encouraged to use these tools on daily bases

6. Technologies- various technologies which are integrated within the platform and could be used for different types of production, fruit, vegetables, grains, livestock, poultry, etc…

7. Tools - waste calculator, calibration of mechanisation, sprinklers and other tools which could be managed throughout the platform, and all these modules are included in the designed curriculum.

Common Core Aligned Lesson Plan Template

Subject(s): Precision Agriculture **Grade: _____**

Teacher(s): _____ School: _____

LESSON ELEMENT	**Duration: 15h**
1. Common Core Learning Standard(s) Addressed: The AgroSense system is comprised of a wireless network of small meteorological stations given to the school and other measuring equipment which the school could buy or already possess. It is easy-to-install, accurate and reliable solution to collect high-resolution data such as soil moisture, leaf wetness etc, and do identify needs for irrigation, application of pesticides and other treatments	
2. Learning Target(s): (What will students know & be able to do as a result of this lesson?) The students will be able to learn how to optimally make some decisions based on the input the add to the platform and afterwards make conclusions based on the algorithm from these precision agriculture tools. Also, the students will be able to get some information on their agriculture production on the spot.	
3. Relevance/Rationale: (Why are the outcomes of this lesson important in the real world? Why are these outcomes essential for future learning?) The most important thing to consider is the effect of precision agriculture generally in the world. The farmers were more likely to make decisions based on Their own experience and knowledge on the subject, but now their knowledge will be upgraded with these tools and models. Young farmers-students will be the ones using new technology as a referential point on which to base their decisions and older will be able to complement their ideas.	
4. Formative Assessment Criteria for Success: (How will you & your students know if they have successfully met the outcomes? What specific criteria will be met in a successful product/process? What does success on this lesson's outcomes look like?) The students will be the ones adding information to the platform on the agriculture production crops, amount of pesticides, which pesticides were used, monitoring activities, etc. The algorithm takes into account all the inserted information as well as information from weather forecast and the students must be literally to understand how to add inputs, how to read from the information provided from the algorithm, how to navigate the platform and considering all of this, the students will be asked to construct a brief report on all the all activities which will be held out according to the platform.	
5. Activities/Tasks: (What learning experiences will students engage in? How will you use these learning experiences or their student products as formative assessment opportunities?) The platform will provide same main features and benefits to the students so they could easily understand the opportunities provided: Print: Instantly print data collected in any of the field operations Secure: Only accessible to the authentic user Reliable: Generate all the updated information in the correct order Availability: Any information about the farm is quickly available to the authorized user	

6. Resources/Materials: (What texts, digital resources, & materials will be used in this lesson?

The materials used for these lessons will be the AgroSense platform, the platform guide, leaflets about the platform properties, how to be used, etc. Also, PA4ALL provided the meteostations which was installed in front of the school.

7. Access for All: (How will you ensure that all students have access to and are able to engage appropriately in this lesson? Consider all aspects of student diversity.)

We provided additional equipment to the school, computers, a printer and a video projector which could help all students to access the platform and navigate the platform themselves.

8. Modifications/Accommodations: (What curriculum modifications and/or classroom accommodations will you make for Students with Disabilities in your class? Be as specific as possible.)
The model will actually provide an opportunity for the disabled children in agriculture, since not everything about agriculture revolves around the field work. Now, within this model, we will be able to give an opportunity to the disabled children to work in the field of agriculture by using solemnly their computers.

Common Core Aligned Lesson: Reflection

- Does this lesson reflect one of the "shifts" in instruction? If so, which shift how?

This adds a completely new model to the school system, something that did not exist before. It will provide a completely new overview of the education in schools specialized in agriculture and bring the system closer to foreign methods of education.

- How did this lesson support 21st Century Skills?

The main aim of the platform is to provide monitoring on crops by combining processed Sentinel pictures with meteorological data (historical data and forecasts) and on the ground information received through various measurements. The advanced algorithm processes the parcel specifications provided by the registered farmer and suggests which smart farming technologies might be used. The algorithm takes into account all the inserted information as well as information from weather forecast.

- How did this lesson cognitively engage students?

The students are interesting in new technologies due to their young age and generation characteristics. Therefore, this gives them an opportunity to grow as individuals, decide about their future profession and engage them to go deeper in the precision agriculture subject. This is not the only technology which goes under the term precision agriculture, it is also important to know about other technologies, which will also be included in this module as an extra activity.

- How did this lesson engage students in collaborative learning and enhance their collaborative learning skills?

It is crucial to emphasize that end-users (farmers) don't want to be informed about scientific research outcomes, but rather to have information about ready-to-use solutions, available on the market. As the result, the user of AgroSens platform receives the list of available and appropriate solutions for his/her farming practice. This links the AgroSens platform directly providing information on suitable smart farming technologies to the 3.000 Serbian farmers already registered in AgroSens.

Fig 31: Main content of the new curriculum

In Fig 31, the demonstration of the designed curriculum with the needed hours for conducting as well as topic description is displayed. The document describes the main implications for the current curriculum and why it is crucial for high school education nowadays to include ICT subjects such as precision agriculture. The curriculum document includes activities, materials and programme unit name. All the following information is based on the AgroSens platform designed by the researchers and developers at BioSense. A specific template has been used, created by PA4ALL, acknowledging its efficacy for the upcoming activities since it summarises all the information in one place. Fig 5.3 demonstrates the proposed curriculum to be presented to the policy makers together.

AgroSense platform study plan	**SISCODE PROJECT**		
Name of program units	Lectures		In total Lecture hours
	Material	Activities	
Parcels	-AgroSens platform -Various additional materials which we are providing such as manuals (available only in Serbian)	-Type of production on each of the parcels and its varieties -Crop rotation -Correlation between different crops planted in the parcel	2
Meteo	-AgroSense platform -The Hydrometeorological institute of Serbia	-Simple overview on how the meteo screen data can determine the decisions imposed for the agricultural production	1
Costs	-AgroSens platform	-Cost fluctuation based on the inputs and outputs from cultivation -Useful data and how to use it	2
PIS	-AgroSens platform -Additional material on most common pests provided by the school	-Most common pests which attach the crops mainly being cultivated in Serbia and the region	2
Technologies	-AgroSens platform -Additional material provided by the lab	Technologies such as N-eXpert, Smart Plant, Duport Liquiliser Wingsprayer, PAIS and others on the platform	1+3
Tools	-AgroSens platform -Their own input	-How to use the Universal Grain Harvester Loss Calculator -Spread crop sowing distance calculator -Calibration of row drills -Adjusting the sprayer -Spreader calibration Adjusting the sprinkler	3

Fig 32: The proposed learning module

Demonstrator's description

The curriculum's activities are based on the use of the BioSense AgroSens platform. Additionally, PA4ALL team is now developing a set of customisable materials and documents to facilitate its local deployment in schools. Apart from the guiding documents for running the teaching activities described in the previous session, the ongoing demonstrator includes a facilitated access to this platform and a meteostation to install with dedicated technical instructions.

About the AgroSens platform (https://www.agrosens.rs/#/app-h/welcome)

AgroSens is a digital platform that provides support to farmers and agricultural companies in monitoring the growth of crops and planning of agricultural activities. It was developed by BioSense Institute from Novi Sad and represents an important step in digitisation of agriculture and an increase in efficiency and competitiveness of Serbian producers.

AgroSens digital platform, through a single user profile, allows the access to the whole system: AgroSens web application intended for comfortable work on a PC and AgroSens Android application that turns a mobile phone into a new useful tool for farmers. AgroSens web application is designed for visualisation and in-depth analysis of data, while AgroSens Android application, besides giving instantaneous insight into all data, on the field, allows for a quick and easy input of data to the system.

The platform enables domestic farmers to monitor the condition of crops and plan agricultural activities completely free of charge with the help of a mobile phone or computer. Registration is very simple, and the user is only required to select his plots from the cadastre or draw them on a map of Serbia. After that, a whole series of data is obtained, among which are: time forecast for the location of the plot, historical meteorological data, data on the occurrence of plant diseases, information on the latest technologies available on the market, etc. Satellite imagery makes AgroSens a unique platform in the world. Users can access processed satellite images and vegetation indices free of charge their fields and thus follow the growth and development of crops, even from a remote location. Because of the rich functionality, AgroSens currently uses more than 15,000 users, and more than a quarter of arable agricultural land in Vojvodina has been entered into the system. This is a confirmation of the digital transformation of agriculture in Serbia and greater awareness of farmers on the importance of new technologies.

The following features were also presented to SISCODE workshop visitors in-depth: digital book of agricultural activities, weather forecast for the location of the parcel, satellite images in crops and parcels, soil analysis and crops images, plant diseases occurrence notification system and many more.

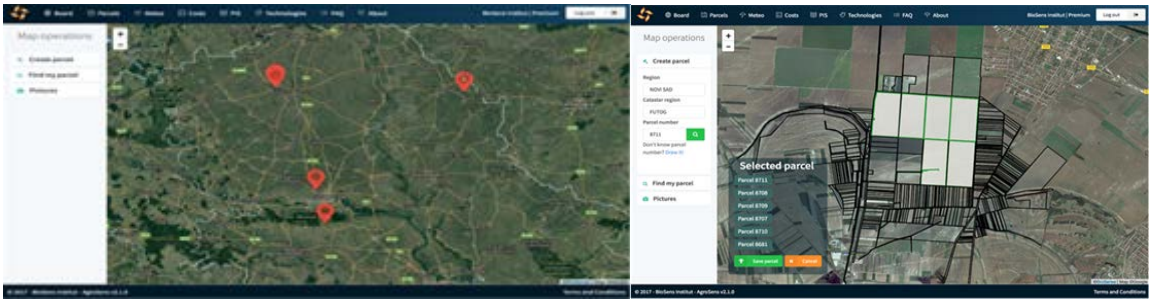


Fig 33: AgroSens platform preview photos

The following basic services are available to users of AgroSens digital platform:

- Diary of agricultural activities
- Weather forecast for the location of the parcel
- Satellite indices of crops that describe plant growth, photosynthesis intensity and the availability of water and nutrients
- Overview of soil analysis
- Overview of photographs of crops
- Information about smart technologies used in agriculture
- Latest information about the occurrence of pests and plant diseases
- Basic services are completely free of charge
- Data that the user feeds into the system will not be distributed to a third party without the user's prior approval, except for the data in anonymised and aggregated form
- AgroSens digital platform is intended for other types of users as well – state and local government and scientific and research institutions, which are given an insight into specific aspects of agricultural production

The following additional services, custom-made to fit their needs, are available to premium users:

- Collection, visualisation and analysis of data from their own sensors: meteorological stations, soil and leaf moisture sensors
- Storage and visualisation of data from their own sensors mounted on agricultural machinery (yield and moisture maps, terrain profile maps and others)
- Storage and visualisation of maps of physical and chemical properties of the soil
- Delineation of management zones
- Visualisation and analysis of drone images
- Incorporation of other data, defined by user, into the system

About the manual on how to use the meteostation.

A specific short manual has been designed to support the installation of the meteostations. It consists of the information on basic meteostation performances and explains how to use how to install it on the field (see Fig 34).

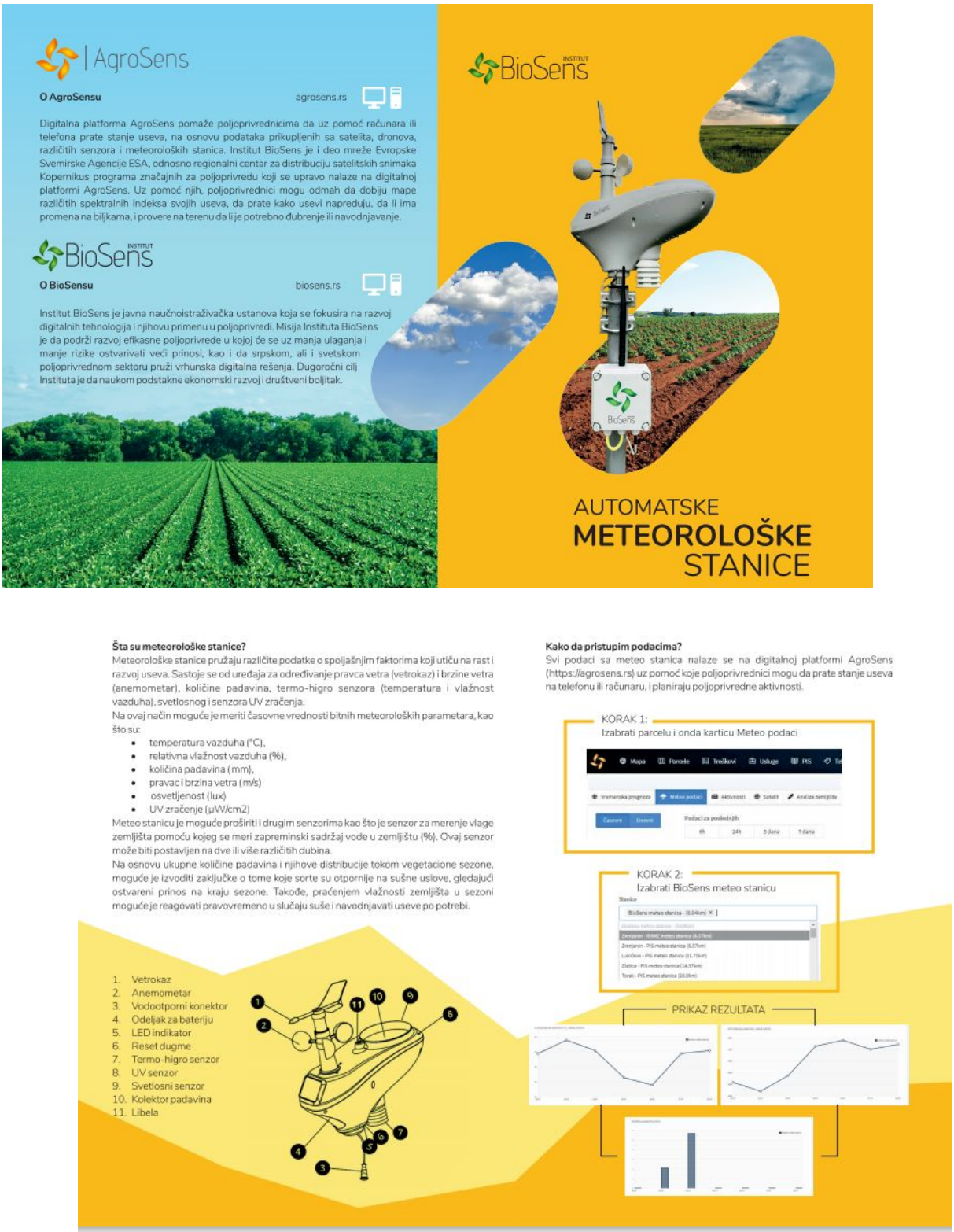


Fig 34: Manual on how to use the meteostations (in Serbian language only)

Evolution and ongoing validation of your prototypes

The educational module has been co-developed and tested with one specific school specialised in agriculture in Novi Sad, Serbia, since October 2019.

In the first workshop, the benefits of using the AgroSens platform were presented to high school students and teachers. The workshop consisted of 30 students and teachers from the school who were introduced to the platform and meteostation which was installed in front of the school in the yard. The group of actors gave comments and asked questions regarding the usage of the platform and expressed potential future needs. PA4ALL provided an account especially established for the school. Positive feedback on the relevance of such platforms and approaches were shared by the participants who were appealed to test it in the following months. The researchers from PA4ALL conducted workshops for teachers and some students on how to use the AgroSens platform, immediately understanding if there were some doubts or questions on each of the modules.

In the next period, the school was supposed to add parameters to the platform during the extracurricular lessons which took place in the school and start using the platform and exploring it in the right way. However, it was of extreme importance for this pilot that this year's planting processes in the school were delayed due to an immense problem with the overly warm weather. Therefore, the students started using the platform a bit later than scheduled being highly dependent on the planting schedule and the weather conditions as a key input.

A second loop of the prototype was supposed to take place in the same school, but due to the COVID-19 situation, it had to be postponed and adapted to a one-day event held on September 24th. The idea for the event was to gather the teachers to understand which difficulties the students encountered when the module was put into practice.

All activities were organised virtually, since the COVID-19 situation did not allow gathering people in closed spaces at the Institute. The ZOOM platform was used as an online communication tool.

The teachers and students at the schools were invited to attend online activities, as well as the advisory organisations of the agriculture sector. The collected feedback highlighted that the teachers are fundamental nodes in the system being the ones facilitating the learning processes with and for their students. As a conclusion, it was that precision agriculture must play a crucial part of the high school curriculum and that the AgroSens platform could represent a great starting point for supporting the entire process. One reason evoked is that the digital records of farm activities will be obligatory in future legislations.

Those activities will continue with new national and EU projects and with a close dialogue with national policy makers.

4.6. Partners of Experience by Thess-AHALL|AUTH

written by Evdokimos Konstantinidis, Despoina Mantziari, Despoina Petsani, Panos Bamidis

Context and Societal Challenge

Within the SISCODE co-creation journey, the Thessaloniki Active & Healthy Ageing Living Lab (Thess-AHALL) aims **to tackle ageism and the risk of social discrimination and the cultural stigma related to it, experienced frequently by older adults and chronic patients** due to their loss of physical, mental and social abilities, as they age or due to their health problems. To do so, Thess-AHALL has introduced an experiential learning programme for the targeted population, the so-called **'Partners of Experience' life-long learning programme**, addressing **"'early-stage' researchers over 65 years old** and aiming at the enhancement of their competences and active citizenship. The 'Partners of Experience' programme includes a series of life-long learning & co-creation research activities, exploiting co-creation, citizens science and open science principles as its means. The choice of close collaboration between older adults/chronic patients and the scientific research community as a driver to increase competences and skills of primary beneficiaries was not accidental.

More specifically, the lab's empirical knowledge of working with older adults and chronic patients or residential care receivers, as well as related desk research and preliminary interviews with local stakeholders and Policy makers have shown that the targeted population often feels like marginalised and as inactive citizens, either due to their retirement or because they experience the cultural stigma of losing their mental and physical abilities. On the other hand, even though science has a high impact on society, the scientific community is still seen as a 'close elite', not always addressing citizens' real needs. Taking these into account, **Thess-AHALL's 'Partners of Experience' programme exploits citizens' science to open academia to the society and embrace older adults, as an alternative research group, to co-create solutions for everyday challenges of their everyday life.**

The challenge aims to prove that a more accessible scientific community with the high involvement of citizens in participatory research and decision-making, could become a solid ground for the targeted populations to tackle potential ageism and stigmatisation, as well as for societies to effectively address key societal problems with the assent and mutual collaboration of citizens, experts and policy makers.

Blueprint: final description of your solution

The 'Partners of Experience' solution was introduced as a life-long, experiential research programme to address everyday living challenges of older adults as early-stage researchers. More specifically within the SISCODE context, Thess-AHALL's challenge is to welcome chronic disease outpatients and older adults back to social life and communities by reintroducing them as an alternative research group that collaborates with the University and Lab's researchers, applying step-by-step scientific & co-creation research methodology to promote their solutions for research questions related to their own health and well-being problems.

The implementation of the SISCODE co-creation journey using its toolkit provided Thess-AHALL a fertile ground to experiment the proposed solution in a real-life setting and co-validate along with end-users the research assumptions of using co-creation and citizens' science to tackle ageism and social discrimination. During the prototyping phase, Thess-AHALL piloted the 'Partners of Experience' programme with 44 older adult researchers in the local context of the City of Thessaloniki, where the participants, split in three smaller thematic groups (Environment-Health & Social Welfare-Active Citizens), worked for a whole academic year, mentored by the lab's researchers, to provide solutions for three main Health & Well-Being societal issues of their own interest, which were also related to an 'umbrella' research question on 'How to make Thessaloniki a healthier and more accessible city to older adults & vulnerable population.'

