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GREEN-LOG

DELIVERABLE

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Executive Summary

The GREEN-LOG project deliverable D1.2 details an 18-month effort focused on developing sustainable urban logistics solutions through Task 1.3 “Living Lab Co-Design of Last-mile Solution Blueprints” and Task 1.4 “Cooperative Business Models for City Logistics”. Analysing urban contexts in Ispra, Barcelona, Oxfordshire, Flanders, and Athens - where the GREEN-LOG Living Labs (LL) are established - this deliverable examines factors affecting mobility and environmental impact. Specifically, through continuous stakeholder engagement and iterative co-creation workshops, Task 1.3 elaborates on GREEN-LOG solutions, identifying key factors in urban freight and service demand, and creating the GREEN-LOG conceptual architecture based on the Observe, Orient, Decide, Act (OODA) paradigm. Task 1.4 explored cooperative business models, contributing to the design of the GREEN-LOG solutions, positioning them for targeted customers, and examining cost structures and revenue streams using hybrid approaches based on the Osterwalder methodology. The development of cooperation agreements and decision support approaches to resolve stakeholder conflicts was also part of this task and is detailed in this deliverable. The current report highlights the innovative last-mile delivery solutions offered by this project, such as autonomous droids and cargo bikes, integrated with public transport. Key findings emphasize sustainable urban logistics, stakeholder engagement, and continuous improvement through co-creation and collaborative strategies, providing recommendations for future city logistics planning, input to technical components’ development (WP2, WP3) and implementation (WP4).

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1.0	28-06-2024	INTRA	Final QA'ed version

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Definitions, Acronyms and Abbreviations

Acronym/Abbreviation	Title
AUEB	Athens University of Economics and Business
BYOD	Bring Your Own Device
CAV	Connected Autonomous Vehicle
DAEM	Dimos Athinaion Epicheirisi Michanografisis
EV	Electric Vehicle
FGC	Ferrocarrils de la Generalitat de Catalunya
HALM	Halmstad University
JRC	Joint Research Center
LaaS	Logistics as a Service
LL	Living Lab
LSP	Logistics Service Provider
MCC	Micro-Consolidation Center
MDH	Mobile Delivery Hub
OCC	Oxfordshire County Council
OECD	Organisation for Economic Co-operation and Development
PDA	Personal Digital Assistant
PoC	Proof-of-Concept
PPP	Public-Private Partnership
RFID	Radio Frequency Identificator
SULP	Sustainable Urban Logistics Plan
SUMP	Sustainable Urban Mobility Plan
UAegean	University of the Aegean
UFT	Urban Freight Transport
UoA	University of Antwerp
VANaPED	Solucions Ultima Milla Sl
VIL	Vlaams Instituut Voor De Logistiek VZW
ZEZ	Zero Emission Zone

1. Introduction

1.1 Document Scope

This report presents the result of the first eighteen (18) months of work in the GREEN-LOG project, specifically on task 1.3 and task 1.4 to deliver 'Solutions Blueprints and Multi-actor organisational and business models' according to the specification of Deliverable 1.2 in the Grant Agreement. The outputs of T1.3 and T1.4 are detailed in this deliverable and will feed subsequent WPs and specifically, WP2, WP3 and WP4. This deliverable is meant to be updated with the results from Task 1.3 and Task 1.4 which will continue until M33. The updates will be reflected in the updated version of D1.2, which is D1.4 "Solutions Blueprints and Multi-actor organisational and business models - 2nd Version" (to be submitted on M33).

1.2 Document Structure

The document is divided into six main sections.

Section 1 "Introduction" is the introductory section of this deliverable.

Section 2 "Urban context and current mobility situation" examines the urban environment and its impact on mobility patterns. It focuses on how factors such as city layout, population density, and existing transportation infrastructure shape urban mobility. This section provides a detailed analysis of how these elements contribute to challenges like congestion and pollution, laying the groundwork for discussing potential improvements.

Section 3 "Co-creation workshops and use cases" details the application of co-creation workshops that brought together stakeholders from various sectors to collaboratively design solutions for urban mobility challenges. It showcases multiple use cases from all GREEN-LOG LLs, illustrating the diverse approaches and strategies developed through these workshops to address specific local needs.

Section 4 "Conceptual architecture and design approach" outlines the theoretical framework and design methodologies employed to develop innovative solutions for improving city logistics. It discusses the conceptual underpinnings that guide the design process and the strategic approaches used to ensure these solutions are both effective and scalable.

Section 5 "Cooperative Business Models for City Logistics", focuses on the development of cooperative business models, discussing how different stakeholders within the urban logistics ecosystem can collaborate to create sustainable, efficient, and economically viable transportation solutions. It covers the identification of key partners, the structuring of collaborative agreements, and the economic frameworks that support these models.

Section 6 "Conclusions" summarizes the key findings and insights derived from the analysis of urban contexts, co-creation processes, and the application of new business models. It reflects on the impact of these initiatives on urban mobility and provides recommendations for stakeholders to enhance future city logistics planning and implementation.

2. Urban Context and Current Mobility Situation

The urban context and current mobility situation reflect the complexities of managing space and mobility in densely populated areas, highlighting the need for sustainable urban planning and efficient transportation systems. This section focuses on the five specific Living Lab (LL) areas considered in the GREEN-LOG project, each with its own unique characteristics and challenges. These areas include Ispra in Italy, Barcelona in Spain, Oxfordshire in the United Kingdom, three cities in Flanders (Ghent, Mechelen, and Leuven) in Belgium, and Athens in Greece. By examining the size, geographic location, and economic development of each LL, we gain insights into how different urban contexts influence the implementation of logistics solutions. Additionally, the state of mobility, including traffic congestion, public transportation options, and infrastructure for walking and cycling, provides a comprehensive overview of the current mobility landscape in these cities.

In the following sections, we explore the specifics of each LL area, examining their current mobility situations and the innovative last-mile delivery solutions being deployed. We also discuss the challenges and opportunities related to mobility and logistics within these urban environments, such as the integration of autonomous delivery systems, the use of cargo bikes, and the establishment of micro-hubs. These examples illustrate how cities are adapting to the growing demands of urban logistics while striving to create more sustainable and efficient transportation networks.

2.1 Ispra

The Joint Research Centre (JRC) in Ispra ranks as the third-largest European Commission site, following Brussels and Luxembourg. Originally established in 1960 as a nuclear research facility, it has evolved into one of Europe's premier research campuses, boasting numerous laboratories and unique research infrastructures.

The European Commission's JRC in Ispra, Italy, leverages its advanced infrastructure to demonstrate the capabilities of last-mile delivery solutions at its LL for future urban ecosystems. This facility, expansive and fully equipped like a small town, serves as an excellent testing ground for innovative mobility applications, combining real-world conditions with a controlled environment.

Figure 1: JRC staff test self-driving delivery robot as part of research on future mobility (Source: European Union)

The role of e-Novia (Yape and Measy) is instrumental in showcasing the effectiveness of autonomous droids and cargo bikes in the last mile delivery of lunch boxes.

Figure 2: MEASY electric cargo bike (Source: e-Novia SPA)

E-Novia has adeptly incorporated YAPE[1] autonomous droids to meet the daily delivery needs of the local canteen, which sees up to 10 deliveries per day as of 2023. The droids streamline an efficient ordering system where lunch boxes are gathered, stored at a central refrigerated sorting point, and delivered according to the time preferences chosen by users. Similarly, E-Novia utilizes MEASY cargo bikes to move lunch boxes from the canteen to the sorting point. This operation demonstrates a semi-automated handling system that combines manual labor with technological tools like PDAs for tracking and routing, ensuring smooth and effective delivery processes within the specified area.

2.2 Barcelona

VANaPED, a partner in the GREEN-LOG project, collaborates with other stakeholders and Logistics Service Providers (LSPs) to enhance urban logistics in Barcelona. Various last-mile delivery solutions, led by VANaPED, Mensakas, Trèvol, and Cargobici, are deployed to optimize these efforts. These operators have established micro-hubs across the city under a Public-Private Partnership (PPP) model, effectively covering all ten districts of Barcelona. This network supports the extensive use of cargo bikes, which are vital for reducing congestion and emissions in the densely populated urban areas.

[1] https://yapemobility.it/

Figure 3: VANaPED cargo bikes and e-Van

The micro-hubs cover city-wide needs, with data indicating significant parcel volumes managed through these facilities. Additionally, the integration of smart lockers and stores by providers like Geever[2] enhances the accessibility and efficiency of parcel deliveries, especially in districts like Sant Gervasi, which are included in broader logistical planning efforts.

Barcelona is also exploring innovative pilot projects for 2024 that involve e-vehicles, integration of public transport with cargo bikes and trains, and even robotic delivery systems at train stations. These pilots aim to test the efficiency and scalability of integrating last-mile delivery with public transportation infrastructures, such as the services provided by Ferrocarrils de la Generalitat de Catalunya (FGC).

To support these initiatives, Barcelona has developed a Sustainable Urban Logistics Plan (SULP), which is currently under consultation. This plan aims to structure the management of city-wide logistics in a sustainable manner. The document outlining this plan can be accessed through the Barcelona city council's repository.

