Advancing the circular bioeconomy in Regione Lazio

Co-creating improvement proposals in the Biowaste Club of the region through the analysis of HOOP Trainers' challenges

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This document is the result of a participatory research using citizen science and co-creation methodologies to identify strategies for optimising the separate collection of the organic and non-organic fraction of waste in Regione Lazio.

The research goal consisted in the co-creation of improvement proposals based on the challenges identified in the HOOP Trainers game, a gamified citizen science tool with pedagogical purposes. The collected data allowed us to gain valuable insights into the neighborhood's perception of biowaste separation, the acceptance of products derived from it, and collect opinions to develop a greener and more circular city. During two co-creation workshops, participants reflected on the Hoop Trainers challenges and provided recommendations to enhance citizens' motivation to recycle, overcome barriers that hinder proper waste separation, and identify potential strategies for HoReCa sector professionals to effectively separate the cooked and uncooked organic waste fractions.

This research has been conducted within the framework of the European project HOOP. It has been possible thanks to 296 HOOP Trainers users and the active participation, motivation and enthusiasm of 68 secondary students from the Istituto Comprensivo IC Campagnano in the Municipality of Campagnano and the Caravaggio Artistic Institute in Municipio I of Roma Capitale, who have been involved in the conversion of the challenges identified in HOOP Trainers into recommendations.

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Images: Captured during Biowaste Clubs events.

Contents

1. Introduction

HOOP project: Vitalising Europe's Urban Bioeconomy

Did you know that, on average, Europeans generate approximately 200 kg of organic waste per year, and a staggering 75% of this waste is either landfilled or incinerated? This alarming statistic highlights the urgent need for action. In response to this pressing issue, the HOOP project is actively supporting 8 European lighthouse (LH) cities and regions in implementing circular bioeconomy solutions to produce innovative and sustainable bio-based products from urban biowaste and wastewater. One crucial aspect of this endeavour involves the creation of Biowaste Clubs (BC), which serve as **collaborative spaces where stakeholders regularly exchange ideas and foster a shared vision for enhancing circularity within their cities**.

To facilitate these exchanges, Science for Change implemented in 2023 a citizen science program utilizing the gamified App HOOP Trainers, which was adapted to 6 HOOP lighthouse context and needs: Kuopio (Finland), Lazio Region (Italy), Münster (Germany), Murcia (Spain), Porto (Portugal) and Western Macedonia (Greece). **The program's objective was to collaboratively design a highly efficient selective collection system, with a particular emphasis on the Organic Fraction of Municipal Solid Waste (OFMSW), while also actively engaging and raising awareness among citizens in HOOP lighthouses**. The data collected through the App has played a significant role in discussions within the Biowaste Clubs, contributing to the formulation of the co-created recommendations that you'll see below. By analyzing users' decisions during HOOP Trainers missions, a deeper understanding of citizens' perspectives on biowaste separation, acceptance of products derived from biowaste, and their proposals for building a greener and more circular region has been attained.

HOOP Trainers: Shaping the circular bioeconomy through citizens science and co-creation

In order to create customized versions of HOOP Trainers for each lighthouse, collaborative co-design sessions were conducted with representatives from each city/region. In Regione Lazio, the co-design sessions were arranged with ANCI LAZIO (which represents the Lighthouse city of Albano-Laziale within the HOOP project). The aim was to align their local circular bioeconomy challenges with the potential of citizen science. These sessions proved valuable in identifying waste selection challenges, determining the necessary data to address them, and devising strategies to involve citizens in the data collection and analysis processes.

While each lighthouse has its own adapted version of the game, they all share a common objective: **training an avatar called Dubbiopp to transform organic waste into useful bioproducts by completing three missions. As Dubbiopp learns the art of giving waste a new purpose, it evolves into Virtuopp, a creature capable of constructing a more sustainable city.**

Dubbiopp symbolizes a city that adheres to a linear production and consumption model, where raw materials are extracted to manufacture new products for consumption, only to be disposed of through landfill or incineration once they are no longer useful. Virtuopp represents a green and circular city that reduces, recycles, reuses, repairs, and recovers the waste it generates. By doing so, the city breathes new life into its waste, finding diverse ways to reuse it, while minimizing waste-related pollution and emissions, and easing the strain on natural resources.

