



CODEZERO DELIVERY AND RETURN SOLUTIONS – V1

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List of abbreviations and acronyms

Acronym	Meaning
HMW	How might we
TNO	TNO
TOI	Transportøkonomisk Institutt
TRT	TRT Trasporti e Territorio Srl
VUB	Vrije Universiteit Brussel
WP	Work package
LSP	Logistics Service Providers
PUDO	Pick Up / Drop Off

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Abstract

The project CodeZERO aims at testing new sustainable solutions for the last mile in e-commerce. A co-design approach is at the core of the development of these solutions where stakeholders are engaged through a series of three workshops. That approach was developed and presented in Deliverable 4.1. This deliverable reports on the application of this approach in Antwerp, Milan, Oslo and Utrecht.

The workshops resulted in different solutions. In Antwerp, the parcel lockers of bpost will be further expanded and online shoppers will be encouraged to further use the infrastructure when choosing their delivery method. In Oslo, mobile pick-up points will be tested by Ikea for goods of up to 30kg in weight. In Milan, the focus is on improving consignments in the city centre by testing new delivery models by cargobike and increasing the visibility of these solutions to citizens. In Utrecht, goods ordered from the city centre will be delivered to a micro hub in the city centre, from which the last mile will be done by cargo bikes. These solutions will be tested in WP5 and evaluated with the stakeholders in a second version of this deliverable to be published in December 2026.

Beyond the innovative outputs generated by these workshops, lessons learned from the co-design process are emphasised by reflecting on each workshop experience. The feedback of the participants showed indeed how the approach supported the team to build trust and mutual understanding thanks to an inclusive participation and equal contribution. Hence, the process allowed more creativity and confidence in the development of the solutions.

This deliverable is to be approved by the European Commission

Executive summary

This deliverable reports on the second task of CodeZERO WP4 which aims at running the co-design approach described in Deliverable 4.1 to identify new sustainable solutions for the last mile in e-commerce. It describes the output of the co-design workshops organized in Oslo, Utrecht, Antwerp and Milan. As this deliverable is the first version, it describes the results of the two first workshops. A final version of this deliverable will be published by the end of December 2026 after the completion of the piloting phase and of the third co-design workshop.

The first workshop focused on the two first steps of the **Double Diamond Design model (discover and definition)** where problem statements calling for new delivery options were formulated. The second workshop was focused on the **creation** step where solution(s) to the problem(s) were discussed with stakeholders. As a result from the two workshops, solutions to be tested in the different cities are outlined. These solutions are being further developed in follow up meetings with pilot partners and expected to be tested in the period January – June 2026 (indicatively).

The following solutions emerged from the co-design process:

- In Antwerp, the parcel lockers of bpost will be further expanded and online shoppers will be encouraged to further use the infrastructure when choosing their delivery method.
- In Milan, where the collaboration between So.De and IKEA already provides environmentally and socially sustainable deliveries in the city, the focus is on improving consignments in the city centre by testing new delivery models and increasing the visibility of these solutions to citizens.
- In Oslo, mobile pick-up points will be tested by Ikea for goods of up to 30kg in weight.
- In Utrecht, the focus will be on consolidated deliveries to a micro hub in the city centre from which the last mile will be done by e-bike (or a similar vehicle).

Beyond the innovative outputs generated by these workshops, lessons learned from the co-design process are emphasised by reflecting on each workshop experience. The feedback of the participants showed indeed how the approach supported the team to build trust and mutual understanding thanks to an inclusive participation and equal contribution. Hence, the process allowed more creativity and confidence in the development of the solutions.

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1 Introduction

1.1 About CodeZERO

CodeZERO is a three-year Horizon Europe research project aiming to co-create **sustainable and zero-emission last-mile delivery and return solutions for ecommerce** that align with **consumers'** preferences while being sustainable for **retailers, logistics operators** and **local authorities**. Additionally, the project is focused on providing clear, consumer-friendly communication and developing tools for local authorities to promote eco-friendly behaviour.

CodeZERO is articulated in four phases:

- An **ANALYSIS** phase which provides (1) an analysis of existing delivery and return options and an understanding of how they are shaped by the needs and constraints of all involved stakeholders; (2) an in-depth intersectional analysis of various groups of on-line consumers to understand what are the features of delivery and return options making them attractive, with the aim to identify mechanisms to incentivize behaviour changes; and (3) develops an assessment framework to measure the impacts in the environmental, economic and social domains of new solutions.
- A **DESIGN** phase, in which CodeZERO engages in a co-design process involving retailers, transport operators, consumers and local authorities in developing (1) guidelines for retailers to raise awareness among customers; (2) a set of zero-emission and sustainable delivery and return options for retailers and transport operators; and (3) a toolset for local authorities to accelerate the transition towards sustainable solutions in last mile consignments in e-commerce.
- A **TEST** phase running 4 pilots in 4 different European cities in Italy, Netherlands, Belgium, and Norway to test a set of sustainable solutions identified in the previous phase with the aim to prove their feasibility, to fine-tune their design and to assess their impacts from the perspective of all stakeholders.
- A **CONSOLIDATION** phase where (1) CodeZERO outcomes are fine-tuned based on the lessons learned from real life applications, (2) requirements for up-scaling of solutions at European level are discussed (3) recommendations are formulated and (4) directions for future research are outlined.

Engagement with consumers and retailers' associations, industry stakeholders, cities and researchers contribute to shaping project results. Running from June 2024 to May 2027, CodeZERO is organized along eight WPs:

- WP1 Analysis of current delivery models
- WP2 Analysis of consumers' behaviour
- WP3 CodeZERO assessment framework
- WP4 Design of CodeZERO solutions
- WP5 Testing solutions: CodeZERO living labs
- WP6 Conclusions and recommendations
- WP7 Dissemination, communication and exploitation
- WP8 Project management.

1.2 Aim of this document

This deliverable reports on the second task of WP4 which aims at running the co-design approach described in Deliverable 4.1. It describes the outputs of the co-design workshops organized in Oslo, Utrecht, Antwerp and Milan. As this deliverable is the first version, it describes the results of the two first

workshops. A final version of this deliverable will be published by the end of December 2026, once the pilots are debriefed in the third co-design workshop planned in this second task of WP4. The main objective of task 4.2 was to propose co-designed solutions for a more sustainable e-commerce in each pilot city. Hence, the first workshop focused on the two first steps of the **Double Diamond Design model (discover and definition)** where problem statements calling for new delivery options were formulated. The second workshop was focused on the **creation** step where solutions to the problems were identified together with stakeholders. The outputs of these workshops generated the ideas for the pilots planned in WP5. The outputs feed also the following tasks planned in WP4.

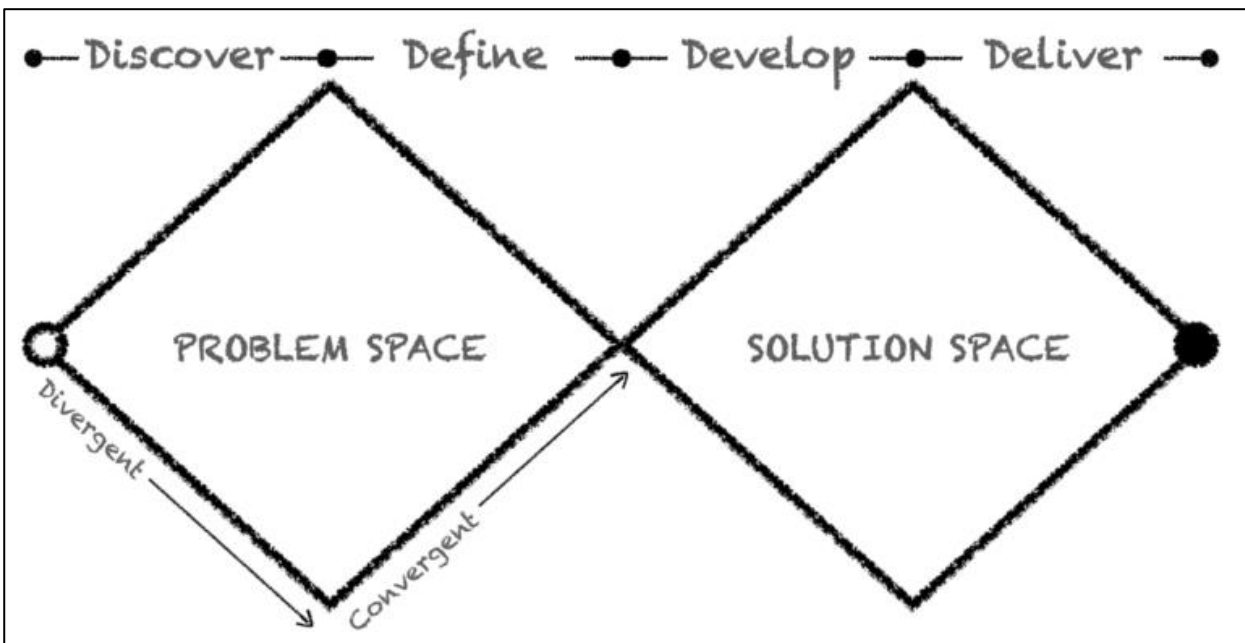
Based on the experience collected during the two first workshops, this deliverable reports as well on the feedback of the participants showing how the co-design approach developed in task 4.1 supported the team to build trust and mutual understanding thanks to an inclusive participation and equal contribution. Conclusions show how the workshops have contributed to the four principles of co-design presented in Deliverable 4.1.

2 Methodology

To prepare CodeZERO co-design workshops, a previous deliverable (Deliverable 4.1) explored the concept of co-design in the context of the last mile. It showed however that the application of co-design in urban freight transport is extremely limited. As a result, the scope of the research was extended to propose a new approach in the last mile where solutions can be co-designed with stakeholders.

Among the different frameworks available, CodeZERO co-design approach was mostly inspired by the Double Diamond developed by the Design Council (2015). It was found to be already used in several co-design processes (Johnson et al., 2024). The two loops of divergent and convergent thinking are particularly useful in design thinking to combine the benefits of deep reasoning while ensuring a generative design. The Double Diamond organizes therefore the process in four phases as Figure 1 shows: **discover** (diverging), **define** (converging), **develop** (diverging) and **deliver** (converging).

Figure 1: The four phases of the double diamond (Source: Sullivan, 2020)



The framework was further adapted to make sure the principles of co-design are well integrated. For this reason, an initial phase was added to the Double Diamond to **build the right conditions** for the team to co-design together. Four key principles of co-design remain at the core of the process: **sharing power, priority on relationships, using participatory means, and building capability**. These principles make sure the group can follow a democratic process leading towards innovative and meaningful solutions.

Based on a review of tools and animations that could support the five steps described above, Deliverable 4.1 proposed a comprehensive program for a co-design workshop spread on three half days. A standardized format was therefore developed and presented to the local facilitators in the four pilot cities of the CodeZERO project. Some flexibility in that program was allowed to best engage with the local co-design teams. Objectives of each workshop are summarized below; the description of the activities can be found in Deliverable 4.1.

1. The first workshop defines the focus that the co-design team wants to take when solving the sustainability of delivery and return options of e-commerce in their city. They will aim in finding the most essential barriers that make e-commerce not sustainable yet in their city.
2. In the second workshop, the co-design team brings up solutions that answers the challenges identified in workshop 1. Selected solutions are refined afterwards by the professional stakeholder group to prepare the pilots.
3. The third and last session shares the lessons learned from the pilot with the co-design team and build on them to propose next avenues.

As a key challenge of a co-design process is the engagement of stakeholders, a specific attention to their recruitment was also addressed in Deliverable 4.1. The co-design team should ideally integrate professionals, people with lived experience and provocateurs in a team of a maximum of 20 people to prioritize trust, intimacy and social interactions. To respect a balance between professionals and consumers, it was chosen to limit the number of professionals to a maximum of 10, meaning a target of around three professionals each from the retailer, the logistics service provider (LSP) and the local authorities involved in each pilot. Engaging consumers proved to be more challenging, however. Making use of the right channels was therefore critical for their recruitment in the co-design team. The retailer was therefore encouraged to engage with its customer base. Commitment of participants to join the two workshops was also essential. A financial incentive in the form of purchase voucher was therefore foreseen to reward the consumers after their participation to the two workshops.

The responsibility of recruiting, organising and reporting on the three co-design workshops is given to the local facilitators with VUB for Antwerp, TOI for Oslo, TNO for Utrecht and TRT for Milan. The following sections describe for each co-design team the recruitment of stakeholders, the results of each workshop (1 and 2) and the lessons learned from the co-design process.

3 Antwerp

3.1 The engagement of stakeholders

3.1.1 The recruitment

In Antwerp, the recruitment of the co-design team was organised in two phases, focusing on the professionals at first. With the partners of CodeZERO involved in the pilot, a date and a place were selected. To make it as convenient as possible also for consumers, a Wednesday morning was considered the best option in the week. It is often a calmer day of the week at work. Schools in Antwerp ends indeed at noon on Wednesdays. If parents do not work full time, Wednesdays are therefore often preferred for a day off. A central location in Antwerp was also preferred. Based on these choices, a doodle was circulated among the professionals to select the best weeks to organise the workshops.

In a second phase, consumers were contacted to join the two workshops with the message shared in Deliverable 4.1. By using their customer base and filtering on customers located in Antwerp, TORFS contacted 10,109 customers. The customers were invited to register through a form. This allowed to ask questions to ensure diversity in the group of consumers. This resulted in 18 customers interested to join the workshops.

From these customers, the large majority was female with only 11% men. Also, 11% of the customers had a first or second degree maximum. But the diversity across the other categories was better. On the education level, 47% of them received maximum a higher secondary degree while 42% of them had an academic degree. The age diversity was also better spread. The form received 5% in the category 25-34 years, 15% in the category 35-44, 26% in the category 45-54, 32% in the category 55-64, 15% in the category 65-74 and 5% in the category over 74 years. Given these demographics, 8 consumers based at first on gender, then education level and finally age were selected in order to maximise the heterogeneity of the co-design team. Then 2 man and 6 females were invited. The sample included 2 customers with a low secondary diploma, 4 with a high secondary diploma and 4 with an academic diploma. Finally, at least one (and maximum two) customer was represented in each category of age except above 74. Unfortunately, two customers did not attend the workshop. The workshops received therefore the attendance of 6 customers.

3.1.2 Location & timing

The workshops took place at the offices of the City of Antwerp on a Wednesday morning from 8h30 to 12h30. Participants were welcomed between 8h30 and 8h45 with a breakfast and the workshop started at 9h00.

The first workshop took place on the 12th of March, and the second workshop took place on the 2nd of April. Table 1 presents the attendance for each workshop. VUB supported the co-design team by facilitating the workshops and guiding them through the co-design process.

3.1.3 The co-design team

The co-design team reached 14 members with a good balance across the different stakeholder groups. The full list of participants to the workshops is listed in Table 1.

The co-design team was supported by the VUB team. Philippe Lebeau and Kathleen Cauwelier facilitated the first two workshops. They followed the process described in Deliverable 4.1. They were also responsible of the minutes of the workshops which are reported in the next sections.