These logistical efforts are supported by collaborative discussions and workshops involving multiple logistics service providers to coordinate efforts and integrate various delivery methods. This approach ensures that the city's logistics framework remains adaptable to growing demands and changing urban environments, facilitating efficient and sustainable urban logistics practices.

2.3 Oxfordshire

Oxfordshire has embraced a range of innovative last-mile delivery solutions to enhance urban logistics and sustainability. Key service providers include Pedal & Post (GREEN-LOG project partner), UniPart[3], and Velocity[4], alongside various retailers providing Click & Collect services, and infrastructure such as Amazon[5] and InPost[6] parcel lockers.

Pedal & Post, a limited liability company, operates a parcel consolidation pilot at the University of Oxford colleges, providing a practical demonstration of streamlined delivery within educational institutions. UniPart manages a regional Urban Consolidation Centre, servicing a

[2] https://www.geever.es/
[3] https://www.unipart.com/
[4] https://velocityds.co.uk/
[5] https://www.amazon.co.uk/
[6] https://inpost.co.uk/

broad area and offering insights into regional logistics management accessible via their website. Velocity specializes in cargo bike and zero-emission logistics specifically within Oxford, indicating a focus on eco-friendly transport solutions.

The city also benefits from dedicated parking spaces for loading and unloading, enhancing the efficiency of delivery operations. Access restrictions, such as the Oxford Zero Emission Zone (ZEZ) and low traffic neighborhoods, are enforced by local authorities to reduce congestion and pollution, making Oxford a leader in sustainable urban transport.

In terms of delivery specifics, Pedal & Post has reported handling between 13,000 to 187,200 deliveries in 2023 across various services, including local deliveries and partnerships with national parcel carriers like EVRI[7] and DPD[8]. These operations are supported by modern logistics technologies such as the Insta-dispatch[9] system, which optimizes routing and scheduling to improve delivery efficiency.

Oxfordshire's approach to last-mile logistics is backed by comprehensive planning and cooperative efforts among local businesses, educational institutions, and government bodies. The region's SULP, detailed in the Local Transport and Connectivity Plan, outlines strategies for future freight and logistics operations. Additionally, Oxfordshire's freight and logistics strategy, alongside national strategies like the Future of Freight plan and Gear Change for active travel, provide a robust framework for sustainable logistics.

To support these initiatives, Oxfordshire has established a Last Mile Freight Sprint Group, which includes local authorities, universities, and large businesses. This group works collaboratively to refine and implement logistics solutions, sharing knowledge and resources to enhance the efficiency and sustainability of last-mile deliveries across the region. This cooperative structure exemplifies how Oxfordshire is integrating logistical improvements with broader urban planning and sustainability goals.

2.4 Flanders (Ghent – Mechelen – Leuven)

2.4.1 Ghent

Ghent has developed a comprehensive approach to last-mile delivery solutions that aligns with its SULP. The city employs a variety of innovative strategies to manage urban logistics and enhance the efficiency of goods delivery within the urban space, particularly focusing on reducing congestion and emissions.

The city has implemented several initiatives through PPPs and public ventures. The GentLevert[10] urban consolidation platform, for example, involves a collaboration among the City of Ghent and various logistics partners to optimize the delivery and collection of goods in the inner city. This initiative aims to reduce traffic in the city center by centralizing the distribution of goods to and from a single consolidation point.

Microhub e-commerce solutions, managed by the City of Ghent, have also been established within the city's ring (R40) to facilitate parcel transshipment from a centralized garage box location to final destinations via cargo bikes. This hub notably supports operations by PostNL and invites other partners to join.

[7] https://www.evri.com/
[8] https://track.dpd.co.uk/
[9] https://www.instadispatch.com/
[10] https://gentlevert.be/en/about-gentlevert

Additionally, Ghent has designated car-free areas, pedestrian streets, and official school streets, where vehicle restrictions support a safer and more pleasant urban environment. These areas not only enhance the quality of urban life but also push logistics services towards more sustainable practices like using cargo bikes.

Specific projects like the LOOP Gent Project under PPP attempt to integrate smart contracts to create efficient and sustainable delivery routes for urban logistics, focusing on city offices and university buildings. Other private initiatives, such as the City Depot by BD Logistics and City Antz by Veolia, focus on sustainable urban distribution and on-demand waste collection, respectively.

Bike courier services are widespread, with operators like Cargo Velo, Foodsprint, Urbike, and BPost providing agile and environmentally friendly delivery options across the city. These services highlight the shift towards more sustainable urban freight practices.

Moreover, Ghent is exploring innovative logistics models such as Horizon DISCO, a project that seeks to optimize urban logistics through a data-driven, integrated, synchromodal, collaborative, and optimized urban freight meta-model. This initiative is part of a broader effort to digitally transform urban logistics planning and support the city's sustainability goals for 2030.

The city's SULP and other policy documents like the urban logistics plan provide a structured framework for these initiatives. These documents outline strategies for managing urban logistics not only to improve traffic management and reduce environmental impact but also to enhance the livability and accessibility of urban spaces.

In terms of governance, Ghent has established supportive structures such as GentLevert, which, despite its limited stakeholder engagement due to linkage to a 24-hour permit for the car-free area, represents a step towards more inclusive and recurrent stakeholder engagement platforms. The city plans to expand these platforms to include a wider range of stakeholders, facilitating better coordination and implementation of logistics solutions.

2.4.2 Mechelen

Mechelen has established a variety of last-mile delivery solutions to enhance urban logistics and sustainability in line with its SULP. These efforts are primarily aimed at reducing congestion and emissions, improving the efficiency of deliveries, and increasing the use of green transportation methods.

Mechelen’s approach to urban logistics includes the use of private operators like ODTH, which operates the City Hub, offering city-wide logistics services detailed on their website. Bike courier companies such as Ecokoeriers, Cargovelo, and Foodsprint also play significant roles in delivering parcels across the entire city area, utilizing cargo bikes for a more sustainable approach to package delivery. These companies ensure efficient parcel delivery within the urban core and support the city's commitment to reducing vehicular traffic and emissions.

Bpost, the national postal operator, has established a network of parcel lockers throughout Mechelen, which facilitates the easy pickup and drop-off of parcels, reducing the need for door-to-door deliveries and thus minimizing traffic. However, their micro-hub in the city center, aimed at consolidating deliveries for last-mile distribution by cargo bikes, does not currently serve the GREEN-LOG demonstration area.

In addition to these services, Mechelen is actively pursuing innovations in logistics through partnerships and pilot projects. For instance, the City Hub by ODTH and bike couriers from

Ecokoeriers are integral to a pilot project where consumers can choose their delivery preferences via the LaaS-platform. This system allows consumers to decide how they receive their parcels, whether through direct delivery to home addresses or via parcel lockers, enhancing flexibility and efficiency.

Mechelen's commitment to sustainable logistics is further underscored by its convenant on sustainable urban logistics, signed by more than 40 logistics companies and organizations. This agreement aims for zero-emission logistics by 2030, demonstrating Mechelen's proactive approach to environmental sustainability and urban transport management.

The city has also established a zero-emission working group as part of its supportive structures for stakeholder engagement. This group facilitates regular meetings and discussions among logistics providers, local businesses, government, and other stakeholders to ensure ongoing collaboration and innovation in urban logistics. The group aims to meet at least twice a year to discuss progress, challenges, and future plans, ensuring that all parties are aligned in their goals and efforts towards making Mechelen a model for sustainable urban logistics.

Through these comprehensive measures, Mechelen is not only improving its current logistics operations but also setting a foundation for future innovations that will continue to enhance urban mobility and sustainability.

2.4.3 Leuven

Leuven is advancing in its urban logistics by implementing a range of last-mile delivery solutions tailored to enhance the efficiency and sustainability of the city's transport systems. The city has established various partnerships and initiatives that underscore its commitment to creating an integrated and environmentally friendly urban logistics network.

Urban Consolidation Centre and Microhubs

Leuven has engaged in significant collaborations with private and public entities to streamline urban deliveries. CityDepot, a private operator, manages an urban consolidation center that services the entire city, helping to reduce congestion and improve delivery times by centralizing goods distribution. Additionally, cycle logistics companies such as Urbike and Cargo Velo are starting operations in Leuven, setting up microhubs that facilitate the use of cargo bikes for last-mile deliveries.

Cycle Logistics and Electric Vehicle Diffusion

The city promotes the use of cargo bikes through providers like Urbike, Cargo Velo, and bpost, which not only contribute to reducing traffic but also lower emissions in the city center. Leuven has also seen an increase in electric vehicle use, particularly through subsidies and tax advantages offered by the Flemish Government. Bpost has designated parts of Leuven as an "ecozone," where all deliveries and pickups are done using electric vans or cargo bikes, further supporting the city's sustainability goals.

Smart Parking and Access Restrictions

Leuven has implemented smart solutions for parking and vehicle access, including dedicated spaces for loading and unloading with restrictions to ensure smooth flow during peak hours. The city also employs advanced systems like ANPR cameras and circulation plans to manage vehicle access and reduce congestion in key areas.