Dubbiopp Virtuopp

HOOP Training missions in Regione Lazio

MISSION 1: Correct waste sorting

Dubiopp lacks the knowledge to properly separate waste and needs assistance in depositing items into the appropriate bins. Users are tasked with training Dubiopp to effectively sort the following **types of rubbish**:

MISSION 2: Uncover the situation in Regione Lazio

More details of the questions asked in this mission are shown in the next page.

To advance Dubbiopp's transformation, more individuals must sort their waste effectively. Thus, in Mission 2, users must actively initiate conversations with their neighbours, exchanging experiences and insights that can aid Dubbiopp in comprehending the most effective measures to promote recycling in Regione Lazio. Of particular emphasis is the sorting of organic waste fractions.

The questions primarily revolve around the **factors that motivate and hinder waste sorting**, as well as **identifying potential strategies for HoReCa sector professionals to effectively separate the cooked and uncooked organic waste fractions**. Additionally, users are encouraged to **provide their suggestions for prioritizing actions that they believe an entrepreneur should undertake to optimize waste selection**.

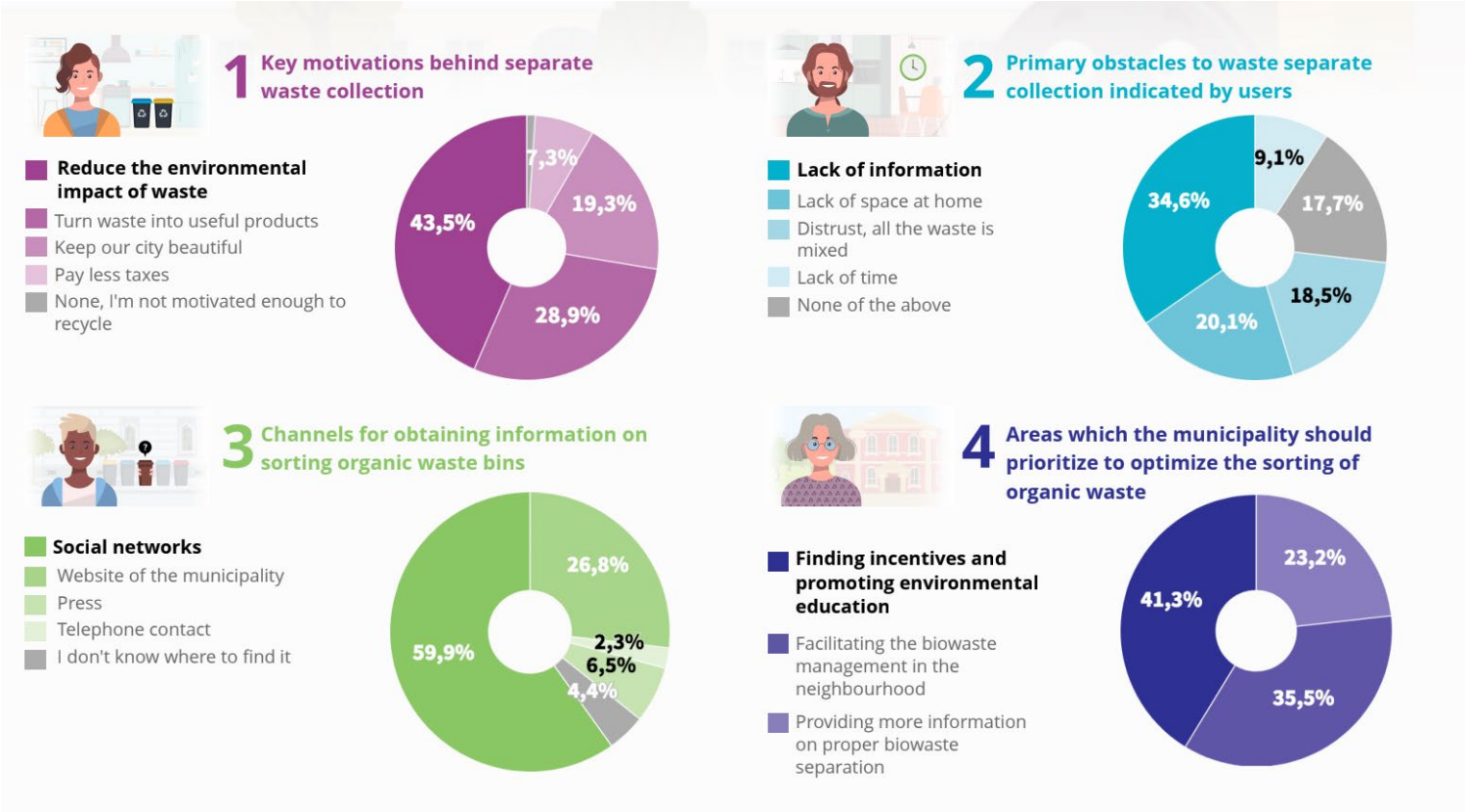
MISSION 3: Create a Bioproduct

Building upon the success of the previous two missions, users are enthusiastically invited to assist Dubiopp in choosing and creating one of the following types of bioproducts from the abundant resources at hand:

- Fertilisers
- Nutrients
- Bioplastics
- Green chemicals products

Specific questions and corresponding answers from Mission 2

Bellown are shown the Mission 2 questions addressed to HOOP Trainers players regarding domestic waste separation, which came from the co-design session done with Regione Lazio:



Summary of the quantitative outcomes obtained in each training mission

In Regione Lazio, 296 HOOP Trainers users played the game. **Women comprised the majority of users, constituting almost 61% of the participants**, while men accounted for nearly 24%. The number of non-binary participants and individuals who chose not to provide their gender was insufficient to draw any statistically significant conclusions. In terms of age distribution, **nearly 82% of participants were between 14-19 years old**, followed by just about 7% in the 20-39 age group, and almost a 5% in the 40-59 age group. There were also a few users over 60 years old.

During **Mission 1**, the waste items that caused the most **uncertainty** among participants were **greasy pizza boxes, tickets, ceramics and broken toys** (nearly 37% of users made errors). In contrast, the waste items that generated fewer doubts among users were carton boxes (approximately 4% of users made mistakes) and fish bones (nearly 10% of users made mistakes).

In **Mission 2**, users expressed primary **motivations** for separate waste collection, including **reducing the environmental impact of waste** (nearly 46%), **transforming waste into bioproducts** (around 22%), and **maintaining city aesthetics** (approximately 15%). The possibility to pay fewer taxes was the main motivation for almost 14% of participants. The most significant differences between genders were observed in the area of taxes, 20% of males identified it as their primary motivation, whereas only 10% of females did the same. **Key obstacles** reported were **limited space at home** (nearly 25%), **distrust** (around 21%), and **lack of time** (nearly 15%). Lack of incentives was not a significant obstacle (around 10%), while the option "Others" accounted for almost 29% of responses, reflecting additional obstacles identified during the Biowaste Club meetings held in Rome. The key obstacles varied slightly between females and males, particularly concerning the lack of incentives and the option "others". Notably, the lack of incentives appears to be a more significant challenge for males, with almost 23% citing it as their primary obstacle, while approximately nearly 5% of females reported the same. On the other hand, the option "others" seems to be a more prevalent concern for females, as nearly 33% of them mentioned it as a main issue compared to around 23% of males. In terms of **identifying potential strategies for HoReCa sector professionals to effectively separate the cooked and uncooked organic waste fractions**, the most voted option appears to be introducing a **new municipal service with double collection of wet waste**, which garnered close to 33% of the votes. Following that, approximately 25% of users favored recycling organic waste using a **compost bin**, and around 21% suggested choosing suppliers who help professionals reduce waste and dry waste. Interestingly, compost bins seem to be a more appealing option for males than females, with approximately 31% of males selecting it as their primary choice, compared to nearly 24% of females. Conversely, around 25% of females preferred choosing suppliers who help professionals reduce waste and dry waste as their first option, while only 12,5% of males did the same.

When users were asked about the **areas that an entrepreneur should prioritize to optimize the sorting of organic waste**, the responses were fairly distributed. The top priorities identified were as follows: **Organize school activities to provide information** (around 36.5%); **promote environmental education for the recovery of raw materials across a wide range of age groups** (nearly 35%) and design information campaigns to improve staff collection in catering (approximately 28,5% of the responses). Notably, promoting environmental education for the recovery of raw materials was selected as the main action by nearly 37,5% of males, whereas approximately 27% of females chose the same option. The specific types of activities were identified during the Biowaste Club meetings.

In **Mission 3**, 32% of users chose to create **fertilizers** or **nutrients**, followed by bioplastics (23%) and green chemical products (13%). A few slight differences can be detected between the bioproducts preferred by females and males, particularly concerning fertilizers. This option was chosen as the primary choice by 37,5% of males, compared to almost 30% of females.

The detailed HOOP Trainers outcomes can be shown in the document *HOOP Trainers App game implemented in Regione Lazio: Study results*.