Fig 35: Moments captured from the Partners of Experience's programme

The SISCODE case study, explored by Thess-AHALL, provided Lab's researchers with the requirements, as well as showing barriers and drivers, to establish a specific life-long learning methodology as a programme, adjusted to a more experiential and user-driven

approach, however, including all the core activities of the scientific research methodology. In the 9-month duration of the prototyping activity, older adult researchers tested and evaluated the proposed methodology, which is summarised in 5 main steps, as following:

Fig 36: Main steps of the programme

In the case of the 'Partners of Experience' prototyping, the 3 older adult research groups followed, step-by-step, the above-mentioned methodology working on their selected thematic areas: Environment-Active Citizens-Health & Social Welfare, reaching practical solutions on the achievement of their common goal to make Thessaloniki 'healthier' as a city. Older adult participants completed the 'Partners of Experience' life-long learning programme, attending a series of 12 activities of which eight were conducted as face-to-face sessions, including field visits and intergeneration sessions with medicine students, policymaking workshops etc. (September 2019 - February 2020). The remaining activities had to be conducted virtually, via Skype/Viber and phone group calls, due to the COVID-19 situation. The face-to-face events included the entire 1st loop of the prototyping and the activities related to the three first steps of the methodology with a part of the fourth, while the virtual sessions then included the whole 2nd loop and consequently the final stage of solutions' implementation, the dissemination and final evaluation of the programme.

The following service Blueprint scheme summarises the proposed solution reflecting in detail on all the frontstage and backstage actions, the involved stakeholders and tools/processes explored and validated in each step of the prototype phase:

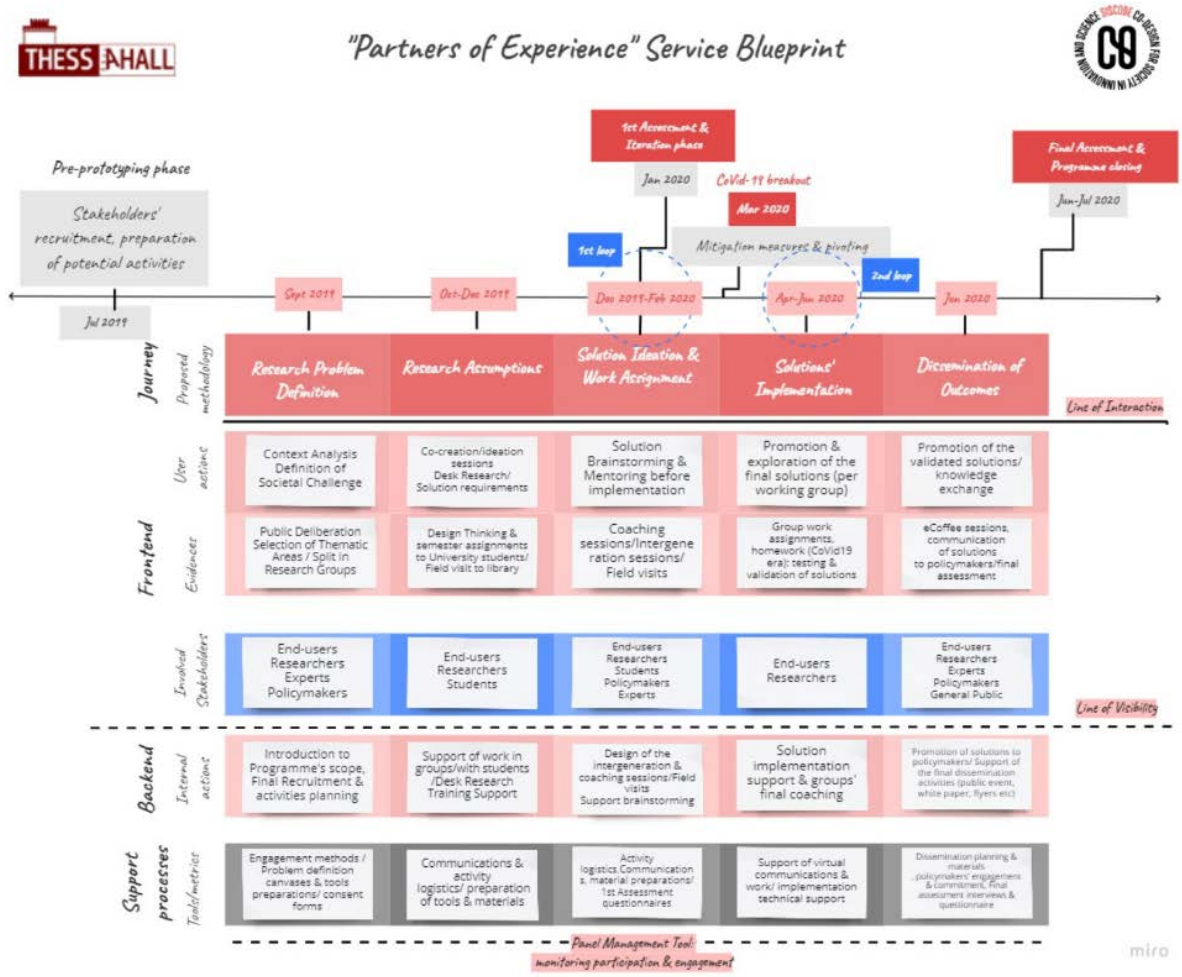


Fig 37: Overview of the final Blueprint of the Partners of Experience's programme

Demonstrator's description

The demonstrator prepared by Thess-AHALL, regarding the 'Partners of Experience' prototype, is an illustrated handbook, including all the different steps of the proposed methodology, the solution Blueprint, main lessons-learnt & tips, as well as indicative shots and descriptive texts from the Thess-AHALL use-case with older adults in the context of SISCODE project. The 'Partners of Experience' demonstrator aspires to be a practical guide that will help those interested in applying the proposed life-long learning programme to their own targeted population and context and foster the collaboration of all the integral parts of a society like citizens, experts, researchers, Policy makers, under the common goal of addressing societal challenges and improve active citizenship by exploiting co-creation and citizens' science as their means. The following graphic depicts an overview of the demonstrator (Fig 38):

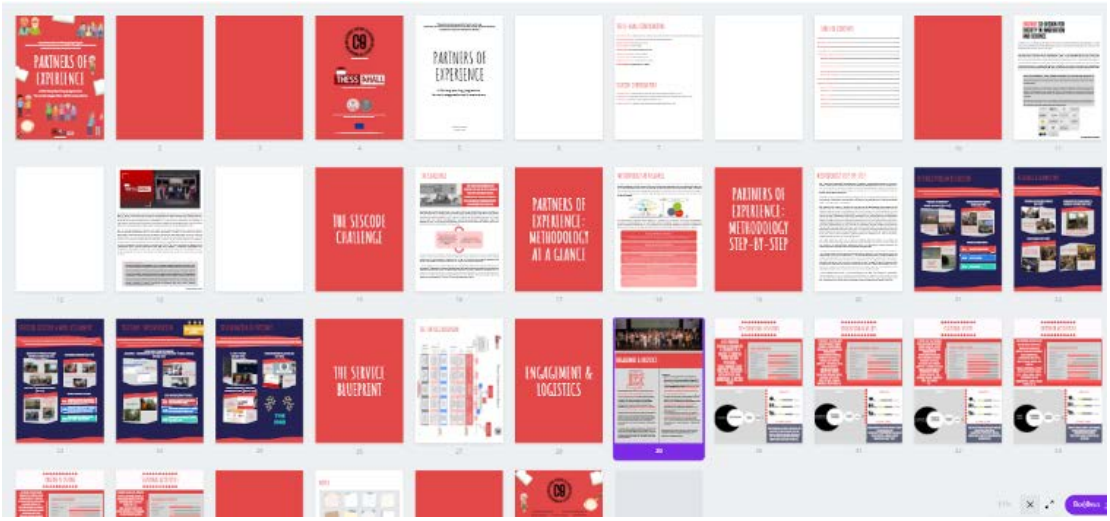


Fig 38: Overview of the demonstrator of the Partners of Experience's programme

The 'Partners of Experience' handbook is divided into three main parts: the first part, which is the introduction, provides information about the concept, general information about the SISCODE project and Thess-AHALL as a lab, as well as describing the societal challenge addressed within the SISCODE context, that led to the development and exploitation of the proposed experiential learning programme and its methodology.

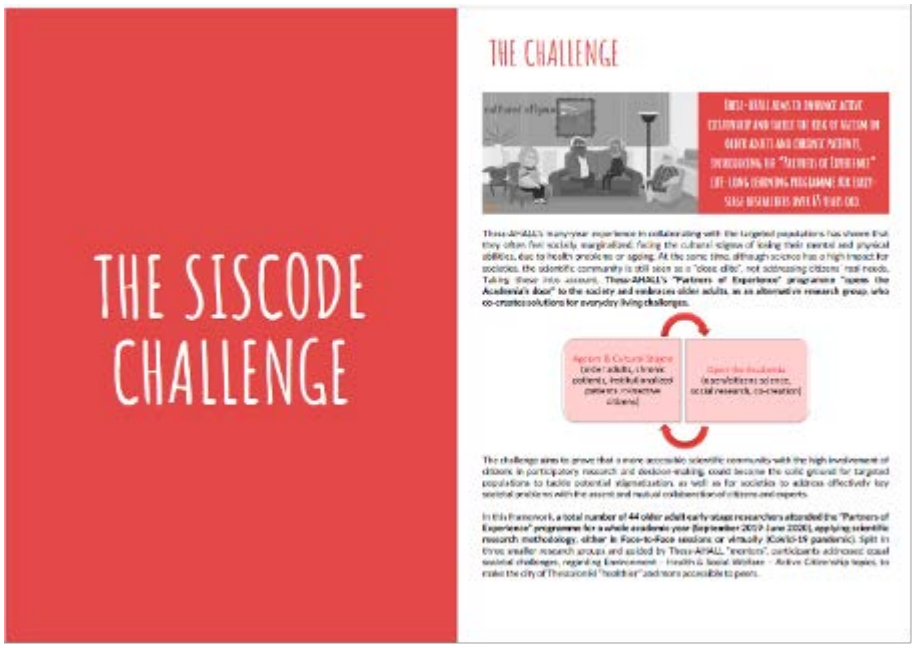


Fig 39: The first, introductory part of the handbook

The second part is focused on the methodology, explained step-by-step, as it was tested and validated by the Living Lab and its community of older adult early-stage researchers, in the context of SISCODE. This part also includes all the different phases of the experiential learning, the involved stakeholders, processes, activities and tools used.

Fig 40: The second part of the handbook focused on the methodology

The third and last part of the handbook summarises the experiences of both Thess-AHALL's researchers and older adult participants, providing information on the impact of the programme's activities on its beneficiaries and their engagement in the entire process, as well as researchers' acquired knowledge on organisational practices.

Fig 41: The third part of the handbook as a summary of the experience

The demonstrator can be used either in a linear or in a non-linear way, allowing its readers to follow the entire path or to focus on specific parts of the methodology, activity types and examples.

The main objective of the handbook as an empirical guide is to become a practical tool/training material for those who are interested to apply co-creation and citizens' science, exploring the connection and engagement between different stakeholder groups that would normally not collaborate, raise awareness and sensitivity towards everyday living concerns/challenge of certain groups/individuals or societies, create a mutual space of trust for sharing and common understanding, enhancing the competences, skills and quality of life of specific targeted populations through alternative means of education.

How to access it?

The demonstrator has been designed in the form of a handbook with high graphic resolution, in order to make it available to anyone interested, both in digital and printed form.

The digital version of the 'Partners of Experience' handbook will be available and openly accessible through the website of the Thessaloniki Active & Healthy Ageing Living Lab (Thess-AHALL) (http://www.thessahall.com/) and the project website of SISCODE

(https://siscodeproject.eu/) in PDF format. In addition to this for the purpose of this project, the demonstrator is also attached in the overall infographic of the project and in the internal database of the project[12].

In the coming period, Thess-AHALL will print a number of the developed handbook that will be available to Living Lab collaborators, co-creators, researchers, health & well-being professionals, adult educators, students, Policy makers and other interested parties, who would like to learn and exploit further the programme. Finally, a Greek version of the printed handbook will be given to the older adult researchers that participated in the first 'Partners of Experience' life-long learning programme, as a memento and recognition of their participation and contribution to both the project and the lab's challenge.

Evolution and ongoing validation of your prototypes

About the cycles of prototyping

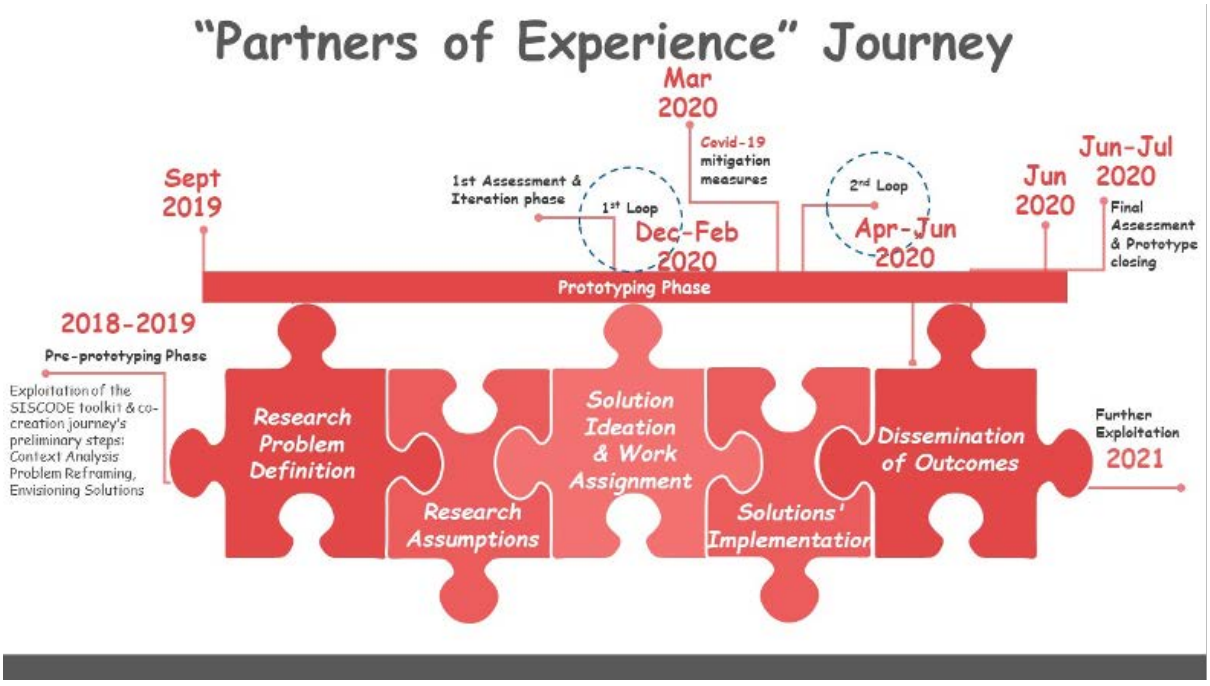


Fig 42: Timeline of activities

During the prototyping phase, there were 2 phases of assessment of the programme, conducted by the lab's researchers and end-users exploiting both qualitative & quantitative means like questionnaires and interviews. As the proposed 9-month life-long learning &

[12] https://3.basecamp.com/4017473/buckets/7749026/uploads/3211469446

experiential research programme resembles the educational programme of an academic year, the first assessment was conducted in the end of the winter semester (January 2020), providing to Thess-AHALL a rich dataset of insights from participants and researchers, positive and negative aspects or perceived barriers and drivers related to the promoted activities of the programme. Based on this feedback, Thess-AHALL started the redesigning of some aspects of the 'Partners of Experience' programme, in order to be validated in the second half of the academic year (February-June 2020). The iteration process included changes both in the duration and frequency of the group sessions (end-users asked for additional meetups of less duration), the type of activities (more outdoor and field visit activities) and the interaction with other types of stakeholders (more sessions with the involvement of experts and Policy makers).

But then, due to the start of the COVID-19 pandemic in early spring (March 2020), the urgent need for a second pivoting, earlier than it was expected, led Thess-AHALL's team to redesign the solution once again.

On the one hand, all the activities had to go virtual, posing a real challenge when working with older adults of low digital skills and limited access to online means of communication, and on the other hand the research groups' activities had to turn into alternatives that could be conducted under the measures of safety related to social distancing, while participants' were forced to stay at home. Older adults' strong will to continue with the 'Partners of Experience' programme brought new concepts on the focal point of the research and the thematic research groups were assigned some homework, instead of face-to-face sessions.

Moreover, the so-called 'e-coffee' sessions, using Skype/Viber/phone group calls, an initiative, undertaken by the Thess-AHALL researchers contributed to stakeholders' engagement in the second half of the programme and its successful completion. Last, but not least, policy makers' active involvement in the first half of the prototyping (co-creation sessions, seasonal coaching workshops etc.) created the needed value for them to support the programme. To this end, they remained engaged in the second half, helping older adult researchers to promote and implement their pivoted-due to COVID-19- solutions in the City of Thessaloniki.

About indicators and testing

Six different types of life-long learning & experiential research activities (Co-creation Sessions, Educational Visits, Cultural Visits, Outdoor Activities, Online Sessions and Seasonal Events) exploited during the 'Partners of Experience' life-long learning programme, have

been assessed and the evaluation outcomes were included in the handbook summarising both Thess-AHALL researchers and programme participants' experiences & insights on each of the aspects, based on three main pillars: Impact for stakeholders – Impact for the Living Lab – Organizational Practicalities (Logistics).

The assessment was based on a series of user satisfaction surveys, filled in by participants after each activity, a series of phone calls and an online final questionnaire, regarding the overall evaluation of the programme, as well as a self-assessment, answered by researchers of the Living Lab, engaged in programme's activities.

In order to create a common baseline and understanding of the input requested for the self-assessment tool, the responses of the Thess-AHALL research team have been based on the common assumption that each one out of the seven events is designed and hosted for a maximum of 20 participants per activity.

In summary:

· The **impact for stakeholders**, in other words the 'what's in for me?' participants' most frequent question to take part in an activity or become a member of a team has been assessed based on the following eight factors in a 6-degree Likert scale from 0 (not impact at all) to 5 (extremely high impact): Socialisation inside the Group, Active Citizenship, Life-long learning, Entertainment, Interaction with other age groups, Interaction with the City, Sense of belonging in a group, Long-term involvement.

· The **impact for the living lab**, which means the 'value' and possible outcomes of the engagement activities were focused on the living lab's community building and its sustainability. The reflection included the four following factors - Input for research, sustainability/engagement, dissemination/exploitation, policymaking – all evaluated for their perceived relevance, accordingly, in a 6-degree Likert scale from 0 (not important at all) to 5 (very important).

· Finally, the **Organisational Practicalities** pillar included questions related to the resources (cost & human resources), as well as the time effort and overall estimation of the minimum and maximum workload for each type of activity to be organised and conducted. This pillar was assessed in a low-medium-high scale.

About the Further steps

Further validation of the proposed solution will be provided through the replication and re-assessment of the methodology in similar targeted populations and contexts. And this is fully aligned with the lab's future plans for sustainability. Specifically, Thess-AHALL aims to replicate and exploit further the 'Partners of Experience' programme, both at the local/national and the EU level (scaling up). It has already discussed opportunities for running the programme again, addressing new societal challenges in cooperation with the Municipality of Thessaloniki Day Care Centers for Older Adults, after the end of the COVID-19 pandemic. Similar to the SISCODE prototyping phase, Thess-AHALL aspires to co-organise and co-validate its proposed solution in cooperation with stakeholders (older adults and chronic patients) educational organisations inside Greece and abroad, collaborating with European Living Labs and institutions, running participatory research activities in different cultural and policy contexts (scaling out). 'Archangelos Michail' Nursing Home in Cyprus has officially expressed its interest to incorporate the 'Partners of Experience' programme in the activity calendar for its beneficiaries. Labs or entities, interested in other kinds of citizens marginalisation, target groups that are beyond Thess-AHALL's research interest, could also implement the prototype, adjusted to their stakeholders' needs, in order to monitor and evaluate its potential impact on social inclusion (scaling deep).

4.7. Caiaques as rio by CIENCIA VIVA,

written by Gonçalo Praça and João Marques

Descrição

Um projecto social do Náutico Clube Boa Esperança apoiado pelo FabLab Lisboa e que resultou na produção de 70 kaiakes.

As peças foram re-desenhadas para a fresadora do FabLab Lisboa e o desenho de corte optimizado por forma a evitar desperdícios de material. Os desenhos vectoriais foram feitos em Autocad e utilizámos o Artcam 2018 para calcular os percursos e parâmetros de corte para a máquina. No corte foi utilizada uma fresa com 6mm de diâmetro e inclinação da lâmina à esquerda, que empurra o material para baixo, permitindo um corte mais limpo. Os parâmetros usados foram calculados a partir das referências de fábrica e optimizados pela experiência de corte.

