Designers' Hackathons.

Ocean Plastic Hackathon 2020 – 2021

WP4 Stakeholders' Engagement Tool

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Report

Ocean Plastic Hackathon Report
2020 - 2021

Project Credits DFA

Director
Teresa Franqueira

Project Manager
Alexandre Kumagai

Workshop Technician
César Rodrigues

Strategic Partnerships
Ana Afonso

Project Assistant
Liliana Teixeira

Photography and Video
Hélder Antunes
Afonso Lourenço

Reports
Bárbara Cruz

Graphic Communication
Mafalda Santos
Afonso Lourenço

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1. Introduction

This report documents the Ocean Plastic Hackathon project, under the theme: Circular Economy to free the environment of foamed polystyrene, divided into four events – Hackathons – held between December 2020 and June 2021. This product/service development marathon was presented by the OceanWise INTERREG Atlantic Area Project and organized by the Design Factory Aveiro (DFA).

The main objective of this initiative was to challenge participants to create innovative solutions that could solve problems linked to the worrying source of foamed polystyrene products (EPS and XPS) marine litter in the Atlantic Ocean, an issue the OceanWise project has been focusing on in the past 3 years.

Four ocean plastic hackathons were organized with different teams, approaches and mentors that ended-up with creative solutions for a diverse range of contexts linked to the global problem.

This document describes all the information regarding the organization and implementation of the four Hackathons as well as the results of this challenge.

The entire branding process and the dissemination of the events was essential for the positioning of this initiative and for attracting participants.

The creation of the digital platform for involvement of stakeholders was necessary to disseminate and subsequently present the results of the various events.
Attached are all the elements relating to this process.

2. Stakeholders, digital platform and dissemination

For this initiative, a digital platform for the involvement of stakeholders was developed in order to publicize the Hackathons and inform interested parties about the process and results of each event.

In order to get a quick and adequate response, Wordpress was used as the basis for the creation of the platform, adapting the template to the content and graphic image of the respective Hackathon.

In the pre-event phase, the platform's home page worked as a means of dissemination and encouragement for the registration of participants. Therefore, the google forms link for registration was placed and the banner was changed to the one corresponding to the event that would take place. The initiative was also promoted on Design Factory Aveiro's social networks, since they already had a strongly built community, which was an advantage to reach a greater number of participants.

Dissemination was made to the students of the University of Aveiro, through teachers from diverse areas, such as design, mechanical engineering, materials engineering, chemical engineering, environmental engineering (…) and all those who showed interest in participating in the challenge . Finally, members of the Desis Network (Design for Social Innovation towards Sustainability) were also invited to participate in the hackathon to bring an international perspective. The idea was to understand the different contexts of the problem of EPS/XPS pollution in the oceans and find solutions focused on this scenario.

During the Hackathon there was live-sharing through the social networks of Design Factory Aveiro.

After each Hackathon, a new tab was added to the digital platform, which contained a brief description, photographs and video, the miro board filled in by the participants during the activity and information regarding the mentors who accompanied the groups.

1st HACKATHON

1. Introduction

The 1st Ocean Plastic Hackathon, under the theme: Circular Economy to free the environment of foamed polystyrene, took place between the 16th and 18th December 2020. This marathon for product/service development (Hackathon) was hosted by the OceanWise INTERREG Atlantic Area Project and organized by Design Factory Aveiro (DFA).

It was a 3 day event where the participants worked in shifts either at the Design Factory Aveiro installations or virtually, through ideation in the Miro platform.

This event was destined to anyone interested in this issue: university students, professionals or researchers that were willing to work in teams to develop proposals and tools that contribute to solving this problem.

The Hackathon involved not only the participants in the challenge, but also the OceanWise project stakeholders, who contributed with keynotes and mentorship to the solutions developed in this hackathon, providing focused inputs to the development teams.

2. Online / presential-set up

Since the first Hackathon was online and in person, reconciling these two environments was one of the biggest challenges. As a rule, a Hackathon takes place in a physical context or in an online/virtual context, however, due to the pandemic and in order to allow greater geographic diversity and the participation of a greater number of people, a hybrid event was chosen.

It was necessary to make the connection between the online participants and the participants in a physical environment, so that everyone could follow the event and the work in a balanced way. The use of platforms such as the zoom and miro were crucial for the collaboration between the participants to be effective.

That said, a workstation was prepared for each group. Each one of them had two computers: one of them was connected to the zoom platform, so in that way, all the elements of the group could communicate with each other, in real time. The second computer was connected to the "miro", an online collaborative platform for workgroups. This made it easier to share and represent ideas among all participants. The mentors were online, linked through zoom.

Fig. 1 - Workstation

3. Keynotes e mentors

In addition to participants and the people in the organization, two hackathon mentors helped the groups in their ideias, giving feedback and important inputs to construct a solid project based on their real experience and knowledge. This was really important across all the process as the participants had little knowledge about EPS/XPS properties and the ways of transforming it. Having experts on this area that could confirm the viability of an idea was crucial.

One of the mentors was **Thomas Maes**. He has a wide educational background, including pre-MBA, civil engineering, terrestrial & marine biology. In 2020, joined GRID-Arendal, a collaborating centre of UNEP. Thomas contributes to expert working groups on waste & marine litter and develops products to inform policy-makers. Marine litter, POPs, biomarkers, circular economy, waste management, waste trade, sanitation & wastewater are topics that Thomas specialises in.

The other mentor was **Elisa Setién**, an electromechanical Industrial Engineer by profession with a Master degree in Business Administration. Since 2008 she has been Director General of several International Trade Associations in Brussels, representing the industry towards the EU institutions on key legislative dossiers such as Product Stewardship, Chemical, Plastics, Sustainability, Circular Economy, Non-toxic environment, Waste Management and Marine Litter.

Another important contribution came from the **keynote speakers** who presented their work and experience for all participants, enriching the knowledge of the groups.

Raquel Lopéz de la Banda, a building Engineer by Universidad Politécnica de Madrid, with a complementary training on marketing and finance. Also director of ANAPE (Spanish EPS Association) since 2009. ANAPE Technical Coordinator, from 2007 to 2009. Before: 10 years experience on chemical products for construction at several European companies.

Ana Pires has a PhD in Environmental Engineering from the NOVA School of Science and Technology (FCT NOVA). She is a Researcher at the NOVA FCT in the area of solid waste management and circular economy. Author of several articles and communications, with a book awarded by the International Solid Waste Association. Her research areas focus on the development of biotechnology recycling solutions. Circular Economy models and sustainability metrics for hierarchical waste management. She is co-founder of the waste@NOVA network of researchers dedicated to innovation in waste treatment and management technologies.

4. Participants

The first Hackathon had more than 40 participants, including: design students, professionals and researchers in the environmental area willing to solve and deal with the problem of polystyrene present in the oceans, actively working to find solutions to overcome this problem. During the event, the participants give testimonials about their experience that were collected and recorded on video.

Participant 1 :"I wish I had more time to join this team more often. I want to be part of all steps of the process." "I am really enjoying because we are actually making progresses every day"

Participant 2:"It's going great. I thought it is going to be more of applying our knowledge but in reality we are learning before we can actually apply"

Participant 3: "My expectations are that we can find some kind of solutions for this problem and I don't think that we will end up with a complex solution but we are working forward, making a path to brilliant solutions"

Fig. 2 - Participants

5. Canvas - miro and program

In order to record the progress of each group and share information to all participants, the "miro" platform was used. That said, the platform was previously prepared with guidelines for each group, containing the three days of the event.

On the event board the space was divided into 3 frames, one for each day and within each frame the space was divided into two, one for each group. In all frames, the schedule of planned activities was placed so that participants knew how much time they had to perform each task. Thus, the work followed the alignment of the target in an organized and intuitive way.

Fig. 3 - Miro first hackathon

Frame day 16:
The first frame had an area to "problem storming" and "idea storming", that was the first two tasks to be done by all participants regardless of the group. Below, space was left for brainstorming in groups, followed by the choice and development of two ideas. Finally, the "concept generation" field was placed, where participants had to answer some questions to explain the two concepts concisely. At the end, a place was added to identify the winning idea, chosen by votes, and also to leave some clues for the participants who would be part of that group the next day.

Frame day 17:
For this day the frame was less detailed as the focus was on continuing the development of the idea chosen the day before. Therefore, there was a space to go deeper into the concept, with questions that guided the process (what, target audience, direct partners, indirect partners, expected results).

Frame day 18:
Here, the space served as a template for presenting the ideas to the mentors and the project members. It started by identifying the project and explaining it by answering the questions - what ; to whom; with whom; how. Next, a scheme was placed to identify the project's direct and indirect partners, as well as the project's objectives and innovative factors.