Innovative Delivery Solutions

The project "wij.leveren" (we.deliver) represents a horizontal logistics collaboration involving the City of Leuven and six neighboring municipalities, designed to facilitate local pick-ups and deliveries through a data-driven approach. This project has successfully integrated traditional delivery methods with innovative logistics solutions, improving the overall efficiency of parcel deliveries in the region.

Parcel Lockers and Click & Collect Services

Leuven has a robust network of parcel lockers operated by bpost and Bringme, facilitating convenient parcel collection and drop-off at various locations throughout the city. This system not only reduces delivery trips but also provides residents with flexible options to retrieve their packages, contributing to lower vehicle emissions and traffic.

Sustainable Urban Logistics Plan (SULP)

Leuven is in the process of finalizing its SULP, which includes a comprehensive approach to managing city logistics. This plan is designed to integrate with broader transportation and environmental policies, ensuring that logistics operations contribute positively to the city's sustainability targets.

Stakeholder Engagement and Supportive Structures

Leuven is proactive in engaging various stakeholders through platforms that facilitate information exchange and collaboration on urban logistics projects. These platforms include working groups, regular meetings, and brainstorming sessions that help tailor logistics solutions to the city's needs and challenges.

Through these initiatives, Leuven is setting a standard for sustainable urban logistics, leveraging technology and collaborative strategies to enhance delivery efficiency and reduce the environmental impact of its transport systems.

2.5 Athens

Athens, a densely populated metropolis, has faced significant urbanization throughout the 20th century, resulting in various urban and transportation challenges, particularly in the realm of urban freight transportation. The city's layout is compact and highly dependent on cars, contributing to energy consumption and environmental degradation. In response to these challenges, Athens has undertaken measures and strategic plans to promote sustainable urban mobility and address climate change impacts, focusing increasingly on urban freight solutions. Athens is addressing its increasing logistics demands through a coordinated effort involving public officials, logistics providers, and residents. This collaboration focuses on creating sustainable delivery solutions that enhance Athens' economic recovery and urban development.

The demonstration will occur in the historic center of Athens, which, according to the Sustainable Urban Mobility Plan (SUMP) issued in April 2021, will become a Limited Traffic Zone (LTZ). In the LTZ, vehicular traffic is restricted, except for taxis, public transportation, and small delivery vehicles.

The LL aims to explore and demonstrate multistakeholder partnerships through the design, deployment, and use of open shared MCCs, logistics hubs, and white label schemes for picking up and delivering parcels with cargo bikes, and electric vehicles which will also act as Mobile Depot. The municipality will provide public spaces, including parking lots, to serve as shared micro consolidation points.

Figure 4: Municipal parking lots in the heart of Athens that will be used as shared MCCs.

3. Co-creation Workshops and Use Cases

In the GREEN-LOG project, LLs are essential for driving innovation and facilitating collaboration among stakeholders to improve logistics efficiency and sustainability. These labs serve as dynamic forums for the development of new delivery solutions, enhancing community and business partnerships and aligning with local authorities to foster sustainable urban development [REF-01]. The project's groundwork began with substantial stakeholder engagements that led to a series of co-creation workshops across Europe, each tailored to the unique logistical challenges of the participating cities. From Ispra's innovative use of delivery robots and cargo bikes to Athens' implementation of micro-consolidation centers and mobile depots, these sessions have showcased diverse approaches to enhancing last-mile delivery systems.

3.1 Continuous Stakeholder Engagement

LLs are collaborative spaces where diverse stakeholders work together to solve complex urban problems. In city logistics, LLs provide a platform for testing innovative solutions to improve the efficiency, sustainability, and resilience of Urban Freight Transport (UFT) systems. They facilitate knowledge exchange and learning among stakeholders without conflicting interests. LLs offer a multidimensional perspective by examining how different UFT solutions are perceived by stakeholders such as shippers, public authorities, residents, and recipients, and how these perceptions impact adoption and use.

The GREEN-LOG LL model provides a dynamic demonstration set of sites for innovative delivery solutions . It is also aimed to be part of the development of relationships between local communities, businesses, and authorities to create opportunities for social innovation along with long-term engagement in developing greener last mile delivery solutions. To achieve this, WP1 and specifically Task 1.1 was focused on identifying key stakeholders in the city logistics sector. Based on Smith & Iversen [REF-02], a conceptual framework for establishing LLs has been developed. This framework includes three phases: scoping, development, and scaling [REF-03]. This framework implies a process for creating a shared vision, establishing governance structures, and promoting stakeholder engagement continuously throughout the life of the project. This is achieved by bringing together not just users and companies, but also government and academic institutions in the development.

The GREEN-LOG LL scoping phase has been conducted between M1-M18 through activities in Tasks 1.2 and 1.3 that include establishing key stakeholders, creating core teams, aligning the goals and visions through activities to identify barriers and key success factors [REF-03]. An important segway into the LL development phase of the delivery solutions was to bring the stakeholders together to discuss where and how to place the solutions into the city landscape, as well as discussing the particularities of what was needed in the next steps in terms of engagements, deeper understandings of different user types and user scenarios. This was discussed in co-creation workshops with each LL core team. The results of these co-creation workshops are presented below in the LL core teams' descriptions of their use cases.

Next step after these co-creation workshops has been to describe the users of the delivery solutions in more detail through continuous stakeholder engagements through Task 1.2. These activities have been facilitated to go into more detail about what can be implemented in the first demonstration of the development phase (Tasks 4.2-4.6) to move the LL activities toward the third phase (scaling) in the second round of demonstration. In these engagements the core teams have been facilitated by WP1 task leaders to identify the primary users of the delivery solutions, what they already know about their needs and the unknowns that need to

be explored through the first demonstration. These engagements have also been organised to outline what kind of user studies can be organised to unfold the identified unknowns and how this can be integrated into the first demonstration. The organisation and results of these interactions are described in more detail in D1.6 [REF-04].

The regular integration of co-creative approaches ensures the maintenance of constant engagement with relevant stakeholders. As such, this applies not just to the level of interaction with the stakeholders who are actively part of the LL teams, but also extends to the process of reaching out and maintaining contact with the citizens who are considered actors within the use case of each city. For this reason, a co-creative approach has been introduced to create and strengthen channels of communication between the LL team and their respective users, as well as promoting inter-city communication among LLs as well. This strategy exists as an option that is available to be used while the development of GREEN-LOG solutions continues through the upcoming stages. Besides serving as an effective way of engaging stakeholders as we continue monitoring their requirements, it would also play an active role in monitoring the impact of GREEN-LOG solutions as they begin to be implemented within the LLs. By fulfilling this dual purpose, the co-creative filmmaking strategy ensure a smooth transition between the development and scaling stage of the LL development.

In the following sections, the details of five co-creation workshops organized within the GREEN-LOG project are presented. Each workshop aimed to harness the collective expertise and insights of participants from diverse backgrounds, including local government representatives, research institutions, and logistics professionals. The ultimate objective was to co-create innovative solutions and validate the use cases to be tested in the different LLs (

3.2 Ispra

3.2.1 Co-creation Workshop

The workshop titled "Co-Creating Next-Generation Last-Mile Solutions," held on September 29, 2023 in Ispra, Italy, was a collaborative effort to address last-mile delivery challenges at the Ispra LL within the GREEN-LOG project. With a mix of nine onsite participants from the JRC, including representatives responsible for canteen and site management and logistics, and eighteen online participants, the workshop served as a platform to discuss and co-create environmentally friendly and socially beneficial delivery services. Key discussions centered on the unique infrastructure of the JRC, which includes a vast internal road network ideal for testing innovative delivery methods such as cargo bikes and autonomous vehicles. Stakeholders highlighted various needs, such as improving food hygiene, enhancing payment processes, and integrating human-robotic interactions without competing with existing services. The workshop also explored the potential for using advanced technological solutions to meet the diverse demands of the site, emphasizing the importance of reducing carbon emissions, and creating efficient, user-friendly services for ordering and tracking deliveries. Looking forward, the Ispra LL aims to refine and expand these solutions, leveraging the insights gained to enhance service offerings and potentially scale operations to larger areas.

It is noted that the JRC use case serves as a proof of concept intended for implementation in the city of Milan where similar user characteristics and freight transport challenges appear.

The agenda of the Ispra workshop can be found in Annex A (A1. Ispra).

3.2.2 Use Case

The Ispra LL consists of one use case.

Use case: Next generation last mile delivery integrating delivery robots and cargo bikes
In the setting of Ispra, on the JRC campus in Italy, an innovative delivery system is transforming the way lunch is served to its community. This system, a collaboration between Measy and Yape companies under the umbrella of e-Novia, leverages a blend of human and robotic efficiency to cater to the campus's needs.

In the setting of Ispra, on the JRC campus in Italy, an innovative delivery system is transforming the way lunch is served to its community. This system, a collaboration between Measy and Yape companies under the umbrella of e-Novia, leverages a blend of human and robotic efficiency to cater to the campus's needs. UAegean participates in this initiative in its capacity as an academic consultant. Leveraging its expertise in logistics and technology, UAegean provides crucial insights and guidance on optimizing the integration of delivery robots and cargo bikes. Other key users involved in this delivery ecosystem (but not partners of GREEN-LOG consortium) include the Canteen, which prepares the lunchboxes, the administrators of the JRC campus, who oversee and facilitate the smooth operation of the system, and the consumers of the lunchboxes, who benefit from the efficient and timely delivery of their meals.