CIÊNCIA VIVA | PAVILHÃO DO CONHECIMENTO CENTRO CIÊNCIA VIVA

Context and Societal Challenge

Lisbon is a coastal city with mild weather along the year; it is an international beach tourist destination; and the sea plays a central role in its history and its national mythologies and culture. The Tejo estuary, which borders Lisbon, is the largest wetland in Portugal and one of the largest estuaries in Western Europe.

But compared to other cities with similar geographies, marine leisure activities are not so common here. This is mostly a space of contemplation, not interaction. Public access to the water surface for recreational purposes is almost non-existent; current infrastructure and equipment is paid-only and located in too few locations; it is still unusual to see people engaged in any activity in the river outside organised sports events or, more recently, organised tours.

There is some public demand for access to Tejo: proposals for open swimming pools in the river are regularly submitted to municipal participatory budgets. Researchers, companies working in tourism development and policy makers speak of 'giving back the river to the city'. Recent work in urban planning also has called for the development of recreational water-based activities as a drive for urban regeneration, in particular in the neighbourhood surrounding Pavilhão do Conhecimento, Parque das Nações.

Ciência Viva has been involved in several projects related to 'ocean literacy'. In this field, it is generally held that marine leisure activities putting people in direct contact with water – sea sports, but also other sustainable, human powered activities pursued for fun, instruction, tourism, etc. – are proven ways to increase engagement of the public with the ocean. But to have any real impact, marine leisure activities must be widely practised.

This is the challenge that Ciência Viva wanted to address in SISCODE: how to get more people into Tejo? What service, equipment or practice can help engage the public, while promoting ocean literacy and awareness, and being accessible to a wide range of users?

Blueprint: final description of the solution of Ciência Viva

Ciência Viva's solution consists of designing an engaging festival with practical year-long activities that could *show* that the river is interesting, and thus has the capacity to become more populated. Among various activities, the design and construction of life-sized and usable watercrafts was selected for its originality, its co-creative power and its direct connection with the river.

Ciência Viva's prototype is a service to support the co-design and co-development of an annual festival devoted to the DIY design, customisation and/or construction of real-size kayaks that can be used in rivers or in similar conditions (i.e. lakes, lagoons).

While designing such a service, the team has made effort to develop a narrative of the various activities necessary to prepare, run and sustain such a festival. Seeing it now, these activities should address two sets of interests: 1) show and tell, 'make happen' demos and workshops for the general public about DIY boat building and related skills happening during the festival; and 2) awareness and advocacy initiatives for better engaging with creative citizenship in the river (from new water sports to guide tours along the river to 'serious games' to citizen science projects, etc.)

The success of the festival is based on a strong engagement of schools all along the process. In Ciência Viva's case, an early-stage call for participation is planned to be addressed to the school community in Greater Lisbon, in particular those schools already involved with Ciência Viva, including through the Ciência Viva's School clubs (clubes.cienciaviva.pt/), and the Government programme of Blue Schools (escolaazul.pt/en).

The call needs to engage participants in a three-folded way: by participating to contribute to a better public engagement with the river; by working together creating or customising kayaks that should feed a public event in the river; and by documenting this work in an open knowledge repository devoted to DIY kayaks.

To synthesise, the service encompasses an online learning and engagement module focused on boat design, building and co-creation skills, and dissemination. This module should be used – and developed – along the school year, while the festival would be an annual event before the summer break.

An important value of the developed solution is embedding the ideals of co-creation deeply within the participants' experience. They will be challenged to create and develop contents for all the components of the initiative – learning processes, documenting and dissemination and engagement.

Participants will be encouraged to work in multi-stakeholders' teams, exploring diversity in gender, age, skills, among others, and recruited in their schools and their creative ecosystem (e.g. local Fablabs, makerspaces, associations, etc.). They will be invited to add as many creative 'layers' as they wish, developing the concept of their kayaks in terms of design, materials, artistic dimensions, uses (touring, games, sports, science, etc.), and activities for the festival.

This work should be fully documented and made available in the project's site – including 'making of', things that did not work, etc. Ultimately, participants will be encouraged to develop, complement or revise contents of the documentation offered in the site (e.g., manuals, tutorials), with their ideas and creative work. This will enrich the learning module itself, much in the spirit of recent open DIY innovation platforms like wikifactory.com or www.scopesdf.org.

The technical core of the service is the online peer-to-peer learning and engagement module, which for now is also the best 'material' illustration of the concept. Please see the reference below to the mock-up of this module.

The present service blueprint describes the steps of a typical creative journey using the module, including relevant touch points, backstage actions, emerging changes in the ecosystem, critical moments, and things that need to be developed by the lab.

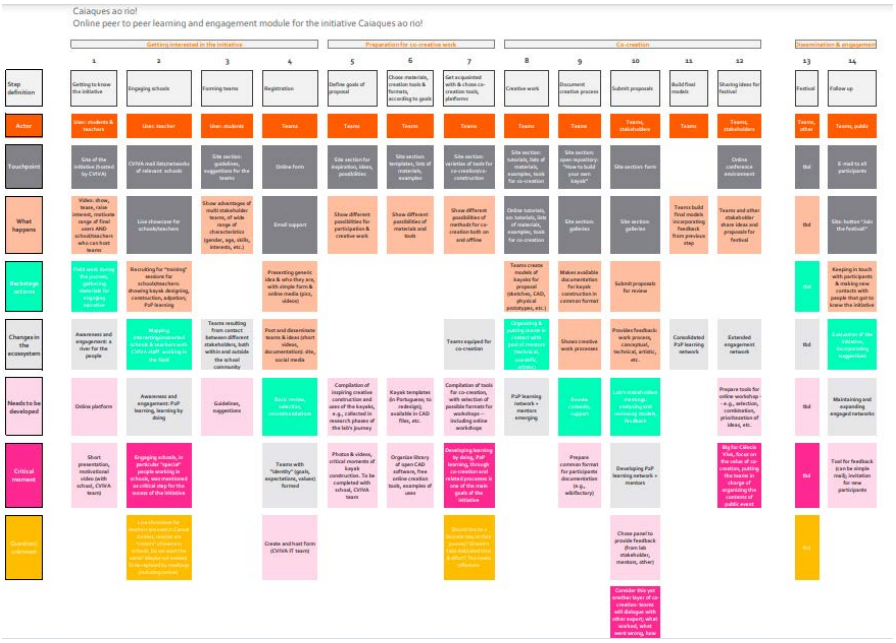


Fig 43: Overview of the 'Caiaques as rio' blueprint

Getting interested in the initiative (steps 1-4)

This section describes how participants get involved in the initiative. Two main actors have to be considered at this stage: students, the ultimate target of the initiative; and teachers (or equivalent), as many of the involved stakeholders made the point that initial enrolment of the right educators was essential to secure the participation of the students, and their work in the context of the school.

Participants will form teams and start thinking of an idea inspired by examples offered in the site, reflecting the values stated in the initiative's manifesto: not only what relates with the topic at hand (active and creative engagement with ocean literacy), but also the importance of learning by creating things together.

The relevant touchpoint here is the whole site of the initiative, including a 'motivational' video that is being planned with some of the lab's stakeholders, and developed in the context of the partner school workshop for kayak building, as well as other materials obtained in this context. Importantly, teams and their ideas should be publicised right from the beginning, also in accordance with the idea of sharing, and engaging by example.

Preparation for co-creative work (steps 5-7)

At this stage, teams are formed, and their mandate is to define the goal(s) of their project, i.e., how will they create their kayaks for what. The site should offer inspiration and suggestions for this. Teams will have to choose formats, materials and tools, from resources available in the site, or elsewhere. Initially, these resources will be based on the existing kayak workshop maintained by the lab's partner school. As the initiative unfolds, the resources will be continuously updated by the teams.

A critical decision to be made here has to do with how and to what extent should the initiative – and the module – be concerned with the tools and methods for collaborative work and creation. Should specific time and effort be dedicated training for these tools and methods?

Co-creation work (steps 8-12)

They then develop their proposals – in sketches, CAD, 3D models to scale or real-size prototypes, etc. – with resources (tools, tutorials, templates, etc.) available. In principle, teams will be in contact with 'mentors' selected from a pool of the lab's stakeholders. Participants will document the development of their proposals; this work will feed both an open repository, an ongoing 'wiki' for DIY kayak construction – in a common format prepared by the lab – and the multimedia galleries showing the creative journeys.

Proposals are then submitted and reviewed by lab's stakeholders. The initiative is not envisioned as a 'contest'; this was also recommended by participants in prototyping sessions, who believe that that the initiative should value learning with peers, learning by example, and even learning by failing'. Considering this, 'reviewing' will be not an evaluation, but another layer of collaboration, this time with other experts. All stakeholders will offer relevant feedback about the creative process, conceptual, technical, artistic, etc., with the sole purpose of helping the teams improve their projects for the public event and the open repository.

A final step of this stage – sharing and reflecting together on ideas for the festival – is particularly meaningful for Ciência Viva/Pavilion of Knowledge, as an agency dedicated to the public engagement in science. It brings to the fore the value of co-creation, putting the teams in charge of organising the contents of a possible event for active and creative public engagement with the river, ocean literacy, and related interests. This is a novelty in the Portuguese science communication field.

Dissemination and engagement (13-14)

Participants then work on their final models of the kayaks, with two, not mutually exclusive scenarios in mind: 1) the models and activities designed by the participants will be the foundation of an annual weekend event in the river, a festival that should show the creative journeys and the resulting creations, and invite the public for active participation in river-based activities; or, the worst-case, pandemic scenario 2) the models will feed an event, in which showing and interaction with the public will take place online. The lab has yet to make critical decisions about this stage.

Demonstrator's description

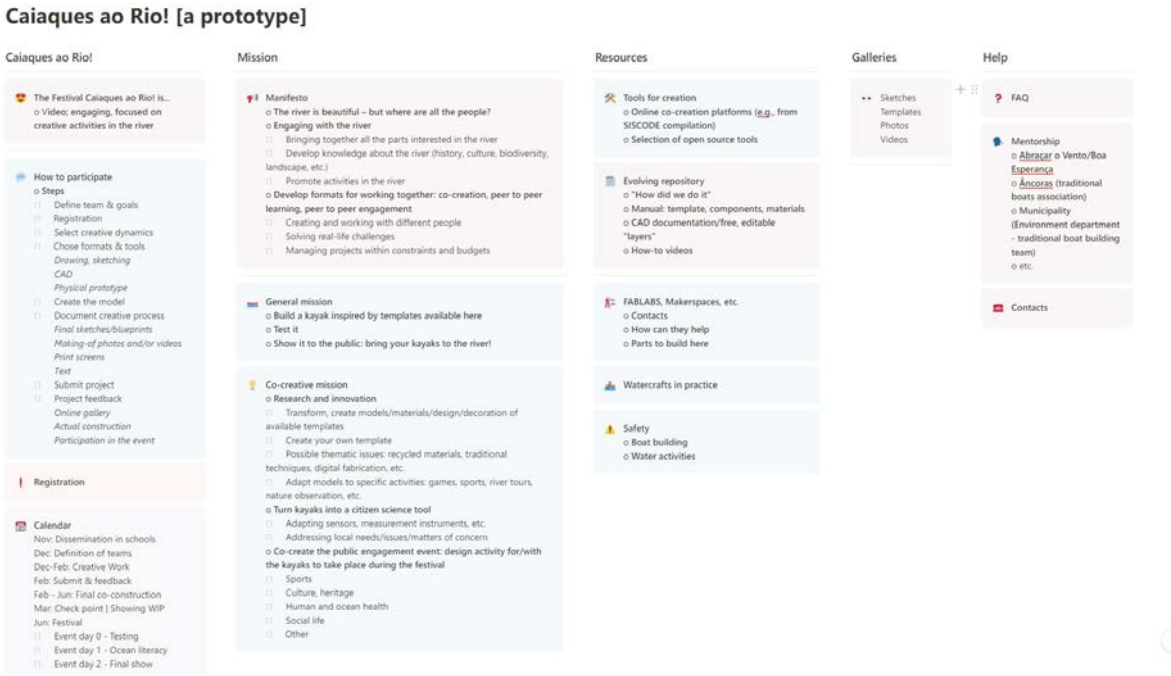
The demonstrator is a mock-up of the web platform that should be the hub of the service offered by the team. For now, due to serious technical constraints with Ciência Viva's IT team, this mock-up exists as an interactive PDF or as a web page here: https://www.notion.so/golp/Festival-Caiaques-ao-Rio-a-prototype-9802c0d1373c4f239427f4cc45847ba2

This should provide a generic idea of the contents and rationale of the entire service offering a partial view on the language, and on some of the visual contents of the final platform.

Currently, this web platform has seven main sections plus a help and FAQ page:

- **Kayaks**| Presenting and teasing the initiative.

- **Mission |** A 'manifesto' for the active and creative citizenship in the river, and how it translates into a challenge for the participants: design, transform, build your own kayak, and co-create the final event.
- **Join** | Practical information for participation.
- **Resources** | Set of resources to help designing, building and transforming kayaks, including specific tools for (remote) creative work. Continuously updated by participants, a wiki for DIY kayak construction.
- **Galleries |** Drawings, illustrations, photos and videos of/by participants, about their creative journeys.
- **Partners** | Information about Ciência Viva's partners, including history and activities (as motivational 'narrative') and contacts for 'mentors' selected from relevant stakeholders of the lab.
- **Teams** | Internal area for teams, with team's composition and contacts, section for uploading deliveries of their work.
- **Help** | Ongoing FAQ, fed by issues raised by participants.



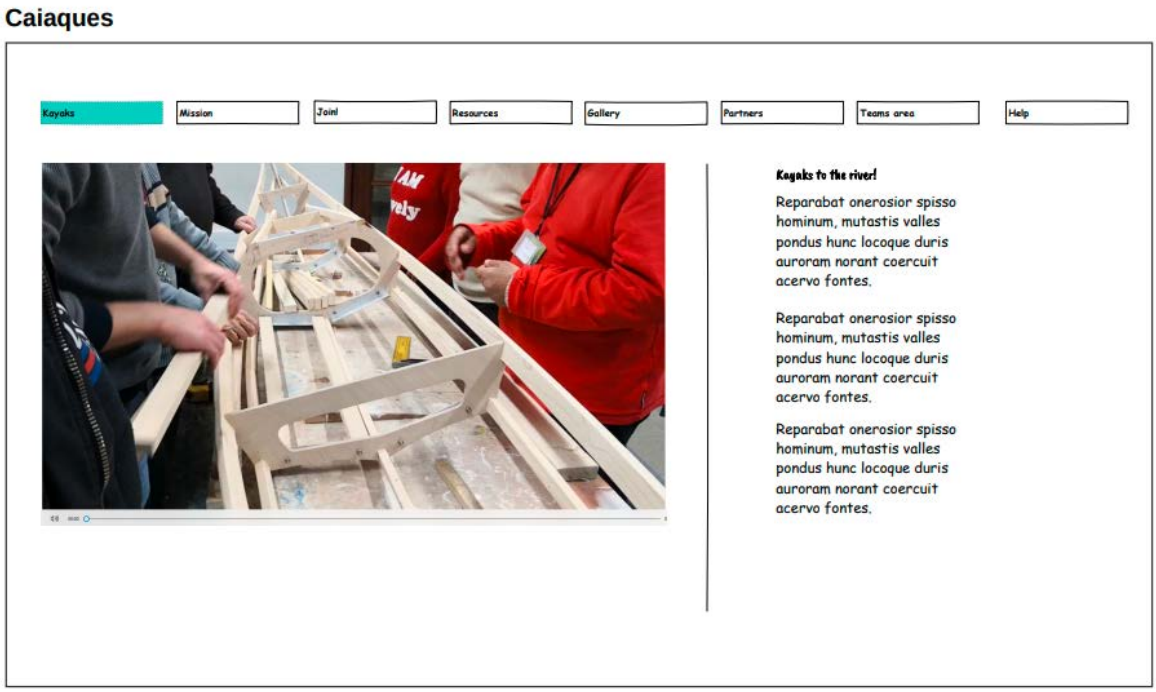


Fig 44. Caiaques ao Rio! [a mock-up prototype]

All the main information will also be updated in the SISCODE website in the blog of Ciência Viva: https://siscodeproject.eu/pavilhao_conhecimento/

Evolution and ongoing validation of your prototypes

Development and prototyping of this solution owe a lot to a project with stakeholders of the lab. The project, Abraçar o Vento ('Embracing the wind'), stems from a partnership with the school Marquesa de Alorna, the nautical club Boa-Esperança, and GIRA, a non-profit association for the rehabilitation of adult mental disease patients. It aims at fostering peer-to-peer, informal learning, to raise awareness about water sports and environmental protection, and promote social inclusion – all this around a DIY kayak workshop hosted by the school, in which students, adult patients, a carpenter and a 'mentor' build complete kayaks based on a free template obtained from a friendly project across the world. Development and prototyping phases were devoted to understanding how to generalise, expand and innovate from this learning experiment in the developed workshop-with-festival. Initially, the solution was more focused on the designing of a festival to populate the river with real size, usable kayaks, built by teams according to a well-tried template. From the contact with the school, and subsequent discussions with other partners, more specific goals emerged. The final solution should facilitate and support a peer-to-peer learning-by-doing

process. This should result in the co-design, creative transformation and construction of kayaks, which should be fully documented to feed an open knowledge repository. And these materials should be the source for the creation of contents for the festival itself, of which participants would be explicitly in charge of.

These dimensions have been addressed in prototyping sessions based on the kayak construction workshop running in Marquesa de Alorna for the (interrupted) school year of 2019-2020. In practice, developing and prototyping included partial immersion in key moments of kayak construction, with students and adult patients; it also involved stakeholders in one workshop, and during later incursions to the school.

Developing and prototyping is mostly about trying to make decisions on aspects of the learning module, especially 4 main dimensions that keep emerging in interactions with and between stakeholders*:*

- How can we motivate students, the schools, other stakeholders, to participate in the initiative?
- What needs to be in place from the lab's side (Ciência Viva, lab's stakeholders?) to facilitate a creative peer--to-peer learning and engagement environment? What do we need to create in terms of contents, support, materials, contacts and network?
- Authority and transmission of knowledge of kayak building: are open source resources (tools, templates, tutorials) enough? Will participants need live training?
- How much creative freedom should we give participants? Should we offer them a single, mandatory template for the kayaks, or different, even their own templates? How complete and 'right' should their projects be?

Involvement of end-users in shaping or validation of the solution was somewhat limited. The main prototyping and testing workshops that would have been organised with teachers, students, and the general public were cancelled due to COVID-19. The settings in which other live prototyping sessions were planned – the partner school and nautical club workshops, Pavilion of Knowledge itself –, as well as prospective participants in these sessions, also became unavailable. During the lockdown, it was attempted to organise online prototyping sessions with key stakeholders; but this was possible only with staff from Ciência Viva not previously involved in SISCODE.

In mid-October 2020, during an Open Weekend for Teachers at the Pavilion of Knowledge, a series of workshops/events were organised to validate the developed solution. These activities focused on two dimensions: assessment of the engagement potential of the

initiative; and scoping its weak points, 'what could go wrong'. The process was developed in collaboration with colleagues from Ciência Viva not exposed to SISCODE but experienced in comparable activities involving the school community; with key stakeholders of the co-lab; with teachers; and with the public. Participants were invited to discuss the model of the 'service', in 2 workshops, and/or to interact with a partial rendition of a kayak DIY workshop and showcase.

The workshops introduced a new view on the expectations of specific end-users – teachers – regarding the solution: importantly, it was clear that they would be interested in participation in a festival like the one planned, and involving their schools, but not necessarily by working in design and construction of kayaks. Instead, they want to bring their ideas to such an event. This could include kayaks, e.g., as an 'anchor' for other activities; but would include other creative work.