Table 1: Co-design team in Antwerp

Name	Gender	Organisation	Stakeholder group	Workshop 1	Workshop 2
Liesbet BATEN	F	Bpost	Logistics Operator	X	X
Kris STEVENS	M	Bpost	Logistics Operator	X	X
Sébastien LEROY	M	Bpost	Logistics Operator	X	X
Chris VAN MAROEY	F	Stad Antwerp	Local Authority	X	X
Anton RENARD	M	Stad Antwerp	Local Authority	X	X
Tim VERVOORT	M	Stad Antwerp	Local Authority	X	X
Toon TORFS	M	TORFS	Retailer	X	X
Claire / Hanna	F	TORFS	Retailer	X	X
Joni	F	Online Consumer	Consumers	X	
Carina	F	Online Consumer	Consumers	X	X
Els	F	Offline Consumer	Consumers	X	X
Kristof	M	Offline Consumer	Consumers	X	
Sandy	F	Offline Consumer	Consumers	X	X
Sarah	F	Online Consumer	Consumers	X	X

- **3 red, 0 blue:** Torfs community for joint deliveries (*Torfs community voor gezamenlijke leveringen*)
- **2 red, 4 blue:** information on product, delivery, returns (*informatie met product, levering, retour*)
- **1 red, 6 blue :** more data needed (*meer data nodig*)
- **1 red, 5 blue:** returns (retours)
- **1 red, 2 blue:** public field for innovation and solutions (openbaar terrein voor innovatie en oplossingen)
- **1 red, 0 blue:** convince customers to opt for sustainable delivery (klanten overtuigen om voor een duurzame levering te kiezen)
- **0 red, 7 blue:** fewer bestelwagens (minder bestelwagens)
- **0 red, 1 blue:** better local policy with regional or best european regulation for carrier (beter lokaal beleid overstemmen met gewestelijke of best europese regelgeving voor transporteur).

3.2.2 Selection of a challenge

After the break, the co-design team reconvened to discuss the challenges based on the evaluations they made earlier. The conversation naturally centred on the challenges that received a balanced mix of red and blue dots.

Initially, the shortage of data was identified as key issue for developing effective solutions for e-commerce. As the discussion unfolded, it became clear that the most valuable data would be related to understanding the shopping behaviour of online consumers. In this context, the group focussed on excessive return behaviour. However, the retailer emphasised that this was not a significant problem among their customers. The discussion then shifted to consumer behaviour around delivery method choices. Several solutions were suggested, including using delivery points. The facilitators refocused the group on the task of identifying core challenges instead of solutions. The group also emphasised that delivery points are not always more sustainable, it depends on how consumers travel to collect their parcels. As a result, the group concluded that the sustainability of delivery methods must account for consumers' mobility behaviour. To capture the direction of the conversation, each team member was invited to individually propose a "How might we..." question using the Wooclap app, summarizing the emerging focus of the group. Figure 3 shows the co design team working on the app.

Figure 3: Co-design team during the "How might we...?" activity



Each member was then able to vote for two different propositions. Here are the top 5 of the questions proposed:

- How can we make consumers in the City of Antwerp more aware of the environmental impact of their deliveries and encourage them to make sustainable choices, such as opting for greener delivery options or joint deliveries?'
- How can we get consumers to deliver fewer parcels at home but at a more centralised points (Locker, pick-up point, etc.)?'
- How can we use data to encourage consumers to choose sustainable delivery.
- How can we encourage consumers to choose other delivery methods (besides homedelivery) to reduce traffic pressure in the city?'
- How can we encourage customers to choose a more sustainable delivery option so that there is a net reduction in the number of vans driving through the city?'

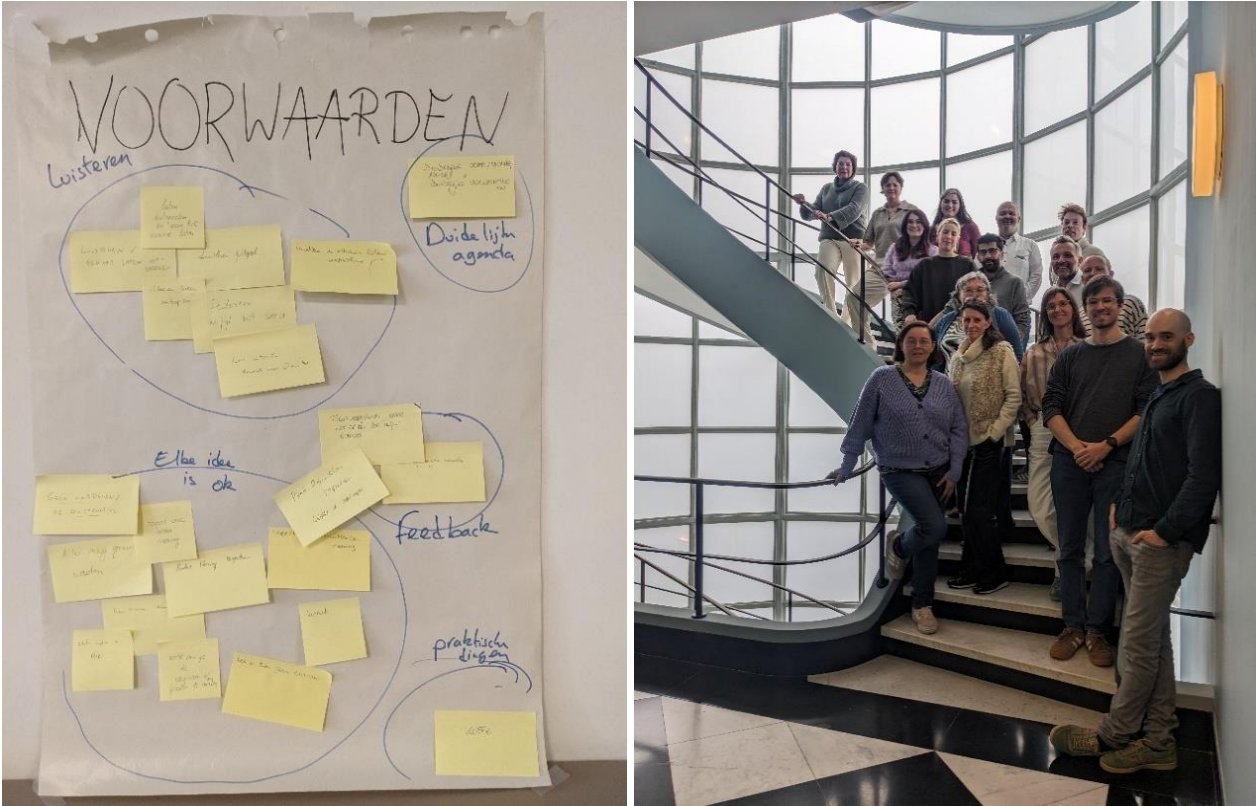
During the debrief, the group reviewed the most popular “*How might we...*” questions and collectively agreed that one in particular best captured the essence of the discussion and offered the most inspiring direction to pursue. As a result, the second workshop focused on the following question: **How can we make consumers in Antwerp more aware of the environmental impact of their deliveries and encourage them to make sustainable choices, such as opting for greener delivery options or joint deliveries?'**

3.2.3 Building of a co-design team

By the end of the workshop, it was evident that the group members had become well integrated. The first round of introductions helped participants learning each other's names and gave everyone a first opportunity to speak in front of the group. As the workshop progressed, active participation was observed, especially during the group discussions. At one key moment, when the group was deciding on the challenge they wanted to address, the facilitators encouraged four members to speak up a bit more to help to reach a consensus. Overall, the size of the group was conducive to equitable participation. The ground rules established at the start of the workshop ensured a safe place and supported this fair and balanced sharing of the floor.

Figure 4 below shows the set of rules defined collaboratively by the group (*Voorwaarden*). Key expectations included active listening and respect for all ideas which were essential values for the co-design team. Participants also emphasized the importance of building on each other's ideas and giving and receiving constructive feedback (*feedback*) to ensure the design process moved in the right direction. Two additional themes emerged: the need for clear guidelines and a structured agenda (*duidelijke agenda*), and the value of creating moments for relaxation and informal connection (*koffie*). The facilitators ensured that the group and the process of the workshop respected these expectations. The session was structured to ensure a balance between productivity and informal interaction. The welcoming breakfast and the coffee break gave the participants time to further connect. Feedback collected at the end of the workshop highlighted that participants found the session inspirational, useful and instructive with a constructive atmosphere. They appreciated the clear process, effective timing and tangible outcomes. However, some participants noted that explanations could occasionally have been clearer.

Figure 4: Set of the rules defined by the co-design team (on the left) and the team (on the right)



3.3 Workshop 2

Building on the question formulated during workshop 1: *“How can we make consumers in Antwerp more aware of the environmental impact of their deliveries and encourage them to make sustainable choices, such as opting for greener delivery options or joint deliveries?”* the goal of Workshop 2 was to identify the most effective solutions to address this problem/challenge. To achieve this, the group began by brainstorming a wide range of potential solutions. These ideas were then refined and narrowed down, ultimately leading to the development of a solution that would be tested during the pilot. Figure 5 shows the different small groups refining the nine ideas shared in the section.

3.3.1 Description of key ideas

- **Sustainable rewards system:** Consumers are incentivized to choose eco-friendly delivery methods and reduce returns through a point-based loyalty system. The more sustainable their choice, the more points they earn. These points can later be redeemed for rewards such as discounts or small gifts, fostering a habit of responsible shopping.
- **Eco-impact score:** Consumers receive a visual representation of the environmental impact of their chosen delivery method. Instead of CO₂ emissions, the impact is displayed using an easy-to-understand eco-label, ranging from A to E, similar to a traffic light system. This makes the consequences of their choices more tangible and actionable.

Figure 5: Final discussions before presenting the nine ideas to the group in Antwerp.



- **Locker pickup incentives:** Lockers will be placed outside stores, allowing parcel pickup beyond business hours. Customers who use lockers will receive a thank-you message, reinforcing the sustainable choice they made. To further encourage their use, a promotional campaign can feature a "Golden Ticket", a reward hidden in some lockers.
- **Encouraging sustainable choices through pricing:** Consumers are incentivized to select greener delivery options through dynamic pricing. Discounts are applied based on factors such as delivery location, speed, and vehicle type, making sustainable choices the more cost-effective option.
- **Raising awareness about e-commerce impact:** A communication campaign will educate consumers about the environmental footprint of e-commerce, with a particular focus on reducing returns. AI-driven shopping assistance could help customers select the right items, minimizing unnecessary returns and waste.
- **Reusable and reduced packaging:** Consumers are given the choice to opt for sustainable packaging alternatives, such as reusable or minimal packaging, reducing waste and promoting eco-friendly shipping practices.
- **Enhancing locker accessibility:** Lockers will be better integrated into urban spaces to remove barriers to their use. Potential locations include mobility hubs with shared bikes equipped with parcel-friendly baskets, enabling easy transportation without a car. Additionally, placing lockers in retirement homes could foster social engagement while improving accessibility.
- **Loyalty points for green deliveries:** Similar to the first idea, retailers can encourage sustainable delivery choices by rewarding customers with loyalty points, reinforcing responsible shopping habits.
- **City-led awareness campaign:** A municipal communication initiative will inform citizens about the environmental impact of online shopping, encouraging more sustainable delivery behaviours. This aligns with previous ideas focused on awareness and education.

3.3.2 Development of the solution to be tested

The nine solutions emerged through a structured brainstorming process, beginning at an individual level, then in pairs, and finally in groups of four. Once each group had selected their top three ideas, the three groups presented them to co-design team. These presentations were limited without

immediate critique. Each group was encouraged to link their ideas to previous ones, though the primary focus was on clearly explaining their own concept.

To filter and rank the ideas, the group discussed about the differences and similarities. As seen in previous section, some ideas were similar and could be merged, reducing the number of options. However, during the workshop, this process evolved organically. Instead of choosing among the alternatives, the co-design team naturally began integrating the different ideas into a cohesive solution, merging the similar ideas, building on the complementary ideas and leaving aside the ideas that were not compatible.

3.3.2.1 Nudging strategies for the consumers

Many ideas were centred on nudging consumers toward more sustainable delivery choices. Differences appear mainly on the customer journey. Working first on attitudes, the team worked on raising general awareness to initiate behaviour change of consumers as proposed with the idea 9. Once aware of the need to change, the team wanted to encourage the consumers in choosing their delivery method as proposed with the idea 1, 2, 4 and 8. Finally, the team wanted to reinforce the sustainable behaviours as proposed with the idea 3. These different options are non-exclusive and are all considered feasible for the pilot. It was only commented that penalizing unsustainable behaviours would not be a feasible option according to the retailer. They would fear that such measures might drive customers to competitors with more flexible policies. Instead, they advocated for a positive approach that highlights and rewards sustainable choices rather than punishing less sustainable ones.

Next to such a reward system, the co-design team agreed that click-and-collect in stores and locker pickups should be free whenever possible. On the other hand, home deliveries should carry the highest cost while remaining competitive with other platforms. Retailers were open to including sustainability impact information at checkout and sending follow-up communications to raise awareness. They also agreed that sustainable delivery options should be prioritized in the purchasing process.

3.3.2.2 Locker boxes as a delivery method

Besides nudging strategies, the group also integrated implementation-focused ideas into the pilot. The use of parcel lockers emerged as a central theme, with widespread stakeholder agreement on their convenience. However, several challenges were spotted for the pilot. First, implementing infrastructure takes time. LSPs were however already in advanced discussions to deploy locker shops in Antwerp after the summer. This plan aligns therefore well with the project timeline. This leads to the second challenge. Antwerp's current locker network is limited, primarily due to city policies that restricts private (closed network) parcel lockers in public spaces. To navigate this challenge, the co-design team suggested a neighbourhood-focused approach instead of a citywide rollout. With such a focus, the pilot could pay more attention to the integration of the locker box into the mobility and social ecosystem to remove barriers to their use. Potential locations include mobility hubs with shared bikes equipped with parcel-friendly baskets, enabling easy transportation without a car. Additionally, placing lockers in retirement homes could foster social engagement while improving accessibility.

Retailers were open to this localized strategy but emphasized the need to select areas where they have a strong presence. They also need to overcome operational barriers given that they work mostly based on postal codes and not at neighbourhood levels. Logistics service providers (LSPs) noted that the stability of delivery infrastructure varies across neighbourhoods, with some areas experiencing frequent changes in pickup points. Working on several neighbourhoods would help to better isolate the impact of the pilot on the behaviour and reduce the risk of such changes in the network to affect the evaluation of the pilot. Selecting relatively stable and representative neighbourhoods was seen therefore also as an important criterium to consider in the selection of the neighbourhood.

3.3.2.3 *Involving citizens around the new infrastructure*

To maximize adoption, the team proposed using visuals on parcel lockers to make their function self-explanatory and encourage active transport modes like cycling. Co-branding efforts could further engage local residents by incorporating recognizable neighbourhood elements into campaign materials. Additionally, the city could support the initiative through a communication campaign explaining the relevance of new delivery infrastructures in selected areas. That communication should be able to explain the contribution of locker boxes on the quality of life and air quality in Antwerp. It should also encourage consumers to use active modes to these infrastructures. The campaign could make use of posters, flyers, website updates, and social media campaigns. These efforts require however prior approval, which could pose a challenge given the reduced capacity in July and August. The available budget would also influence the format of the campaign.

3.4 Reflection on the workshop experience

By the end of the workshop, the co-design team members were asked to rate their satisfaction with the proposed solution on a scale from very happy to not happy. Most participants positioned themselves at 4 out of 5, indicating general satisfaction with the outcome.