The operation begins each day at the canteen, where a Measy cargo bike, loaded with freshly prepared lunch boxes, sets off towards an intermediary exchange point (Figure 5). Here, the task of delivering meals is transferred to Yape's trio of droids, which then spread out to serve meals within a predetermined delivery zone, accommodating 1,000 employees. It is worth noting that the demand is variable, as half of this population typically works remotely, and some prefer to bring their own meals.

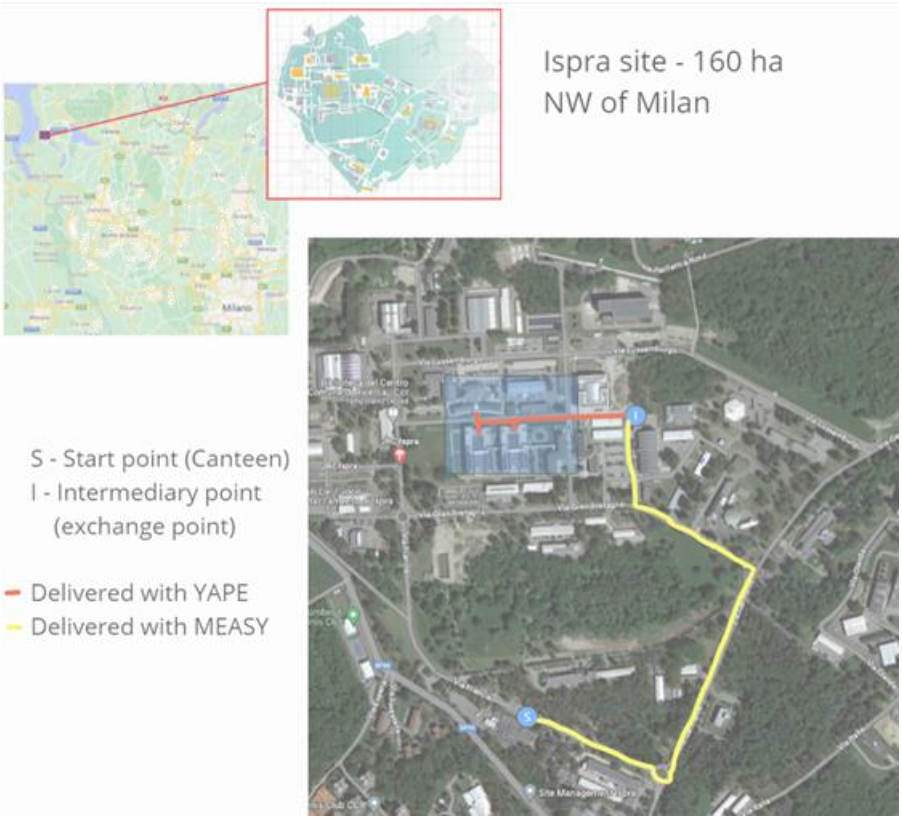


Figure 5: Schmematic representation of the use case

Currently, the described system successfully manages to deliver 10 orders daily. However, with plans to scale up, the future looks promising, aiming to quadruple this capacity to 40

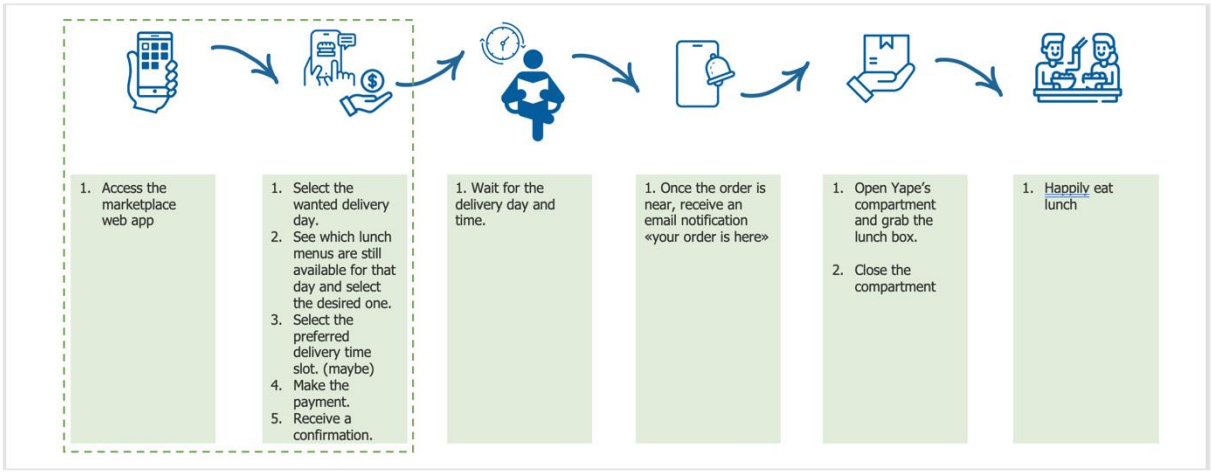
orders per day. This goal is supported by the operational capabilities of the Yape droids, which can complete a delivery in 10-15 minutes and carry up to four lunch boxes simultaneously, and the Measy cargo bike, which can transport between 10 to 20 lunch boxes in one go.

The integration of the fleet management system with the GREEN-LOG platform is a testament to the innovative approach to catering and delivery. This multimodal service is designed to be as efficient and user-friendly as possible, from the moment an order is placed to the moment it is delivered. The system's flexibility in handling unforeseen circumstances, such as low battery charges or technical faults, ensures that the service remains reliable and efficient.

As the last delivery is completed and the vehicles return to the intermediary point, the day's operation concludes. This model not only showcases the potential for integrating technology into everyday tasks but also sets a precedent for sustainable and efficient delivery services. The Ispra campus's lunch delivery system is a glimpse into the future of catering, where technology and human ingenuity come together to create seamless experiences.

3.2.3 User Journey

The process is meticulously planned to ensure efficiency and satisfaction. Customers place their orders through JRC's internal system, namely pre notation system through which the employee will declare their chosen lunch and preferred delivery times. On the day of delivery, they are notified via email when their order is about to arrive. The joy of receiving a meal is as simple as opening the Yape droid's compartment, retrieving the lunch box, and enjoying a delicious meal.



Note1: Steps 1 & 2 are not part of the GreenLog solution
Note2: Marketplace stands for the pre-notation system, which could possibly in the future include other vendors (but not in GREEN-LOG context)

Figure 6: Ispra end user journey

Behind the scenes, the canteen operators and the Yape & Measy teams work to ensure a smooth operation. The canteen prepares and packs the orders, which are then loaded onto the Measy cargo bike and transported to the exchange point. Here, the Yape droids take over, each assigned to specific deliveries based on an efficient algorithm that considers proximity, route length, battery status, and user preferences.

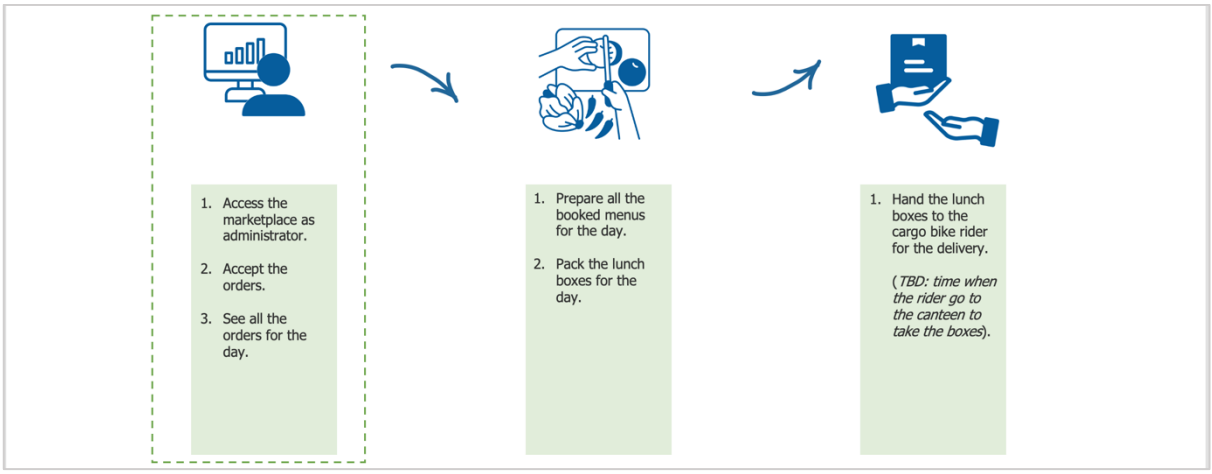


Figure 7: Ispra Canteen operator journey

The canteen operator starts their day by preparing all the meals that users have booked through the Logistics as a Service (LaaS) marketplace platform. Once the meals are ready, they carefully pack them into lunch boxes, ensuring everything is neatly organized for delivery. Next, the operator logs into the pre-notation system to manage the day's orders. With all orders reviewed, the operator organizes the packed lunch boxes and hands them over to the cargo bike rider, ready for delivery.