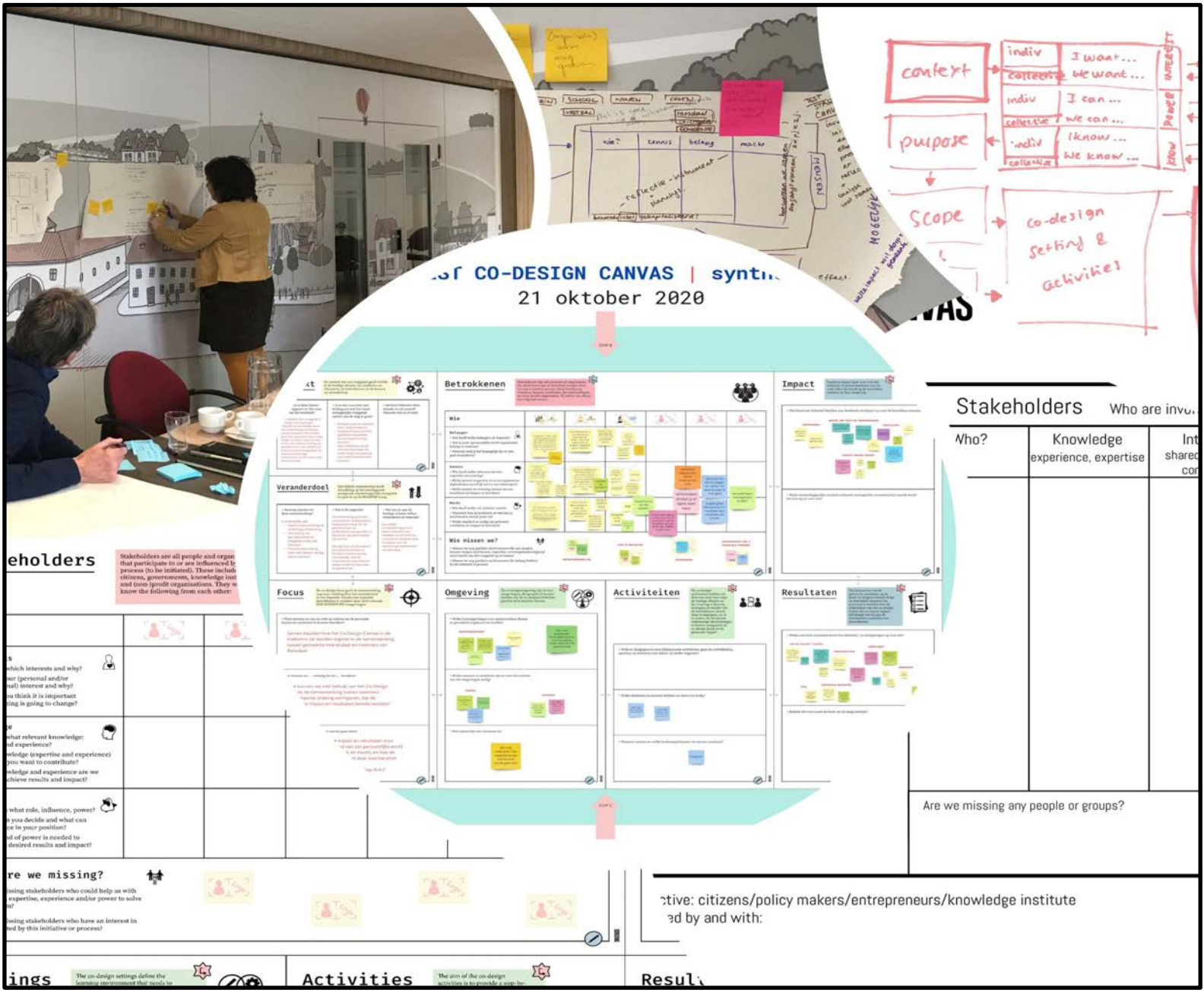
Views on 'what could go wrong' focused on dangers and limitations of the solution, some of them not clearly anticipated in the plan: safety of a water event with kids; need for funding and of partnerships; bureaucracy and regulations specific to each school; lack of time and staff, especially considering the pandemic. A crucial challenge was mentioned in the workshops and during the live demo, which has also been hovering around the solution from its first versions: how to ensure the transfer of technical skills to students? It seems consensual that the online learning module should be just an 'anchor' for other real-life learning environments, based on trial and error and exchange between people with different skills.

Despite the small scale of the event (due to COVID-19 constraints), it also provided a good grasp on how the public may interact with this kind of activity. Contrary to the previous expectations, people seemed to be more interested in the narrative side of the show – e.g., live and video presentations about the motivations behind the kayak project at the partner school: social inclusion, integration of migrant communities, attending special education needs, etc. The public, as well as staff from Ciência Viva, also enjoyed the display of 'artistic' kayaks. The kayak building in action, however, attracted less attention than we were expecting.

This was also a small test of requirements and potentials in terms of space, equipment, human resources, etc. of a 'real' event that may be developed from here. In this regard, there were no problems of note, and the event was very well- regarded by the Pavilion of Knowledge staff that helped with the organisation.

4.8. The Co-Design Canvas by CUBE DESIGN MUSEUM

written by Anja Köppchen



cube design labs

CUBE DESIGN MUSEUM

Context and Societal Challenge

The municipality of Voerendaal and the citizens of Ransdaal have committed themselves to improve the quality of life of all citizens and to achieve long-term liveability in Ransdaal. The shared ambition is a liveable and future-proof village. Ransdaal is a village where many bottom-up initiatives arise; inhabitants enjoy a high life quality, and they want to keep it that way in the future. The municipality wants to give citizens more space to take matters into their own hands. The question is how to strengthen and support both stakeholders in their endeavours. Both municipality and citizens (initiatives) feel the need to improve their collaboration and coordination of initiatives. Furthermore, they are looking for ways to increase engagement of all inhabitants aiming for a larger support base for community initiatives. There are many ideas on the one hand, but not enough time and resources and not enough active people involved on the other. There is thus also the need for more focus and to prioritise among citizen initiatives and ideas for the community. The aim of this pilot is therefore to design a tool that helps citizens (initiatives) and policy makers to better collaborate, plan, evaluate and coordinate co-creation and co-design processes.

Blueprint: final description of your solution

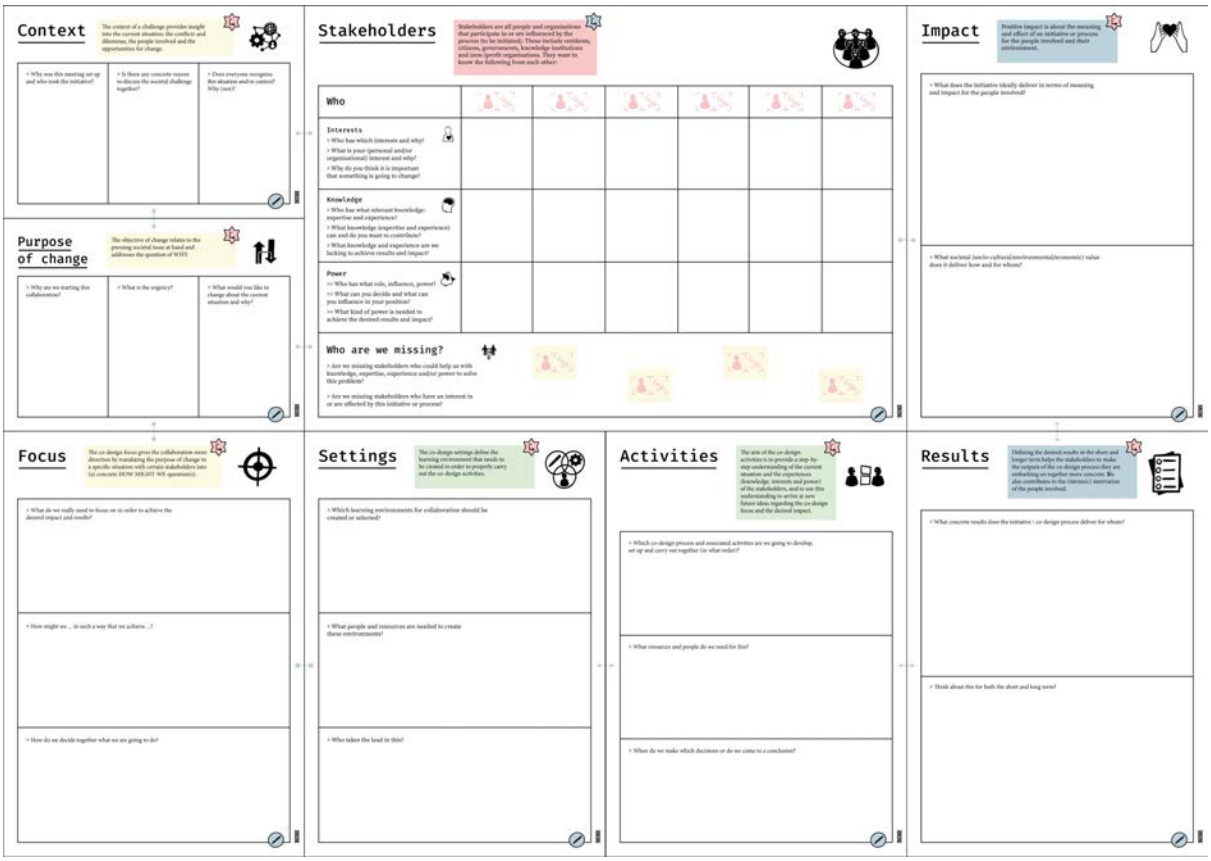


Fig 45: Co-Design Canvas - overview

The Co-Design Canvas aims to connect people on the same level by utilising their collective wisdom to act together. It is first and foremost a conversation tool that can help by facilitating an open and transparent dialogue about each other's experiences and interests, managing expectations, being empathic, and talking about knowledge, power and shared responsibilities in both planning, conducting and assessing a co-design process. The canvas does so by making the process and the different elements that affect the process more explicit for all stakeholders involved. It can thus be a tool for policy makers who want to engage citizens and other stakeholders, as well as the other way round, by providing a shared language and clear starting point.

The Co-Design Canvas is initially designed as a physical conversation tool, consisting of 8 cards that represent eight variables that influence a co-design process: the context, the (initial) purpose of change, the stakeholders, the results, the impact, the co-design focus, and the co-design settings and activities. These variables do not only affect the process as such, but also each other. The stakeholders for instance decide on the co-design focus and the focus

in return determines which stakeholders need to be involved. Furthermore, the people involved affect which results and impact are desired and viable, etc.

The design of the canvas aims to provide a flexible and accessible tool, that can be used in different ways depending on the context and the needs within different stages of the process. The cards can be discussed separately, in different orders, to not overwhelm the stakeholders with the complexity of the entire process. The cards can then be put together into one canvas, to understand the bigger picture and address the relations between the different variables. On the front side of each card, guiding questions help to stimulate the discussion. There is room to write, draw or put sticky notes on the cards. The back sides of the cards explain the variables, provide tips and tricks, and suggest additional tools from the SISCODE toolbox, and other design thinking and social innovation methods.

In short, the Co-Design Canvas aims to connect all the variables that define and affect a co-design process and it can guide and facilitate an open conversation between multiple stakeholders. This requires shaping the conditions of having a conversation in the first place. Once different stakeholders are willing to start a conversation, the canvas can help them by providing a shared language to better understand each other, and to align expectations and thus to literally get everyone on the same page.

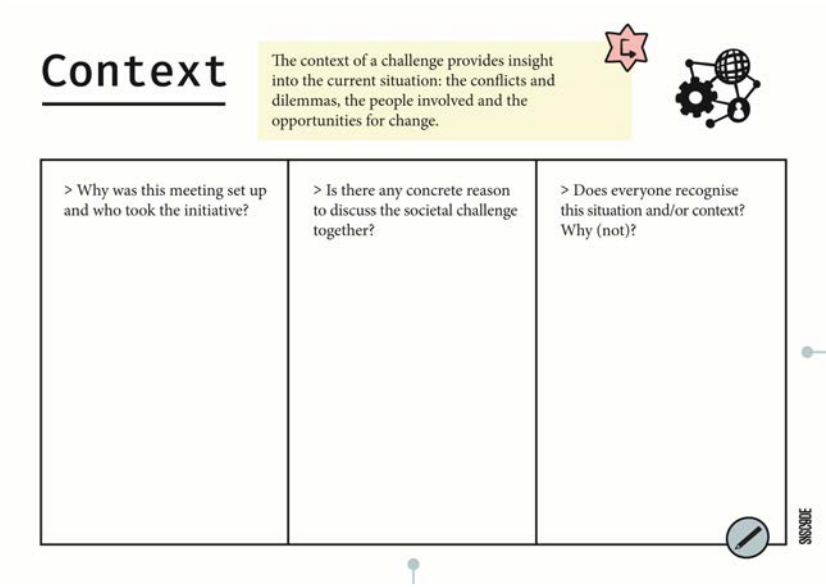


Fig 46: Co-Design Canvas - context card FRONT

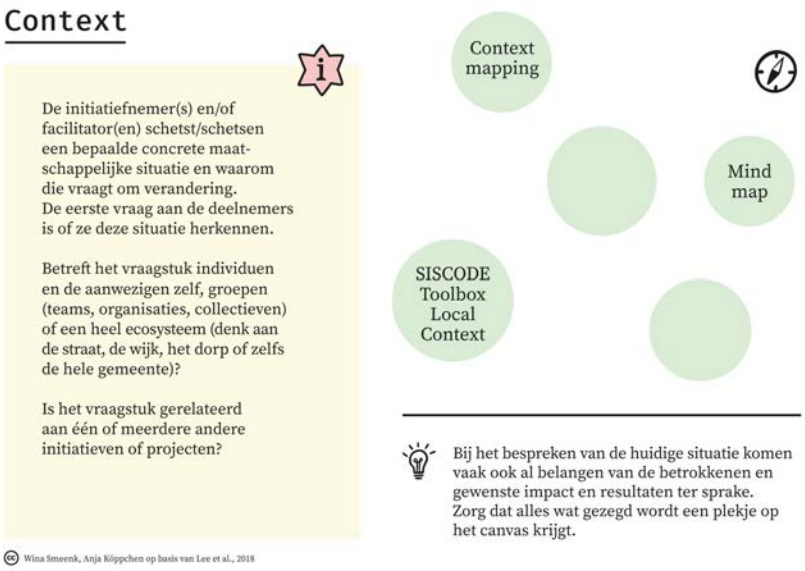


Fig 47: Co-Design Canvas - context card BACK (NL)

Demonstrator's description

The demonstrator of Cube is an accessible and ready-to-use kit including the Co-design Canvas. While the kit is still work in progress during the moment of writing, the canvas itself is ready to be used (see Fig 45).

It is important to make the Co-Design Canvas (freely) accessible and easy to use. The cards are designed in such a way that they can be printed on any standard A4-printer. It will be provided as a downloadable pdf-file via the SISCODE project website under a Creative Commons licence. It will be possible to access it here: https://siscodeproject.eu/cube/.

The participants of the co-design process during the experimentation phase will receive a high-quality printed version of the canvas.

Furthermore, new tools need practice or instructions on how to use them. During the development and experimentation phase of Cube's co-creation journey, policy makers and citizens suggested that the successful use of the canvas requires a skilled facilitator or otherwise at least instructions or training on how and when to actually use and apply the canvas in practice. Cube is therefore working on a guideline that helps people to prepare for such facilitation and to make the use of the canvas as intuitive as possible by design. The

guidelines will be accompanied by a couple of storyboards to visualise the tool's use in different contexts.

The guidelines and the storyboards are work in progress. There is a draft version of the guidelines/instructions (in Dutch), but especially the visualisations and illustrations for the storyboards need more time. One of Cube's design students in-residence, Ambre Reijntjens, has made the icon illustrations on the canvas and will also help in illustrating the storyboards. Below is an example storyboard from Ambre, to demonstrate the style that the final product will have:

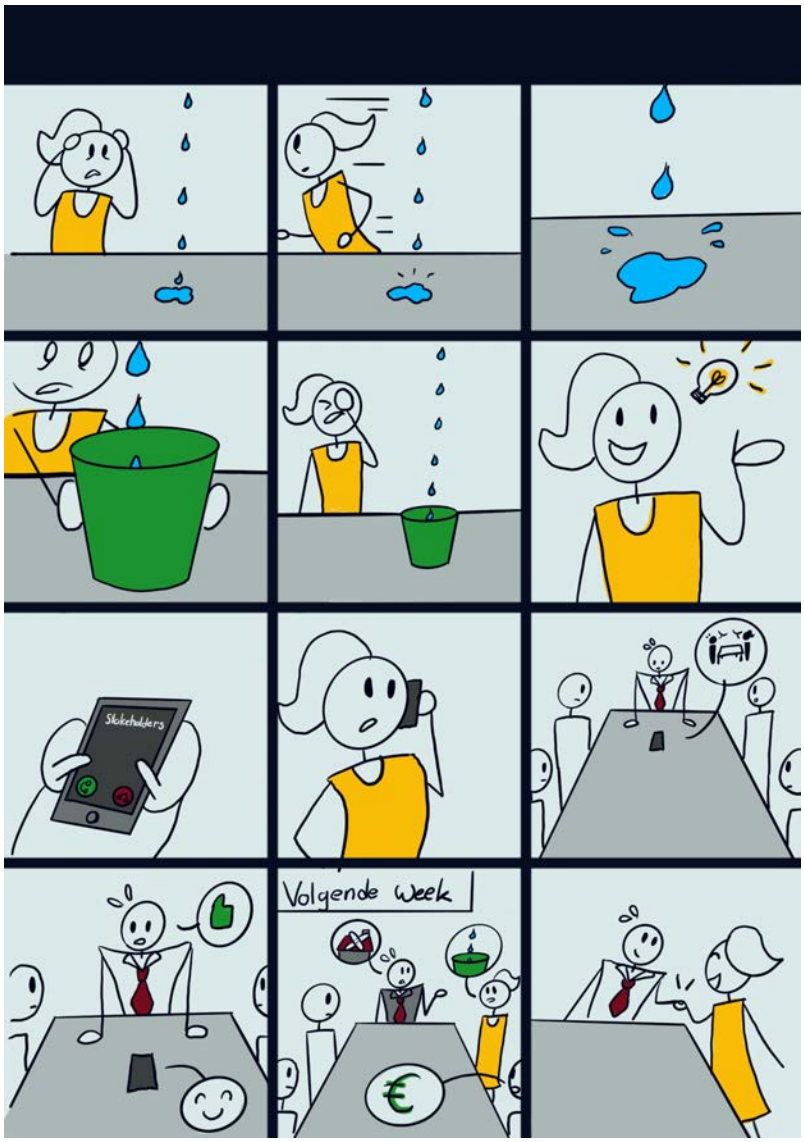
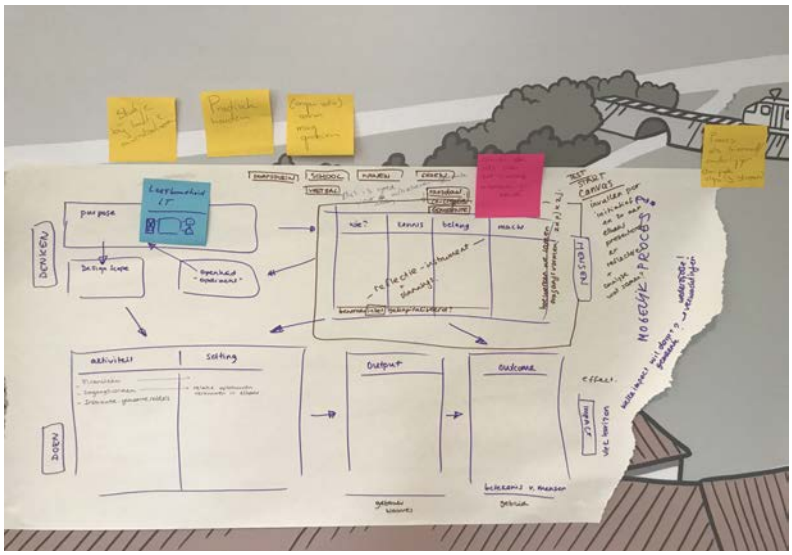


Fig 48: example sketch storyboard (by Ambre Reijntjens)

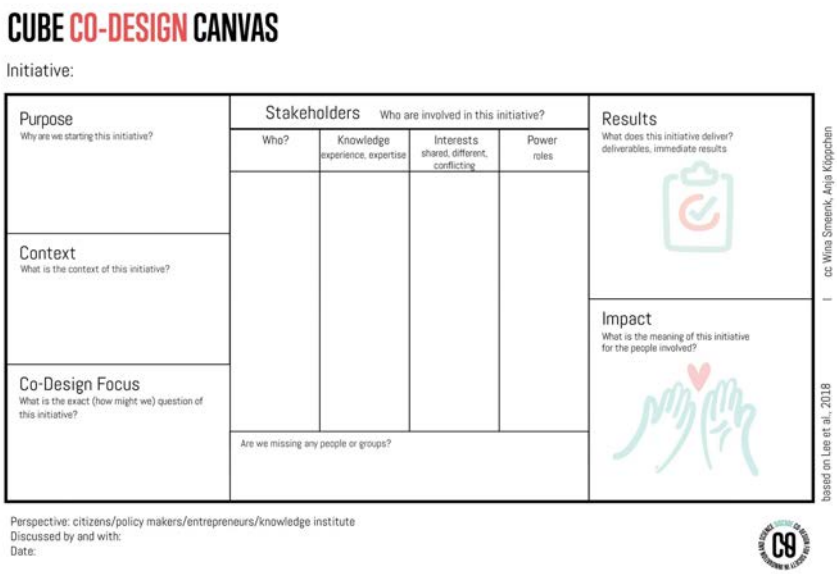
Evolution and ongoing validation of your prototypes

Initiated by empathic co-design expert Wina Smeenk, inspired by and based on the Design Choices Framework for Co-creation Projects by Lee et al. (2018), and co-designed and tested in two rounds of iterations, Cube developed the Co-Design Canvas - a one page tool for social interaction to trigger change.