They particularly appreciated that the solution had emerged through a collaborative and unified process, fostering a strong sense of consensus. Thanks to the process, the different members of the co-design team were able to get to know each other better. More importantly, they were able to understand the aspects that are important for the different stakeholder groups. The discussion was open, with honest feedback. It was not important anymore who was sharing inputs to the discussion.

The constraint remains time and engagement of actors in the co-design team. There were a lot of absence from the consumer side despite incentives. Out of the 10 consumers invited, 6 attended the first workshop, 4 attended the second workshop. The format could have been shorter although it allowed to get familiar and take the time to understand each other.

The resulting ideas could have been more groundbreaking as well. Several key details also needed clarification, especially regarding the selection of the specific district and how communication efforts would be coordinated to ensure a smooth pilot launch in January. Follow up meetings were therefore organised after the second co-design workshop to finetune the pilot description with bpost, TORFS and the City of Antwerp. In that sense, section 3.2 reflects the output of the co-design team while section 3.3 reflects on the follow-up meetings that build up on 3.2.

3.5 Description of the pilot and its support mechanisms

Based on the outputs of the second workshop, the solution was further refined by the professional stakeholder group in order to prepare the pilot that will take place in WP5. In short, the pilot focuses on the deployment and further use of parcel lockers in Antwerp. More precisely, bpost, TORFS and Stad Antwerp will collaborate on three types of actions: the deployment of the infrastructure, the promotion of the solution and the evaluation of the actions.

The infrastructure will be deployed in Antwerp, more precisely on the postcodes 2000, 2060, 2018. In that area, bpost already operates 21 parcel lockers and 31 manned PUDO points today. By expanding the network, the choice of location of these new infrastructures will meet several objectives.

1. First, the pilot project aims to facilitate the accessibility to parcel lockers for online consumers. Currently, the network can reach a potential of 70% consumers within a radius of up to 400 metres from a PUDO point, including parcel locker. With the pilot, the goal is to reach 85% consumers within a radius of 400m by adding 13 additional lockers.

2. Second, the pilot wants to stimulate social inclusion by locating parcel lockers at the premises of retirement homes. The goal is therefore to test the effect of such integration in a minimum of five different sites where parcel lockers can reduce loneliness.
3. Third, the capacity of parcel lockers is increased in high volume areas in order to assure delivery according to preferences.

Besides infrastructure development, the pilot also aims to encourage online shoppers to opt for delivery to parcel lockers instead of home deliveries. The various partners will support that common goal by addressing their “customer base”. To ensure that the message remains consistent and reinforced by each partner, the communication will be tailored to the different channels used. In that respect, communication follows several objectives.

1. It should highlight the sustainable advantages of choosing delivery at parcel lockers over home delivery in Antwerp. The pilot aims to reach 20.000 views in Antwerp. It will raise also the awareness of the solution as such with a map of the pick up points in Antwerp.
2. It should encourage the consumers to change behaviour and choose more frequently the parcel lockers as delivery option. The pilot aims to increase the number of customers using parcel lockers by 8%.
3. It should encourage consumers to use active modes when using parcel lockers in Antwerp to raise awareness around the network of parcel lockers. Through the communication interventions, the pilot aims at increasing by 10% the number of parcels picked up by active modes.

Finally, the pilot wants to evaluate the impact of these interventions on the behaviour of online consumers. Therefore, the evolution of home deliveries and deliveries at parcel lockers will be monitored after each intervention. A detailed agenda will organise the different infrastructure and communication interventions that will allow coordinating and isolating their impact across the pilot. Several monitoring checks will be organised and no simple before/after evaluation.

To achieve these objectives, TORFS, bpost and the City of Antwerp will contribute with the responsibilities described in the following paragraphs.

3.5.1 TORFS

TORFS will encourage their consumers to prefer a delivery in parcel lockers over deliveries at homes by adapting first their website. The check out process will be adapted to make the choice to parcel lockers easier (in terms of visuals), more meaningful (with information on sustainability) and more attractive (free delivery and rewards points). Lockers will move to 2nd place (only after shop delivery – which is typically our most sustainable option), and sustainability advantage will be displayed.

TORFS will use this new layout on the website to spread a national campaign on the use of lockers among its online shoppers. In Antwerp specifically, a golden ticket will be used to thank customers for choosing a more sustainable option. Additional loyalty points will also be experimented when choosing as an option lockers or shop delivery. These actions will be promoted by mail to customers located in the pilot area. It represents a potential of 38.000 customers.

To monitor the impact of their campaign, TORFS will track the number of consumers choosing for parcel lockers over home deliveries in the pilot area and at the national scale. Today, 22% of customers of TORFS choose for a delivery in a pickup point in Antwerp. Through the pilot, the goal is to reach 30% in parcel lockers. To understand better the evolutions, TORFS will also question its customers on hurdles to choose for lockers, and active transport to lockers.

3.5.2 bpost

Bpost will be active especially in the development of the locker box network in Antwerp. Based on the locations decided together with the City of Antwerp and TORFS, bpost will implement these new infrastructures by the beginning of the pilot, in January 2026.

The promotion of these parcel lockers will already start however before January 2026 given that bpost plans a national campaign from October 2025. That campaign will use different channels such as social media, television, ads. Beside these general channels, emails and apps will be used to encourage customers to choose for a more sustainable option such as the parcel locker.

To monitor the impact of their campaign, bpost will track on a weekly basis the number of consumers choosing for parcel lockers over home deliveries in the pilot area from October 2025 until the end of the pilot in July 2026. Today, parcel lockers receive 59.041 deliveries in the pilot area. Through the pilot, the goal is to reach 100.000 deliveries in the same zone. Given that some actions are specific to Antwerp, bpost will monitor also the same evolution in comparable cities such as Gent or Leuven in order to isolate the impact of these interventions.

3.5.3 City of Antwerp

City of Antwerp will support the integration of the locker boxes into the broader social and mobility ecosystem. They will facilitate the implementation of locker box in retirement houses or other social residences where more social interaction is desirable.

The city will also support the pilot through a general campaign and targeted neighbourhood communication. The social media channels of *Smart ways to Antwerp* will be used. The city of Antwerp is aiming at two waves of information (one wave in the beginning and at one wave the end of the pilot project) with in total three posts on LinkedIn, two posts on Facebook, two posts on Instagram. Taking into account the average reach of 622 views on the LinkedIn *Smart ways to Antwerp*, 8.405 views on the Facebook *Smart ways to Antwerp* and 465 views on the Instagram *Smart ways to Antwerp*, the goal is to reach a total of 19.606 views.

That communication will emphasize the sustainability benefits of the pickup points in urban areas, especially when active modes are used. To support the awareness of the network, a map will be developed showing the location of these points across Antwerp. To make these communications attractive, a short content video will also be developed illustrating for example a person on a shared bike (Velo) with a box of Torfs leaving from a bpost parcel locker. The goal is this way to catch 5.000 clicks to the map of pick-up points.

4 Milan

4.1 The engagement of stakeholders

4.1.1 The recruitment

Consumers participating to the workshops in Milan have been recruited through a social media campaign coordinated between the four pilot partners: TRT, IKEA Italy, AMAT and So.De. Every partner posted an announcement on their LinkedIn account and on internal newsletters. An additional newsletter was sent from the official CodeZERO account to all subscribers of the project mailing list.

The group of consumers was heterogeneous. Their age distribution reflects a balanced degree of diversity. The largest group (45%) falls within the 31–45 age range. This is followed by participants aged 46–60, who make up 33% of the total. Both the youngest group (18–30) and the oldest group (61–70) are equally represented, each accounting for 11% of participants. In terms of gender distribution, the workshop included seven men and two women. The educational background of workshop participants is diverse. The largest group (34%) holds a PhD or a post-degree master. Equal proportions of participants (22%) have either a high school diploma or a bachelor's degree. Meanwhile, 11% hold a master's degree, and another 11% have completed post-high school education. The frequency of online shopping among participants shows a relatively balanced pattern. An equal share of participants (44% each) reported shopping online either on a monthly or a weekly basis. A smaller group, representing 11% of the participants, indicated that they make online purchases every 1–3 months.

4.1.2 Location & timing

Co-design workshops in Milan took place at the cyclogistic micro-hub of So.De placed in Via Giuseppe Guerzoni. The first workshop was held on Friday, March 28th, from 14:30 to 18:00, and the second one took place on Wednesday, April 9th at the same time. To help socialising, participants were invited to have a drink together after the workshops at a nearby venue.

4.1.3 The co-design team

The co-design team reached 21 members with a good representation of consumers. The full list of participants to the workshops is listed in Table 2. It shows that, out of the nine consumers participating to the first workshop, eight of them attended the second workshop. This shows a very high engagement rate.

Two logistics operators external to the consortium were invited to the first workshop. Their involvement aimed at gathering valuable feedback and insights that could support the co-design process and contribute to the successful implementation of the pilot project in Milan. The perspectives of traditional operators such as GLS and UPS proved particularly valuable in identifying both the barriers and opportunities related to last-mile logistics in the city of Milan.

The co-design team was supported by the TRT team who facilitated the workshop: Claudia de Stasio, Agrippino Gulizia, Edoardo Repetto, and Giuseppe Galli. The latter also played also the role of the “provocatory” (or offline consumer) to stimulate the discussion and facilitating the exchange of diverse perspectives among participants.

Table 2: Co-design team in Milan

Name	Gender	Organisation	Stakeholder group	Workshop 1	Workshop 2
Naima Comotti	F	So.De	Logistics Operator	x	x
Elia Cipelletti	M	So.De	Logistics Operator	x	x
Veronica Oppici	F	AMAT	Local Authority	x	x
Giuliano Fertonani Affini	M	AMAT	Local Authority	x	x
Sara Dell’Orto	F	IKEA Italy	Retailer	x	x
Marco Massimi	M	IKEA Italy	Retailer	x	x
Marco Coti Zelati	M	IKEA Italy	Retailer	x	x
Gabriel Di Ludovico	M	GLS Italy	Logistics Operator	x	
Carlo Pugliarelli	M	GLS Italy	Logistics Operator	x	
Barbara Terrone	F	UPS Italy	Logistics Operator	x	
Marzia Picciano	F	UPS Italy	Logistics Operator	x	
Fabio	M	Online Consumer	Consumers	x	x
Gaia	F	Online Consumer	Consumers	x	x
Jacopo	M	Online Consumer	Consumers	x	x
Federico	M	Online Consumer	Consumers	x	x
Annamaria Elisabetta	F	Online Consumer	Consumers	x	x
Adriano	M	Online Consumer	Consumers	x	x

Name	Gender	Organisation	Stakeholder group	Workshop 1	Workshop 2
Fausto	M	Online Consumer	Consumers	x	x
Joao Antonio	M	Online Consumer	Consumers	x	
Filippo	M	Online Consumer	Consumers	x	x

4.2 Workshop 1

4.2.1 Overview of the challenges in Milan

After the icebreaking activities, the workshop started with a brainstorming session where all the participants tried to identify the key challenges in Milan by playing the “rigor mortis” game. By alternatively assuming the role of each of the stakeholders, participants were then confronted with a number of questions in order to understand the reasons behind the lack of development, choice or support to cargobike logistics and sustainable solutions in last-mile deliveries.

Here is the list of questions, divided by stakeholder categories.

Public Authority:

- Why don't you encourage cargobike deliveries as an alternative to bulky and polluting vehicles?
- Why don't you introduce stricter regulations to limit polluting and bulky vehicles?
- Why don't you reserve dedicated spaces for cargobike deliveries to promote them?
- Why don't you fine delivery vans for illegal parking in double rows or on sidewalks?

Logistics operators:

- Why don't you invest in cargobike logistics to reduce traffic and emissions?
- Why do you continue to use bulky vehicles even in urban settings?
- Why don't you consider the social impact of fast deliveries in terms of exploitation and working conditions?
- Why don't you collaborate with local governments and/or with each other to develop more sustainable solutions?

Online retailer:

- Why don't you adopt cargobike logistics or other more sustainable solutions for urban deliveries?
- Why do you continue to promote fast and free deliveries even though they are economically and environmentally unsustainable?
- Why don't you consider the social impact of fast deliveries in terms of exploitation and working conditions?
- Why don't you require your operators to use low-emission or environmentally friendly vehicles?

Consumers:

- Why don't you use lockers or pickup points to reduce the impact of your deliveries?
- Why do you prefer express home delivery?
- Why don't you consider the social impact of fast deliveries in terms of exploitation and working conditions?
- Why don't you consider the environmental impact of returns and express deliveries?

After a very stimulating discussion between the co-design team members, the following challenges emerged:

Public authority

- Although authorities are pushing for more sustainable mobility, actions taken are not always effective.
- There is a limited availability of loading/unloading lots for commercial vehicles available in the city, but it is difficult to increase them because of residents' parking needs. Citizens are always reluctant to reduce available parking lots in favour of commercial vehicles.
- Limited law enforcement prevents sanctioning irregular parking of private cars on cargo reserved lots and this disrupts commercial vehicle operations. However, it is too costly for the municipality to have rigorous enforcement (not enough personnel; other priorities).
- Economic and social issues arise with less polluting vehicles; not all companies can afford them for deliveries.
- Confusion in the division of regulatory responsibilities in mobility.
- City infrastructure is not always adaptable to dedicated routes for vehicles like cargobikes.
- In cities, and especially in Milan, high renting costs make it difficult to find urban spaces for proximity warehouses suitable for delivery with less polluting vehicles (cargobikes and electric vans).

Logistics operators

- Transport by more sustainable vehicles and cargobikes is more expensive, and clients are not always willing to absorb or pass on the cost to consumers.
- It is very difficult to find couriers willing to drive cargobikes due to higher road risks and adverse weather conditions.
- E-tailers do not pass on the efforts made by logistics operators for greater sustainability to consumers. For example, if an operator reduces the cost of a sustainable delivery (e.g., delivery to PUDO, lockers), this saving is not translated into a reduction in delivery cost for the consumer.
- Installing lockers is difficult and expensive, and it is not possible to install them in public areas.
- There is strong competition among clients, requiring an increasingly high level of service that does not allow for more efficient solutions (e.g., next-day delivery vs. slower delivery with optimized means).
- Some product categories must necessarily be transported with larger vehicles.
- Major logistics operators cannot rely on a single technological solution; a technology-neutral strategy is crucial to effectively evaluate and adopt the different options offered by the market.
- Very high renting costs and the lack of spaces for the creation of proximity warehouses can make impossible implementing more sustainable delivery solutions.
- In some cases, such as deliveries made by cargobikes, reaching a significant critical mass is necessary for these more sustainable methods to become economically viable.
- The city is not ready to support a massive uptake of cargobike deliveries: micro-hubs and cycling spaces are lacking. The city risks being invaded by bicycles.

Retailers

- Encouraging certain consumer behaviours could have legal implications. For example, favouring certain behaviours through rewards and/or incentives could be considered a prize competition with complex legal repercussions.
- Too often, retailers turn a blind eye to the ethics of their suppliers. Few retailers verify the social sustainability of the logistics operators to whom they outsource their deliveries. This creates competitive distortions against correct e-tailers.
- Often, an early delivery compared to what the customer requested can mean greater load consolidation and therefore greater delivery efficiency.

Consumers

- Consumers are often not given the option to choose the type of delivery. Too often they are given only to option to choose when (i.e. the day) the delivery is made.
- Consumers are often unaware of the consequences of their delivery choices, and online shops rarely provide information about this. It should be clearly explained what the advantages of cycle logistics are compared to other solutions.
- Consumers should be incentivized towards choosing more sustainable delivery with different costs and/or delivery times.