The data collected from the HOOP Trainers in Regione Lazio is a sample that provides a confidence level of 90% with a 5% error, ensuring valuable insights. However, it is essential to be mindful of its limitations when interpreting the findings. Additionally, we must acknowledge the possible presence of common biases, such as sampling bias and social desirability bias (the tendency to answer questions in a manner that will be viewed favourably by others), which could have influenced the outcomes obtained. By recognizing and addressing these biases, we can attain a more comprehensive and nuanced understanding of the data and its constraints. Given that the main objectives of this initiative were the engagement and participation of citizens, the method for sampling and obtaining data was not probabilistic but strategic, and therefore the representativity of the sample over the whole population in Regione Lazio is not assured completely (e.g., the overrepresentation of some age groups). All these factors were thoroughly considered during the Biowaste Club events, which presented a valuable opportunity to integrate the opinions of 296 HOOP Trainers digital users with those 68 students from Regione Lazio. The discussions delved into the entirety of the items that appeared in Mission 2 of the game, ensuring a comprehensive analysis beyond just the most voted options.

Biowaste Club meetings to transform HOOP Trainers outcomes into improvement proposals

On the 13th of April of 2023, the **HOOP Trainers Mission 2** challenges were discussed in two Italian Biowaste Clubs events carried out in the Riscarti Festival of Rome. During both events, 68 secondary students from the Istituto Comprensivo IC Campagnano in the Municipality of Campagnano and the Caravaggio Artistic Institute in Municipio I of Roma Capitale **collaboratively transformed the HOOP Trainers challenges into improvement proposals for optimising waste sorting management in the region**[1].

The discussions of both Biowaste Clubs meetings, focused on the **first three questions of Mission 2, delved into the factors motivating and hindering waste sorting, as well as the areas that an entrepreneur should prioritize to optimize the sorting of organic waste**.

The following synthesis presents the final recommendations co-produced by the participants. These proposals have been drafted based on the recommendations submitted during the co-creation sessions. The proposals are categorized according to the challenges identified in HOOP Trainers and are listed in order of priority based on user feedback from the game.

[1] *Mar Escarrabill and Blanca Guasch conceptualized the sessions. The methodological design of the co-creation sessions was carried out by Blanca Guasch under the Torres Quevedo grant for contracts PTQ2020-011264, financed by the Ministerio de Ciencia e Innovación: MCIN/AEI/10.13039/501100011033 and by the European Union NextGenerationEU/PRTR. Julia de la Cruz and Francisca Fuenzalida designed the materials used in the sessions.*

2.1. Enhancing organic and non-organic waste separation in Regione Lazio: Motivations and Recommendations

How to read these recommendations

In the following pages, you will discover the recommendations put forth by the Biowaste Club participants in response to the challenges identified by the HOOP Trainers players. The outcomes will be distributed as follows:

HOOP

2.1. Enhancing organic and non-organic waste separation in Regione Lazio:
Motivations and Recommendations

Topic posed to HOOP Trainers players to collect their perceptions, analyzed by the Biowaste Club participants

Reduce the environmental impact of waste

One of the **potential responses** that players could choose from for the posed topic

*It is the main motivation for **46,03%** of HOOP Trainers players.*

Percentage of players who chose that particular answer

students

Profile of the Biowaste Club participants

Prioritize reuse over recycling to minimize waste and conserve resources effectively.

Consciously **reduce consumption** to lessen our environmental impact.

Choose local and seasonal food options while avoiding fast food to promote environmental preservation and minimize waste generation.

Advocate for the **manufacturing of biodegradable products**, contributing to a more sustainable and eco-friendly approach.

Recommendations proposed by the Biowaste Club participants

Reduce the environmental impact of waste

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Consciously **reduce consumption** to lessen our environmental impact.

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Advocate for the **manufacturing of biodegradable products**, contributing to a more sustainable and eco-friendly approach.

Transform waste into useful products

*It is the main motivation for **22,22%** of HOOP Trainers players.*

Repurpose plastic bottles.

Consider **purchasing second-hand items**.

Transform trash into art pieces or everyday objects like shoe racks, allowing us to repurpose items for different uses and reduce waste effectively.

Ensure proper waste sorting.

Keep out city beautiful

*It is the main motivation for **15,34%** of HOOP Trainers players.*

Choose **public transport** or walking as your preferred modes of transportation.

Educate young children about recycling practices.

Pay less waste taxes

*It is the main motivation for **13,75%** of HOOP Trainers players.*

Students did not delve into this aspect.