First designs



a)



b)

Fig 49: a) First sketch of co-design process on 1 page (workshop March 13, 2020)
b) First prototype of Co-Design Canvas (May/June 2020)

ITERATION 1.0.

Initially, Cube planned to organise physical workshops for both Citizens and Municipality to test the prototype of the Co-Design Canvas. Due to the COVID-19 measures, it was no longer possible to meet physically in groups and therefore it was decided to test separately with a group of citizens and the municipality, because of their slightly different aims and interests and it allowed a real focus on the online tests regarding the different stakeholders' needs.
The first round of testing consisted of the following 4 steps:

- CITIZENS RANSDAAL: online (Microsoft Teams) introduction and first reflection on purpose and use of prototype; this was also a first check if the purpose and the tools are clear and what the participants think of it.
- CITIZENS RANSDAAL: two groups of citizen initiatives were sent to work 'in the field'. With the prototype and a draft manual, they started the conversation offline with the stakeholders of two initiatives (nature conservation/development and conservation of toddlers' playroom); of course, according to safety regulations such as keeping distance of 1.5 meter.
- MUNICIPALITY VOERENDAAL: Parallel to the online and offline tests with the citizens, an online reflection session with the municipality according to a semi-structured interview approach, using Microsoft Teams.
- CITIZENS RANSDAAL: Co-reflection with residents online (Microsoft Teams) according to a semi-structured interview approach.

Based on the results of the tests, the canvas has been adjusted and extended into a more playful and more flexible tool, that consists of separate cards, instead of one big canvas.

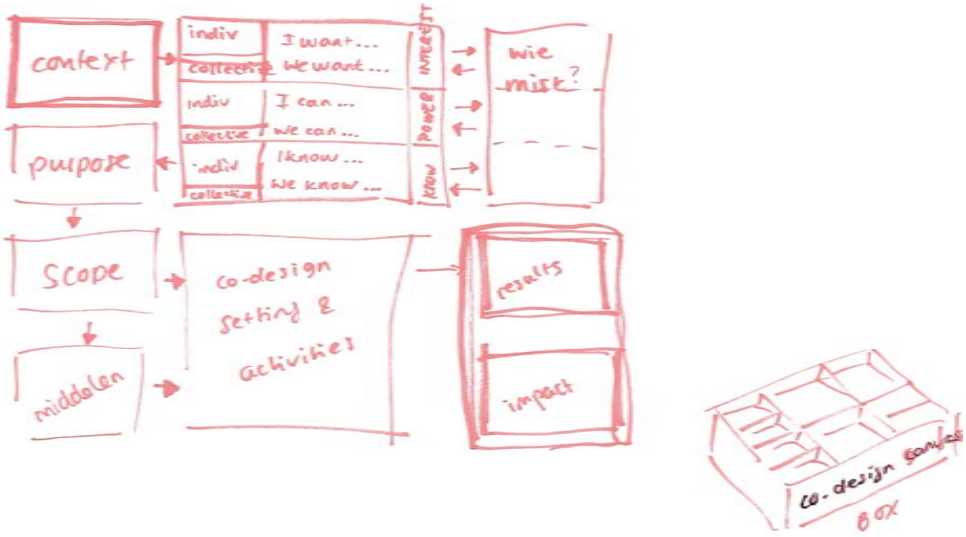


Fig 50: Sketch to illustrate the second iteration of the prototype (July 2020)

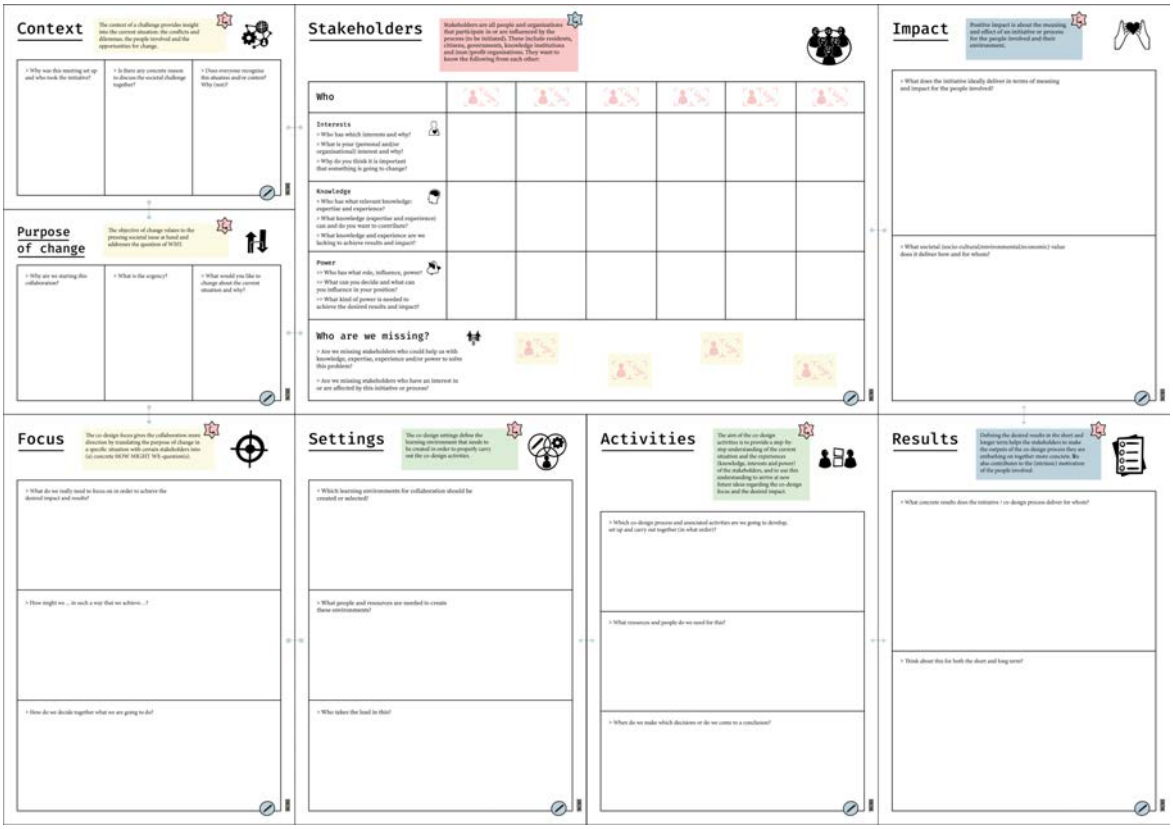


Fig 51: Overview of the Co-Design Canvas cards (September/October 2020)

ITERATION 2.0

- Modification of prototype based on research with citizens and municipality
- CITIZENS + MUNICIPALITY: Joint reflection in a physical meeting. The aim was to organise a kind of focus group on a few themes, addressing the so-far experience with the prototype and perspectives on its future use.

Unfortunately, as a result of intensified measures to contain the COVID-19 pandemic, the municipality's alderman cancelled all physical meetings and asked the development team to do the same just a few days before the planned meeting. The meeting was scheduled for 21 October and took place online in an adapted form, using Microsoft Teams, Miro, and Padlet.

In Padlet three conclusive/reflective questions were asked:

- I think the Co-Design Canvas is valuable because…
- I think the Co-Design Canvas can be improved by…
- In the future I would like to use the Co-Design Canvas in/at/for…

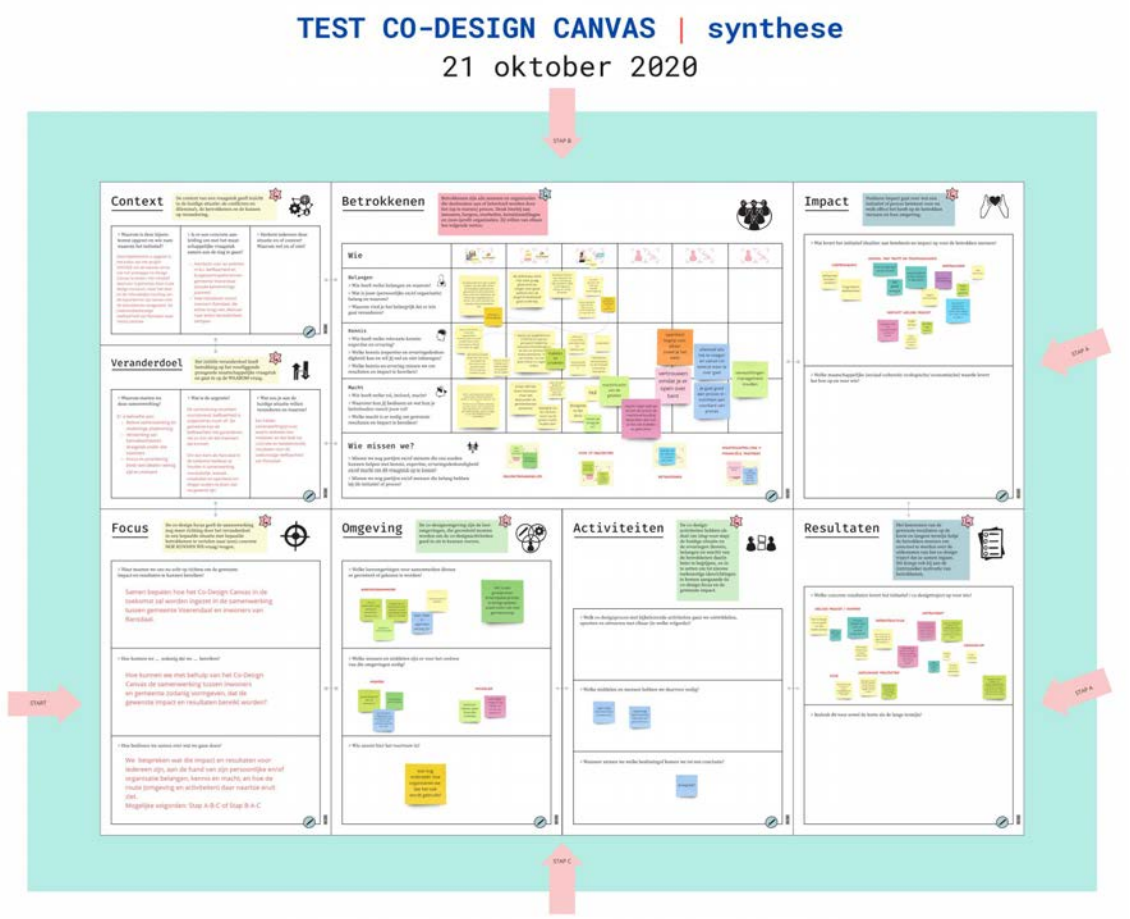


Fig 52: Synthesis of results online co-reflection Co-Design Canvas in Miro

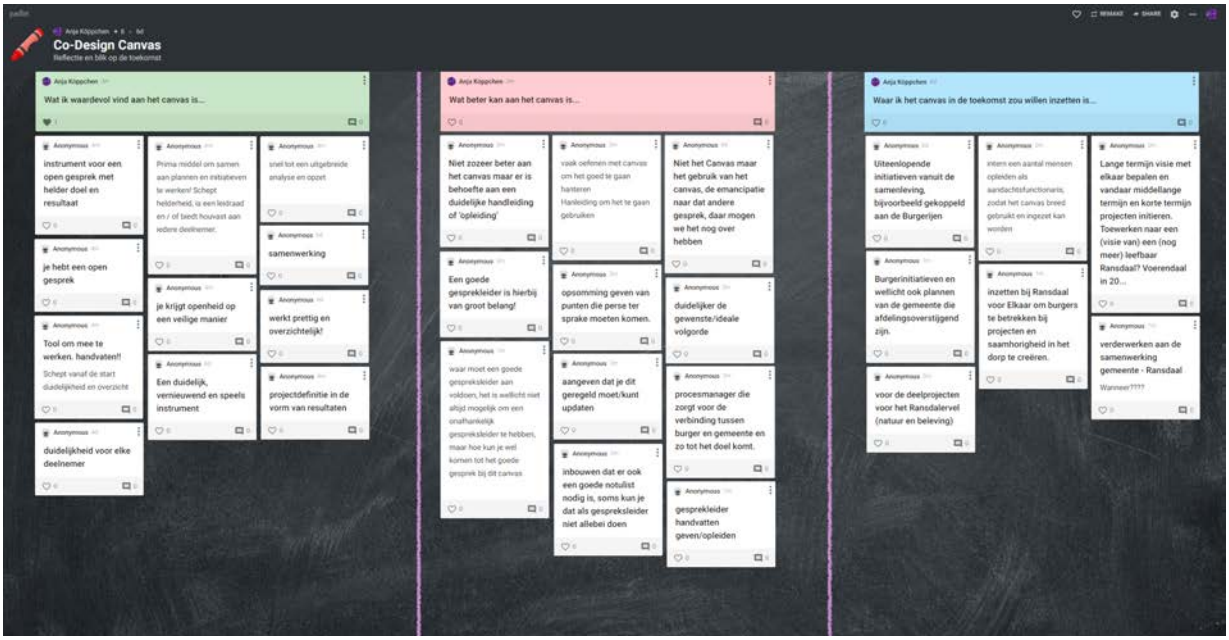


Fig 53: Synthesis of results online co-reflection Co-Design Canvas in Padlet

Research questions and assessment criteria

For the evaluation and assessment of the prototype, the following main research question was defined:

To what extent does the Co-Design Canvas prototype contribute to a clear co-design process?

Two types of criteria were identified; one related to how the prototype practically works and one related to whether the prototype serves its purpose:

Usability criteria

This is about the extent to which people can practically work with the prototype; think about usability, ease of use, clarity, attractiveness, etc.

- How do people interpret the different terms; are the terms and concepts clear?
- How does the design work; how do people use the canvas?
- What else is needed to make the canvas work in practice (think of guidance)? (implementation; sustainability)
-

Effectiveness criteria

This is about the impact, i.e. the extent to which the prototype contributes to the set objectives.

- Stimulating/facilitating discussion
- Project evaluation/ reflection on project
- To what extent does the prototype offer a common language? (also, inclusivity)
- To what extent does the prototype help to involve more people, both in numbers and in diversity? (reach/support and inclusivity)
- To what extent does the prototype help with collaboration and coordination between initiatives? (collaboration and coordination)
- To what extent does the use of the prototype lead to concrete results for the community? (concrete results = difficult to measure due to longer term goal - based on personal evaluations of participants)
- To what extent does the use of the prototype provide the municipality with insights into the needs of the community? (future-proof liveability)
- To what extent does the prototype help both the municipality and the community to arrive at a joint prioritisation of goals and initiatives? In addition to this prototype, what else, if any, is needed? (focus and priority setting)

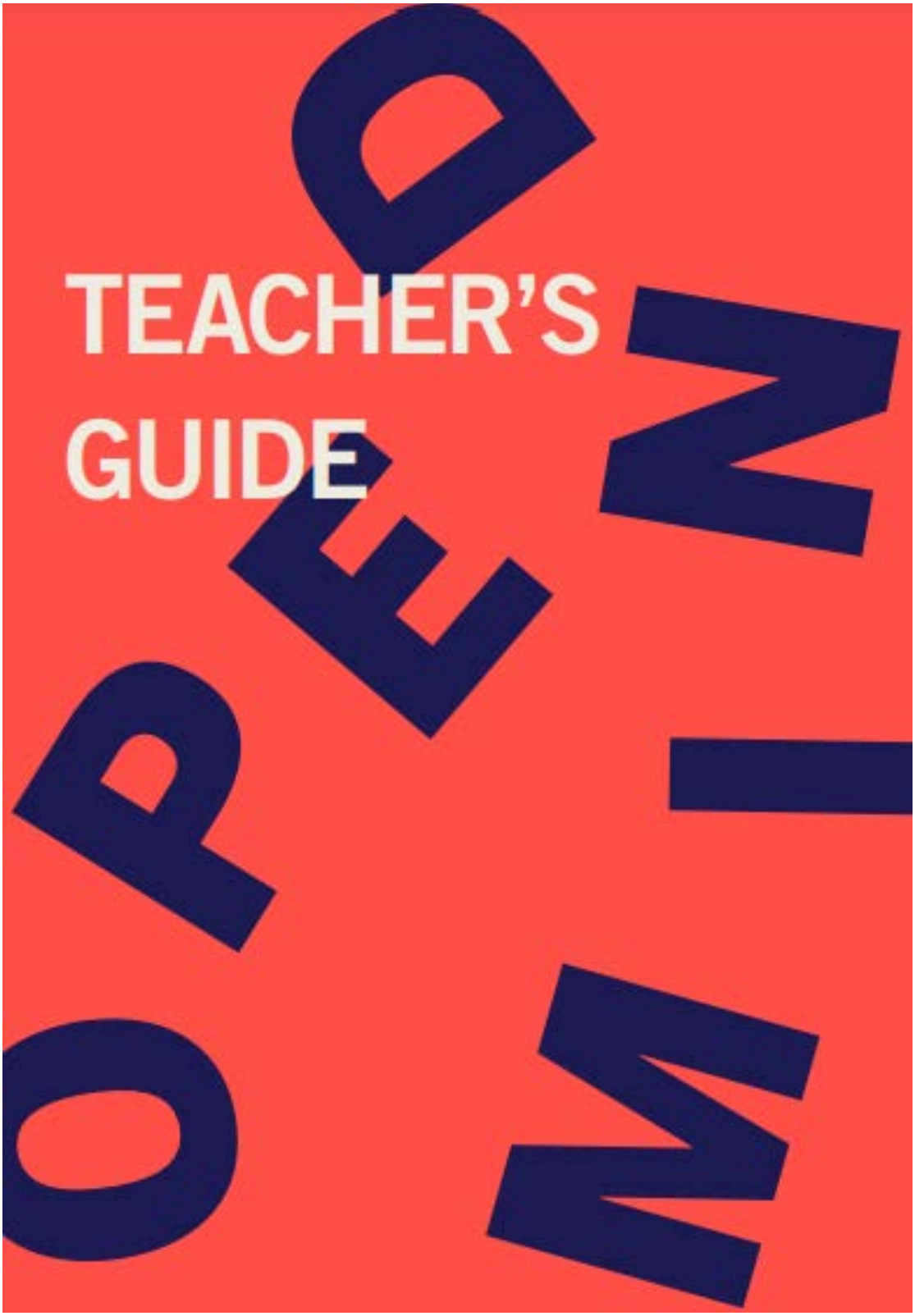
Those criteria have been used to frame and reframe the various iterations and will guide the future activities to sustain the use of the Co-Design Canvas.

References

Lee, J. J., Jaatinen, M., Salmi, A., Mattelmäki, T., Smeds, R., & Holopainen, M. (2018). Design choices framework for co-creation projects. International Journal of Design, 12(2).