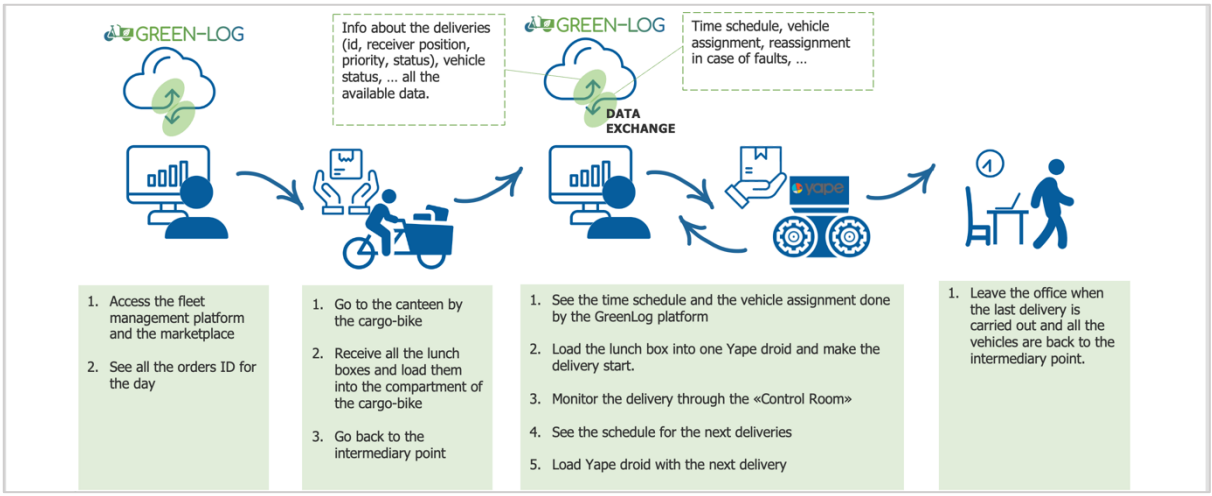


Figure 8: Ispra Yape & Measy operators journey

3.2.4 Service Blueprint

The Ispra Blueprint focuses on a streamlined process for lunchbox delivery to JRC employees. Initially, orders are placed in an Excel sheet two days in advance, which the canteen staff access and prepare accordingly. On the day of delivery, JRC employees either walk or drive to the canteen to collect their prepared lunchboxes, completing the transaction by making the payment at the canteen. In another use case, the process integrates a more complex delivery system where orders are placed via the JRC prenotation platform, managed and transported by e-Novia and Measy cargo-bikes. The Green-Log platform oversees the entire process, from receiving the orders to updating delivery statuses, ensuring efficient and timely delivery to the employees.

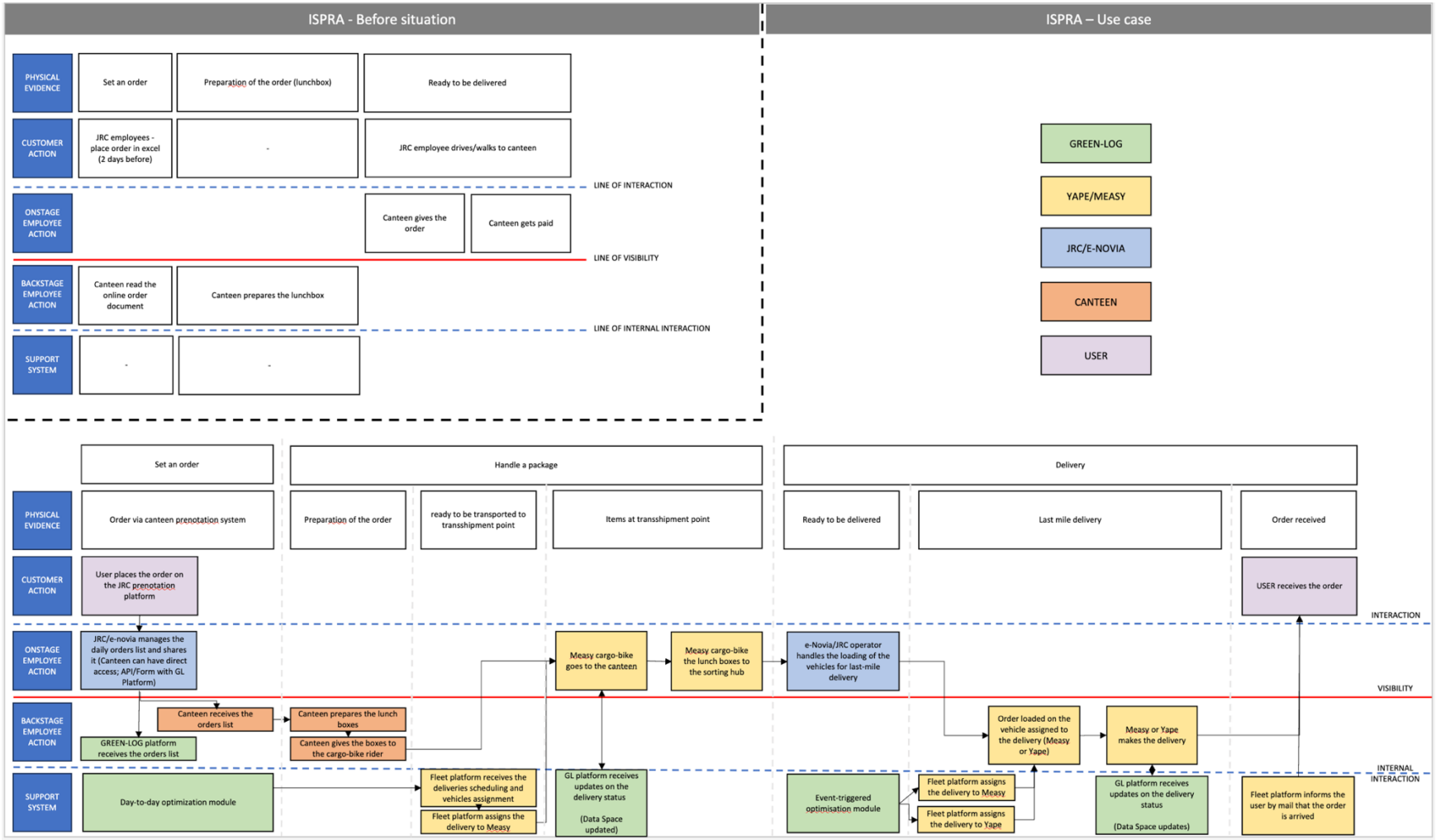


Figure 9: Ispra Blueprint

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3.3. Barcelona

3.3.1 Co-creation Workshop

The "Co-Creating Next-Generation Last-Mile Solutions" workshop held on November 16, 2023 in Barcelona brought together various stakeholders, including local government representatives and the metropolitan logistics research community, to explore innovative last-mile delivery solutions at the Barcelona LL as part of the GREEN-LOG project. With 17 on-site and over 20 online participants, the workshop was a collaborative platform for validating user stories and developing multi-modal sustainable logistics services that integrate rail with zero-emission vehicles like cargo-bikes, e-vans, and e-scooters. The participants examined three distinct use cases designed to enhance last-mile delivery by combining different transport modes and technologies, including a novel approach using robotic assistance for parcel delivery at rail stations. These discussions highlighted the need for a robust analysis to define the economic viability and necessary subsidies for these innovative models, especially concerning the integration of advanced technologies and public transport systems. The outcomes from the workshop guided the ongoing development and potential expansion of the Barcelona LL's activities, focusing on establishing effective partnerships and refining the logistics models to support sustainable urban delivery solutions.

The agenda of the Barcelona workshop can be found in Annex A (A2. Barcelona).

3.3.2 Use Case

The Barcelona LL consists of three use cases.

Use case 1: Multi-Modal delivery (cargo bikes, e-scooters and e-vans) without rail.
The first use case revolves around an environmentally sustainable delivery system, leveraging "zero-emission" vehicles operated by VANaPED such as cargo bikes, e-scooters and e-vans. This eco-friendly delivery system is designed to transport parcels directly from VANaPED depot to their final destination, i.e. the consumer.

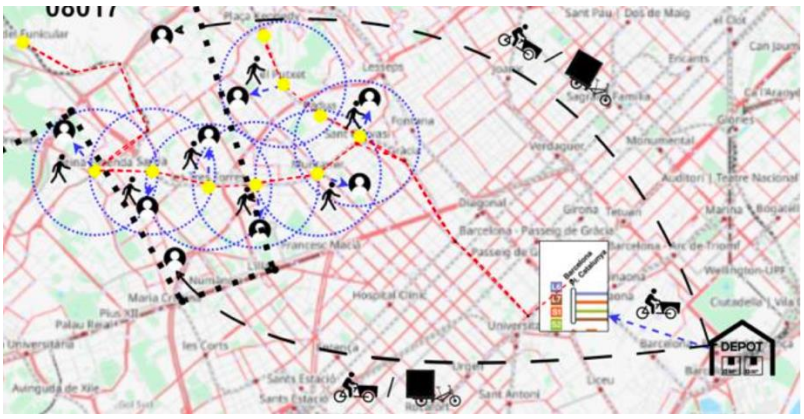

Figure 10: Location of VANaPED depot in Barcelona

The choice of vehicle for each delivery is determined based on the volume and dimensions of the parcels, as well as the specific route conditions anticipated during the trip. This ensures that each delivery is executed with optimal efficiency and minimal environmental impact.