6. Description of the event

The Ocean Plastic Hackathon was a three days event with a lot of activities and team work. Furthermore, keynote speakers give their contribution by sharing their works and knowledge, and the two mentors were present during the 3 days to help both teams.
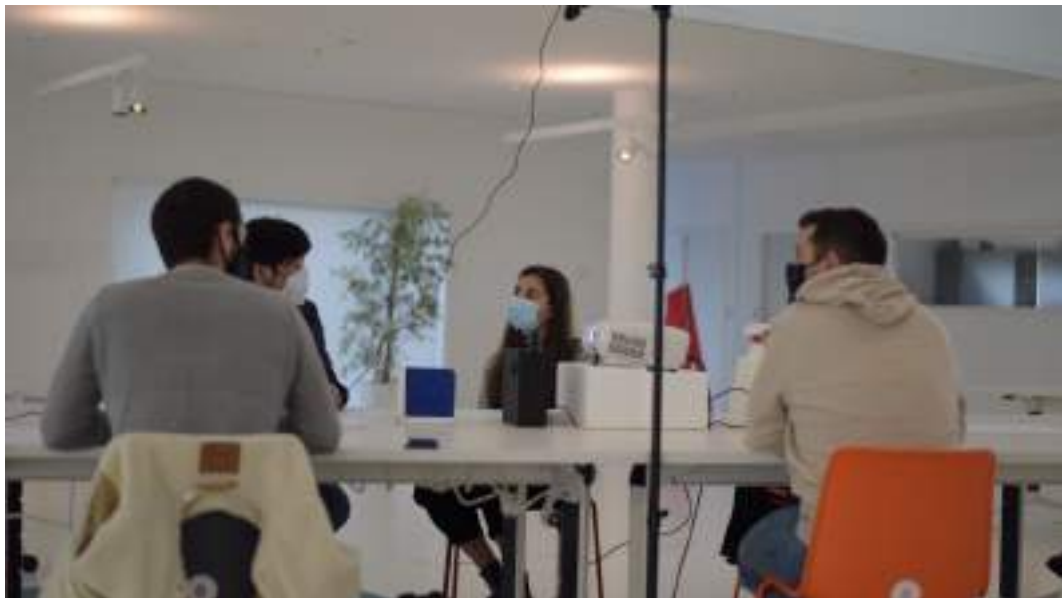
Fig. 4 - Brainstorming session

First day:
The event started on Wednesday afternoon around 2 pm with the opening session. The director of Design Factory Aveiro, Teresa Franqueira, the coordinator of the OceanWise project, Sandra Moutinho and Lia Vasconcelos from Nova University, presented about the project and received all participants with enthusiasm!

The first Keynote Speaker, Ana Pires, introduced the theme of EPS/XPS, talking about its characteristics, some issues, thus transmitting relevant information about the material so that participants could become more involved in the theme they would work on.

After the presentations were finished, the participants, both online and in person, started the brainstorming session. First, they reflected on the problems related to the use of EPS/XPS and then on possible solutions that could solve the situations identified above.

After the brainstorming session was over, the participants were divided into two groups. Each group chose two brainstorming themes to be able to further develop and then present to mentors. With the two ideas developed and presented, it was necessary for each group, together with the mentors, to lean over and choose only one idea to deepen.

The theme/idea was then selected for each group to develop on the remaining days.

Second day:
The second day was focused on developing the themes of each group, which included a lot of teamwork, brainstorming sessions within the group and also with the mentors.

That said, at this stage of the work it was necessary to define: what was the theme; what is the target audience; direct partners; indirect partners and what are the expected results.
In the afternoon, some tests were carried out on the material - EPS - at the Design Factory Aveiro Smart Plastics Lab, to try to understand how the material reacts to some experiences and to explore the use possibilities of this material.

Keynote speaker Raquel López also did her intervention on the afternoon of this day.

Fig. 5 - Material testing

Fig. 6 - Experiences with the material

Third day:
Finally, the third and last day was dedicated to preparing the final presentation of the project that each group developed during the three days of Hackathon.
In this way, the morning served to finalize all the details of the projects. In the afternoon, each group presented their work to the mentors, receiving feedback from them.

The first Hackathon ended with the closing session led by the Design Factory Aveiro Director and Coordinator of the OceanWise project.
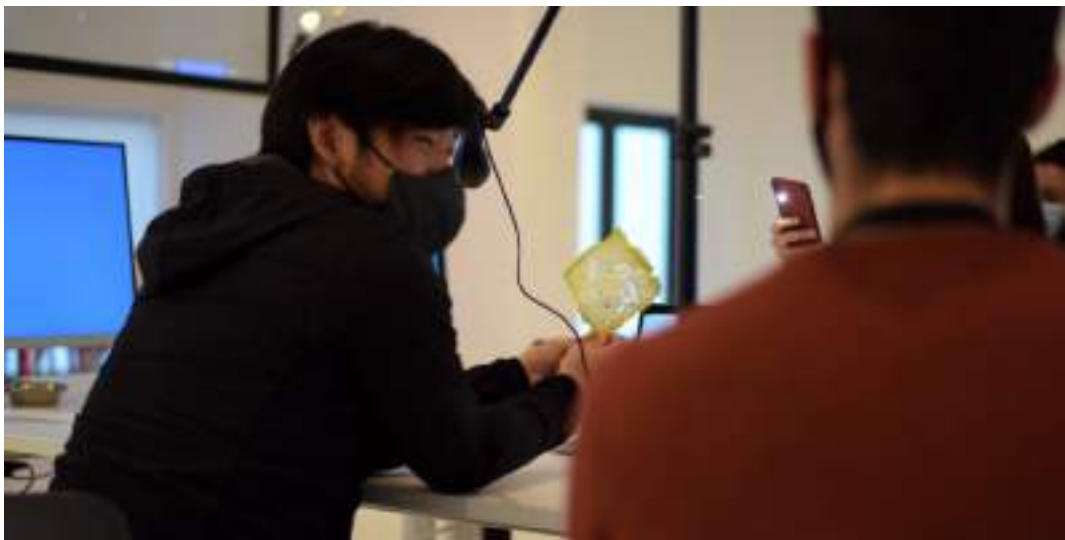

Fig. 7 - Samples

7. Expectations and results

The main objective of the first Ocean Plastic Hackathon was to think of innovative solutions that could solve the problem of EPS/XPS in the oceans, and with this objective in mind the participants developed two services:

GROUP 1:
Group 1 developed a service called "Kids, let's recycle our wasted EPS!", which consisted of raising awareness and educating children and their families about the problem of EPS in the oceans and its recycling. Together with schools and recycling companies, EPS waste collections would be carried out to later prepare workshops. In this way it is possible to involve children, families, schools and teachers themselves, as well as recycling companies and the government.

This project's main objectives are to minimize the impact of EPS/XPS, change mentalities and behaviors, making children in their schools create new objects with waste, giving new life to the material and even creating competitions between educational establishments.

Since schools bring together children of different ages, the workshops would be different for each age group. Children aged between 6 and 10 years could observe the biodegradation of the material through mealworms farms at schools. Students aged 10-15 years could perform mechanical processes such as thermal compression molding. Finally, between the ages of 15 and 18, could they explore other chemical and mechanical processes. In this way, creativity and the ability to learn with practical cases were promoted in schools.

GROUP 2:

The project developed by group 2 is called "EX.PS for Planet Safety". It consists of an EPS/XPS recycling service, which aims to show people that they are capable of making a difference and that it is possible to recycle this type of material.

To carry out this project, it would be necessary to have several collection points, such as markets, appliance stores, and others, so that people could deposit their material.

This service would contain strong communication, with television and digital campaigns and in-store communication on EPS/XPS packaging. This way, people would know where to go to recycle and also feel more motivated through a rewards system with points.

During the project and if possible, it would be ideal to develop a container that would compact the packages in an eco-friendly way, managing to transport more material in less space.

8. Reflection

Despite the pandemic context, it was possible to create an appropriate environment for creativity and group work. Reconciling the online and physical participation was the biggest challenge of this first hackathon, but it was possible to find a suitable solution for it. However, it was noted that the experience of the face-to-face participants was better than the online ones, because it was easier to create empathy. Also being able to do the EPS tests at the main workshop at design factory aveiro improved the experience of the participants because they could touch and manipulate the material. saw the tests.

2nd HACKATHON

1. Introduction

2nd Ocean Plastic Hackathon – Circular Economy to free the environment of foamed polystyrene.

The 2nd Hackathon consisted of a 3 day (28, 29 and 30 april) event where the participants worked in shifts at the Design Factory Aveiro main workshop and open space to find solutions to this problem. In this hackathon we were more focused on experimental work with the EPS/XPS to understand the behavior of the material and to find ways to transform it.

This hackathon involved university students from different backgrounds: mechanical engineering,product design and environmental engineering. They worked with the Precious Plastics set of equipment available at Design Factory Aveiro main workshop.

Several mentors were invited for each session to help the participants explore and achieve relevant results from the EPS/XPS experiences.

2. Online / presential-set up

The main objective of the 2nd Hackathon was to focus on exploring the material to better understand its behavior. This led to the decision of e helding it in person at Design Factory and then live-broadcast the event.