4.9. OPEN MIND by SCIENCE GALLERY DUBLIN

written by Grace D'Arcy



Context and Societal Challenge

The broad challenge Science Gallery Dublin chose to tackle was 'mental health and well-being management in young people' believing that this is one of the biggest problems facing Ireland's youth today.

Ireland has one of the highest rates of mental health illness in Europe, ranking joint third out of 36 countries surveyed. Science Gallery decided to focus on young people as they have been shown to be the most vulnerable group in Irish society in relation to mental health. Within young people (aged 15-19) Ireland had the 7th highest rate of suicide across the 33 countries investigated. A national study profiling mental health in nearly 15,000 young people across the country found that mental health difficulties emerge in early adolescence and peak in the late teens and early 20s. This peak in mental health difficulties, in general, was coupled with a decrease in protective factors such as self-esteem, optimism and positive coping strategies.

This broad challenge became more defined through a series of desk research and within the stakeholder sessions carried out through the process. The stakeholder group was made up of young people, mental health professionals, teachers, parents, mental health charities and researchers. These stakeholders had diverse interests and backgrounds, but all exchanged similar experiences of struggling with mental health in a school setting. Gaps were identified in the Irish education experience of well-being management. The challenge became around 'Co-creating mental health resources with young people to use in a school setting'. The stakeholder group wanted to cultivate a resource that would develop students' understanding of mental health and to equip young people with tools to manage their well-being, with a focus on the importance of personal hobbies and interests.

The stakeholder group focused on schools as a natural and accessible way to teach adolescents how to look after their mental health as they spend a substantial amount of time there. The social context also provides an environment where a range of life skills can be learned (Goldberg et al., 2018)

To contextualise the policy background of this defined challenge, from 2016 the National Council Curriculum and Assessment undertook an ongoing review of education in Ireland and identified well-being as a key theme to be improved and supported.

Blueprint: final description of the Open Mind Program

OPEN MIND programme is a co-created educational module for teachers to implement in school. The programme aims to develop students' understanding of mental health and to equip young people with tools to manage their well-being, with a focus on the importance of personal hobbies and interests. 3 designs of the blueprint have been developed all along the process of prototyping.

The first pilot phase of prototyping the OPEN MIND module involved close oversight, Science Gallery Dublin facilitating the sessions in two of the four schools. This allowed the team to capture rich insights and feedback on the activity design from students as the module was rolled out and small tweaks were made to delivery and approach. Science Gallery Dublin provided pilot schools with all workshop materials needed for the activities. The first phase also involved working with the School of Psychology in Trinity College Dublin to stringently evaluate the impact of the programme on participants. This close oversight and facilitation of the module was not sustainable, so the feedback session focused on mechanisms for independent uptake and use of the module and delivering it in the classroom. Several iterations of the programme were run, to refine the content for optimal independent use of the resource outside the lifetime of the SISCODE project.

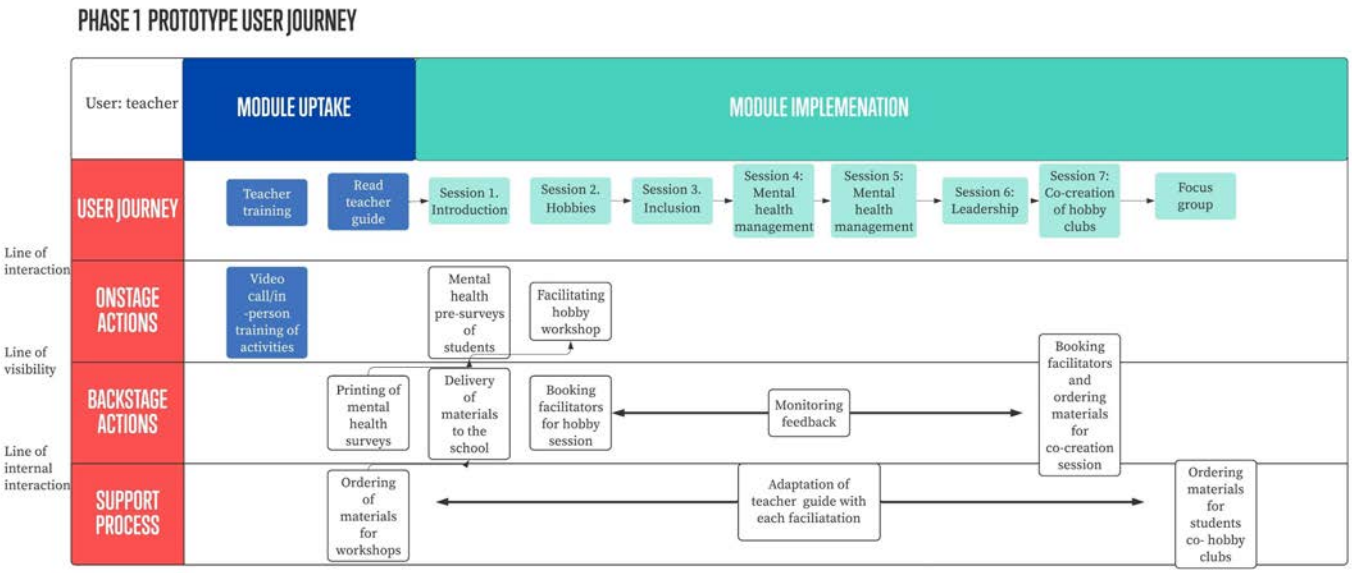


Fig 54: First version of the Open Minded Blueprint

The second phase placed emphasis on the teachers' guide as a tool to support teachers delivering the module in the classroom independently. The module activities were redeveloped to provide an engaging learner experience with reduced reliance on workshop materials that teachers would need to source, and focused on case studies, worksheets, student videos. With the activities and content refined, in October 2020 Science Gallery Dublin onboarded three teachers to uptake the module. These teachers were trained in the module with video calls and email support. The teachers ran the eight sessions to report back on their experience in the classroom.

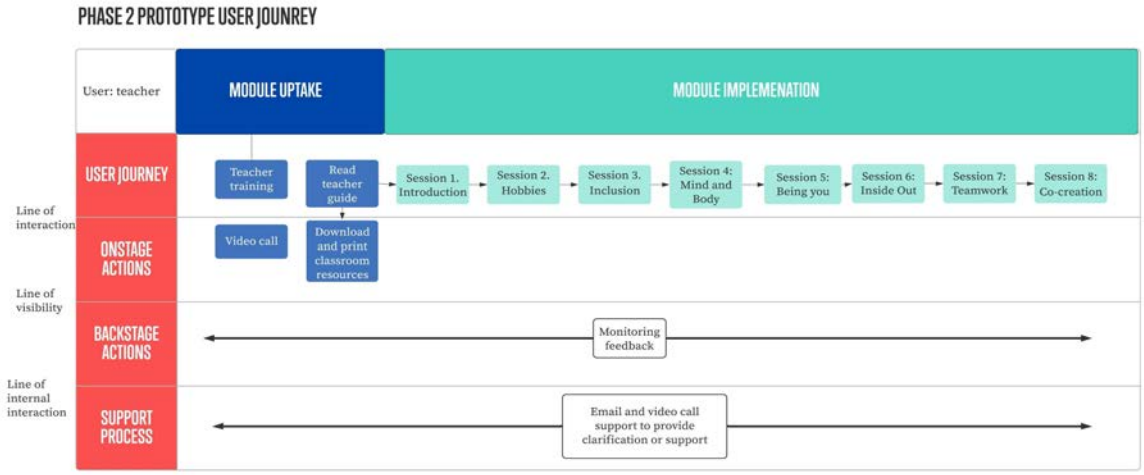


Fig 55: Second version of the Open Minded Blueprint

The final solution, compromising of slides, posters, worksheets, and video content will be made available on Scoilnet, the official education portal of the Department of Education in Ireland, for teachers use. A video resource by Science Gallery Dublin will provide initial teacher training, and the platform facilitates sharing of insights on best application of the resources between teachers.

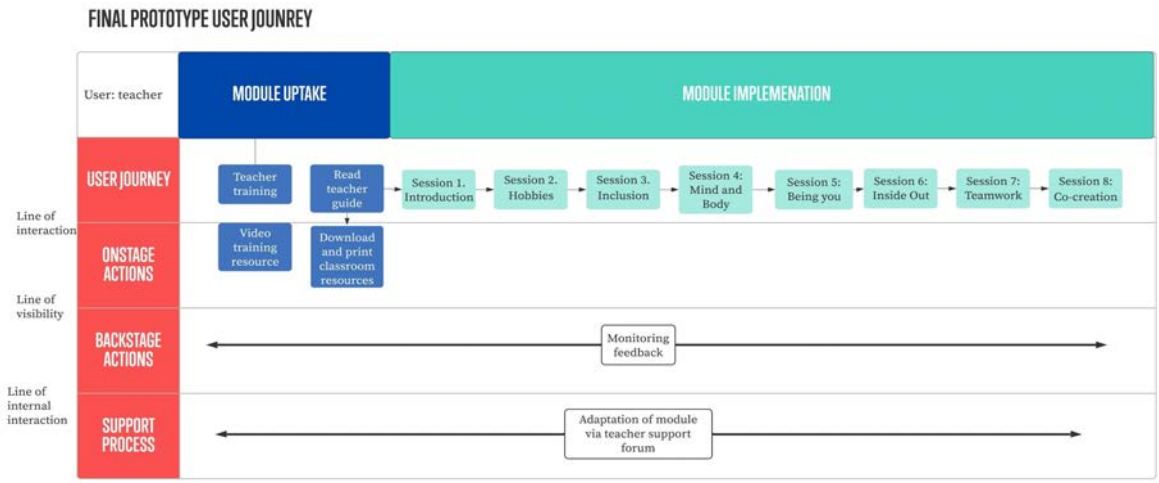


Fig 56: Final version of the Open Minded Blueprint

Demonstrator's description

As a demonstrator, Science Gallery Dublin created a teacher guide for the OPEN MIND programme. This document supports the teacher to deliver the well-being programme in the classroom. It contains an in-depth overview of each session plan, description of learning objectives and hyperlinks to all resources developed and needed for the programme. Each session involves hands-on learning activities, class and group discussion and reflection.

How to access it?

https://drive.google.com/file/d/101s2r9JmJHugEsFJP64R-DtieGCqgGXW/view?usp=sharing

What is the content and how to use it?

The programme is split over 8 sessions, with the broad aim of promoting

- empathy and inclusion skills
- mental health literacy
- well-being management tools
- teamwork and co-creation skills

The 8 sessions are structured as follows:

Part 1
1. Introduction to OPEN MIND
2. Hobbies as a way to promote well-being
3. Inclusion

Part 2
4. Mind & body
5. Being you
6. Inside/out

Part 3
7. Teamwork
8. Conclusion

Slide decks are provided to teachers to prompt through each session. All additional resources are hyperlinked in the teacher guide pdf for teachers' convenience. Student worksheets are used in several sessions to structure student activities.

Fig 57: Overview of the teacher's guide

Evolution and ongoing validation of your prototypes

The school programme was tested over several phases of piloting. From September 2019 it was piloted in four schools nationally. The Science Gallery Dublin team facilitated the sessions in two of the four schools to capture insights on the activities developed and for rich student and teacher feedback. The other two schools ran the content independently. This close oversight allowed tweaking of content during the pilot. Focus group feedback sessions were organised with students in each participating school group and with teachers to reflect on the programme and to capture insights. These insights were analysed and visualised and used to inform the next steps.

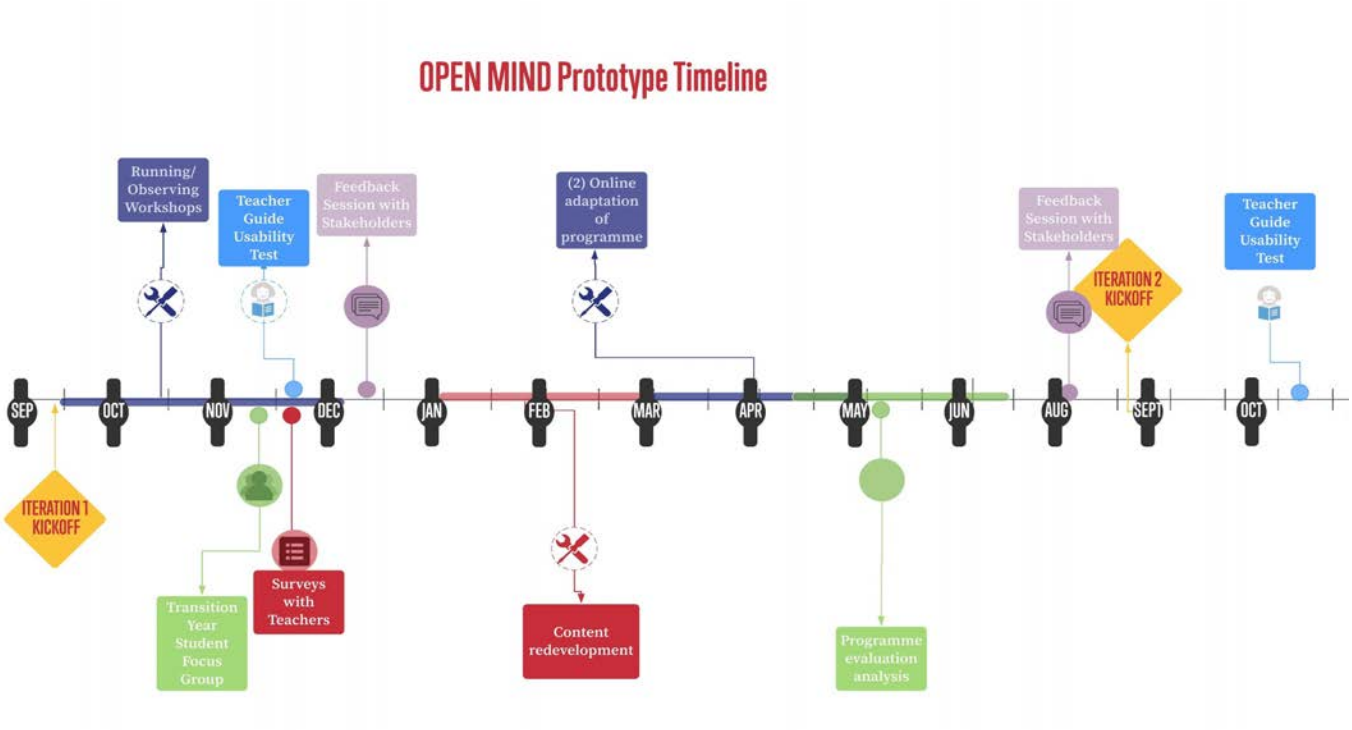


Fig 58: Timelines of the prototyping phase

After this first iteration, in December 2019, the SISCODE team gathered the stakeholders, participating schools and several relevant policy makers to evaluate the programmes delivery and goals, and plan the adjustments needed. The visualisations of student and teacher feedback focused the agenda, and during a 2- hour session, this extended group dived back into the content and worked together to refine the activities and content that young people wanted to see emphasised.

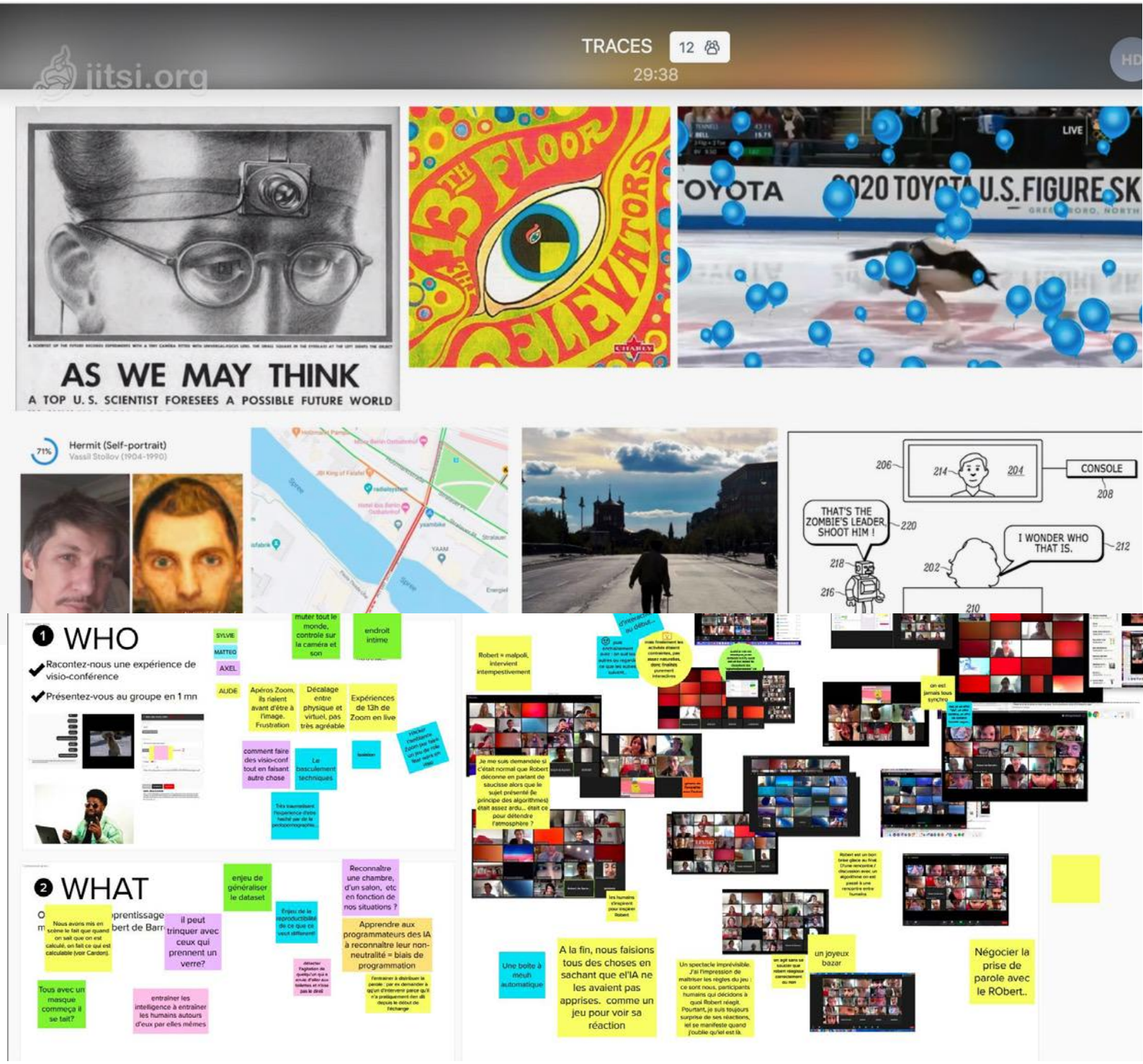
The COVID-19 pandemic interrupted the planned second iteration of the programme in additional schools in Spring 2020. During this time, the OPEN MIND programme content was adapted to create an online mental health resource.

Phase 2 iteration was rescheduled to when schools returned in September 2020. The second phase placed emphasis on the teacher guide as a tool to support teachers delivering the module in the classroom independently. During Phase 2 iteration Science Gallery Dublin held calls with teachers to train them briefly in the materials and programme goals and handed over the resources to deliver themselves. Feedback on its use in the classroom was collected for final revision of the resources.

Each phase helped to support the programme to become more conducive to independent use, which allows its uptake beyond the lifetime of the SISCODE project. The Science Gallery Dublin team is now working to have the OPEN MIND programme validated by the National Council Curriculum and Assessment, within the Department of Education and Skills. The Science Gallery Dublin team is also working with a youth stakeholder from the SISCODE journey, who has taken up a role in the Irish Second-Level Students' Union with a specific focus on youth mental health. This exploitation strategy would further ensure for the programme to carry on the initiative beyond the lifetime of the project.

4.10. AI as co-spectators by TRACES

written by Aude Ghilbert and Matteo Merzagora



Context and Societal Challenge

TRACES's challenge aims at raising the issue of intelligibility of AI, at a time where it has become pervasive of all human activities.

How can we enforce our "right to be informed" in automated decision processes using algorithms?
How can the presence of AI support to professional or everyday life decisions become noticeable and readable for citizens so they can make informed choices in crucial aspects of their lives?
How can we make people more conscious of automated decision processes / services / applications and of criteria used by algorithms?
How can we make ethical issues explicit and understandable for the generic users?