The goal is to achieve a seamless and direct delivery pathway ("All the Way") from the hub to the consumer. This system not only prioritizes sustainability by reducing carbon emissions but

also enhances urban mobility by alleviating congestion typically associated with traditional delivery vehicles.

Use case 2: Multi-Modal delivery using public transport (public bikes with rail)
The second use case explores the use of public transport modes as a means of delivery without requiring the LSP to deploy additional (zero-emission) fleet resources. The proposed system retains the zero-emission ethos but could potentially also significantly extend the reach of the delivery services beyond current geographical limitations.

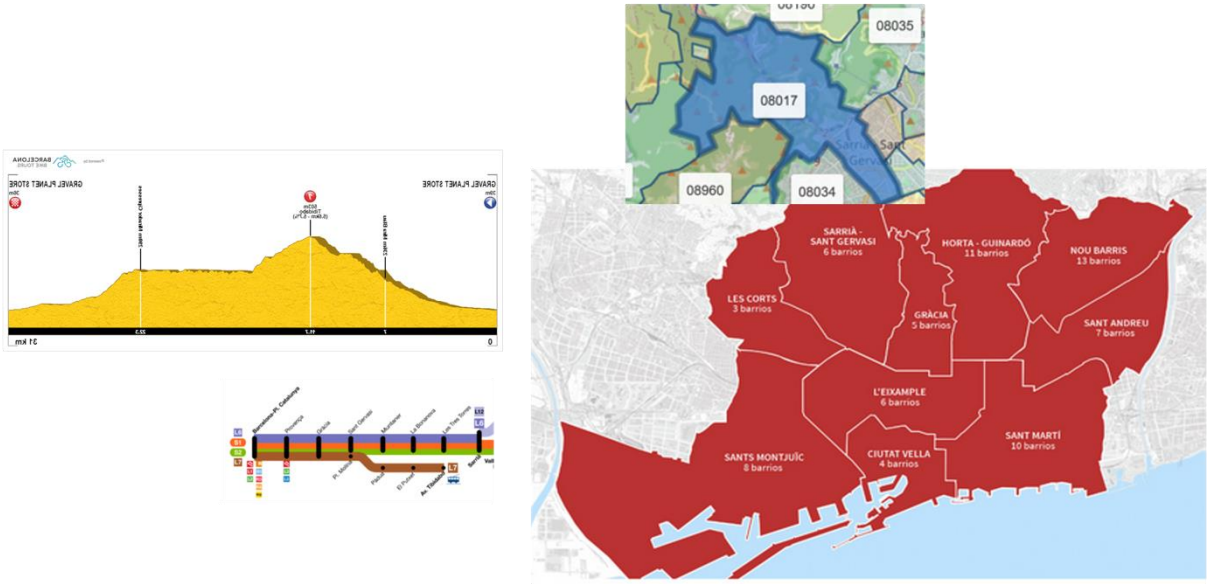

Figure 11: Schematic representation of use case 2

A pivotal component of the system is the seamless transition of parcels from the depot to the rail network. Parcels are initially transported by dispatch riders from the hub using public bikes to access the first rail station - Plaça de Catalunya. From there, these parcels can embark on a journey across the city or venture further inland. Partners ATM and FGC are examining how destinations beyond VANaPED's city-wide service coverage might be included in a 2nd phase of the pilot. The number of parcels that the rider can carry is limited (by the backpack) to around 10 per delivery route. The GREEN-LOG planning tool, developed by AUEB in WP2, is instrumental in selecting which receiver locations are chosen for delivery; there are 8 rail stations in the District of Sant Gervasi and the optimisation has to select those that lie within walking distance of the destination station (catchments of 10, 15 maybe 20 minutes could be trialed).

Use case 3: Multi-Modal delivery (cargo bikes with rail): Robot replaces rider on the train
Expanding upon the previous use cases, combinations will be explored. One possibility is to combine cargo-bikes with rail – if parking at the first rail station makes sense. Another possibility is to incorporate robotics into the multi-modal delivery network. This evolution retains the core elements of zero-emission multi-modal deliveries while introducing a groundbreaking component: the potential replacement of human riders with robots on the train.

The use of a robot (provided by EUT) will be explored to assess the capabilities of a robot prototype at a railway station. Specifically, the ambition is to enable the robot to autonomously navigate onto and off trains. Should this ambitious goal be met, it would mark a significant leap towards reducing labor costs and enhancing efficiency.

Central to the system is the strategic incorporation of lockers located at train stations. On the one hand, this addition allows the LSP to drop the parcels at the first station, with the robot riding the rail leg of the journey and leaving the parcels at a locker at the destination station(s).

Despite the enthusiasm surrounding this technological advancement, several challenges that lie ahead are acknowledged. The current state of robotics and infrastructure does not yet support seamless navigation through complex station environments, including navigating doors, stairs, lifts, and ticketing machines. Additionally, the intricacies involved in parcel handling, such as retrieving items from lockers or accepting them directly from riders, and managing changes in floor levels, present unsolved technical hurdles that necessitate further dedicated research and development. Nevertheless, a Proof-of-Concept (PoC) focusing on a robot's ability to navigate a station on a single floor —performing tasks such as entering and exiting train wagons or crossing through open doors— will provide invaluable. This PoC aims to demonstrate the feasibility of robotic assistance in the delivery process, setting the stage for future advancements.

3.3.3 User Journey

Parcel delivery orders from city centre businesses are received at VANaPED's portal as requests for next day delivery to customers located city-wide. Although the current demand for deliveries within the target district of Sant Gervasi is low, the planning tool (Day-to-day optimisation module) developed by AUEB can simulate a 10-parcel order request for the pilot and assess potential upscaling to 100 delivery orders. The following scheme describes the parcel delivery process as it is currently envisaged for Pilot Phase 1 city-wide.

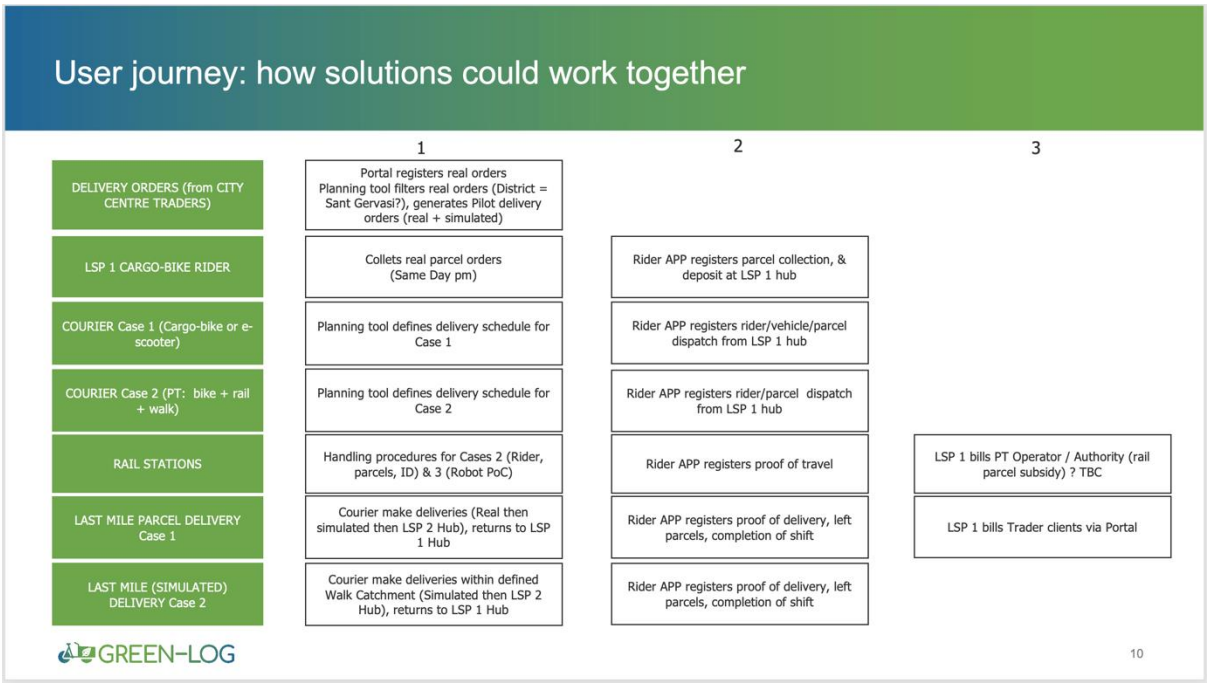

Figure 12: Barcelona LL User journey

3.3.4 Service Blueprint

The Barcelona Blueprint employs the Vanapp24h platform for managing parcel deliveries. Local shops place online orders, which are collected by cargo-bikes or dedicated riders. Parcels are assigned to vehicles based on criteria such as destination and volume, managed by software like VONZU and AIMSUN. The delivery process includes multiple legs, with the VANaPED system handling assignments and parcel deliveries. This setup ensures efficient first, mid, and last-mile deliveries, with detailed routing and vehicle selection to meet the varying delivery requirements of the area.