4.2.2 Selection of a challenge

After the initial brainstorming activities, the co-design working group selected the most relevant challenges and translated them into "How might we...?" questions. Figure 6 shows the co-design team during this activity.

Figure 6: "How might we...?" activity



As a result, the following selected challenges were identified:

- How might we promote the development of local warehouses suitable for cycle logistics?
- How might we make the city more suitable for cargobike delivery solutions?
- How might we communicate to consumers the characteristics/advantages of different delivery solutions?
- How might we incentivize/disincentivize consumer behaviour?
- How might we transform innovative solutions into structural solutions?

During the co-design work, great attention was given to communication with consumers, with the aim of understanding and defining how to inform them so they can make informed and sustainable choices. Considering the partners involved in the Milan pilot and the pivotal role of ethical cycle logistics in this context, the co-design process has been adapted to address the specific challenges of this setting and to explore how the benefits of sustainable cargo bike deliveries can be effectively communicated to consumers.

Based on these challenging questions, the co-design team was split into four working groups as can be seen in Figure 7. Participants of each group were invited to identify and write on sticky notes actions that retailers, logistics operators, consumers, and local authorities could make to address the emerged challenges.

Figure 7: Co-design team working on possible actions



This activity was followed by a debrief moment where a spokesperson from each group summarized the actions discussed by the group. Below the list of possible actions emerged:

1. Communicate the impacts of different delivery options to consumers.
2. Provide consumers with sustainable delivery options.
3. Invest in the development of alternative delivery methods.
4. Collect reviews on the chosen delivery method.

5. Provide reviews on the chosen delivery method.
6. Make the most sustainable delivery option the default (and secondary those less sustainable).
7. Disincentivize less sustainable delivery options through increased transportation costs.
8. Disincentivize less sustainable delivery options through increased delivery times.
9. Transfer cost reductions for deliveries to lockers/PUDO to consumers.
10. Prefer logistics operators who work sustainably.
11. Promote/incentivize synergies between different operators (e.g., shared warehouses, mixed last-mile, cost strategies, etc.).
12. Awareness campaign on the impacts of different delivery options.
13. Identify public and private areas to be designated for sustainable urban logistics spaces.
14. Incentives and grants to redevelop/designate private areas for sustainable urban logistics.
15. Adapt bike networks for use by professional operators (cargobikes).
16. Introduce dedicated signage for cargobike logistics.
17. Systematically address the issue of irregular parking.
18. Convert vehicle parking spaces into cargo parking spaces.

4.2.3 Building of a co-design team

By the end of the first workshop in Milan, the group had developed a strong sense of cohesion and collaboration. From the very beginning, participants from diverse stakeholder categories actively engaged in discussions, bringing a wide range of perspectives to the table. The open and inclusive atmosphere made it easy for everyone to share their ideas and contribute meaningfully to the co-design process. The unique setting of the workshop -held inside a cargobike hub- further enriched the experience by immersing participants directly in the context of the last-mile logistics. The physical environment not only sparked inspiration but also grounded the conversations in real, tangible challenges and opportunities. Interaction flowed naturally throughout the session, with participants building on each other's inputs and showing genuine interest in different viewpoints. The final moment of the day, marked by an informal drink with all attendees, was unanimously positive: participants valued the dynamic exchange, the collaborative spirit, and the opportunity to contribute in a setting that was both stimulating and welcoming.

4.3 Workshop 2

4.3.1 Description of key ideas

The second workshop started by recalling to the participants the actions identified during the previous workshop. The 18 key actions, plus one that came out during the plenary briefing, have been clustered by the stakeholders who can implement them. Table 3 shows the categorisation of the different actions.

Table 3: Key actions identified by the co-design workshops in Milan

Number	Actions	Stakeholders involved
1	Communicate the impacts of different delivery options to consumers	Logistics operators; e-tailers
2	Provide consumers with sustainable delivery options	e-tailers
3	Invest in the development of alternative delivery methods	Logistics operators
4	Collect reviews on the chosen delivery method	Logistics operators; e-tailers

Number	Actions	Stakeholders involved
5	Provide reviews on the chosen delivery method	Consumers
6	Make the most sustainable delivery option the default (and secondary those less sustainable)	e-tailers
7	Disincentivize less sustainable delivery options through increased transportation costs	Logistics operators; e-tailers
8	Disincentivize less sustainable delivery options through increased delivery times	Logistics operators; e-tailers
9	Transfer cost reductions for deliveries to lockers/PUDO to consumers	Logistics operators; e-tailers
10	Prefer logistics operators who work sustainably	e-tailers
11	Promote/incentivize synergies between different operators (e.g., shared warehouses, mixed last-mile, cost strategies, etc.)	Logistics operators
12	Awareness campaign on the impacts of different delivery options	Local authorities
13	Identify public and private areas to be designated for sustainable urban logistics spaces	Local authorities
14	Incentives and grants to redevelop/designate private areas for sustainable urban logistics	Local authorities
15	Adapt bike networks for use by professional operators (cargo bikes)	Local authorities
16	Introduce dedicated signage for cargobike logistics	Local authorities
17	Systematically address the issue of irregular parking	Local authorities
18	Convert vehicle parking spaces into cargo parking spaces	Local authorities
19	Develop synergies between logistics operators and e-tailers to improve the lead time of more sustainable deliveries	Logistics operators; e-tailers

4.3.2 Development of the solution(s) to be tested

4.3.2.1 Ranking & filtering

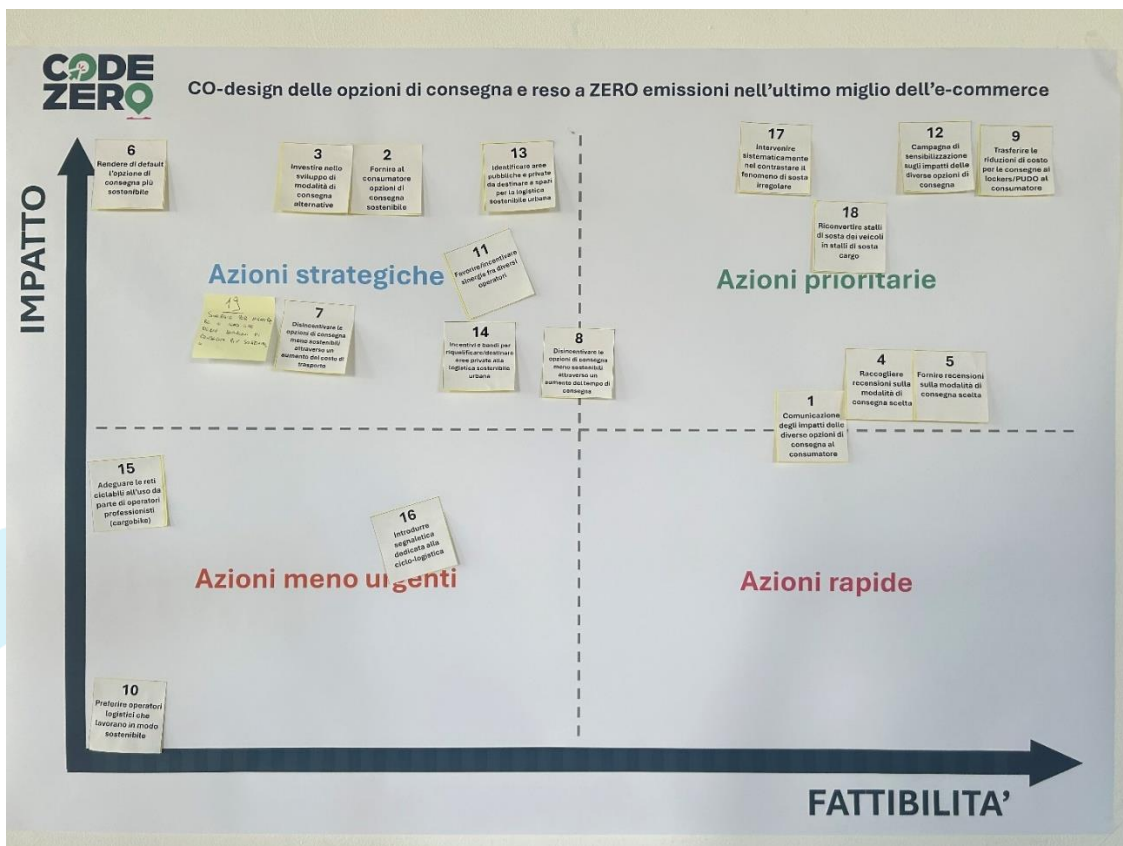
In a second phase of the workshop, the participants worked together to prioritize the identified actions aimed at achieving zero emissions in the last mile of e-commerce delivery and returns in terms of their potential impact and feasibility. Each action was reported on a sticky note and placed into a matrix structured along two axes:

- **Vertical Axis – Impact (Impatto):** measuring the potential impact of the action on enhancing the adoption of sustainable deliveries. The higher an action is placed on this axis, the greater its potential impact.
- **Horizontal Axis – Feasibility (Fattibilità):** indicating how practical or easy it is to implement a specific action. Actions on the right of the chart are more feasible in terms of time, cost, or resources.

The actions are then categorised into four quadrants as pictured in Figure 8:

- **Strategic Actions (Azioni strategiche), high impact, low feasibility:** these are long-term, transformative initiatives that require significant effort or systemic change but can greatly support sustainability goals.
- **Priority Actions (Azioni prioritarie), high impact, high feasibility:** these are actions that can be quickly implemented and can deliver good results. They are both effective and practical.
- **Less Urgent Actions (Azioni meno urgenti), low impact, low feasibility:** these actions are less crucial at this stage or may be difficult to implement relative to their benefit.
- **Quick Actions (Azioni rapide), low impact, high feasibility:** these are easy-to-implement actions with modest impact.

Figure 8: Impact-feasibility matrix



The matrix reveals that **transparent communication and clear information to consumers** are considered key enablers for change. Actions such as informing users about the environmental impact of delivery options (Action 1) and collecting reviews of deliveries (Actions 4 and 5) are not only highly feasible but also foundational in driving more sustainable consumers' choices. These “quick actions” can be implemented immediately and help shift consumer behaviour.

In contrast, **structural interventions**—such as redesigning urban logistics infrastructure (Actions 13, 14, 15, 18) are placed in high-impact but low-feasible areas, highlighting their **dependency on long-term planning and the involvement of local authorities**. These actions go beyond the feasibility of CodeZERO pilots and require systemic coordination, regulatory changes, and significant investment. The matrix, therefore, highlights the importance of starting with what's actionable now, i.e. **informing and empowering consumers, while acknowledging the parallel need for broader urban and policy transformation**.

4.3.2.2 Group activities

Given the importance of provide transparent and effective communication to consumers, in the second part of the workshop the participants have been divided into three working groups, each working on a specific assignment.

Figure 9: Group 1 working on improving IKEA website



Group 1 – “IKEA Website”: in this group, participants collaborated to identify potential improvements on the communication of delivery options currently offered by the IKEA online shop. Lessons learned are the following:

- The most sustainable delivery option should be made more visible and appealing to consumers, e.g. it could be highlighted using a green colour and/or accompanied by a leaf icon.
- When cargobike delivery is the default option, the standard van icon could be replaced with one that represents a cargobike, making the environmentally friendly choice more intuitive.
- Additionally, informing consumers about the CO₂ savings associated with cargobike deliveries would help raising awareness and encouraging more sustainable choices. This information

could be further supported by a small pop-up activated, for example, by hovering over an information icon that clearly explains the advantages of cycle logistics.

- Finally, a helpful alert could notify users about the maximum allowable weight for their order to be eligible for cargobike or light delivery services, ensuring clarity and managing expectations.

Group 2 – “So.De. Post-delivery postcard”: participants in this group collaborated to enhance and develop new graphic solutions for the post-delivery postcard that IKEA includes with parcels delivered by SO.DE cargobikes. Lessons learned are:

- The postcard could be made more appealing and engaging by using more vibrant colours and visual variety.
- Introducing a series of collectible postcards, each featuring different photos or illustrations of cargobikes, could encourage users to keep or share them, triggering a sense of curiosity or even collectability.
- Another idea is to incorporate hidden messages within the text: by bolding specific words, for instance, it would be possible to subtly convey a message like “Thank you for supporting us!” without altering the core content.
- Adding interactive elements, such as a small labyrinth, a crossword, a “connect-the-dots” image, or a section to colour in, could turn the postcard into a playful experience, especially appealing to families or younger recipients.
- In terms of visuals, using a real photograph instead of an illustration might strengthen the emotional connection and authenticity of the message.
- Moreover, the design could be transformable, allowing the recipient to fold or cut the card into a small gift—like an origami figure or a bookmark—giving it a second life beyond simple communication.
- Finally, including a short and catchy slogan, such as “Play. Collect. Remember. Share Joy.”, could further reinforce the postcard’s identity and message in a fun and memorable way.

Figure 10: Group 2 working on improving So.DE post-delivery postcard



Group 3 – “Leaflet”: in this group, participants collaborated to create a leaflet that local authorities can distribute to promote greater consumer awareness and encourage more responsible behaviour. Lessons learned are:

- The campaign could start by engaging the audience with a simple yet relatable question: “Are you a frequent e-buyer?” This opening serves as an invitation to reflect on personal habits and sets the stage for a deeper message.
- To raise awareness, it could be highlighted the sheer volume of e-commerce deliveries—communicating, for example, how many parcels are delivered every day or even every minute in a city like Milan. This data helps to frame the scale of the phenomenon and its relevance to everyday life.
- It’s also essential to communicate the key negative impacts associated with traditional urban logistics. These include increased traffic and congestion, air pollution, time lost in transit, and the excessive occupation of public space—all of which directly affect quality of life in urban environments.
- In contrast, the benefits of sustainable logistics should be clearly presented: cleaner air, fewer vehicles on the road, less congestion, and a general reduction in stress for everyone involved—from delivery drivers to city residents. The final goal is to encourage more responsible and sustainable choices. Consumers can be guided to prefer e-commerce platforms that offer eco-friendly delivery options, to choose delivery to lockers instead of home drop-offs when possible, and to help spread the message by actively promoting a change in consumer behaviour.

Figure 11: Group 3 working on the design of a communication and awareness leaflet



4.4 Reflection on the workshop experience

The strong continuity in consumer participation between the first and second workshop—with only one participant unable to attend the follow-up—demonstrates that the co-design process was both well received and perceived as valuable by those involved. At the end of the second session, all participants reported a high level of satisfaction with the workshops, highlighting the constructive and engaging nature of the discussions. Beyond this, many expressed a genuine sense of involvement and ownership of the process, readily confirming their interest in joining the third session, which is scheduled to take place after the pilot phase. Notably, a few participants even chose to share their positive experience

spontaneously on social media, further reflecting their enthusiasm and sense of connection to the initiative.

What worked particularly well was the openness of the environment and the ability of the group to engage in dialogue respectfully and collaboratively. Participants built on each other's input and remained focused on exploring meaningful contributions. The main challenge, however, lay in managing the flow of conversation: at times, discussions risked drifting away from the workshop's core co-design objectives. This required careful facilitation to maintain alignment with the intended outcomes without limiting the natural exchange of ideas. Overall, the balance between structure and flexibility contributed to a productive and motivating experience for all involved.