The work area was prepared with two stations, one for each group. Each had a computer connected to the "miro" platform so that the progress of each group could be recorded online.

All the machines from the Precious Plastic project were available at the Design Factory Aveiro's Open Space, so that all participants could use them in order to test the material.

Fig. 8 - Machines from the Precious Plastic

3. Keynotes e mentors

Due to the fact that it was more experimental and hands-on, the 2nd edition of the hackathon had the presence of mentors at Design Factory Aveiro, who worked towards finding solutions together with the participants.

Cândido Cruz is one of the founders of the project ReCUA. With the aim of making the world more sustainable, the ReCUA-ReCycle, ReUse, ReAct project was created when its team came across the possibility of transforming plastic waste into new products. Its main objective is to involve and educate the community and to work towards the promotion of recycling, ecology and sustainability.

Isabel Bourbon is a product designer and one of the founders of Oiá Plast project. Founded in 2019 in Cape Verde, Oiá Plast creates 100% recycled and 100% recyclable products through the transformation of plastic waste in raw material. It works towards having fewer plastics ending up in the environment, giving them a new, longer lasting and valuable life opportunity. Their main goal is to transform this environmental invader into recycled objects while cleaning the beaches and raising awareness of the community, now in Cabeceiras de Basto.

Emanuel Faúlha has developed his Master's thesis with the main objective of finding a solution to reuse the waste of materials caused by the production of surfboards.
The motivation to develop this theme derived from the fact that he was born in a fishing environment in a city surrounded by the sea, having grown up with awareness of the issues of nature preservation, especially marine habitats.

Víctor Neto is a professor in the Department of Mechanical Engineering and a researcher at the Center for Mechanical Technology and Automation at University of Aveiro.
He's teaching and research area are around Advanced Production Technologies, especially involving Plastic Materials, Eco-design and Eco-efficiency in product development and production.

Ana Gomes holds a PhD in Applied Environmental Sciences and a Degree in Environment Engineering by the University of Aveiro. She is Assistant Professor at the Department of Environment and Planning at University of Aveiro and has been teaching a wide range of courses in the field of environment engineering. Her research interest is in the field of waste management with an emphasis on collection and on organic recovery for the production of soil improvers and their application. Marine litter has become her most recent focus of study.

4. Participants

The second Hackathon was attended by 20 participants from different scientific areas (product design, mechanical engineering and environmental engineering), enthusiastic about finding solutions to solve the problem of EPS in the oceans.

We noted that the practical aspect of this 2nd event allowed the students to have a hands-on experience that motivated them to work actively throughout the day.

Participant 4: It's been extraordinary, it's been a long time since we've participated in a face to face workshop like this, so it's been good also because of that, a bit of teamwork and we're trying to value in a material that often ends up in the oceans".

Participant 5: "I came here to the second hackathon because I liked the first one a lot, I thought we made interesting progress, it was necessary to make this more practical so that we could get more tangible results."

Fig. 9 - Participants

5. Canvas - miro and program

Again, the miro platform was used so that each group could register their work over the three days. In this hackathon, the platform worked as a diary to record experiences made with the material and possible working paths from the observation of the material's behavior when subjected to predetermined processes.

Fig. 10 - Miro second hackathon

Frame day 28:
The 1st frame had several spaces to fill in with the various experiments carried out with the material. The objective was to record the initial state of the material, the process and the final result through photos and text.

Frame day 29:
The second frame contained an area reserved for a brainstorm of ideas and sketches of possible objects to be carried out from the material transformation processes tested the day before. Afterwards, a space was placed to record the attempts to carry out the intended objects, and ended with another table to register brainstorming and relevant notes that could serve as tips for continuing the work the next day.

Frame day 30:
The last frame was aimed at documentation through photographs of the development and final result of the objects designed the day before. A description was also requested in order to obtain more details about the process that led to the artifact.

6. Description of the event

First day:
The second Hackathon started with the opening session conducted by the Director of Design Factory Aveiro, Teresa Franqueira. After the presentations and instructions given by Liliana and Alexandre, the two working groups were formed.

Mentors Cândido and Vítor Neto were helping the participants on this day, which was mostly dedicated to experiments . The groups tried to better understand the material they were working on. To do this, EPS was transformed in different ways and tested on the various Precious Plastic machines. An oven and hot air gun were used to heat the material, a blender and crusher to reduce the material to small pieces, and also a filament extruder. It was important for all participants to understand how this material reacted when subjected to different processes.

At the end of the work shift, each group documented their experiences and all the information on the miro platform (Figure 10).

Fig. 11 - Blender

Fig. 12 - Heating and compressing

Fig. 13 - Crushed EPS
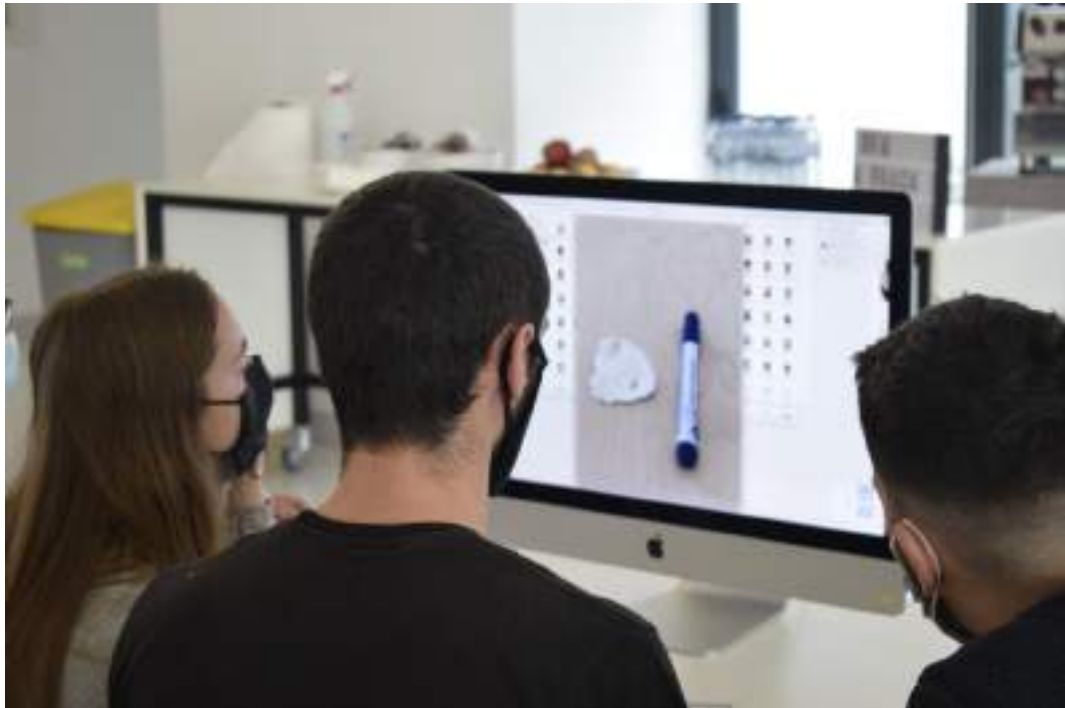

Fig. 14 - Experiences with molds

Fig. 15 - Documenting the information

Second day:

The second day began with the experimentation of the only machine that had not been used the day before, the injection molding machine. Some molds brought by the mentors, Cândido and Isabel, were used and they tried to fill them with EPS in a viscous state. Then, based on the experiments carried out on all the machines, each group focused on a process and continued to explore the material according to that process in order to conclude which would be the best way to produce a final object.

That said, both groups worked on preparing the material to be used in the machines, exploring the method that most interested them and pointing out more concrete data.

Before the end of the session, each group defined some ideas and sketches of final objects to be able to accomplish on the last day of the event.
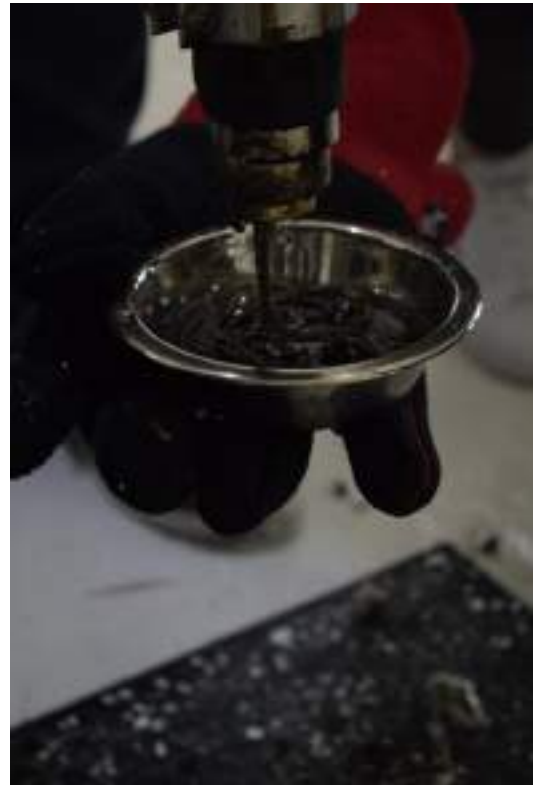
Fig. 16 and 17 - Injection molding machine

Fig. 18 - Ideas and sketches

Third day:
On the last day of the Hackathon, each group focused on their idea and tried to develop it as much as possible, trying to achieve an even more final result. On this day, the participants had the help of Emanuel, Cândido and Ana Gomes.
After the objects were completed, information was collected and conclusions were drawn.