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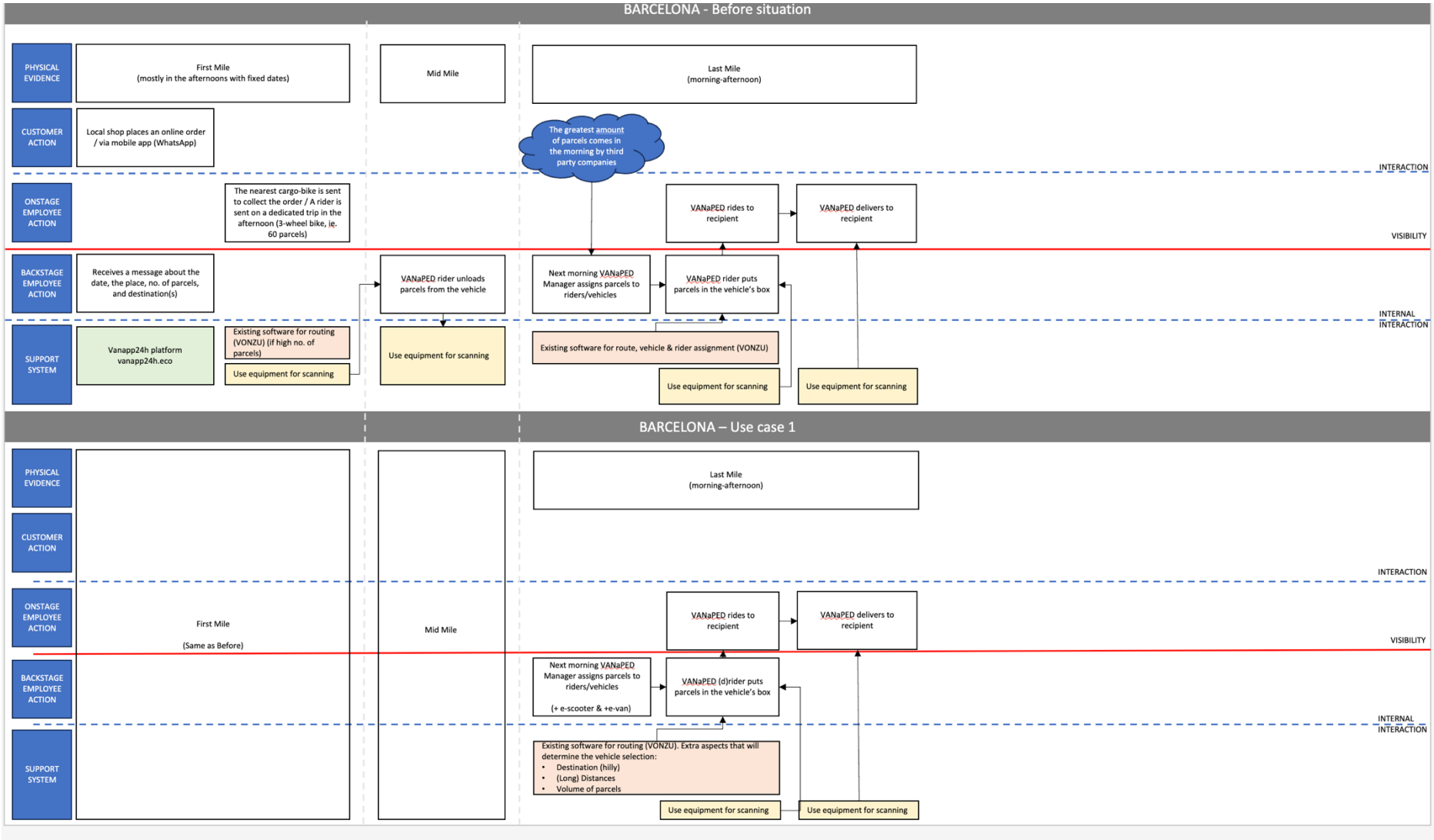

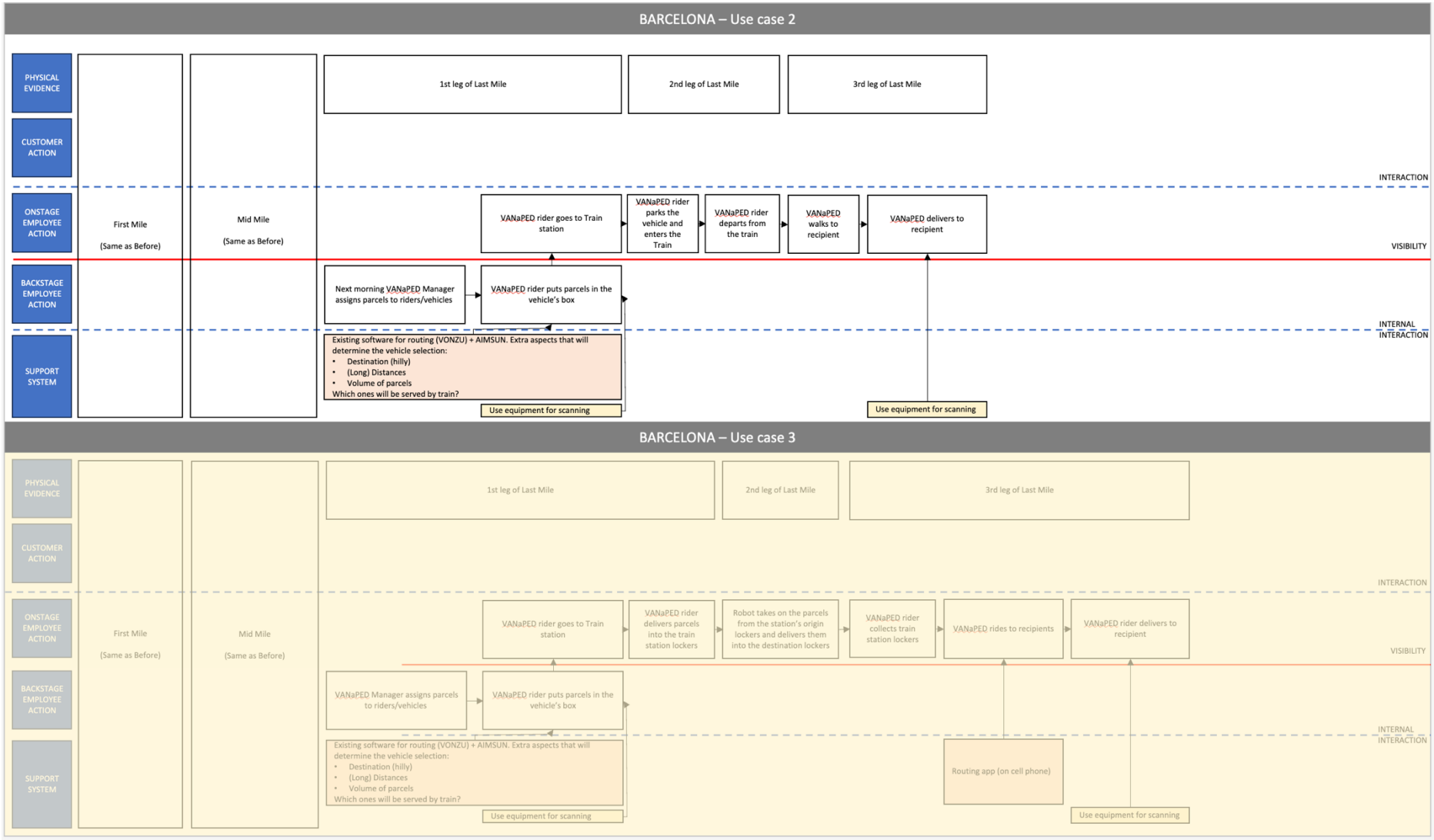

Figure 13: Barcelona Blueprint

3.4 Oxfordshire

3.4.1 Co-creation Workshop

The "Co-Creating Next-Generation Last-Mile Solutions" workshop held on December 1st, 2023 in Oxfordshire, United Kingdom, assembled stakeholders from various sectors including the Oxfordshire County Council (OCC), FEED, Pedal & Post, and the University of Wolverhampton, to co-create innovative last-mile delivery solutions for the Oxfordshire LL. The workshop focused on addressing Oxford's specific logistical challenges and opportunities, with an emphasis on creating environmentally friendly and socially beneficial services. Discussions revolved around three proposed use-cases: (1) a Micro Consolidation Hub (MCH) that would facilitate the transfer of goods from heavy goods vehicles to e-cargo bikes, (2) an e-commerce platform designed to support local traders and promote zero-emission delivery, and (3) a pioneering self-driven Mobile Delivery Hub (MDH) intended to increase the efficiency and capacity of e-cargo bike operations. The workshop participants, including representatives from Oxford City Council and local logistics providers, engaged actively, providing valuable feedback and exploring the feasibility and potential implementation strategies for each use case. The event underscored the importance of collaborative efforts in developing sustainable urban logistics solutions that cater to the growing needs of Oxford's population and business community, setting the stage for future innovations in last-mile delivery within the region.