4.5 Description of the pilot and its support mechanisms

Considering the input of the co-design workshops, the Milan pilot focuses on encouraging a consumer-driven shift toward more sustainable delivery options by cargobike. While cargobike deliveries are already in use thanks to a collaboration between So.De and IKEA, the core idea of this pilot is testing refinements to the existing delivery model and increasing the adoption of these solutions by citizens.

The pilot will focus on enhancing deliveries by cargobike in the city centre and on providing clear, effective communication at the IKEA on-line shop checkout to influence consumer choices in favour of zero-emission delivery methods.

Access to Milan city centre is restricted under 'Milan Area C' policy, a combined Urban Road Toll and Low Emission Zone. Access for goods transport vehicles is limited between 9:00 to 11:00 and from 20:00 to 01:00, with an additional time slot from 16:00 to 20:00 for the transport of food/perishable goods. Depending on the characteristics of the vehicle, exemptions or the purchase of an entrance ticket is required, and most pollutant vehicles are banned from the city centre. In this context, deliveries by cargobike are a suitable solution to ensure compliance with Milan access policies.

While the exact solution to be tested is still under refinement, using larger pedal-powered vehicles (e.g. tricycles, quadricycles) in this context could enable fewer trips to cover the same area, increase the size of delivered items or acting as mobile micro-hub for optimising operations. By boosting the cargo capacity, these vehicles can make operations in Milan's restricted traffic zones more efficient and sustainable while freeing up traditional cargo bikes for their use in other parts of the network. As a result, the overall fleet could be optimised, reducing congestion and improving the last-mile logistics operations.

In addition, by clearly presenting the environmental and social benefits of cargobike delivery at the moment of delivery choice in IKEA on-line shop, the pilot intends to activate more sustainable consumer habits without requiring structural changes to the purchase journey.

In essence, the Milan pilot is not about testing new technologies or delivery methods but about fine-tuning an already existing sustainable solution through better alignment with logistics needs and user behaviour. It is intended to test to what extent change in e-commerce last-mile logistics can stem from informed consumer choice, supported by effective design, communication, and local planning expertise.

4.5.1 Stakeholders involved

At the heart of the solution(s) that will be piloted in Milan are IKEA Italy and So.De., two partners that already work together to provide delivery services by cargobike designed to be both environmentally sustainable and socially responsible.

IKEA Italia (e-tailer) is the Italian branch of the global home furnishings company, known for its flat-pack furniture, sustainable practices, and wide-reaching e-commerce operations. IKEA's goal is to achieve 100% zero emissions for last-mile home deliveries by 2025. Milan is a frontrunner in this transition.

During the pilot, IKEA will implement communication improvements on their online shop to influence consumer choices in favour of zero-emission delivery methods. In partnership with So.De they will also test new delivery models by cargobike to increase the uptake of deliveries by cargobike in the city centre.

So.De – Social Delivery (Logistics Operator) is a Milan-based logistics cooperative that provides last-mile delivery services using cargobikes, with a strong focus on social and environmental sustainability. The organization not only promotes zero-emission logistics but also prioritizes social inclusion by employing workers from vulnerable or marginalized backgrounds under fair and stable working conditions.

AMAT – Agenzia Mobilità Ambiente e Territorio (Local Authority) is the in-house technical agency of the Municipality of Milan, supporting the city in areas such as urban planning, mobility, public transport, environmental resources, and sustainability. AMAT, will play a supporting role during the pilot. Leveraging on its expertise in urban planning and sustainable mobility, AMAT is positioned to contribute to in-depth territorial knowledge and to the provision of strategic urban data. This input will be key in adapting the delivery model to Milan's specific urban contexts, optimizing routes, and ensuring the service is well-integrated with the city's infrastructure and community needs.

5 Oslo

5.1 The engagement of stakeholders

5.1.1 The recruitment

Recruiting two half-day workshops can be challenging as it asks a lot from the participants; they must travel to the location and be willing to spend time during the work week to participate. For this reason, several different strategies for recruitment were implemented. First, in an earlier phase of the project, interview participants were recruited through Facebook neighbourhood groups, but not all candidates were interviewed. Those that were not interviewed but had expressed interest in the CodeZERO project were asked if they would be interested in participating in the workshop. Second, by sharing information on TOI's home page and social media accounts, such as Facebook and LinkedIn. Third, collaborating with IKEA to send out information in their newsletter in mid-March, which included a flyer and an invitation to the workshops. The information was presented in a template provided by Eurocities' communication team (see Figure 12). The posts linked to a short survey, which provided more information on the workshop and asked for the participants' age range, gender, education, and their general location in the city.

The number of potential participants interested in the workshop rose sharply immediately after the IKEA newsletter was sent, suggesting that most were recruited through this channel. Some of the workshop participants specifically mentioned an Instagram (IG) pop-up. As IG was not used directly as a recruitment method, it is suspected this might be related to activity on Facebook.

Figure 12: Recruitment template adapted for the workshops in Oslo!



VI TRENGER DINE MENINGER!

- i** La oss høre dine meninger om og/eller erfaringer med netthandel og hjemlevering i vårt forskningsprosjekt
- 📅** Delta i to halvdags idemyldringssesjoner i Oslo den 10. april og 8. Mai 2025 kl. 8.30-12.30
- €** Som takk for din deltakelse får du et gavekort på IKEA på kr. 1000,-

Logos at the bottom: CIVITAS, European Union, tõi, Oslo, IKEA, CODE ZERO

The recruitment pool consisted of 25 people who expressed interest in participating. Ten participants were selected and invited to the workshop, attempting to ensure diversity among the participants in terms of the attributes collected from the recruitment survey. Of those contacted, three were no longer interested. Attempts to replace them were unsuccessful. An additional three cancelled in the days

leading up to the workshop. Consequently, there were a total of four consumer participants at the first workshop.

5.1.2 Location & timing

As planned, the workshop was held at the headquarters of the City Environment Agency of the City of Oslo (BYM) – Thursday morning from 8:30 to 12:00. Participants were welcomed between 8:30 and 9:00 with coffee and a light breakfast. The workshop officially began at 9:00.

The first workshop took place on April 10th, while the second was held on May 8th.

5.1.3 The co-design team

From the CodeZero project partners, IKEA, Bring, and the City of Oslo participated in the workshop with three, one, and five representatives respectively. Including the four consumers, there were a total of 13 participants. The full list of participants to the workshops is listed in Table 4. TOI was represented by two facilitators, Howard and Guri.

Table 4: Co-design team in Oslo

Name ¹	Gender	Organisation	Stakeholder group	Workshop 1	Workshop 2
Erik	M	Online consumer	Consumer	X	X
Maria*	F	Online consumer	Consumer	X	X
Ingrid*	F	Online consumer	Consumer	X	X
Anne*	F	Online consumer	Consumer	X	X
Stig Magne	M	IKEA	Retailer	X	X
Teo	M	IKEA	Retailer	X	X
Marianne*	F	IKEA	Retailer	X	X
Erlend*	M	Bring	Logistics operators	X	X
Patryk	M	BYM	Local authorities	X	X
Stine*	F	BYM	Local authorities	X	X

¹ * For consumers appropriate and participant not directly involve in the CodeZERO project names have been reported i.e. given anonymized names based on gender, age and social background.

Name ¹	Gender	Organisation	Stakeholder group	Workshop 1	Workshop 2
Kristina*	F	BYM	Local authorities	X	X
Tiril*	F	BYM	Local authorities	X	X
Tomas*	M	BYM	Local authorities	X	X

As mentioned, four participants representing consumers were recruited, they have the following demographics: three females and one male, one student, and three workers employed at businesses and a university employee (including a researcher in a different field). There was also a geographical range of residents, including two who were about to change residential location.

5.2 Workshop 1

The first workshop aimed to define the focus that the co-design team wants to take when solving the sustainability of delivery and return options of e-commerce in their city. To reach that goal, two critical milestones needed to be reached. First, the group needs to identify a list of challenges/problems that make it difficult to enact more sustainable delivery solutions. Second, the group needs to focus on one challenge and define it into a how-might-we question. That question will form the basis of the second workshop.

Another essential objective of the first workshop was to build a team that felt comfortable sharing ideas and opinions with each other. Supporting such group dynamics is necessary in order to have a productive co-design process.

5.2.1 Game Rigor Mortis – the process!

During the Rigor Mortis (RM) game, four groups were made representing different stakeholders. One of the consumer participants played the role of planet Earth. Participants were divided up as much as possible to have different viewpoints in each representative group. This meant that all groups in the game had representation from both IKEA and BYM. It was clear that both the personality of individuals and the composition of the groups could affect the intensity of the discussions when coming up with excuses as for why sustainability was challenging to achieve.

When all was set, the “Retailer” group was asked to begin the game and start with a reason why the last delivery from IKEA was not carried out in a sustainable manner and to place the blame on one of the other groups. Each group was given a couple of minutes to formulate and state their argument/excuse when they responded to “Earth” and then transferred their blame to another group. Based on test runs of the game in preparation for the workshop and from discussions from other CodeZERO research partners, a rule was also included where you could not send the blame directly back to the group from which you received it. All arguments were written on Post-it notes and placed under the picture of the respective groups, i.e., those who stated the argument, as illustrated in Figure 13. Arguments that received a “green nod” from “Earth” during the game were marked with a green dot.

Figure 13: The different arguments/excuses on post-it notes placed beneath the originating group!

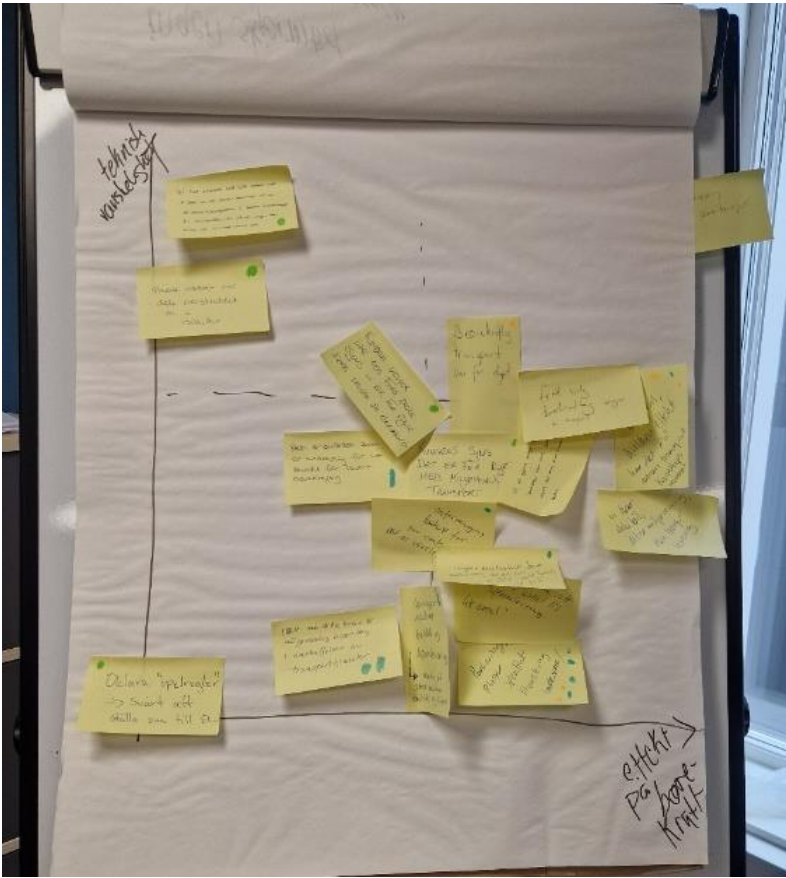


After a couple of rounds, i.e., the question of blame had been passed around different groups, it became apparent that the discussion was focused only on electrification and that the arguments started repeating. The facilitator and one of the group members then raised this issue and broadened the conversation and perspective. From then on, the debate became freer and moved away from the RM game setup. All arguments were noted, and the discussion seemed to be fruitful and dynamic, with all stakeholders taking part. However, as is often the experience with workshops with multiple stakeholders, commercial actors represent their interests clearly and directly. In contrast, actors from the public authorities cannot always respond as directly, presumably because their main work is more complex regarding representing many actors for the greater good of their city. Likewise, the consumer participants are often relying on their personal experience and may not be able to rebut specific arguments made by commercial actors.

5.2.2 Overview of the challenges and the selection process

During the break, participants were asked to go through the different arguments/challenges/problems displayed in Figure 13 and evaluate them based on two criteria: 1) How technically difficult it would be to solve the problem and 2) How large of an impact solving the problem would have on sustainability. Participants were asked to mark the most technically difficult problem with a blue dot and the largest impact from a sustainability perspective with an orange dot. Afterwards, the facilitator then placed the different arguments (Post-its) on the figure with technical challenges on the vertical axis and impact on the horizontal axis, resulting in the Figure 14.

Figure 14: All challenges placed on a technical-impact axis, based on the marked blue and orange dots by each participant



In total, 11 blue dots and nine orange dots were given, illustrating that some participants did not mark an argument. This was possibly since it was easier to evaluate the technical difficulty of solving a problem as opposed to its impact on sustainability. Table 5 gives an overview of the different challenges suggested and the number of marks they received including whether or not “Earth” gave a green nod.

The placements in Figure 14 were discussed, and the ensuing conversation made it clear that there were primarily two topics the co-design group was interested in solving:

1. The importance of consumer choices and how consumer habits and culture are not sustainable. Consumers are accustomed to a supply of delivery alternatives regarding convenience that is not compatible with sustainable deliveries. These choices are enabled by commercial and logistic actors seeking to maintain market dominance.
2. The importance of land use, and the scarcity of land, especially in urban areas and how this creates challenges for logistics activities across all sustainability axes (cost, environment, social). In a city where many do not have cars, deliveries directly home or at pick up points close to home are especially valuable for residents.

Table 5: Overview of challenges/problems in Oslo

Challenges/problems	Number of blue dots	Number of orange dots	Green nod from planet Earth
Lack of information regarding the extent of goods delivery, lack of data regarding logistics – to regulate.	1	0	
There are few parking spaces/areas specifically designated for goods delivery/loading zones.	4	2	
IKEA must require environmentally friendly vehicles when procuring transport services.	2		
Unclear rules – difficult to transition to electric vehicles.			1
Customers think environmentally friendly transport is too expensive.			1
Sustainable transport is too costly.		2	
It is the store’s responsibility to ensure that customers receive sustainable delivery.	1		
Private actors must share profits to offer discounts.			1
Customers do not choose us because they think we are too expensive (when it comes to sustainability) – they choose competitors instead.			1
We have already taken responsibility by not having a car – therefore we expect local authorities to cover the difference for transporters, so that they in turn can offer us the same low price.			1
We do not own a car, which is environmentally friendly, but then we need delivery of goods.			
Living without a car – what impact does it have on other transport needs? – lack of knowledge base.	1	5	
No possibility to park a car somewhere in order to deliver goods from a fully loaded vehicle.	1		
Solutions between store and home delivery – can we meet somewhere in between?	1		
Everyday logistics must work for us as consumers.			
No space allocated for home delivery – limited space?			
Sum	11	9	5

5.2.3 Selecting the main challenge to address

Based on the discussion and the two main challenges regarding (1) consumer choices and (2) land use and facilitation, participants were asked to formulate a separate "How might we ..." question on either or both topics. When they were ready, they typed their suggestion(s) in Wooclap. Figure 15 (in Norwegian) give an overview of some of the suggestions that were made.