At the end of the day, a presentation of the results was made to Sandra Moutinho and Lia Vasconcelos from OceanWise.

The 2nd Hackathon is now over.

Fig. 19 - EPS cup

Fig. 20 - Lampshade with filament

Fig. 21 - Lampshade

7. Expectations and results

In this second Hackathon, the groups performed more experimental work, testing the material in different processes. It was expected to understand the behavior of the material when subjected to different temperatures and transformation processes, as well as to start exploring small objects that could be made according to the knowledge acquired. The event went well and both teams presented the following results:

GROUP 1:
Group 1 focused on the compression molding process and the bowl was the chosen object to test and improve the process. To reach a satisfactory final result, many tests were necessary. The base material to carry out the object was EPS, previously crushed and heated in the oven, turning it into an airless granulate. The oven compression molding process with a metal mold was then used. Previously, in the mold, glycerin was applied as a release agent. The mold remained in the oven for 10 minutes and also cooled for 10 minutes. After cooling, the bowl was successfully removed from the mold, thus achieving a satisfactory result.

Fig. 22 - Evolution of the EPS cup

GROUP 2:
Group 2 worked on two processes, and to test them the chosen objects were lampshades.

The first process consisted of placing the granulate with air (crushed EPS) between two bowls simulating a mold and countermould. In the oven, the material heats up and is airless, however it is necessary to compress it manually to obtain greater compaction. This process is repeated by adding more material as the volume is greatly reduced. It takes a lot of raw material to get a good result and the process becomes repetitive. The ideal would be to use a real mold and countermould to achieve a better result.

Fig. 23 - Lampshade

The second process explored was the filament in the extruder machine. To obtain the fila-ment, it was necessary to crush the EPS, obtaining the granules, which then went to the oven, to remove air and remained in a semi-viscous state. After the material came out of the oven and cooled, it was placed in the blender to be crushed into small pieces. These pieces of EPS fed the extruder and produced the filament that was wrapped around molds (these were later destroyed to release the filament). In terms of production, greater care is needed when winding the filament, so that it does not become too thin or too thick. Aesthetically, the result was quite interesting as it created a unique environment when used as a lamp.

Fig. 24 and 25 - Lampshades with filament

8. Reflection

Despite the constraints imposed by the pandemic, it was possible to carry out the second Hackathon in a physical environment.

The fact that all participants have access to the same information, contact with the material, handling and testing on the various machines available was quite beneficial for the development of projects and solutions, and for acquiring new knowledge.

In this experiment, the do-it-yourself aspect was essential both to understand the best material and to validate the concepts of the previous hackathon. It also served as an important knowledge base to boost the following hackathons.

3rd HACKATHON

1. Introduction

This third event took place on the 19th, 20th and 21st of May (two full days and Friday morning). The themes chosen for this event were based on experiences made in the previous session, and a specific problem identified in the 1st hackathon.

Thus, one group worked around the problem of collecting EPS/XPS and exploring the processes of crushing and heating the material, while the other group worked on raising awareness for recycling EPS/XPS, focusing on filament molding and extrusion processes for creating children's toys/objects.

2. Online / presential-set up

The third event took place with all participants in a physical environment, only the mentors were online.

The workspace, as in the second hackathon, had two areas, one for each group. Each of them had a computer so that participants could access the "miro" platform in order to record their progress during the work. In DFA's Open Space, all the machines from the Precious Plastic project were once again available so that participants could use and continue their experiences with the material.

The connection with the mentors was made through the Zoom platform in sessions designed so that all participants could watch and intervene.

3. Keynotes e mentors

Pedro Luís is the director of BEWI Circular in Portugal. Currently the only company in Portugal to recycle EPS, BEWI Circular, part of the BEWI group, has launched a project in partnership with Doca Pesca, which aims to collect EPS fishboxes from almost all fishing ports in Portugal. Pedro M. Luís says that this project is one of the best solutions to prevent ocean pollution provoked by these boxes.

In addition to Pedro Luís, Thomas Maes and Elisa Setien were once again part of the mentors panel.

4. Participants

The third event was attended by 15 participants from mechanical engineering and engineering and product design who worked together on the themes proposed in this Hackathon.

Fig. 26 - Participants

5. Canvas - miro and program

The working days of the 3rd hackathon started at 9:30 am and ended at 6:00 pm, with a lunch break between 12:15 pm and 2:00 pm.

The miro platform was organized, but less divided and detailed so that participants could explore solutions in an exploratory way and depending on the solutions found, show the results in the easiest and perceptive way. As usual, the hours of activities and visits by the mentors were indicated in the frames of each day, so that the participants could organize themselves taking into account the time they had for each stage.

Fig. 27 - Miro third hackathon

Frame day 19:
The frames presented an explanation of the theme each group should work on, as well as some processes that could help in solving the problem. Next, a blank space was left, so that each group could place their brainstorm reflections, sketches, or other things that they thought were pertinent there.

Frame day 20:
For the 20th, the program was placed at the beginning of the frames, so that participants would know that mentor Pedro Luís da Bewi would be with them at 11am and Thomas and Elisa at 4pm. There was also a space for each group to post images, sketches, ideas that would explain the work developed throughout the day.

Frame day 21:
For the 21st, the miro was organized to be the template for the presentation of the participants' work. After giving the project a name, the groups had to answer 4 questions - what; to whom; with whom; how. Finally, it was a space to describe the objectives and innovation factors of the generated result.

6. Description of the event

First day:
The event began with the formation of two working groups and the distribution of themes/work objectives.

Group 1 was responsible for collecting EPS while Group 2 was responsible for raising awareness of the importance of recycling EPS. That said, this first work session was more focused on brainstorming in order to better reflect on the problems they were working on.

Models were prototyped for one of the themes that served to test the idea on a smaller scale. The material was also tested in different states and dimensions.
The group also reflected what types of services could be created for the project.

Regarding the issue of awareness, the work group thought about objects, tested different processes with the material and built molds to try to obtain better results.

At the end of the day, each group recorded their work on the miro platform.

Fig. 28 - Cutting EPS

Fig. 29 - Testing the material

Second day:

On the second day, the ideas of the previous day were refined, modeled and prototyped.

For the collection of EPS, a prototype was made to test the idea on a more real scale, taking into account the measurements of the fish boxes. In this way, it was also possible to justify and argue the pertinence of the project.

Regarding the awareness of material recycling, some objects were thought of that could be made with recycled EPS. The material was tested and worked in various ways, with the aim of finding the best process to obtain the products.

Fig. 30 - System to collect EPS

Third day:

On the last day of the Hackathon there was still time for small adjustments to both projects. The projects were described on the miro platform to later be presented to the mentors.

At the end of the morning, presentations were held and each mentor gave their feedback on the projects.

Fig. 31 - Small adjustments

Fig. 32 - Presentations

7. Expectations and results

The third Hackathon, as we've already seen, focused on two more specific themes.
That said, the results were:

GROUP 1:
Group 1 worked on the issue of collecting EPS/XPS. As a solution, the creation of an accessible system at collection points was designed in order to reduce the volume of EPS boxes.

The aim would be for these collection points to be present both on docks or markets to collect fish boxes and also in shopping centers or other commercial surfaces for the purpose of gathering packaging for household appliances or other objects.
These collection points would have a machine with a grid structure that heats and cuts the EPS boxes into smaller pieces, reducing their volume and, therefore, the space that these packages occupy in the big bags that transport the waste back to the recycling companies.

The project would have EPS collection and processing companies as partners.

With this type of collection it is possible to reduce the volume of the boxes, consequently reducing the trips that the collection trucks need to make to transport the material to the company.

It is a more efficient and ecological solution for the collection of EPS.

Fig. 33 - Collection system

Fig. 34 - Reduction the volume of EPS

GROUP 2:

Group 2 worked on the theme of raising awareness for recycling EPS/XPS. The developed project consists in the recreation of toys made from recycled EPS. These objects would be developed with children from 8 to 12 years old at schools, summer camps or workshops.

In order to verify the viability of this idea, the group worked on the creation of a yo-yo and a spinning toy. To build the objects it was necessary to create simple molds made from MDF boards, then heat the material and compress it in the mold, achieving satisfactory results.

Since the purpose would be for the children to recreate the toys themselves, the process would have to be improved in order to make it easier and safer.

With this project, children would realize the benefit of recycling and what they themselves can create, learning with practice and not just theory.