None, I am not motivated enough to recycle

*It represents the response of only **2,64%** of the HOOP Trainers players.*

Create **campaigns targeted at unmotivated individuals**, emphasizing how their actions can contribute to creating a better world to live in.

Incorporating **environmental education into the school curriculum** could effectively address the issue of lack of motivation.

[2] *Detailed in the section "Enhancing organic and non-organic waste separation in Murcia: Barriers and Recommendations".*

2.2. Enhancing organic and non-organic waste separation in Western Macedonia: Barriers and Recommendations

Others

*It is the main barrier for **28,57%** of HOOP Trainers players.*

Students did not delve into this aspect.

Lack of space at home

It is the main barrier for ***24,87%*** *of HOOP Trainers players.*

Install additional **bins near the busiest blocks** for convenient waste disposal.

Highlight how recycling positively impacts environmental conservation and promotes **animal well-being**.

Compact plastic bottles by folding them to reduce their spatial footprint efficiently.

Implement labeled buckets at home, such as “paper” and “plastic,” for effective waste classification.

Offer comprehensible tips about waste sorting techniques and practices that can be easily done at home.

Distrust, all the waste gets mixed

It is the main barrier for ***21,16%*** *of HOOP Trainers players.*

Enhance efficiency and trust by implementing **mechanized waste sorting systems equipped with robotic arms**.

Offer **easily understandable and visually engaging information** to address specific doubts of citizens, such as *How does the sorting process work?* and *Why is it needed and useful?*.

Lack of time

*It is the main barrier for **14,81%** of HOOP Trainers players.*

Establish waste separation as a **habitual practice by integrating it into your daily routine**.

Effortlessly **organize your schedule** and **allocate specific time slots** for efficiently sorting waste tasks.

Lack of incentives

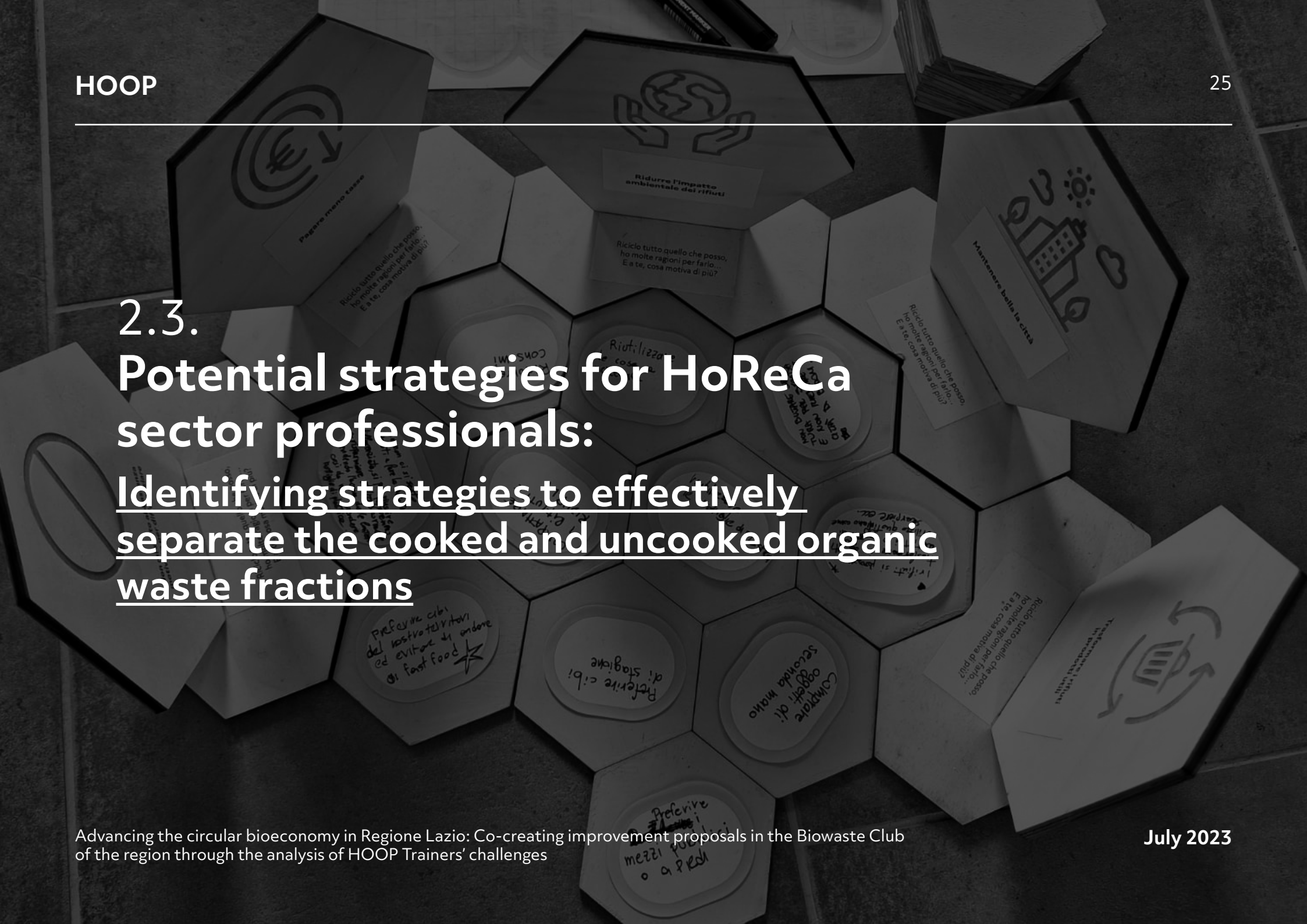
*It is the main barrier for **10,58%** of HOOP Trainers players.*