Figure 15: Wooclap screen 1



Based on this input, a brief discussion was conducted at the workshop. The participants were most interested in the question “How can we drive fewer kilometers for each order delivered so that we reduce costs (climate, economic and social).” However, there was also discussion about the space used for delivery, when it was used, and the overall value for the consumer. For example, some participants raised the point that *when* delivery operations occur is also important and that kilometers driven during rush hour might have a larger negative consequence than at other times. Some suggested that reducing kilometers alone wouldn’t necessarily guarantee an improvement in sustainability. There were also some joking discussions about “spoiled” consumers who are accustomed to extremely high levels of service. There was a consensus that influencing consumer choices would best be done by making the default choice more sustainable as opposed to convincing them to pay more for more sustainable solutions. They felt that focusing on the transport would be more impactful than on the choices of individuals. Based on this final discussion, the facilitators refined the “How Might We” question to the following (in Norwegian and English, respectively):

Hvordan kan reduserer de negative konsekvensene av transport knyttet til netthandel slik at kunder får attraktive, mer bærekraftige leveringsløsninger?

How can we reduce the negative consequences of transport related to e-commerce such that customers get attractive, more sustainable delivery solutions?

5.2.4 Building a co-design team

The willingness of the consumer participants to engage in the discussion with thoughtful questions and insightful comments was consistently impressive. For the opening activity (the icebreaker), each participant was asked to say their name, the last thing they purchased online, and how it was delivered. Each participant then had to repeat everything that had been told, followed by presenting themselves. This ended up being a very light-hearted activity, which ensured not only that everyone was on a first-

name basis but also set the stage for later discussions as the participants were now primed to think of e-commerce and different delivery methods.

5.3 Workshop 2

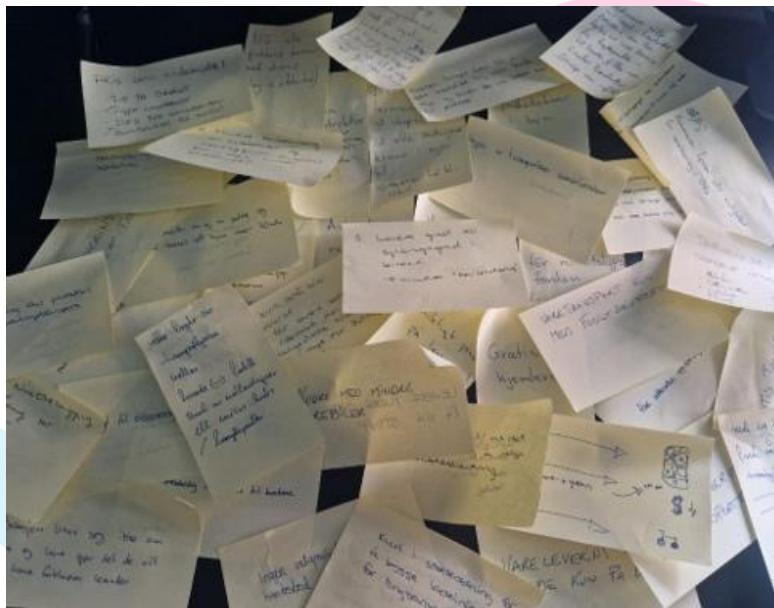
The second workshop aimed to contribute and reflect on the specific delivery and/or return solution to be tested later in the CodeZERO project. Using the “How Might We” question from workshop 1 as a starting point, during workshop 2 specific solutions. Three main steps were conducted in workshop 2: (1) reverse brainstorming, (2) merging of ideas, and (3) selection of a central idea or input to the pilot, which constitutes the solution to the ‘how might we’ question.

All participants from the first workshop attended the second workshop, allowing the group dynamics and discussions from the first workshop to be further built upon. The workshop started with a welcome and once again going through everyone’s name. Participants were asked if they had been thinking about any solutions since the first workshop or to discuss any reflections they may have had since then. One of the consumer participants mentioned that they had changed their purchasing habits since the first workshop and had begun to consider the sustainability impacts of their choices more actively. After a short discussion the workshop activities began.

5.3.1 Reversed brainstorming and merging of ideas

As an initial activity, participants were given eight minutes to write down eight ideas/concepts that would worsen the situation established in the ‘How might we’ question. Afterwards they were asked to do the opposite and write eight ideas that would improve the situation. This allowed the participants to more specifically consider different mechanisms that would worsen or improve sustainable delivery options. There was some discussion about which aspect of the HMW question should be made worse/better and participants were asked to focus on the sustainability of the delivery solution, though with eight different ideas they were also able to explore the consumer experience. Figure 16 shows the post-it notes with ideas from the original brainstorming.

Figure 16: Results of individual reversed brainstorming



Once the initial ideas were produced the workshop continued with two rounds of merging ideas: First with groups of two and then with three groups of 4-5 participants. In each of these rounds, participants chose to share some of their favourite ideas with each other, discussing strength and weaknesses as

well as merging and building on ideas that were similar. After the two rounds of winnowing and merging ideas, nine were left. Table 6 summarises them.

Table 6: Summary of the nine ideas

Idea		Description
1	Mobile Points Pick-up	Vans or trucks would drive to a location and serve as a temporary and conveniently located pick up point for customers
2	Coordinated deliveries to increase fill-rates	Coordination between actors to increase fill rates for vehicles, meaning fewer vehicles needed to deliver the same amount of goods
3	Clearer choices for consumers	An overwhelming amount of information polluting the user interface. Too many choices without a clear idea of what is most sustainable.
4	Logistics planning in building processes	Requirements on loading areas and other facilities for logistics operations included in new-building plans, including residential
5	Purchase in store, consolidated delivery at home	People can purchase goods at a store and receive delivery later. Do not need to arrive at a store by car. Store can consolidate deliveries to send a single van around to perform deliveries later.
6	Road pricing	Road pricing would increase the costs of delivery and incentivize consolidation of goods or pushing that pricing onto the customers. More efficient ways of delivering would become more competitive and attractive for customers.
7(a)	Coordinating app	Space booked in the city for making deliveries
7(b)	Prioritisation of space booking	Green deliveries more highly prioritized in the app (7a)
8	Hub solution	A hub that facilitates transfer of goods to smaller vehicles. Also serves as a pick up point for customers.

5.3.2 Three groups – nine key ideas

After two rounds of merging the ideas, the three groups were asked to select three main ideas, which they should describe and visualize through a drawing, to be presented to the workshop group. Figure 17 shows the groups refining the ideas.

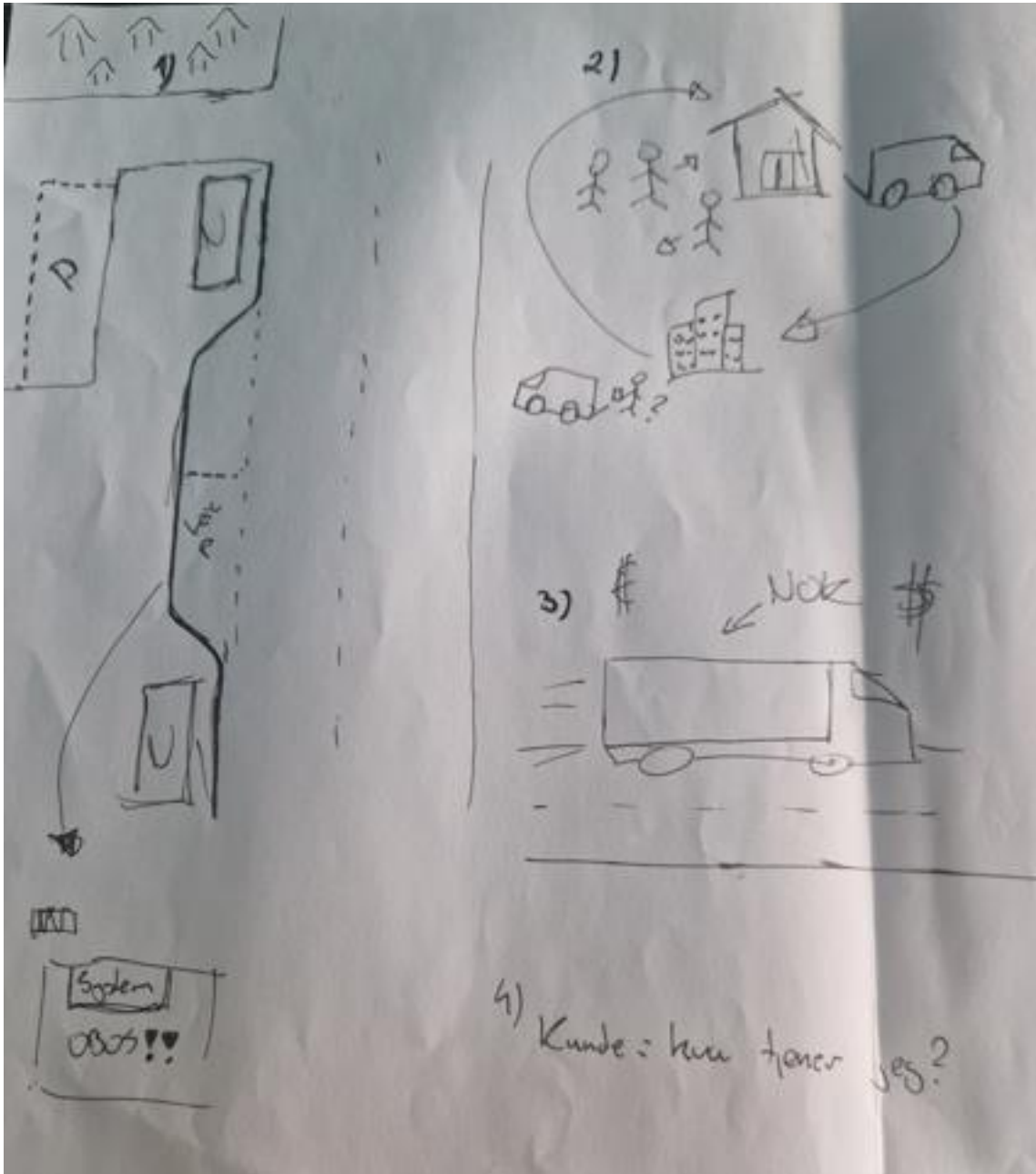
Figure 17: Final discussions before presenting the nine ideas to the group in Oslo.



Group 1 had the following ideas: (1) Mobile pick-up points, (2) Coordinated deliveries and increased fill-rates: attempt to increase the fill rate by coordinating deliveries and consolidating. The third idea concerned limited incentives for consumers to choose more sustainable deliveries (3), a rough idea regarding information. Their solution restricted consumers' options in choice situations, i.e., while ordering on an application or a website. They underlined that the flood of information a consumer is exposed to is problematic and overwhelming. There are too many choices for delivery methods without a clear understanding of what a sustainable delivery is.

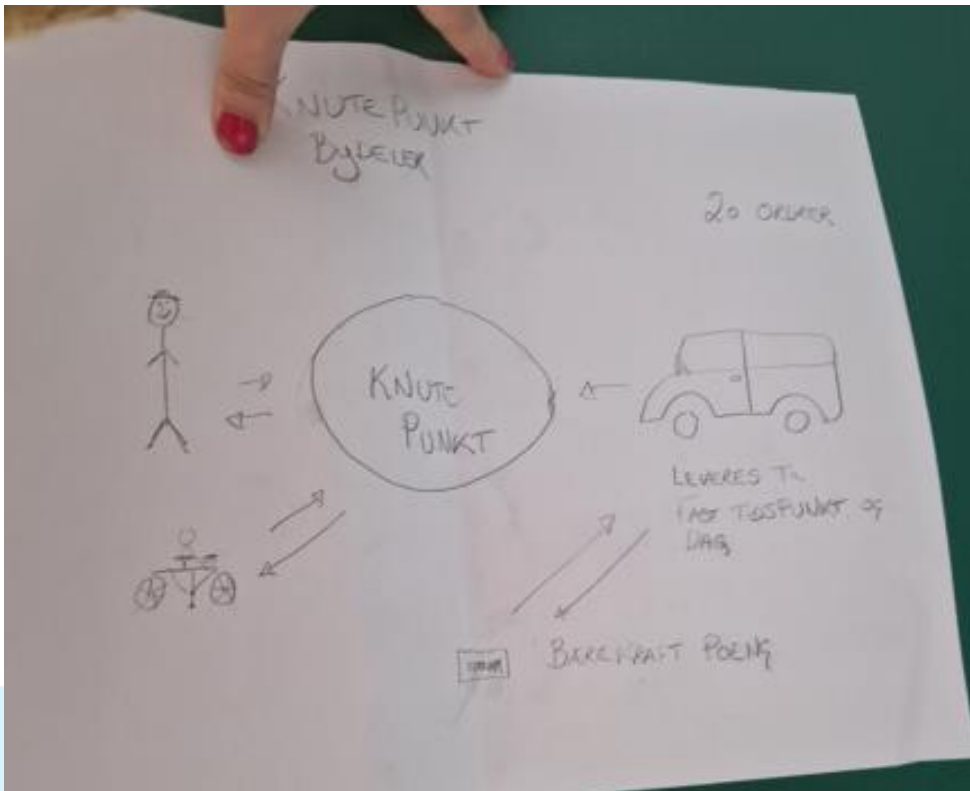
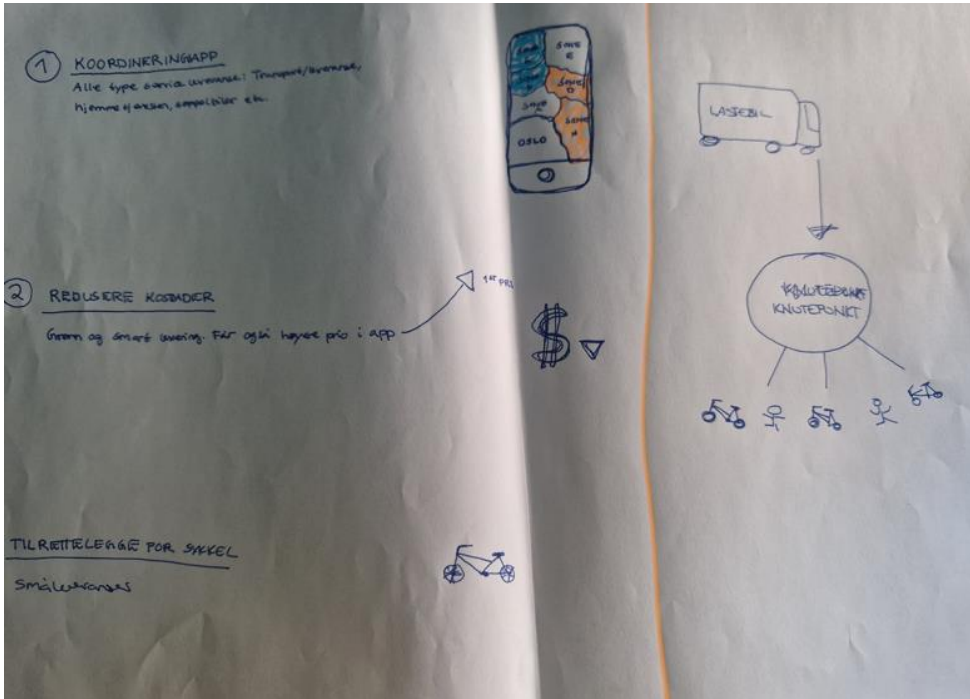
Group 2 presented three somewhat different ideas from Group 1. **First**, they suggested a solution that focused on regulating space when constructing new buildings for residents and businesses. Specifically, for new residential buildings, they wanted to more explicitly consider how to support logistics activities, including official services such as renovation and private deliveries for residents. The idea relies on a more dynamic regulation of space, where space is underutilized and regulated only to serve a specific purpose. Their **second** idea is based on purchasing in physical stores while receiving delivery later, allowing businesses to consolidate orders. This will be especially relevant where purchasing a larger package is not convenient to transport without a private or rental car. It assumes good coverage of public transport and cycle infrastructure. Finally, their **third** idea was the implementation of road pricing – implementing all relevant external costs, which would increase the costs of delivering in each area. Doing so would heavily incentivize using vehicles more efficiently to reduce driving distance through consolidation of goods or offering services such as pick up points. Figure 18 pictures their ideas.