Fig. 35 - Assembling

Fig. 36 - Yo-yo

Fig. 37 - Spinning top

8. Reflection

This third event worked as a way to complete the first Hackathon, as the first hackathon resulted in two services, one intended to make the collection of EPS more effective, and the other focused on raising awareness among children in schools. Therefore, in the 3rd hackathon these services were validated and completed with practical experiments.

In the first case, a more efficient standalone EPS/EPS container was designed, as it can collect more material, and consequently, it is possible to take more material also in the trucks of the recycling companies that collect the material.

In the second case, interesting objects were created for the children, validating the possibility of the workshop, although the process needs some improvements to be safer and easier for children, it was already possible to see that it is possible to reach objects with final results and very interesting finishes.

4th HACKATHON

1. Introduction

The fourth and last Hackathon took place on the 7th, 8th and 9th of June, virtually and in person, in shifts of 4 hours of work with participants working from two different countries.

Once again, the objective was to think of solutions for this challenge, focusing on some contexts, in order to reach tangible results that contribute to solving this EPS/XPS environmental problem.

2. Online / presential-set up

As previously mentioned, this Hackathon took place virtually and in person.

A group from Brazil was virtually present working on the miro platform and interacting with each other and with the rest of the participants via the zoom platform.

And, once again, at Design Factory Aveiro's Open Space, there were two work areas, one for each group, with a computer to access the "miro" platform and connected to zoom to interact with the mentors and with the group that was working virtually.

In the zoom, breakout rooms were created for each group, and situation points and moments of interaction were promoted between all groups in the main zoom room.

The feedback from the mentors happened in breakout rooms with each group, In this way, all groups received advice from all mentors.

3. Keynotes e mentors

Thomas Maes and Elisa Setien, as in past editions of the hackathon, were part of this event as mentors. In addition to them, mentoring was reinforced by Spyros.

Dr. Spyros Bofylatos holds a doctorate in theory of Design from the Department of Products and System Design Engineering of the University of the Aegean. In addition he works with Common Seas to support the transition of the islands of the Aegean in becoming the first plastic-waste free Mediterranean island and a global leader in the fight against plastics in our seas. His research sprawls around design for sustainability, design for the circular economy, craft, service design and social innovation.

4. Participants

In this fourth edition, students from Portugal and Brazil participated.

The group from Brazil included five students from different areas of investigation at the Federal University of Rio de Janeiro . They were a very dynamic and active group of participants despite the fact that they were working from home, and therefore, all interaction was online.

The participants from Portugal were already regular participants in previous hackathons, which made it easier for them to get involved in the proposed tasks, since they were already deeply involved in the problem.

Fig. 38 - Zoom call with Brazil students

5. Canvas - miro and program

For this event, 3 miro boards were created. The first was for participants to confirm their registration by answering three questions. On this board, the links to the other two boards were placed, so that each group could easily enter their team's board.

Fig. 39 - Miro fourth hackathon
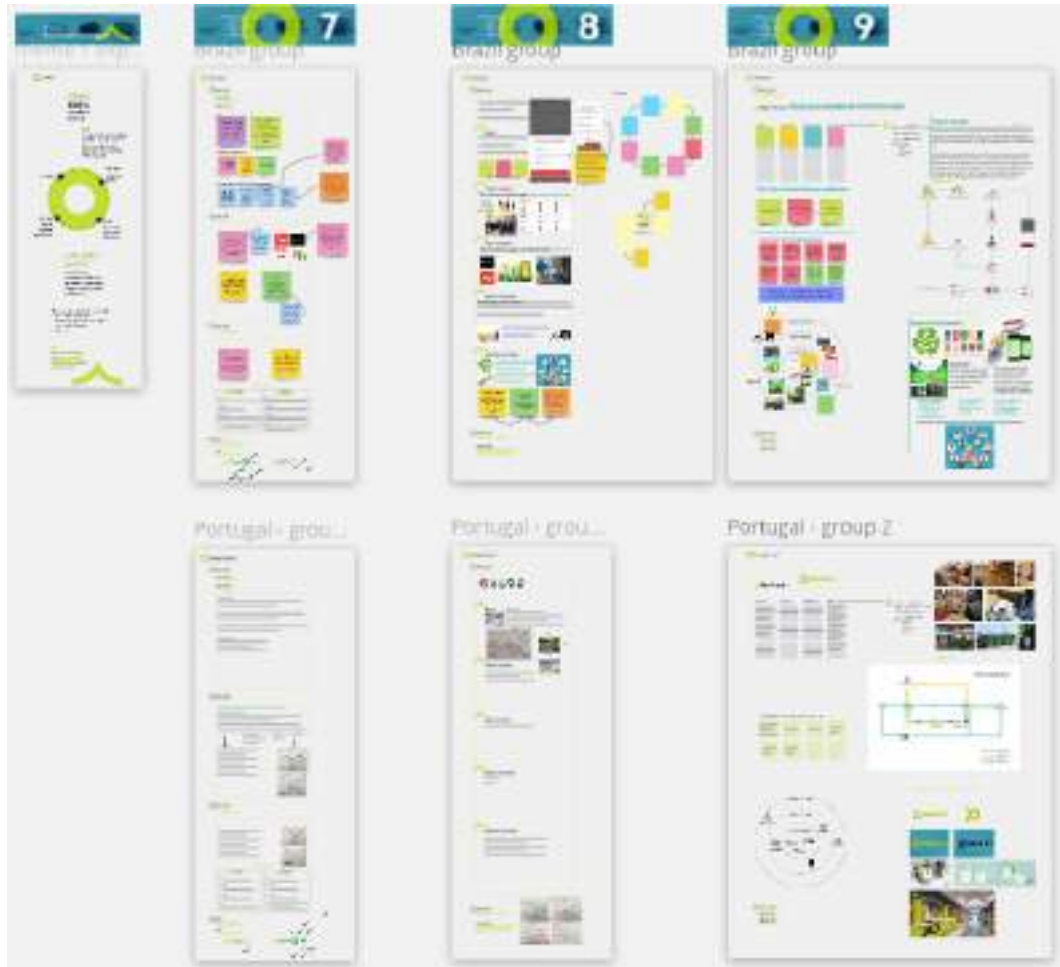
Afterwards, a board was created for each theme. The theme 1 board was worked by group 1 of Portuguese students and the theme 2 board was used by the Brazil group and by group 2 from Portugal.

Inside the boards, there was a frame explaining the briefing, and 3 frames corresponding to each group, one for each day. Thus, the work was more organized and visible for each of the teams.

Frame Brief:
In this frame, the context and the problem to be worked on by the groups was explained, so that everyone was aware of the challenge.

Frame day 7:
The first day was to explore as many possibilities, promoting creativity, but the goal was to focus on an idea to advance in the next few days. For this, the first space was reserved for problem storming, and the second for idea storming. Each of these moments had to be done in 30 minutes. Then, there was a work space to discuss ideas, go deeper and choose the two ideas to pitch present to all participants. For each of these ideas the participants had to answer the questions - what; to whom; with whom; how. For this task they had 1 hour and 50 minutes. Finally, they had to indicate the winning idea voted by the rest of the participants.

Frame day 8:
For this day, a frame was created for the development of the winning idea, with a space to record the process, where there were also indications regarding what guided the process - what; target audience; direct partners; indirect partners; expected outcomes.

Frame day 9:
As usual, the last frame served as a model for presenting the final result to the project's mentors and organizers:identify the project name, followed by the questions - what; to whom; with whom; how. To complete the "how" question, it was suggested the creation of a systems map, in order to be easier to understand how the project worked.
In addition, there was a space to identify the objectives and innovative factors of the project, as well as a pie chart of the possible direct and indirect partners of the project.

6. Description of the event

First day:
The fourth Hackathon began with the opening session once again conducted by Design Factory Director Teresa Franqueira. After that, some instructions were given by Liliana on the work themes for each group. Group 1 from Portugal had the theme of "EPS Tracking" while group 2 from Portugal and the group from Brazil had the theme "Awareness".

That said, the groups started brainstorming problems and then possible solutions. After identifying these solutions, it was time to reflect and analyze which would be the two most viable ones to present to the other groups.

The presentations then took place. Each group presented its two proposals and the other groups voted on the idea they liked the most. At the end of the day, three winning ideas were chosen, one from each group, to be developed in the remaining work sessions.

Fig. 40 - Workstation

Fig. 41 - Brainstorming

Second day:

The second day of work served for each group to reflect better on their own ideia, analyzing all the points and answers to the topics arranged in the miro board. It was necessary to identify what the project was, the target audience, partnerships and expected results. With all this information, each group spoke with the three mentors in order to obtain feedback and clarify doubts regarding the project.

After the conversations with the mentors, each group reflected on their work and lined up the necessary points for the next day of the Hackathon.