Introduce a **monetary system that incentivizes individuals** based on the amount of rubbish they recycle.

Apply **increased fines** as a deterrent to discourage indifference towards environmental issues.

Promote pro-environmental actions without relying solely on rewards.

Advocate for augmented **government funding to support environmental initiatives**.



2.3. Potential strategies for HoReCa sector professionals:

Identifying strategies to effectively separate the cooked and uncooked organic waste fractions

New municipal service with double collection of wet waste

*It represents the response of **32,8%** of HOOP Trainers players.*

Collect pre- and post-cooking waste separately from restaurants, apartment blocks, supermarkets, and hotels on designated days.

Innovate by using leftover fruit and vegetable peels to **create new dishes**, effectively minimizing food waste.

Consider implementing a **two-bucket system**, with one designated for pre-cooking food waste and the other for post-cooking food waste.

Design **specific transportation systems** to manage post-cooking food waste and store pre-cooking food waste in the designated wet waste bucket.

Prevent food waste by avoiding cooking excessive amounts of food.

Recycling organic waste using a compost bin

*It represents the response of **25,4%** of HOOP Trainers players.*

An ideal solution would entail **environmentally friendly replanting of organic residues** that pose no harm to the ecosystem.

Storing leftovers of organic compounds from a meal for consumption the following day, if feasible, can be beneficial.

Introduce **innovative solutions** to encourage **reduced consumption** and waste minimization.

Choosing suppliers who help professionals reduce waste and dry waste

*It represents the response of **21,16%** of HOOP Trainers players.*

Students emphasized the role of consumers over suppliers:

Practice **portion control when serving food** to minimize leftovers and subsequent waste.

Seek access to **comprehensive information** regarding waste reduction strategies and best practices.

Others

*It represents the response of **12,17%** of HOOP Trainers players.*

Repurpose post-cooked food waste by using it as a **natural fertilizer for indoor or outdoor plants**.

Use designated and **appropriate buckets** for efficient sorting and storage of different types of waste.

Using a continuous bag system for separate collection

*It represents the response of **8,46%** of HOOP Trainers players.*

Employ designated and durable material bags at home to ensure efficient sorting and storage of different types of waste.

Efficiently sort post-cooked food waste and repurpose it by using it as a **natural fertilizer** for indoor or outdoor plants.


Vitalise Europe's
The HOOP project supports 8 lighthouse cities and regions in developing large-scale urban circular bioeconomy initiatives that
from urban bi
and wastewater.
hoop

4. Next steps

Next steps

The HOOP project is actively supporting 8 European lighthouse (LH) cities and regions in implementing circular bioeconomy solutions to produce innovative and sustainable bio-based products from urban biowaste and wastewater. The participation of citizens in advancing to circularity is crucial to its success. HOOP Trainers program's objective - aligned with the HOOP Biowaste Clubs - has been to collaboratively design a highly efficient selective collection system, with a particular emphasis on the Organic Fraction of Municipal Solid Waste (OFMSW), while also actively engaging and raising awareness among citizens in HOOP lighthouses. The discussion of the data collected through the App have contributed to the formulation of the co-created recommendations shown in this document. **These recommendations will enhance the HOOP circular innovations applied in Regione Lazio and future region interventions aligning them with social needs.**