Figure 18: Illustrations from group 2.



Group 3 also illustrated ideas regarding coordination, flexible space use, and pricing. The group organized the three ideas as a package with three main components. (1) An application, where all deliveries should be coordinated based on the type of delivery at the neighborhood level. (2) LSPs who deliver more green and smarter will be prioritized in the mechanism of booking space during the delivery. This will, in turn, reduce costs over time, and one can expect reduced costs also for consumers regarding more sustainable delivery options. This idea constitutes the back-end of the application's solution and ties ideas (1) and (2) together. Finally, the third idea (3) is a hub/junction point where one should facilitate a transfer to smaller vehicles, where the hub is supplied by larger vehicles, and serves as a pick-up point for small and more sustainable deliveries, especially in urban areas. Figure 19 pictures their ideas.

Figure 19: Two illustrations from group 3.



When presenting these solutions to the co-design team, it quickly became clear that a time perspective was essential to include when considering the different solutions. Several ideas could build upon each other and expand over time or could be seen as different stages of development of the same idea. Regarding the digital platform, it was necessary to coordinate and regulate space dynamically, as local authorities recognized that technological maturity was not necessarily the challenge, but rather coordination and implementation, along with questions regarding which areas could be used and under what circumstances—especially considering that local authorities need to consider all actors in the urban space, not only logistics actors. Furthermore, how should one maintain an overview—who is responsible, and how to enforce it? A digital platform for space regulation already exists for parking and is available for anyone. This raises further questions, such as whether the municipality should compete in the private market.

Actors from the business also stated that different users have different needs; some may require a space for 15 minutes, while others need it for 2 hours when conducting last-mile deliveries. Moreover, within the local context of Oslo, the workshop participants felt there were already numerous sustainable solutions for smaller packages. Many deliveries are already made with electric vehicles using pick up points and parcel lockers. There is limited traffic associated with medium-sized packages (approximately 30kg), but there is more potential for improvement. 'Nimber' (a crowd sharing delivery solution) was mentioned as a good concept by one of the consumers but could not find a sustainable business model. IKEA also tested such a concept, and their experience was that it did not work due to a lack of knowledge about these cargo hitching solutions, which is potentially problematic.

Consumers agreed with the transporter and mentioned that there is already good coverage of parcel lockers. The discussion ended with a broad consensus that one needs to ensure solutions dealing with pick-up points and areas don't encourage driving. The delivery must be within so-called slipper distance from the consumers to encourage walking.

5.3.3 Contribution to the pilot – selection of a solution

After the discussion on the different solutions, it was clear that multiple ideas would need to be combined. The core of the idea for a solution was formed by combining new ways to organize logistics through policy and regulation, as well as providing more dynamic space for logistics activities. In such a way, there is a dependency between the public and private sectors in implementing new solutions.

As the group focused on solutions that both provide space for logistics activities and coordinate activities between actors, an idea that incorporated iteration, improvement and change over time was developed. The initial solution would start with a fixed point for more deliveries at junction points where businesses can deliver goods to consumers for entire neighborhoods or travelers near public transportation. A digital platform would be needed to interface with consumers. Over time, this could also be developed for use by businesses so that they could book available space, which the authorities would manage for a more dynamic use of space in urban areas.

There was also a recognition that for small packages, existing options commonly used to improve sustainability already exist, such as parcel lockers and pick-up points within walking distance that are serviced by electric vehicles. In addition, technology is not an issue; solutions need to focus on coordination. How can businesses manage consumer orders, and authorities who facilitate urban space coordinate those aspects using digital platforms? Such a platform can, in the long run, alter the demand for delivery options for consumers and delegate urban space use for the most sustainable deliveries by using pricing and assigning attractive delivery spots.

The solution chosen by the co-design group was not a static idea, but is something that would need to improve and adapt over time, starting with a pickup point serving different geographical clusters, developing into dynamic regulation of urban space, and incentivizing consumers through pricing, information, and availability to make more sustainable delivery choices.

Finally, the participants were asked to split into their stakeholder groups and discuss what would be most important for them if they were to evaluate the solutions they had discussed, as summarized in Table 7. The indicators mentioned ranged from more quantitative measurements, such as number of deliveries, to more qualitative ones such as increased cooperation between actors.

Table 7: Evaluation criteria for the potential pilot

Consumers	Business	Municipality
Simplicity of the solution and communication	# of deliveries per hour	Fewer km driven
Price	# of delivers per/km driven	Reduce infrastructure costs
Reward system	How relevant are specific location points for mobile pick up points	Fewer vehicles used
Flexibility of where/how deliveries occur in exchange for differentiation in price	Customer satisfaction	Improved digital infrastructure
	Citizen/neighbour satisfaction	Cooperation and communication between multiple actors
	Economically viable (attractive to implement)	Effective use of area

5.4 Reflection on the workshop experience.

During the first workshop, there was a tendency for the business partners to step forward with their opinions first, but the structure of the activities within the workshop somewhat curbed this instinct. There was rarely a need for the facilitators to push for more voices to be heard, as the participants themselves took the initiative. In the end, despite recruiting fewer consumer participants than initially intended, this seemed to help facilitate deeper discussions for the workshop participants; there was more time for everyone to express their viewpoint. It seems unlikely that more consumer participants would have led to better discussions.

Another recurring issue during workshop 1 was that the facilitators needed to remind participants of the workshop's primary goal: identifying a problem. The participants were often ready to jump to the next phase and begin designing solutions before they had settled on a central issue to solve. The desire to focus on solutions was understandable, but it required frequent reminders from the facilitators to maintain focus on the problem and postpone solution design.

Especially in workshop 2, the main facilitator actively engaged with various groups to monitor the flow of discussions and to offer support when needed. When the participants were split into different groups, the facilitator circulated between the groups and inquired about their progress and whether they had any questions, occasionally engaging in discussions to assess the status of each group's dialogue. It was encouraging to witness lively discussions throughout the workshop. There was rarely a need for

the facilitator to intervene, other than providing some minor encouragement to maintain focus on the problem set out by the HMW question or ask them to further discuss details related to their ideas.

While the discussions went smoothly for the most part, it was seen as important to balance the group compositions. From experience with Workshop 1 and watching the early discussions, it became apparent that some participants were more comfortable in smaller groups while others were more willing to share their ideas in larger groups. The facilitators sought to balance the composition of groups according to the stakeholders within them and also in terms of the personalities of each group. This was done to ensure both that discussion would remain lively and that all participants would feel comfortable making their perspectives heard. To further support this, the facilitator would directly ask questions of participants who were not visibly engaged. This gave them a chance to voice their ideas or understanding of the group discussions. Despite these efforts, it was clear that some groups were more active than others and needed more active support from the facilitator.

The general structure of the workshop was very supportive of engaging the participants. By first forming individual ideas and then discussing them repeatedly in increasingly larger groups, the participants seemed to feel more comfortable discussing their ideas in front of the whole group by the end of the workshop. However, coming to a single idea and solution was challenging. As mentioned above, the participants showed a clear understanding that many of the issues being discussed were interconnected, and interdependencies between multiple actors and different demands made finding a simple clear solution challenging. One of the main benefits of the workshop was clearly engaging the different actors in a setting they would not otherwise have experienced and having the different stakeholders discussing with each other on equal terms despite sometimes conflicting goals.

At the end of the second workshop, attendees were thanked for their participation and IKEA distributed gift cards to the consumers. The facilitators were impressed by the four consumers for engaging actively in the discussions and contributing interesting ideas that brought new perspectives to the co-design team. Several participants stated that the workshops had provided valuable discussions with other partners, offering a new type of discussion forum that allowed participants to engage with people they would not have otherwise met.

5.5 Description of the pilot and its support mechanisms

Considering the input of the co-design workshops and the work performed in CodeZERO so far, the Oslo Pilot will consist of mobile pick-up points for goods of up to 30kg in weight to keep the loading and unloading operations safe for a mobile pick-up point. The 30kg weight limit is intended to allow somewhat bulky goods to be delivered that might not fit in a parcel locker, while still being light enough that a single person can handle them to avoid the need for home delivery. Additionally, multiple orders larger than 30kg would potentially require significant volume in the delivery van and reduce the number of customers that could be served at the pick-up point.

Prior to CodeZERO, IKEA had already been testing mobile pick-up points in more suburban and peri-urban areas. However, they had questions about whether or not this solution was contributing to sustainability and how well it would function closer to the city. There were also questions about where the pick-up points should be, how long a vehicle should park in a given location and whether or not space would even be available to use for this purpose. The co-design workshops confirmed broad interest between stakeholders in understanding how space in cities can be used to provide more sustainable delivery solutions. In addition, the solutions developed during the workshops identified mobile pick-up points as a potential first step on the road towards more effectively using space in cities for logistics. Mobile pick-up points were seen by the co-design team as relatively quick and easy to implement whereas some of the other solutions discussed would require changes to building processes and occur over a timeframe of 3 years or more. A necessary component to all the solutions discussed

during the co-design workshops was the collaboration and cooperation between logistics actors and public authorities.

Oslo and IKEA have since developed a list of 10 candidate locations where mobile pick-up points can occur. These locations are classified by Oslo according to the type of space available (parking space, curb side, park and ride location), safety concerns (need for 2 people in case of reversing), and the current parking signage. IKEA intends to pilot multiple locations simultaneously and is providing feedback on which locations are most attractive for them or suggesting other locations not already on the list. They are also developing communication strategies for launching the pilot using the communication guidelines being developed in WP4. In addition to discussions with IKEA, Oslo is also coordinating with their employees, especially parking enforcement officers, to ensure they are aware of the pilot and that the activities have been sanctioned by the municipality.

6 Utrecht

6.1 The engagement of stakeholders

6.1.1 The recruitment

In the case of Utrecht, the recruitment of consumers was a challenge. The initial plan of using the consumer representative group that already exists at Jumbo, called JOTT'ers, was not possible due to regulatory and organizational circumstances. That plan resulted therefore only in one consumer able and willing to participate in the workshops.

To make sure that the perspective of consumers is well represented in the co-design process, Jumbo chose to ask a third party to support. The thought behind this was not only to get more customers, but more specifically get customers that are not only using Jumbo as an e-commerce grocer, but also other competitors. That created the possibility to discuss the differences between the different options a consumer has (and the impact thereof). This resulted in three consumers that are all using Jumbo, amongst other e-grocers. The consumers were a mix of age, and place of residence (one consumer lived in the outskirts of Utrecht, where the other two lived in the city centre).

6.1.2 Location & timing

The workshops took place at TNO premises. Due to travel constraints within the codesign team, the workshops took place in the afternoon or later in the morning. TNO location is chosen because of two (practical) reasons:

- TNO's office is 'neutral' in the sense that TNO has no active voice in the development of the co-design process. Other offices in Utrecht (e.g. the municipalities office) could possibly give more attention to the voice of that party within the group.
- TNO's office is quite accessible by public transport and car.

During the organisation of the workshops, there were some issues with regards to the involvement of consumers, as discussed earlier. The mitigation for this issue entailed splitting the first workshop into two parts: one to gather the inputs from the local authorities and the retailer/LSP (on the 18th of March), and one (workshop 1.2) where the consumers view is included (on the 25th of June). Thereafter, workshop 2 with the whole codesign team, took place on the 16th of July.

6.1.3 The co-design team

The co-design group consists of multiple actors within the organisation of both the retailer/LSP and of the municipality. This diversity within the organisations ensure that the pilot is not too one-sided. In other words, it makes sure that it is not only in line with policy of the logistics team of the municipality of Utrecht, but it also is in line with the ideas of neighbourhoods in which the pilot would take place.

Three participants in the co-design group are considered as consumers. This is a diversity of consumers in sense of age, but also of the party they choose in e-commerce groceries shopping. More concretely, this method strived to reach people that are a customer of Jumbo itself, but also from flash delivery companies such as Flink.

Table 8 shows the participants who took part in the co-design process.

Table 8: Co-design team in Utrecht

Name	Organisation	Stakeholder group	Workshop 1.1	Workshop 1.2	Workshop 2
Jan Leensen	Jumbo	LSP	x	X	x
Marjolein van der Stok	Municipality of Utrecht	Local authority	x		x
Stan de Caluwé	Municipality of Utrecht	Local authority	x		x
Marlene van Doorne	Municipality of Utrecht	Local authority	x		x
Mark Verhoeven	Jumbo	Retailer		X	x
Wouter	Consumer online/offline	Consumer		X	x
Eeshwar	Consumer online/offline	Consumer		X	x
Judith	Consumer online/offline	Consumer		X	x

6.2 Workshop 1

The goal of the first workshop was to define the focus that the co-design team wants to take when solving the sustainability of delivery and return options of e-commerce in their city. To reach that goal, two important milestones were to be reached. First a list of challenges needs to be identified by the group. Second, the group needs to focus on one challenge and define it into a how might we question. That question will form the basis of the second workshop.

Normally, the additional goal of this workshop is to create a group among the codesign team. Given the challenges of the consumer involvement, this was not a perfect fit. The people present in workshop 1.1 are familiar with each other. The focus during workshop 1.2 is to create a group among the consumers and the retailer. During workshop 2, the focus on creating a group will be a focus point as well.

6.2.1 The workshop – following the double diamond principle

Due to the challenges of recruiting the customer group in time and the mitigation to that problem by splitting the first workshop into two parts, changed the setup of the workshop a bit as opposed to other pilot cities. The same principle was followed (the Double Diamond Process), but the exercises to follow that principle was altered. To gather an overview of the challenges that are relevant to the context of e-groceries in Utrecht, the first diamond of the Double Diamond-method is used. This meant that the parties present thought in a diverging way what (from their perspective) are relevant problems to the

sustainability of the delivery model of e-groceries in Utrecht. These problems were clustered in ‘Logistic optimization’, ‘energy related’, ‘security of supply’, and ‘other’. Figure 20 below shows this process in the first workshop together with the municipality and Jumbo.

Figure 20: Clustering the challenges in Utrecht



In workshop 1.2, involving the consumers, the same process was followed. The minor change and addition to workshop 1.2 as opposed to 1.1 are:

- In workshop 1.2, the consumer got the chance to explain motivations and general frustrations about e-commerce delivery. This resulted in a start of the discussion on why certain elements in e-commerce deliveries are organised in the way they are now.
- After the divergent brainstorming-part, the results of that part in workshop 1.1 is discussed with the participants as well. That way it was possible to integrate both workshops into one result.