The team has identified a real need of including discussions on the topic in contexts and situations easily accessible by general audiences, such as in educational or cultural activities.

TRACES' challenge aims at addressing the issue of the intelligibility of algorithms in a new way by looking at algorithms as a target for educational or cultural products or services. The objective is to shift the usual way of addressing the issue of technological challenges for society in a thought-provoking way. This is setting AI apps in a position of co-spectatorship alongside human perception, thus envisioning AI as a non-fully autonomous agent and seeking to observe how it interacts in social contexts beyond its foreseen functionality.

In his book the science of the artificial, Herbert Simon proposes a definition of design, which is that 'Everyone designs who devises courses of action aimed at changing existing situations into preferred ones' Herbert Simon (1969). The objective of TRACE's process is to shift from a deterministic aspect of envisioning AI (AI as functional agents and innovation as a response to specific need) to forging tools enabling human users not to clarify or render these technologies more transparent, but rather equip people with tools and a shift in paradigm in a provocative way to deal with a non-transparent world.

The examination started from an explorative exhibition, along with live participatory events followed by a journey as part of the SISCODE experimentation of action-research, that led the team to rethink the original paradigm and refine the analysis of the issue. It was with the help of Axel Meunier, design researcher and part of the MediaLab, that it was possible to exploit this notion of co-spectatorship of humans and artificial agents, as Jacques Rancière a French philosopher developed in his book Le spectateur émancipé.

Blueprint: final description of your solution

The outcome of this explorative process, the solution developed for SISCODE, is a procedure to support an audience to engage with AI in the setting of a cultural event, thus enabling them to discover the way humans can live a co-spectatorship with AI. Through this experience, the prototype offers ways of informing various communities of artists and science facilitators on innovative ways of exploring the issue of co-spectatorship among human beings and artificial agents.

This procedure has been and will be tested in several settings and aims at enriching how people consider AI-human relations, as it is not an issue of transparency and intelligibility of algorithms only, but a matter of envisioning a co-spectatorship of the complexity of the world we experience every day.

In very simple terms, the procedure implies assuming a reverse role (identifying ourselves as humans as chaperon of AI to a cultural event), observing a cultural event together with the AI, and analyse how the AI and the human spectators perceives the same event differently.

Even though the prototype is not *per se* a functional product, but a protocol enabling the working group to shift the perception and the viewpoint when interacting with an AI, this protocol has been designed together with a series of steps to take for it to be implemented in various settings.

The shift of perception as the new paradigm to tackle the issue of the intelligibility of algorithms.

It aims to shift the way AI technologies are actually considered as a black box which needs to be rendered transparent and intelligible, answering a need, as functional, to an empowering way of looking at technologies as agents reinterpreting the world, and how people collaborate in the process of understanding its complexities.

The prototype wants to reconsider the AI-human relationship by proposing the AI to be taken by the hand and the human to be their chaperon, like an adult would take a child by the hand to accompany it somewhere.

Table 7: Description of the procedure, step by step.

Step A / Mapping out all elements to mobilise in the exploration	1. Analyse the setting of the cultural activity a. Online/offline b. Main communication media (sound, writing, text, images…) c. Physical configuration (collective, clear division between spectators and performers…) d. Motivation and purpose of the cultural activity e. Motivation and purpose of the human participants f. Other 2. Identify relevant AI that needs to be accompanied to the cultural activity. The prototype is focusing on the social aspect of the technologies and not the technology *per se*, but a scan of these aspects informs about the intent of the original design a. Interfaces (smartphone, computer, sensors, …) b. Type of data produced (text, images, shopping lists…) c. Availability (free, freemium, paid, with registration…) d. Motivation and purpose of the chosen AI (aid for visually unpaired persons, commercial pressure, data collection, research on AI, …) e. Other 3. Analyse ethical and technical feasibility a. Evaluate technical compatibility and acceptability of the presence of accompanied AI (interference with the show, visibility of the artificial participants…) b. Evaluate ethical compatibility (use of personal data, mix of agendas, …) c. Evaluate costs, needed personnel, etc. d. Definition of a "AItiquette" specific for each setting (AI interfaces should not produce sound, AI interfaces should/should not be declared and/or visible…) e. Other
Step B / Experiencing live co-spectatorship in a specific setting	4. Equip human participants with AI a. Organisers provide a device or participants use their own device b. Participants use AI in their own name vs on organisers' name c. Take care of practical technical issues (help participants download apps, provide interfaces, have predefined accounts…) d. Icebreaker: an exercise of describing the world, objects and people around altogether in the style of an AI, paying attention to what is described, as a choir 5. Take the AI to the cultural activity or performance a. Define (if needed) requirements for the chaperon (AI always on, AI activated on pre-defined moments, etc.) b. Define (if needed) a beginning and an end for the participation of the AI c. Organisers keep track of accompanying participants and AI participating to the event d. Action!
Step C / Reflective processing	6. Collect feedback/data from AI and participants a. Set up a data collection system (collaborative board, dropbox/gdrive folder, …)

of collected materials	b. Facilitate participants to feed in the data collection system c. Organise AI data and connect them with the cultural activity / performance d. Provide questionnaire / interviews with human participants 7. Analyse and restitute collected data a. Imagine a format for restitution (Prezi, exhibition, short film, data representation, …) b. Organise collected data with such format c. Imagine a situation for restitution (online, live events, within the original event/after the event, 1 day later or 1 year later).
Step D / Iteration of machine learning process	8. Having seen the shortcomings of the artificial 'intelligence' and "autonomous' aspect of the technology, it is necessary to consider what to 'teach' the AI, in a low tech way (using technologies that are available to the wider public).

Fig 59: Overview of the solution

In this exploration, only readymade technological artefacts have been used, all developed by GAFA Silicon Valley modules and mainstream applications: even though it would not be possible as nonexperts to enter the box, it is still possible to experience it with the audience - and the help of researchers in the domain - some machine learning processes in order to imagine potential aspects to be taught to the machine.

This has been a starting point for explaining biases and preconceptions that all humans have as well.

It has been tested it in three specific situations:

- in the context of a live performance

Examples of end-product of the 'live event' particular situation (Fig 60)
Hamlet in the Gym with MTV : https://prezi.com/view/9Z5oepJn3Yxg3RrpC09G/?webgl=0

Fig 60: Visual for restitution of the play 'Hamlet in the Gym with MTV'

- In the context of a Zoom meeting

Example of an output of the introduction of AI 'Robert de Barretin' as a participant of the meeting, which is a funny rendition of exchanges reinterpreted by an AI.

- In the context of a living lab festival (see the blueprint *Fig 61)* and the Miro board: https://miro.com/welcomeonboard/f0xK5fwXbNVnKEqarMa2fytX2Y33yIsjbWUfxjegsRFit62GbZblIeycB8li0m7B)

Fig 61: Service blueprint for the context of a living lab festival

Demonstrator 'AI as co-spectators' 's description

What is it?

The developed demonstrator is a website describing TRACE's journey, a Prezi describing the co-spectatorship of a play with artificial agents and a Mural describing a situation of machine learning as a show.

More precisely, the demonstrator of the solution is the description of a situation of co-spectatorship with artificial agents which are represented through several interfaces:

1. ***Pearltree***

A Pearltree for background information and direct links to resources informing the exploration: https://www.pearltrees.com/t/siscode-project/id29028594#l270

2. ***PREZI***

The PREZI is describing and documenting the situation of co-spectatorship experienced during a theatre play with 8 different artificial agents that are: SeeingAI, GoogleLens, Yolo, Camfind, Ava, Voice translator, Teachablemachine and the famous Robert de Barretin, an artificial intelligence developed by the collective DataDADA. *(see Fig 62)*

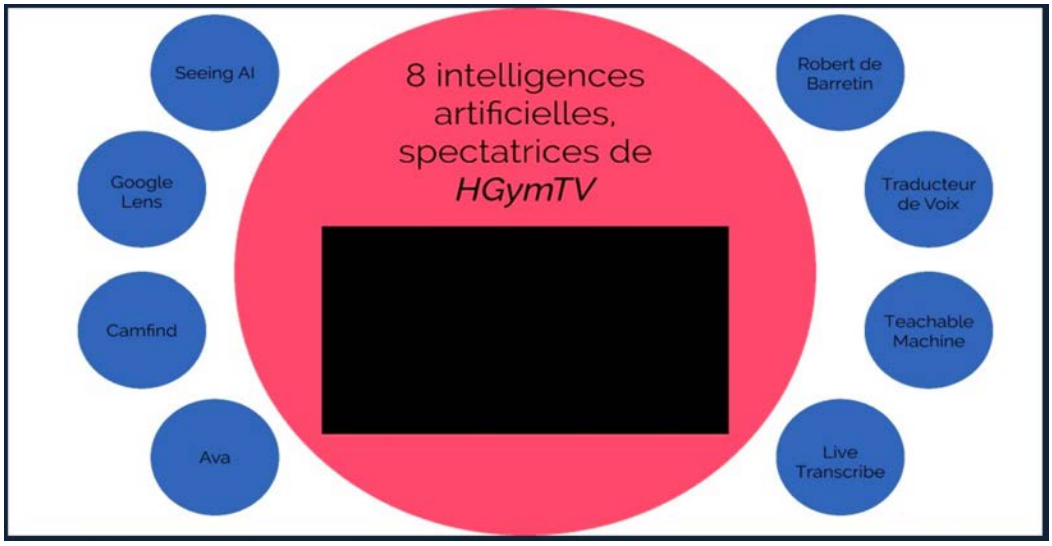
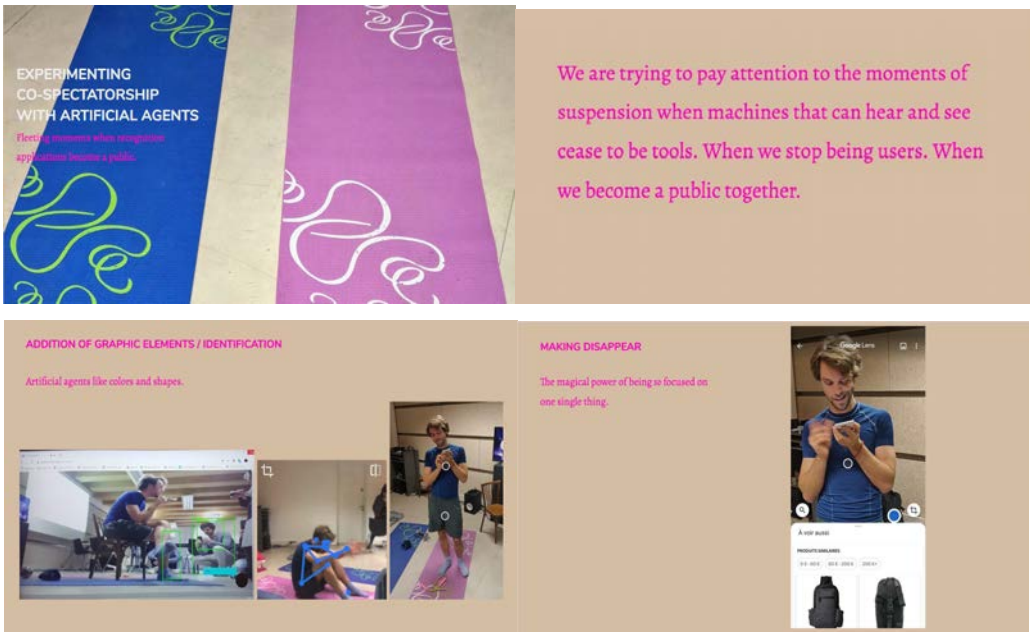


Fig 62: Prezi introducing 8 AI apps and what they so of the live theatre piece

It allows the public to witness a play watched by humans and artificial agents together, with a short video extract that also describes what the artificial agents caught from 'watching' the play, what information they processed, what their feedback was and how it adds on to the human experience of watching a play with potential glitches and alternative readings of the play, replacing the local experience in a globalised and interconnected activity via the Internet.

The experience has also been interpreted in a more analytical way on what were the outcomes from watching Hamlet in the Gym with MTV, (performance by Paul Boniface), with these artificial agents.



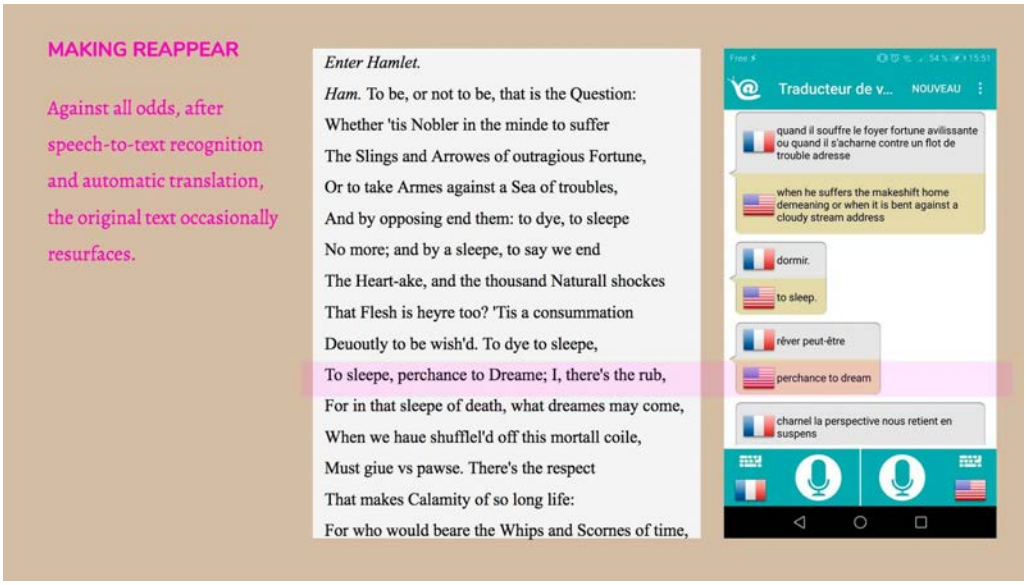


Fig 63: Examples of filters, interpretations of AI apps

3. MURAL

A mural documenting the machine learning experience together with an interface to interact with Robert de Barretin, an AI developed by artist collective DataDADA.

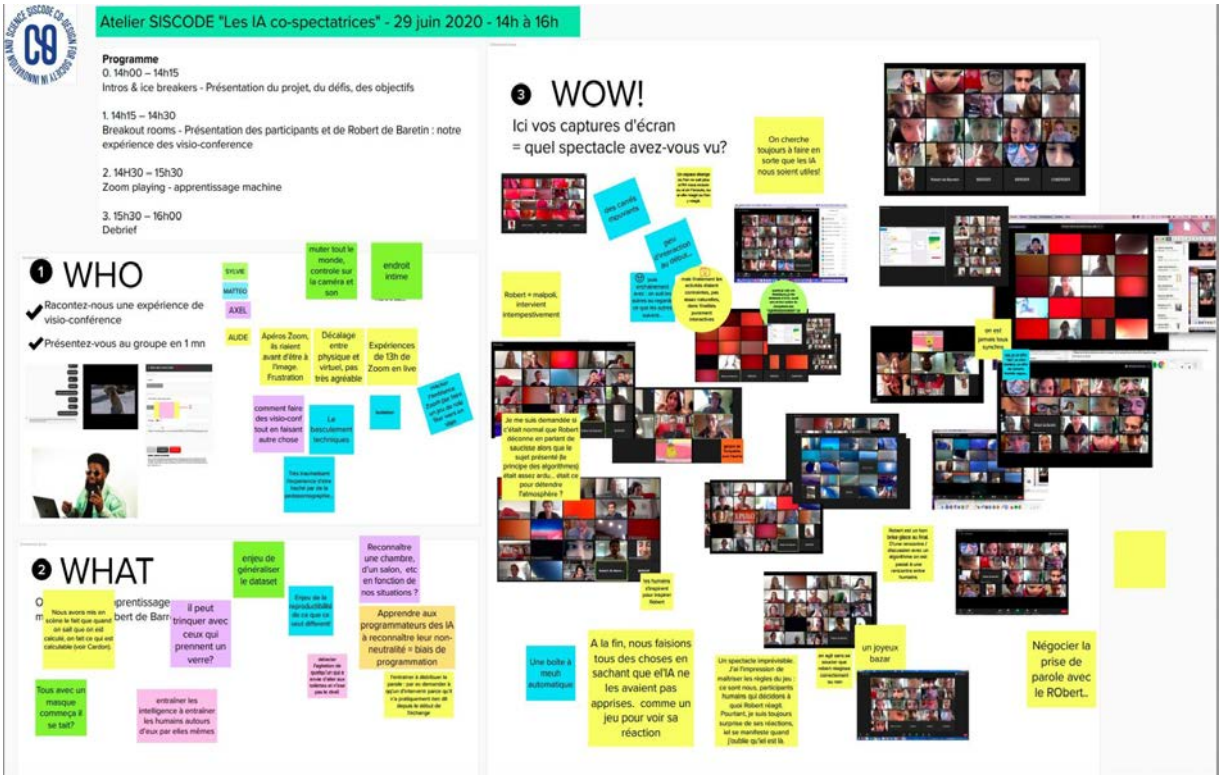


Fig 64: MURAL canvas used to facilitate a live Zoom session with an AI

This Mural is the result of a prototyping workshop that allowed participants to interact with an AI and understand more of the process of machine learning and its limits.

It contains traces of the dialogue with the AI, Robert de Barretin and from the participants' interaction with it.

This is a documentation that has also been used as a demonstrator of interactions between man and machine during the following live event, creating a kind of play, which can indeed turn out to be quite hilarious.

4. Padlet

A Padlet - as an Instagram live video - presenting the material collected and its interpretation by the AI apps, taken by the binomen human accompanying an AI, during a Living lab festival (TURFU festival).

The Padlet is accessible here: https://padlet.com/asso_traces/TURFU

This Padlet aggregates all the material that participants to the AI co-spectators of the TURFU festival gathered, is very interesting as it allows a reflection on the way AI apps interpret reality. It is very rich and provides many threads to pull in order to understand the way the AI apps function and the shortcomings also of their misinterpretations or translation of reality.

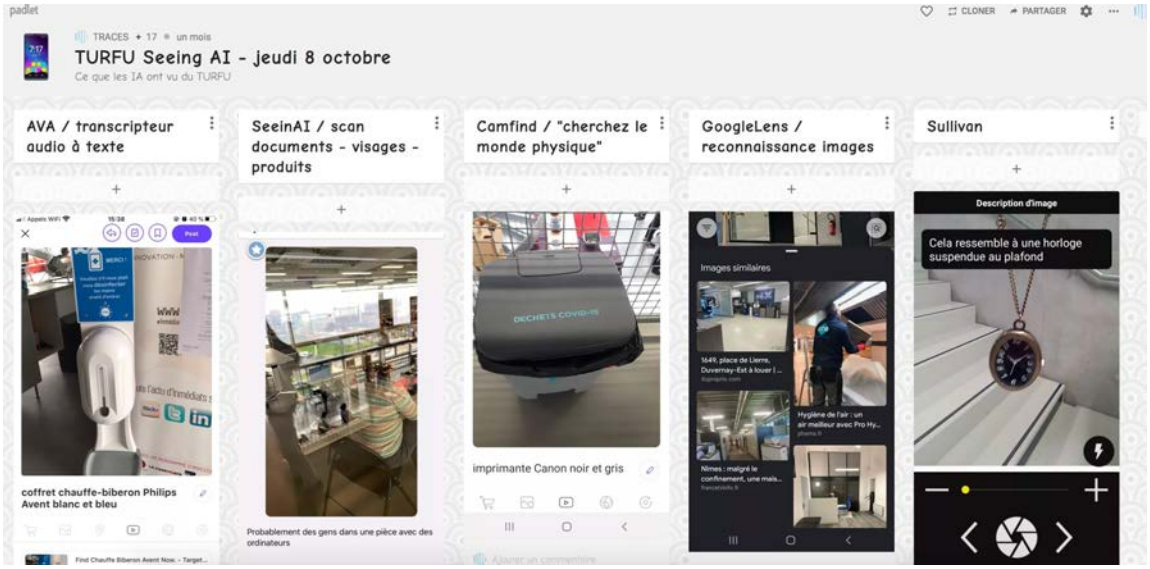
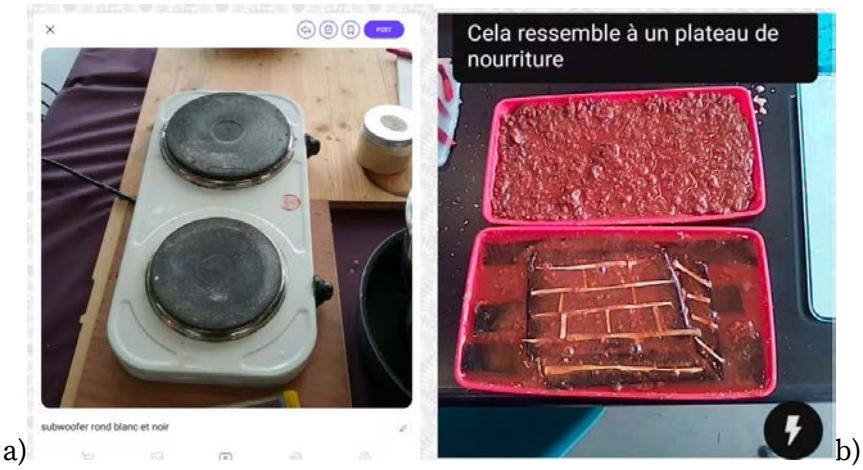


Fig 65: Padlet of materials gathered by 5 AI apps used at TURFU festival - October 2020

This multiplicity of images gathered is like an Instagram feed witnessing what the TURFU festival is about. It displays also how the AI apps mostly developed for visually impaired and blind people are promising regarding their scope to interpret the reality around but at the same time presenting some shortcomings. Some interpretations were quite accurate, most of them not at all, some quite disturbing and some also quite poetic.



a) b)

Fig 66: AI interpreting

a) 2 hotplates as "a black and white subwoofer" during the Precious Kitchen workshop at TURFU, b) some results of materials (leather and others) mixed and cooked to produce new material as 'looking like a dish' during the Precious Kitchen workshop at TURFU

How to access it?