Fig. 42 - Experiences with color

Fig. 43 - Meeting with the mentors

Third day:

On the last day of work, the groups refined their proposal, trying to answer some key points. It was also important to mention what the main ideas, objectives and points of innovation would be. The groups also built schematics and drew other elements that helped to illustrate the services proposed.

With all the information displayed in the miro each group presented their proposal to the other groups and mentors. In the end the mentors and Sandra gave their feedback.

After this moment of sharing, the fourth Hackathon was finished.

Fig. 44 - Project development

Fig. 45 - Last adjustments

7. Expectations and results

The fourth Hackathon featured three groups that worked on two different themes. The work during these three days of the event resulted in three services:

GROUP 1 - Portugal:
Group 1 from Portugal decided to solve the problem of traceability of EPS/XPS by adding color to the material used without additives of other chemical substances, for example food packaging. In this way it would be possible to identify and separate the material with additives from the material without additives in the EPS/XPS recycling company, making the process easier and more efficient, and consequently, the number of recycled material would increase.

For this to happen, the government would have to impose this color placement standard depending on the material properties, a standard that already exists for other types of materials. In addition to the government, the packaging and recycling production companies would be direct partners, and the consumer would be an indirect partner, as it is necessary for them to place the material at the collection points to be recycled again, without this the cycle is interrupted.

It was decided to add color to the materials without additives, since if they were white and the others had color, it would only be possible to identify the materials without additives in many years' time, since currently practically all the EPS produced is white in color.
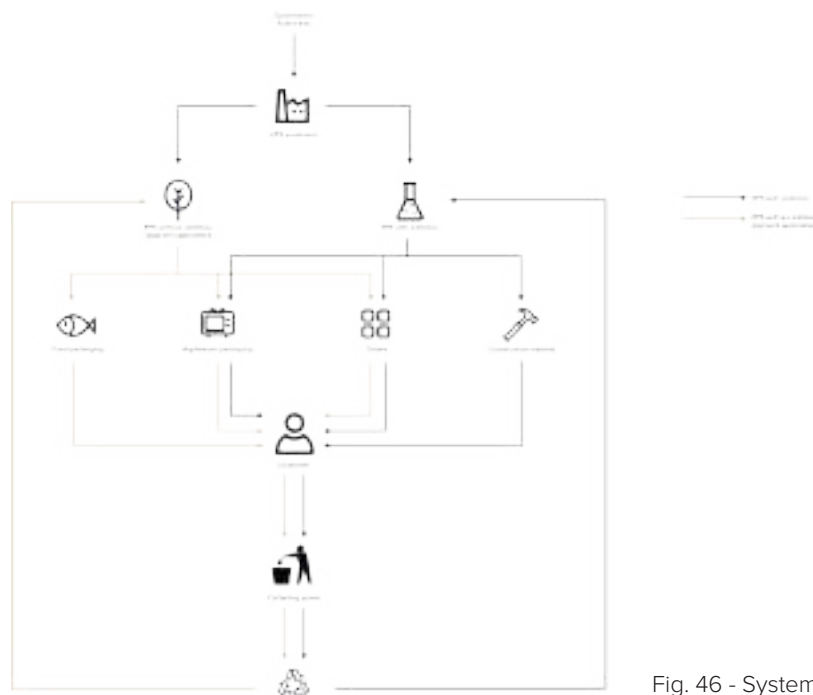

Fig. 46 - System map Group 1 - Portugal

GROUP 2 - Portugal:

Group 2 developed a service called "Peixeco", more focused on the problem of EPS packaging present in fish markets, and was divided into three parts: the creation of containers that would be present in the markets to collect EPS; creating EPS boxes for consumers to transport their fish; a campaign to raise awareness and share the project. This service would have as direct partners the fish markets, the city councils and the companies that manufacture the EPS boxes. Indirect partners would be EPS consumers and recycling companies.

The EPS boxes would be purchased by consumers so that they can have the best packaged fish without using plastic bags, which is the current option. In this way the packages would be reused and when they're damaged the consumer replaces them with the fish sellers in the market.

This project promotes a circular economy, a change in consumer behavior, increasing the amount of recycled EPS, and also the creation of an "eco-friendly" identity that attracts new consumers and tourists.
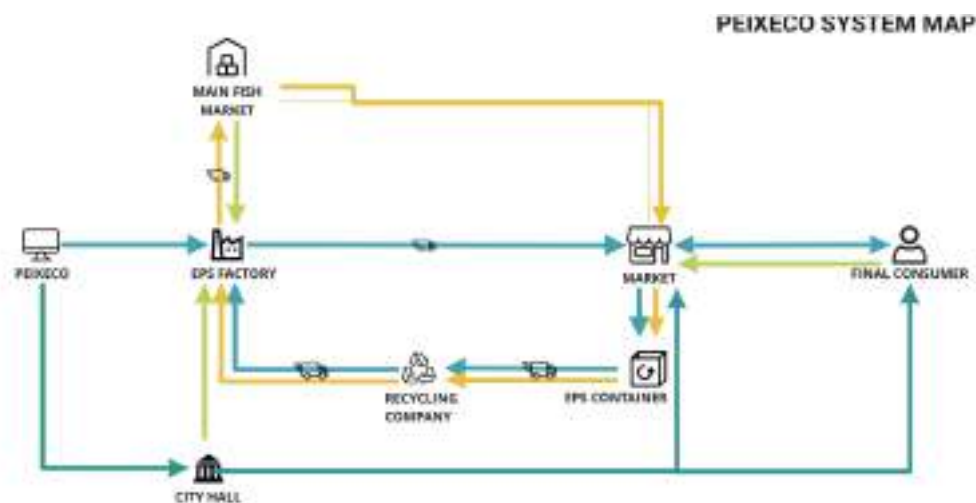

Fig. 47 - System map Group 2 - Portugal

GROUP 2 - Brazil:

The group from Brazil presented the project "Return your packages by Food Delivery App!" which consists of a partnership between food delivery applications, the deliverer and the company that collects and recycles garbage.

Firstly, the user indicates that already has an amount of EPS/XPS to be returned. After that, the app platform will verify if the delivery man has space to transport the material. The client will package his amount of EPS/XPS and the delivery man will tag the package with a pre-printed code tag.

The EPS/XPS collected will be sent off to the next restaurant where the delivery man will pick up a new order. The food shop will check if the material was correctly cleaned, sorting the EPS from the XPS, organize the storage of the packs to optimize their own space, and then send to recycling cooperatives. To finish the process, they will evaluate the customers, rewarding or punishing them by a score system.
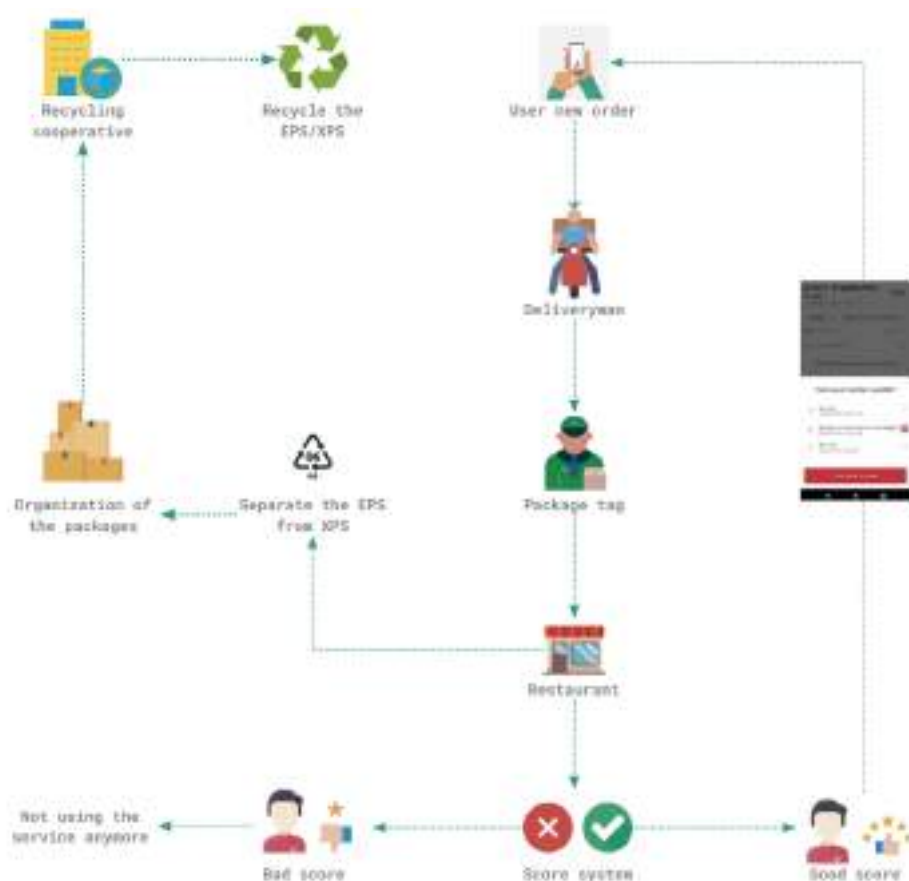

Fig. 48 - System map Group 2 - Brazil

8. Reflection

All projects of the 4th hackathon have potential and are very interesting within the context they are inserted. The projects could be quite simple to implement once guidelines are created for it, and will have noticeable results in the short term.