During this workshop, some additions were made to the problems formulated in workshop 1.1 and some of the formulated problems were altered a bit to make it more in line with the view of consumers (e.g.: “the growing number of kilometres driven for e-commerce deliveries” is changed to “the growing number of kilometres driven for e-commerce deliveries, making deliveries more expensive and more nuisance in streets by vehicles.”).

An overview of the challenges identified in the workshops are summarised in the following Table 9.

Table 9: Overview of the challenges in Utrecht

Logistics optimization	Energy related	Security of supply	Other
Cost of operations in limited spaces (time windows, weight restrictions, etc.)	Share energy with neighbours for charging delivery vans	Suppliers block roads when delivering goods	Safety of supply during the trip
Special driver's license for delivery vans	Electrification of fleet vs. net congestion	Lack of parking possibilities for delivery vans	Safety of ZE vehicles (with regards to the lack of sound in neighbourhoods)
Congestion problem: autonomous growth city logistics + growing pressure on space		Streets in neighbourhoods are not designed for (un)loading	Image of e-commerce logistics vs private car use
Growing amount of km's for delivery of e-commerce, making deliveries more expensive and more nuisance in streets by vehicles.		'boodschappenarmoede' (poverty for groceries)	Image of delivery vans in neighbourhoods
Time windows			Negative effect of e-commerce on the decrease of visits to physical stores
Differentiation in price on time windows (and the lack thereof)			Sound of cooling engine
Deliveries of groceries are too slow as opposed to flash deliveries			

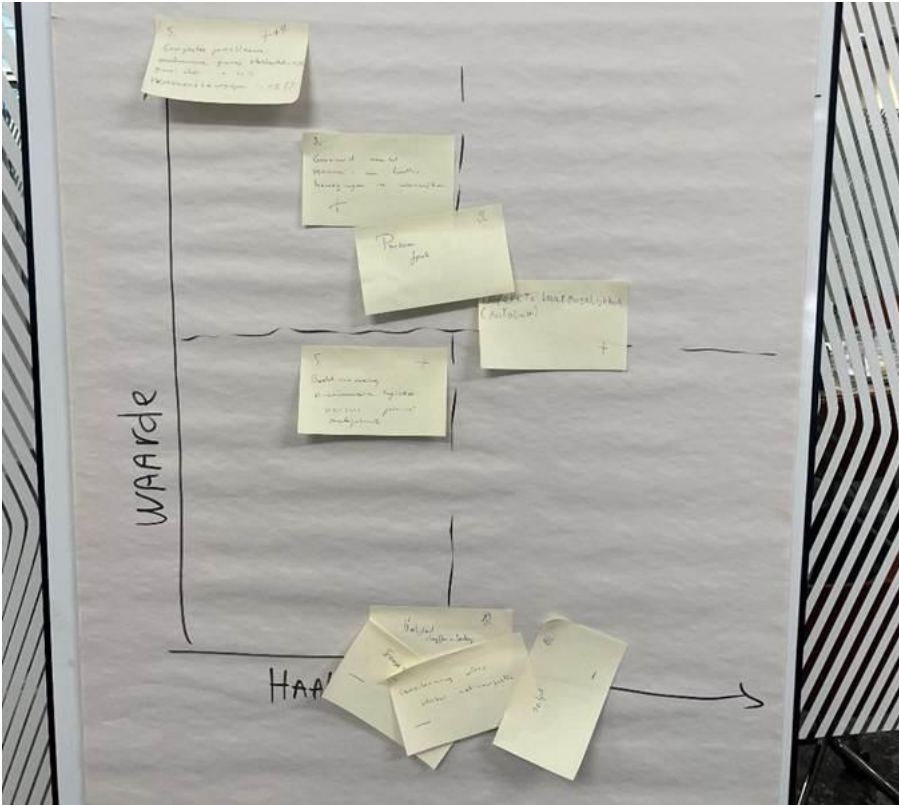
6.2.2 Overview of the challenges and the selection process

In the second round of both workshops, the groups were concerned with the selection/prioritization of the challenges mentioned. From this, a lot of the challenges were, after some discussion, either not relevant to the context of the project, or not feasible according to everyone present.

The challenges that remained were subject to the second round of the workshop. All participants got the chance to give two plus-signs and two minus-signs to the remaining challenges on the post-its. This had to be done based on two criteria: 1) What is the impact of this problem, and 2) Is it possible to solve this during the CodeZERO-project.

In this phase, to integrate both workshop 1.1 and 1.2, the signs from the first workshop were added to workshop 1.2. This made it possible to create one overview for the whole workshop 1 as pictured in Figure 21.

Figure 21: Challenges identified in Utrecht



The discussions during this selection mainly related to the applicability of certain mentioned problems to the project. A few problems, such as the increasing demand of logistics in combination with the increasing demand on space in inner cities was deemed as a very relevant problem. Nonetheless, this problem was also deemed a problem too substantial to be applicable in the timeline of the CodeZERO-project. This discussion resulted in a cluster of selected problems, that is formulated into one *How Might we* (HMW) question, which is: “*How Might we keep neighbourhoods accessible for e-commerce groceries, so that consumers have access to e-groceries in a sustainable way?*”

This HMW-question related to an interaction of regulations from the municipality and the way the e-grocer is dealing with those regulations. More concretely, Utrecht instilled several regulations regarding logistics (weight restrictions, time windows, emission regulations, car-free neighbourhoods, etc.) with the goal of keeping the neighbourhoods as liveable as possible. The downside of these regulations is that Jumbo deals with these restrictions by ‘simply’ ruling out neighbourhoods with these regulations as their service area, possibly resulting in neighbourhoods with relatively lower accessibility of e-groceries.

6.3 Workshop 2

The second workshop focused on shaping a practical idea for a delivery and/or return solution to test later in the CodeZERO project. Using the initial question from the first session as a jumping-off point, different directions were explored and got hands-on with potential solutions.

The workshop had three main parts:

1. Reverse brainstorming to surface challenges and opportunities,
2. Clustering and refining ideas,
3. Selecting one idea to take forward towards the pilot.

This workshop, the whole co-design team (from both workshop 1.1, and 1.2) joined, allowing us to build on the discussions and energy of last time. The workshop kicked off with a short welcome and a quick reintroduction round to ease back into the group flow. During this workshop there was extra time to make sure everyone was acquainted with each other, as the municipality was not present during workshop 1.2.

6.3.1 Reverse brainstorming to surface challenges and opportunities

The first round of the workshop consisted of reversed brainstorming, with the goal of surfacing possible ideas for a solution on the HMW-question. Before this took place, there was some discussion about the regulations of the municipality and to which extent the regulations served their goals. Next to that, there was a minor discussion on the reaction of Jumbo on those regulations. Consumers wanted to make sure that Jumbo is indeed looking for a sustainable way of delivering goods to the consumer in those inaccessible neighbourhoods rather than 'just making money'.

After that fruitful discussion, all individuals started writing up thoughts in line with D4.1. the participants took eight minutes to write down ways to counteract the HMW-questions on the back of some post-its, with the positive act to support it on the front.

After these eight minutes, the participants were grouped to discuss their ideas and potentially merge them into possible pilot ideas for the workshop.

6.3.2 Clustering of ideas and selection top 6 ideas

This discussion is done by making groups of two or three. The grouping was done on basis of two parameters: 1) the duos should be presenting other stakeholder groups, and 2) the dominant persons in the group cannot be in the same group as the person who is not that extravert. This created an ambience that supported all participants to speak their minds and gave interesting discussions on their perspectives on some of their ideas.

The groups had discussions from their own post-its to a few clusters of ideas. Surprisingly, the groups all had similar ideas mentioned. There were some differences though; where the group that contained Jumbo itself had ideas regarding delivery options online to nudge consumers towards more sustainable delivery models, did groups with consumers and the municipality look to possibilities that consumers had to make the delivery model more sustainable (such as picking up groceries from a so called 'Bootschap', which roughly translates into grocery-boat).

The individual groups had to, in the end, select and write down their top three pilot ideas onto a flip over, based on the discussions they had. This resulted into the following six ideas:

- Instilling a micro hub in the city centre, in combination with LEFVs to deliver the last mile
- Giving discounts or adding costs to certain time slots for customers to nudge them into choosing the option for a more efficient delivery model.
- Picking up groceries (pre-packed) from a central location in the city centre.
- Consolidating ordered goods for the city centre and dropping them off at the border of the city, from which cargo bikes deliver the last part.
- Make sure that e-commerce grocery consumer chooses the place (through geofencing) where the delivery company can park their vehicle without causing nuisance.
- Prohibit customers in the city centre to choose a time slot, but instead let the consumer know when their groceries arrive (one day before the delivery moment)

6.4 Reflection on the workshop experience

The case of Utrecht has been a bit different compared to the other cases in the project. The needed mitigation of splitting workshop 1 into two workshops due to lack of consumers in the beginning of the process led to a bit more dynamic co-design group. Nonetheless, all parties explicitly mentioned the added value of having a co-design process in these types of projects and felt the sense of belonging in the co-design group, albeit that not all people could be present at all three workshops. All parties felt that the method used in these workshops was engaging, created a level playing field and above all was fun to apply. An expression of that well-perceived workshop structure was the fact that Wouter, one of the consumers, thought along on how to make this an engaging LinkedIn-post (using this expert knowledge as a communications expert).

The usage of the TNO location as a neutral ground added to the open discussion and good collaboration, according to Jumbo and one of the customers. The mix in groups helped in making sure that everyone had an equal voice in the process.

One main issue was raised during the evaluation of the workshop: keeping on track of the exact goal of the workshop. Especially during workshop 1, it was perceived hard to focus only on the problem selection rather than already thinking about possible solutions. This had to do with the fact that the diverging brainstorm session created a fuzzy boundary between problem-exploration and solution-exploration. Nonetheless, when being reminded of the goal of each workshop, that did not result in bias during second workshop.

6.5 Selection of the pilot idea and elaborating on the plan

The six ideas emerged from the co-design workshops (see 6.3.2) were the basis of the final discussion and selection of the pilot idea for the CodeZERO-project. In the discussion, it turned out that Jumbo had been on the forefront for innovation with regards to e-commerce groceries in the past years. Some of the ideas had already been tested, or even already implemented. The main takeaway from the final discussion was that the pilot should be innovative enough, instead of just tweaking the business model of Jumbo a bit. When it came to the actual selection of the pilot idea, a split between the group arose. Where one part was very much in favour of the idea of using pricing as a nudging-method for customers, the other part was advocating for the idea of using a micro hub in the city centre.

After some discussions, it was concluded that pricing was just not innovative enough for the pilot in CodeZERO, as Jumbo is doing an experiment with pricing on time slots already. The workshop concluded by giving points to the best idea and minus points to the ideas they were not in favour of (like the process in workshop 1). Figure 22 shows the process that resulted in the selection of the pilot idea.

Figure 22: The co-design team working on the selection of the pilot idea



From this point, the only part left was the elaboration on the pilot idea. The remaining 30 minutes entailed a discussion with the whole group on the key steps to organize the pilot, and what should be delved into further. The following points for that arose:

- KPIs – what would be important KPIs to look at when trying this out?
- What exact location could be used for this micro hub, so that the municipality can facilitate this?
- Which vehicle can be used for the last mile?

The co-design group agreed that TNO and Jumbo will come with a concrete proposal about the organisation of these concrete points and communicate them with the stakeholders. The questions that are still open will therefore be answered in the pilot plan for Utrecht.

7 Conclusions

The workshops organised in Antwerp, Milan, Oslo and Utrecht resulted in different solutions that could make e-commerce more sustainable in these cities. In Antwerp, the parcel lockers of bpost will be further expanded and online shoppers will be encouraged to further use the infrastructure when choosing their delivery method. In Oslo, mobile pick-up points will be tested by Ikea for goods of up to 30kg in weight. In Milan, where the collaboration between So.De and IKEA already provides environmentally and socially sustainable deliveries in the city, the focus is on improving consignments in the city centre by testing new delivery models and increasing the visibility of these solutions to citizens. In Utrecht, goods ordered from the city centre will be delivered to a micro hub in the city centre, from which the last mile will be done by cargo bikes.

Beyond the innovative outputs generated by these workshops, lessons learned from the co-design process represent a key outcome. To reach these solutions, four teams of online consumers, retailers, local authorities and transporters were engaged into a workshop format that followed the four key principles of co-design: **sharing power, priority on relationships, using participatory means, build capability**. How these principles supported the engagement of the stakeholders and ultimately the solutions proposed for the pilots in CodeZERO are discussed in the following.

7.1 Sharing Power

The format of the workshops was able to propose spaces where all the members of the co-design team could contribute on equal terms. Given that participants are sometimes more comfortable in smaller groups while others were more willing to share their ideas in larger groups, the mix of activities proposed in the workshop format allowed the different profiles to express their ideas. To further support this, facilitator asked questions to participants who were less visibly engaged.

The participants appreciated the openness of the environment and the ability of the group to engage in dialogue respectfully and collaboratively in particular. Participants built on each other's inputs and remained focused on exploring meaningful contributions. Facilitators did not need to intervene beyond gentle guidance, as the participants themselves took the initiative.

Despite unequal attendance (e.g., fewer consumers than planned in some cities), the process enabled meaningful influence from all those present. They particularly appreciated that solutions had emerged through a collaborative and unified process, fostering a strong sense of consensus. The process was however not always straightforward. Coming to a single problem or a single solution was challenging in some occasions.

7.2 Priority on relationships

Time spent together allowed participants to develop mutual understanding and trust. While the format was long and represents a constraint to stakeholder engagement, the duration of the workshops and the repetition of the sessions supported relationship building. Participants got to know each other across professional and sectoral boundaries, discovering what matters to different groups. Duration did not appear as a constraint, given that more participants might have affected relationship building.

As a result, there was strong continuity in participation, with many individuals attending the second workshop and confirming their interest in joining the third session, expressing a sense of ownership and personal investment. Some shared their positive experiences publicly (e.g., social media), reflecting a sense of connection to the project.

7.3 Using participatory means

The workshops used a highly participatory format, moving from individual reflections to small group discussions and then to plenary exchanges. Some activities such as the “How Might We”-questions helped in keeping the focus and in structuring prompts. Others left the space for open dialogue and co-design. That mix allowed to enable the convergent and divergent phases of design thinking in an engaging and constructive format, albeit sometimes getting to the one problem or one solution was challenging. Facilitation helped to keep discussions focused on the intended outcomes without limiting the natural exchange of ideas. Overall, the balance between structure and flexibility contributed to a productive and motivating experience for all involved.

7.4 Building capability

Members of the co-design team gained a better understanding of the complexity of shared challenges and the interdependence of different actors. They learned how to engage across differences, improving their ability to collaborate. They were also confronted to novel perspectives that changed their thinking and the discussion of the group. More importantly, more confidence was observed through the workshops among members of the co-design team. By first forming individual ideas and then discussing them repeatedly in increasingly larger groups for example, the participants seemed to feel more comfortable discussing their ideas in front of the whole group by the end of the workshop.

Facilitators on their side gained insight into how to structure workshops to foster confidence, encourage quieter voices, and adapt to group dynamics, improving future co-design capability.

Annex I – List of reviewed literature

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Sullivan, Sean (2020). Double Diamond Design Process. Available at <https://www.productstride.com/double-diamond-design-process/>