For French native speakers, the overall work of TRACES is available at: www.ia-spectatrice.net.

You will find an introduction to TRACES's SISCODE journey and presentation of the codesign team, steps of the exploration and direct links to the various platforms aforementioned:

- Prezi: https://prezi.com/view/9Z5oepJn3Yxg3RrpC09G/?webgl=0
- Mural:https://app.mural.co/t/siscodewp69317/m/siscodewp69317/1593179500289/1ab6d14657e37c6736200e6d58269a52bb83f6c9
- An interface to shape an avatar of a zoom participant, able to take part in online conversations: https://app.data.bingo/siscode/agent/admin/
- The user guide: https://app.data.bingo/siscode/agent/admin/userguide
- A Padlet - like an Instagram of the material collected during TURFU festival : https://padlet.com/asso_traces/TURFU and https://padlet.com/asso_traces/TURFU2

For English speakers, a pdf explaining the concept of 'Experimenting co-spectatorship with artificial agents' is available as well as all the contents delivered in TRACE's SISCODE webpage (https://siscodeproject.eu/traces/).

Fig 67: Online resources for documentation

For any questions, please feel free to contact us: merzagora@gmail.com - aude.ghilbert@groupe-traces.fr

Evolution and ongoing validation of your prototypes

About prototyping process

Starting from the simple idea of how artificial agents probe into people's lives and personal information and how this fact could be reversed, or used in an alternative way guided by the question: What if they were also a public of cultural productions?

This shift in mindset is key to understanding the approach of accompanying AIs not as assistants but as co-spectators of a complex reality. Experiencing this co-spectatorship is the starting point of making the AI as social agents more intelligible.

This allowed the working team to envision a situation where AI is part of a collective experience accompanied by a human in order to be placed at the same level. Two potential scenarios were then sketched, and one particular situation has been chosen, the one of a theatre plays watched by humans and artificial agents alike.

This experience was very informative on the path to understanding how AI sees human activity: This has been elaborated in the document 'Fleeting moments when recognition applications become a public'.

With the COVID-19 crisis which forced the team to redesign the future interactions with the codesign team, the group took the opportunity of engaging the selected partners online to experience machine learning collectively as a show and to understand how it informs humans on the way in which AI learns.

As the prototype is an exploratory one and neither a product nor a service but an in-between installation/performance/workshop, it is necessary to engage again with various audiences to retest it, adapt it to various settings (a place like a cultural venue, a live event, a performance).

The choice is either to define a protocol for each situated context or to design a common one which can be used in these various contexts.

About indicators for guiding iterations

Asking specific questions to the workshop/experimentation participants assessing to which extent they learned about AI agents and their presence, and to which extent they would like to experiment further, future possibilities have been explored. For the team as facilitators of the workshops, there is still a large field to explore in this experimentation of co-spectatorship with artificial agents as there were interesting discussions in the last steps of the workshops, whether creatively or intellectually.

About the future steps

For further work, it would be possible to imagine the integration of the two dimensions and contexts that have been experienced: The one of a live performance and that of a live event in a specific place, like a festival. Conceiving an installation-participatory workshop would allow to integrate the various dimensions of the prototype.

To ensure a format that can inspire and be useful for other potential users of the prototype it is important to apply the lessons learned to be used by facilitators, artists or other audiences in the following experimentation.

5. Conclusions

The presentations of the prototypes show in a clear way all the technical knowledge that has been produced by the co-creation labs in their own context all along the past 21 months. The deliverable has been conceived to be synthetic and act as a practical tool pinpointing toward accessible demonstrators from the Labs (see Table 8). The Miro Infographics https://miro.com/app/board/o9J_lfwhbJM=/ is also a satisfying tool to communicate and reinforce the accessibility of the outcomes. For more details on the journey of each lab, we recommend you to read the deliverable 3.4 Co-creation Journey as Case-Studies.

Table 8: List of Demonstrators by Lab

Labs	Demonstrators' access
IAAC|FAB LAB BARCELONA	All the description of the pilot is available in the webpage of Fab Lab Barcelona: https://fablabbcn.org/projects/siscode-remix-el-barrio. The exhibition catalogues and activism campaign kit: https://issuu.com/iaac, the tutorials: https://fablabbcn.org/videos, the gitbook (ES): https://flbcn.gitbook.io/remix-el-barrio/
Polifactory	The BODYSOUND web demo is available at https://www.bodysound.org/play/
Maker	The PIPO exhibition available on @copenhagenmaker and https://siscodeproject.eu/maker/
KTP	All the information about the pilot will be uploaded in the SISCODE website: https://siscodeproject.eu/kpt/ The monitoring of industrial air pollution, the demonstrator is a digital platform available at https://zanieczyszczenia-przemyslowe.powietrze.malopolska.pl/#/zones
PA4ALL	The link to AgroSens is a digital platform: https://www.agrosens.rs/#/app-h/welcome
THESSAHALL	The booklet is accessible in https://3.basecamp.com/4017473/buckets/7749026/uploads/3211469446 http://www.thessahall.com/ and https://siscodeproject.eu/thess-ahall/
CIENCIA VIVA	The mock-up is available https://www.notion.so/golp/Festival-Caiaques-ao-Rio-a-prototype-9802c0d1373c4f239427f4cc45847ba2 and will be soon available through the SISCODE website https://siscodeproject.eu/pavilhao_conhecimento/.
CUBE	The Co-Design Canvas (freely) accessible and easy to use will be provided as a downloadable pdf-file via the SISCODE project website, under a Creative Commons licence. It will be possible to access it here: https://siscodeproject.eu/cube/
SCIENCE GALLERY	OPEN MIND guide for teachers is available at *https://drive.google.com/file/d/101s2r9ImJHugEsFJP64R-DtieGCqgGXW/view?usp=sharing*. *This resource will be uploaded to Scoilnet*
TRACES	For French native speakers, the overall work of TRACES is available at www.ia-spectatrice.net For English speakers, A pdf explaining 'Experimenting co-spectatorship with artificial agents' is available.

Several insights could be gained concerning the typologies of prototypes and their potential developments and collateral effects on the organization and the ecosystem as well as the effective use of iterative cycles, the role of emerging solutions and the diversity of patterns for prototyping processes.

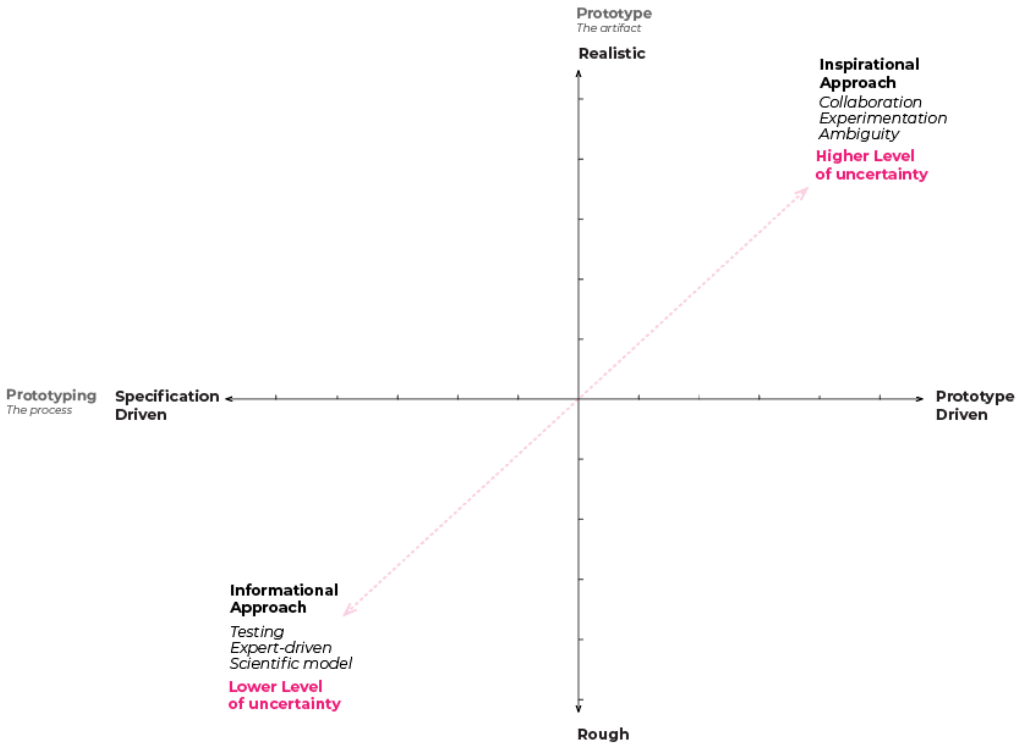
About types of prototypes. Most of the prototypes can be interpreted as services in its wider definition. An interesting point that emerged is that each lab has been involved in diverse forms of prototyping that require transdisciplinary skills and a combination of technical knowledge and soft skills like the development of a sense for facilitating community engagement and envisioning futures narratives. For Fab Lab Barcelona and Maker working both on the implementation of the Fab City narrative in various localities, this meant to create physical prototypes from food and plastic waste while running incubation activities and building new forms of synergies for circular communities. The team of KTP has been dealing with both juridical and political documents while promoting citizen engagement and improving their knowledge on the technical aspects of developing a digital platform.

About iterations. Labs have highlighted many times the importance of the iterativity of the design process. They all made the efforts to go for at least two loops of prototyping and much more implicitly. Meanwhile, the labs have clearly different cultures regarding the prototyping and testing with the stakeholders. For Polifactory's team who has been really active in testing in real life with users, quick and dirty prototyping has appeared as an excellent tool to anticipate results and effects even during the early stages of work, especially if the development process includes co-design moments. Cube's facilitators also stressed the importance of extending different viewpoints on the same problem and explicitly aim at discussions on the potential conflict of interests as long as it is needed to find a common agreement that goes beyond the divergences. The iterations are not always referring to the same perimeter of a system. In the case of Polifactory, IAAC and Ciência Viva, they switched between working on creating scenarios for the entire system and actively test some parts of the systems with the relevant target, saying that this mixed approach becomes even more important when the labs face barriers and constraints in one particular path.

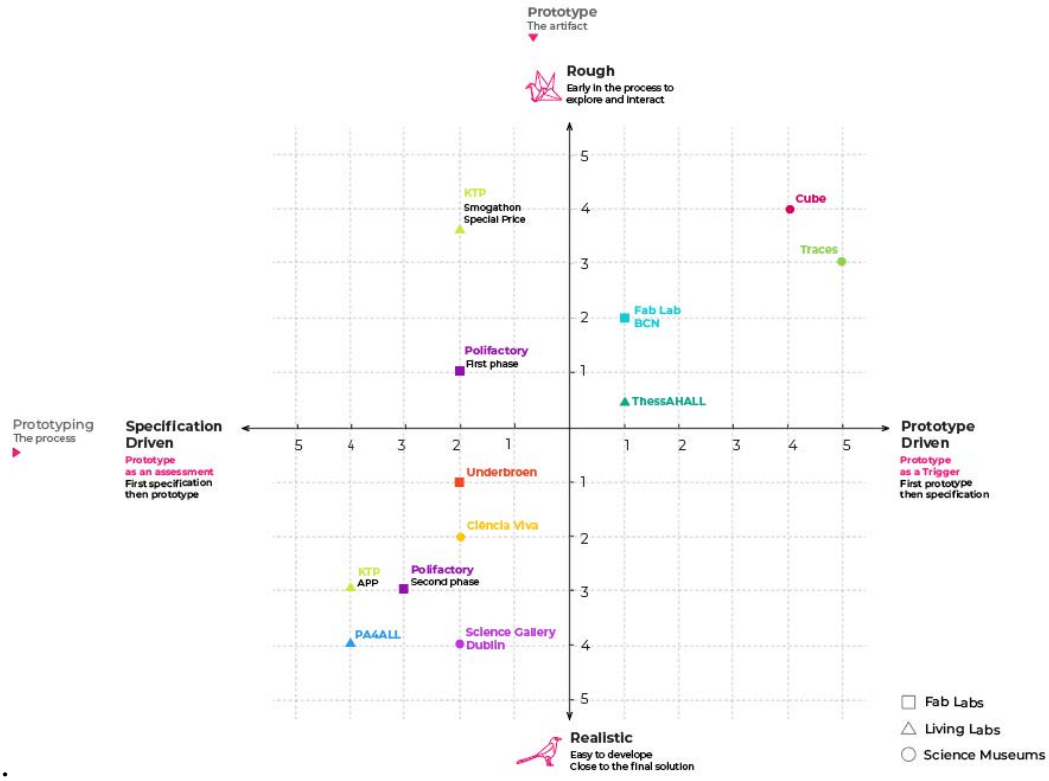
About the role of the emergent solutions. The labs have all clear and defined outcomes from their journey that can now be distributed, replicated and scaled towards other perimeters. Those solutions are the objects of dialogue to foster internal discussions and ecosystemic transformations. Ongoing discussions with SPI, the partner responsible for the sustainability both of the entire project and the one of the single pilots is supporting the labs to use the

prototypes not only as problem-solving artefacts of specific challenges but to imagine new strategies and opportunities to leverage changes at different levels. As for many social innovation stakeholders, labs now can be the ambassadors of a local initiative and can represent, promote it in diverse parts of the innovation ecosystem, from specific types of community and more specifically in the labs network (fab labs, living labs and science centres) or the emergent CORRI network (see SISCODE deliverable D6.3).

About new patterns for prototyping processes. Looking at the prototypes themselves, a heterogeneity of fidelity of prototypes can be observed as well as in the prototyping process. The work of Alejandra Campos, a former student at POLIMI realised her Thesis Research for her MSc. in Product Service System Design on 'Prototypes, uncertainty and Policy makers' engagement in design for policy', has been closely related to the empirical work of the co-creation labs. She has started by observing that prototyping could bring uncertainty into design for policy because of its open nature. She looked at the SISCODE experimentation to better elicit the diversity of prototyping in STI processes and explain why policy maker's engagement could vary according to the degree of uncertainty present in the process. Based on Sanders' work, she has developed a matrix crossing the fidelity of a prototype (from rough to realistic) with the main features of prototyping process (specify first then prototype or prototype first, then specify), and elicit two approaches: '*The first approach is the* ***informational approach****, which is based on a scientific model and expert-driven process to measure performance and specifications. The second one is the* ***inspirational/explorative approach****, which values the perspectives of actors involved in the design and implementation process and is based on experimentation and ambiguity, drawing from the future and the unknown. (Sanders, 2005, p. 10)'.* She observed that the positioning of the prototypes in her matrix might depend on the moment of the design in which it belongs. *This can be seen contrasting two lab cases: on the one hand is Traces, which could be part of an early stage of policy design, influencing Policy makers into new ways of understanding Artificial Intelligence, while handling a high level of uncertainty and a completely exploration-driven approach. On the other hand, KTP is part of a more mature stage of the policy design process, looking already for answers to implement the Air Protection Programme, which is currently part of the Policy makers' agenda of the region.'* In that sense, the way of approaching and engaging with stakeholders might differ according to the maturity of the design process and its level of uncertainty.



a.



b.

Fig 68: Matrix for prototyping approaches: a. Model b. Applied to the SISCODE Labs

Concluding it can be said, that the practices of prototyping and the prototypes as a means and result of the application of those practices led to manifold insights and transformations both related to the specific challenges of the single labs but also influencing the organizations and ecosystems on a greater level.

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Annex 1: Template of prototyping's description for SISCODE labs

What is a blueprint of your solution?

The term blueprint is defined as a reproduction of a detailed plan, what is called in technical drawing. The objective of the Blueprint is to communicate the vision without committing to very specific implementation details. If you are not an expert on design, it is a good way to start envisioning how one solution could be described in various representations and to collaborate with graphical designers.

The form of blueprints differs according to the type of prototypes we are designing.

- For product and materials, it will consist of 2D or 3D models/sketches of the solution, indicating its components, functions and aesthetics…
- For services, the service blueprint unveils the customer/user/stakeholder experience and related internal processes. (see Service design and SISCODE toolkit).
- For systems, the blueprint aims to provide a complete description of the system configuration and how its components fit together. It is a rich picture of your solution, an infographic where you give a coherent overview of the structure, the functions and the behaviours of the system. It could be Synthesis Maps or Giga Maps

How to prepare the blueprint?

Revise what is your solution, the materials you have gathered and choose what you will describe. According to your choice, please document yourself on the type of blueprint you will use, be inspired by examples that you can find online, and start sketching. Discuss it with your collaborators, and other SISCODE partners to have some feedback and refine it until you are satisfied by your drawing. Once ready, you can translate it in an infographic with legends and a text of description.

What is a demonstrator?

For our co-creation journey, the demonstrator will consist of an external documentation of your prototype that can both support the understanding, the dissemination and the testing of your solution.

It could be canvases, pdf, websites, software documentation, Prezi, mock-up, an open-source documentation filled in an external existing platform such as Wikifactory. Contrary to the blueprint, concerning the language, it is up to each lab to decide in which language you will do it. However, we encourage you when it is possible to create an English version (summarised). In any case, a tutorial of the demonstration, in English, will be integrated to this deliverable.

Technical details

As this report is a concise synthesis of all the prototyping activities, some details will have to be cut. All the texts will serve for explanations/descriptions of the illustrations. The various visuals will be needed to be as clear as possible and copy in a high-quality resolution in a joint folder.

General structure for each lab's part

Reminder: Context and Societal Challenge

Here you can briefly introduce and update your challenge and your local context.

Blueprint - Final version of your solution

In this section we would like you to insert the blueprint of your solution (service blueprint or detailed technical drawing or synthesis system map) with additional text description and photos allowing to add clarity and detail about your solution.

Demonstrator's description

In this section, we would like you to describe your demonstrator.

Do you have a demonstrator? Yes - No

What will it be? Please describe it shortly

How to access it? Here put the link / annex reference for us to access it

What is the content and how to use it? Use this section as a tutorial for motivating readers to understand, test, go further with your topic/solution.

Evolution and ongoing validation of your prototypes

In this section, please briefly explain the loops that you have passed to have this ongoing version.

Please introduce synthetically how did you test, redesign and improve the prototype?

Give us some tips about how prototyping helps you and your ecosystem to redesign the solution?

Elicit which dimensions/indicators are you using to revise/test your prototypes?

Reflect on what would you need to do now to 'validate' your solution?


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