3. General results

Following all the events with very fruitful results and project proposals, 5 prototypes were selected and are attached to this report (Attachment B. Prototypes) considering the participants' collaborative work in the miro documents. Each prototype includes a description and a thorough process development. They received very good feedback from the mentors and coordinators of the events, also demonstrating their value and possible outcomes after implementation.

4. Final considerations

The events proved to have potential to promote real change and to foster innovative products and services towards change in the impact of foamed polystyrene. Involving students from various fields of knowledge was very important for the overall results since each one brought valuable inputs. Having a more lengthy event, or making several editions over a period of time, allowed the validation of ideas and projects and also the practical experiments towards the final proposals. Developing digital boards where the participants' work could be registered proved useful to share in future events and to gather information on the various projects.

The digital platform for the involvement of stakeholders was crucial for disseminating the event, but also to become a repository of the results and working as a starting point for the stakeholders with interest in the specific questions addressed in the challenges.

We also consider that Design Factory Aveiro conditions for rapid prototyping and support contributed to the excellent results obtained by the participants. The Precious Plastics machines available made it possible to rapidly experiment with various approaches to processing and testing styrofoam.

We would recommend future events gathering more specialists/ experts and also companies that can provide more specific challenges within the context they are inserted.

ATTACHMENTS

Attachment A. Brand

For this project, and in order to promote the events in a solid and consistent way, an identity was developed.

The brand was inspired by the oceans, the color and shape of the waves, and the simplicity and geometry of the composition was valued.

Fig. 49 - Logo of the first edition

From the second event, with the change of the graphic designer, there was also a search for a new identity that could be worked on and evolved over the three events that were yet to be held.

That said, a more versatile, simple and modern solution emerged from the logo used in the first edition of the event. In this way, the lettering and the same text layout were kept and the form was simplified, seeking to convey more with less. The shape of the wave accompanied by the "O" reminds us of the presence of the sea/ocean.

With this proposal, it is possible to identify the various editions of the event, adding a wave according to the number of the Hackathon. The ocean was built as the Hackathons were carried out, always maintaining the simplicity of the logo, the versatility and above all the coherence and evolution during the communication of events.

It was also possible to explore the elements that constitute the logo, in order to form the graphic image, creating dynamism in the communication of the event.

Fig. 50 - Logo evolution from the second to the fourth hackathon

Attachment B. Prototypes
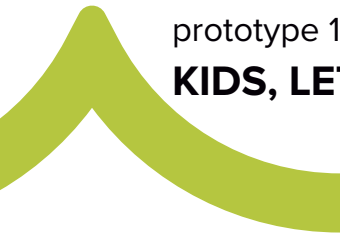
prototype 1

KIDS, LET'S RECYCLE OUR WASTED EPS!

SELECTED IDEAS . OBJECTIVES . INNOVATIVE FACTOR

WHAT?	WHY?	TO WHOM?	WITH WHOM?			
Educational awareness	To give a new live to EPS	Children and teenagers ages 6-18	Schools	Minimize EPS/XPS impact	Change mentalities and behaviours	Age appropriate workshops
Educational sensibilization	Various objects can be made with recycled EPS	Children and their families	Holiday Camps	Contests in/between schools	Transform EPS waste in new forms	Pratical activities instead of theorical presentations
Creation of objects with EPS recycled material			Recycling Companies	Schools become strategic wasted EPS Pick-up points for companies	Promote creativity and ability to make new things	Learn by doing

HOW?

1

Campaign to collect domestic EPS waste

2

Workshops

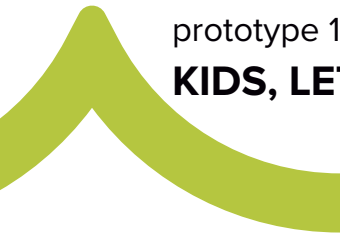Age 6-10: biodegradation - mealworms farm in school

Age 10-15: mechanical processes (thermal and compression molding)

Age 15-18: chemical and mechanical processes

It´s necessary to improve the tools to create the objects... same process, same methodology, but in a safe and easy way to children

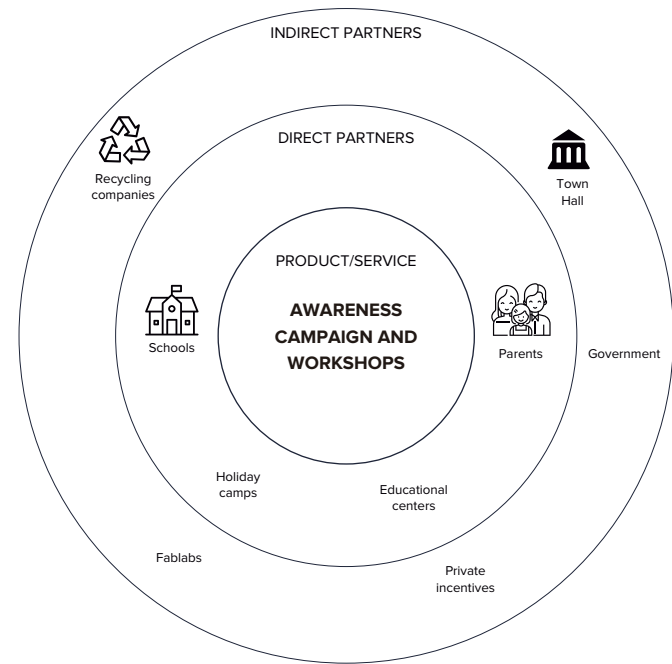# KIDS, LET'S RECYCLE OUR WASTED EPS!

EXPERIENCES WITH DIFFERENT PROCESSES .
TOYS

PARTNERS

prototype 2
EPS/XPS COLLECTION

WHAT?

Changing mindset regarding the ability to recycle and transform EPS/XPS

Implementation of a circular economy through the change of behaviors

An acessible system to reduce the volume of EPS boxes at collecting points

WHY?

EPS is 100% recyclable, so why not recycle all of it?

EPS material takes up a lot of space and more or less 95% is air

The EPS packaging collection truck is filled with little material

Fig.1 - Images collected at Bewi, EPS recycling company. Big bags filled with EPS packaging waste from portuguese fish docks

TO WHOM?

- Fish docks
- Food markets

- Shopping centers
- Other commercial spaces

WITH WHOM?

EPS collecting and processing companies

SELECTED IDEAS . OBJECTIVES . INNOVATIVE FACTOR

Educate people to help recycling EPS/XPS

Tackle the lack communication related to the ability to recicle EPS/XPS

A cheaper and more sustainable solution to collect EPS

Reduce de volume of EPS boxes at collection points

Reduce the number of trips the collecting trucks make

HOW?

1 _____

A communication model to encourage people to recycle EPS/XPS

2 _____

Product - EPS container that reduce the volume of the EPS boxes

Reduce the volume and therefore the space they occupy in the big bags used to transport the waste back to the companies

prototype 3
RETURN YOUR PACKAGES BY FOOD DELIVERY APP!

SELECTED IDEAS .
OBJECTIVES .
INNOVATIVE FACTOR

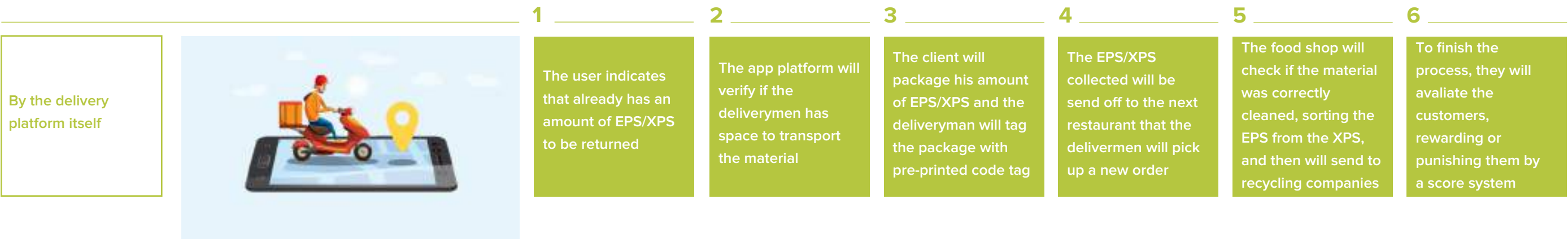| WHAT?	WHY?		TO WHOM?	WITH WHOM?			
Partnership between food delivery app, deliverymen and waste picker or recycling cooperatives	In Brazil, iFood already works with EPS packaging	*ifood*	To the users of these apps	Food delivery apps and deliverymen	The separation of the EPS and XPS will be provided by the food shop	Packages will be sorted by types so they can be stored efficiently	Develop a reverse logistics concept, involving all actors in the EPS/XPS consumption chain
	EPS/XPS recycling logistics is difficult and expensive	*Rappi*		Food shops	The maximum volume that each app user can return at one time is the equivalent of a 5 L	The food shop will check if the customer did the cleaning correctly	Avoid disposing of waste that will possibly end up in aquatic environments
	To make use of the existing structure to enable the reverse logistics of post-consumer EPS packaging	*Uber Eats*		Consumers	In a second moment, the application can ask companies to standardize their packaging, in order to facilitate their storage	Awareness campaigns among users demonstrating the benefits of recycling EPS/XPS	Mutual accountability between food application company and customers

HOW?

By the delivery platform itself		1	2	3	4	5	6
		The user indicates that already has an amount of EPS/XPS to be returned	The app platform will verify if the deliverymen has space to transport the material	The client will package his amount of EPS/XPS and the deliveryman will tag the package with pre-printed code tag	The EPS/XPS collected will be send off to the next restaurant that the delivermen will pick up a new order	The food shop will check if the material was correctly cleaned, sorting the EPS from the XPS, and then will send to recycling companies	To finish the process, they will avaliate the customers, rewarding or punishing them by a score system

RETURN YOUR PACKAGES BY FOOD DELIVERY APP!

SYSTEM MAP

Recycling cooperative

Recycle the EPS/XPS

User new order

Deliveryman

Organization of the packages

Separate the EPS from XPS

Package tag

Restaurant

Not using the service anymore

Bad score

Score system

Good score

PARTNERS

INDIRECT PARTNERS

DIRECT PARTNERS

PRODUCT/SERVICE

COLLECTION OF EPS/XPS USING THE EXISTING LOGISTICS OS FOOD DELIVERY SERVICES

Recycling companies

Deliverymen

Restaurants

Food delivery Apps

Consumer

prototype 4
PEIXECO

WHAT?

WHY?

TO WHOM?

WITH WHOM?

Service of awareness

The recycling of fish packaging in Portuguese markets is not done

Fig.1 - images collected at the Costa Nova market in Aveiro
A- containers outside the market, where the boxes are placed;

Consumers

EPS Factories

Eco-friendly identity to attract new consumers and tourists

EPS Boxes exchange

Promotion of good practices of EPS recycling in fish markets
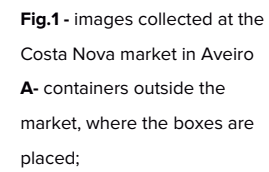
Consumers transport fish to their homes using disposable plastic bags

B- plastic bags to transport the fish

Fish markets

Recycling Companies

Increase the quantity of recycled EPS

Modular stackable EPS Box

Implementation of a circular economy through the change of behaviors
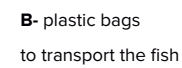
Lack of information and concerns related to sustainability and recycling

C- EPS fish packaging that in our days it is not recycled

City Halls

Circular economy

New mindset in local markets

HOW?

1

creation of containers in markets to collect only EPS waste

2

creation of EPS boxes for consumers to transport their fish

3

awareness campaign and project sharing - making markets eco-friendly

let´s give another life to EPS boxes

100% recyclabe

peixeco

SYSTEM MAP

MAIN FISH
MARKET

PEIXECO

EPS FACTORY

MARKET

FINAL CONSUMER

RECYCLING
COMPANY

EPS CONTAINER

CITY HALL

PEIXECO BOX FLOW

MARKET BOX FLOW

FUND FLOW

CAMPAIGN FLOW

PARTNERS

INDIRECT PARTNERS

DIRECT PARTNERS

PRODUCT/SERVICE

PEIXECO

Recycling
companies

Fish
Markets

EPS Boxes
Factories

Consumer

City
Council

prototype 5
EPS TRACKING CIRCULAR ECONOMY MODEL

WHAT?

Visual identification code of EPS products to distinguish their origin and purpose

Track the origin of EPS residues

WHY?

The production of EPS/XPS for different areas implies the addition or non-addition of chemical elements

The EPS/XPS is a 100% recycable material, but is necessary to be consciously recycled

Eliminate the risk of chemical contamination

Currently, it is impossible to distinguish the origin of the material

The separation is done manually

TO WHOM?

Recycling companies

WITH WHOM?

EPS producers

SELECTED IDEAS . OBJECTIVES . INNOVATIVE FACTOR

Colour code

Easier to separate EPS without chemical elements

Higher amount of recycled EPS/XPS

HOW?

Give a meaning to the material colour

Visual ID

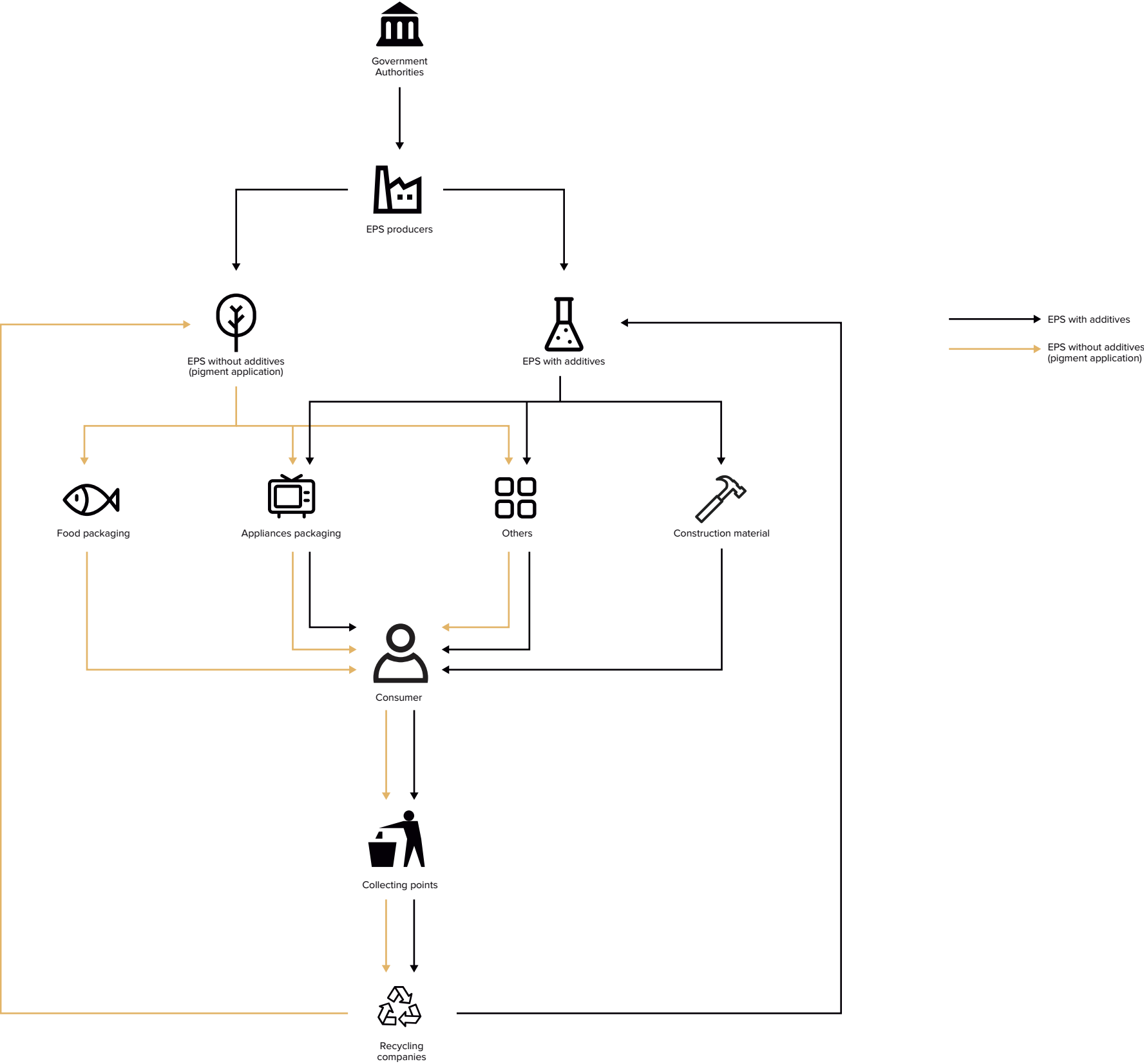For example, all EPS products with alimentation purposes are yellow

EPS TRACKING CIRCULAR ECONOMY MODEL

SYSTEM MAP

Government
Authorities

EPS producers

EPS without additives
(pigment application)

EPS with additives

EPS with additives

EPS without additives
(pigment application)

Food packaging

Appliances packaging

Others

Construction material

Consumer

Collecting points

Recycling
companies

PARTNERS

INDIRECT PARTNERS

DIRECT PARTNERS

PRODUCT/SERVICE

EPS TRACKING

Government
Authorities

EPS producers

food packaging

Recycling
companies

appliances packaging

construction material

Consumer