The agenda of the Oxfordshire workshop can be found in Annex A (A3. Oxfordshire).

3.4.2 Use Case

The Oxfordshire LL comprises one primary use case with three sub-use cases.

Use case: E-cargo bike logistics innovations
The use case in Oxfordshire, UK, titled "E-cargo bike logistics innovations" is addressing the challenges of last-mile delivery within the historic city of Oxford. The proposed delivery system is a response to the city's narrow medieval streets, which are non-conveniently suited for motorized vehicles, leading to congestion and poor air quality. Coupled with a 7% population increase over the last decade and a 42% rise in parcel deliveries across the UK in the past five years, the need for innovative logistics solutions has never been more critical.

The OCC has set ambitious targets to achieve a net-zero transport network by 2040 and aims to eliminate road fatalities or life-changing injuries by 2050. As part of its Freight Strategy, the OCC is focusing on promoting freight consolidation and cycle freight for last-mile goods movement, aligning with LTCP Policy 50.

Two key players in this project are Pedal & Post, a zero-emission last-mile logistics provider with a fleet of 30 e-cargo bikes and couriers, and FEED, a consortium established during the COVID pandemic to support small food traders. Pedal & Post is tasked with designing a MDC and operating the pilot, while FEED Oxford provides feedback on commercial models and supports LL work trials.

Sub-use case: Micro Consolidation Hub
The Micro Consolidation Hub aims to replace van deliveries with e-cargo bike deliveries, thus reducing vehicle movements, congestion, and carbon footprint. This hub is envisioned as a moveable/temporary structure, utilizing six customized shipping containers and capable of loading 24 ecargo bikes per day. This setup could potentially reduce CO2 emissions by 152,750kg per year.

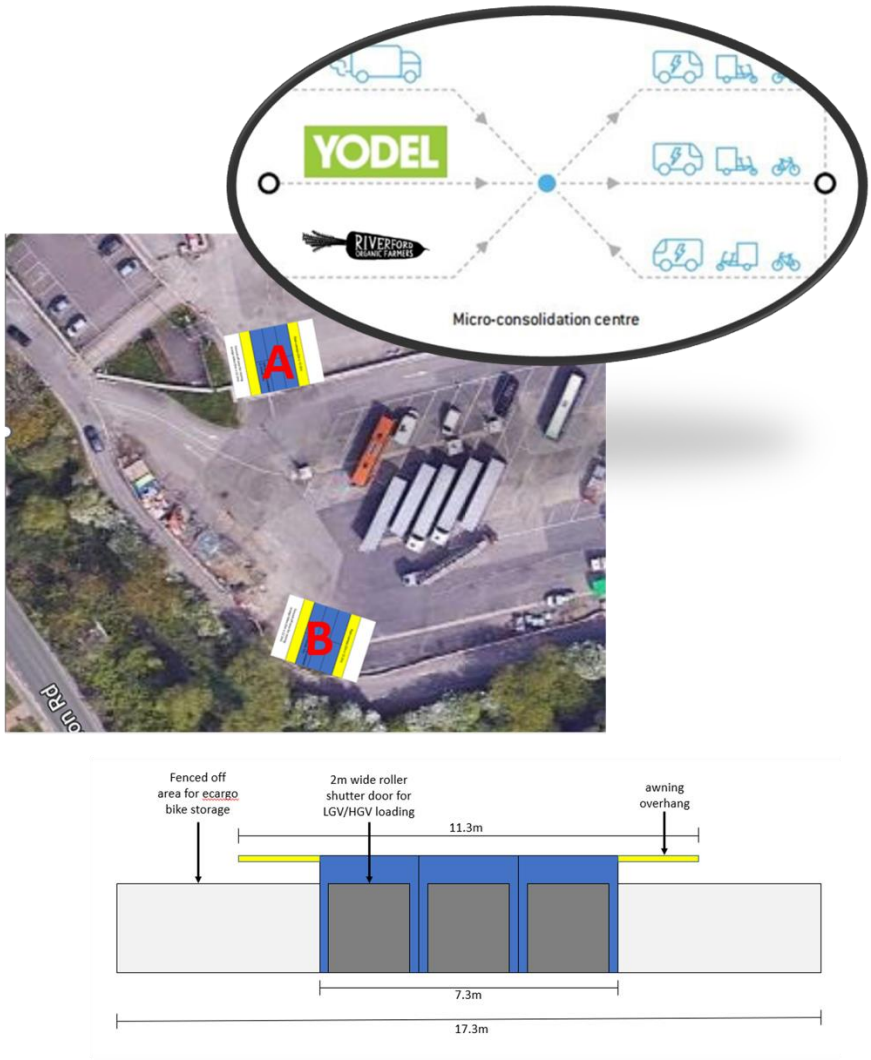

Figure 14: Micro Consolidation Hub

Additionally, the project leverages Park & Ride sites with good cycle and HGV access, owned or leased by the council, for short-term use of undeveloped spaces. An external e-commerce platform for local traders – not part of GREEN-LOG project developments – will also be linked to the GREEN-LOG platform, offering zero-emission delivery options and supporting local businesses by reducing the need for travel and increasing efficiency.

Sub-use case: Oxford Covered Market

The Oxford Covered Market, located within the planned Zero Emission Zone and facing changes due to pedestrianization, presents an opportunity for scale. With over 50 traders, the market can benefit from the lessons learned from the city council's cargo bike delivery trials.

Figure 15: Micro Consolidation Hub

Sub-use case: Mobile Delivery Hub

A MDH, operated remotely and based on a 4-wheel EAV cargo bike platform, supports the delivery system. The MCC can serve:

- To reload couriers in the field, enabling larger parcels to be delivered by ecargo bike.
- As a storage of undelivered parcels either for re-delivery or increase local parcel drop-off point capacity.
- As a mobile locker for residential streets.

Figure 16: Micro Delivery Hub

3.4.3 User Journey

The user journey illustrates how these solutions work together seamlessly. A customer orders a dress through an online platform and chooses same-day collection from a nearby locker. The Covered Market trader prepares the item and loads it into the MDC when it arrives. The MDH then travels to a predefined area for customer collection. Meanwhile, couriers are efficiently reloading and delivering parcels throughout the day, supported by the MCH and the MDH.

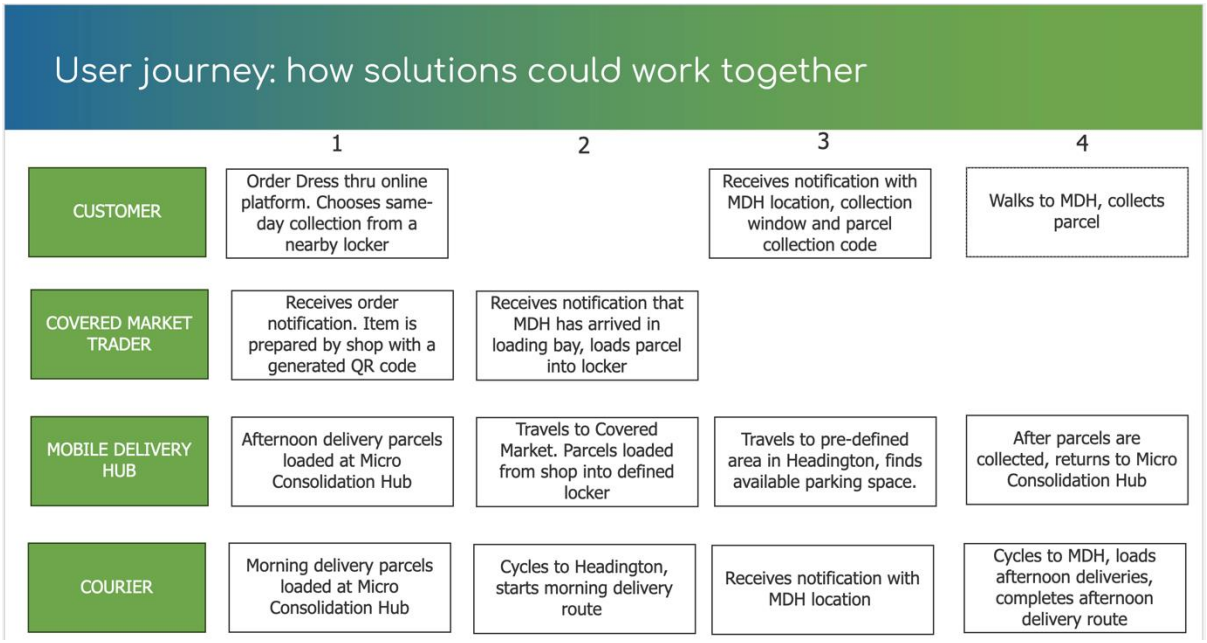

Figure 17: Oxfordshire LL User journey

3.4.4 Service Blueprint

The Oxfordshire use case utilizes Pedal & Post couriers for local parcel deliveries. Customers make purchases online, and shop owners prepare the orders for collection. Couriers from Pedal & Post collect the parcels and bring them to a consolidation center. The delivery process involves either direct delivery to customers or leaving parcels at designated pickup stores. Notifications are sent to customers to inform them of delivery windows and parcel availability.

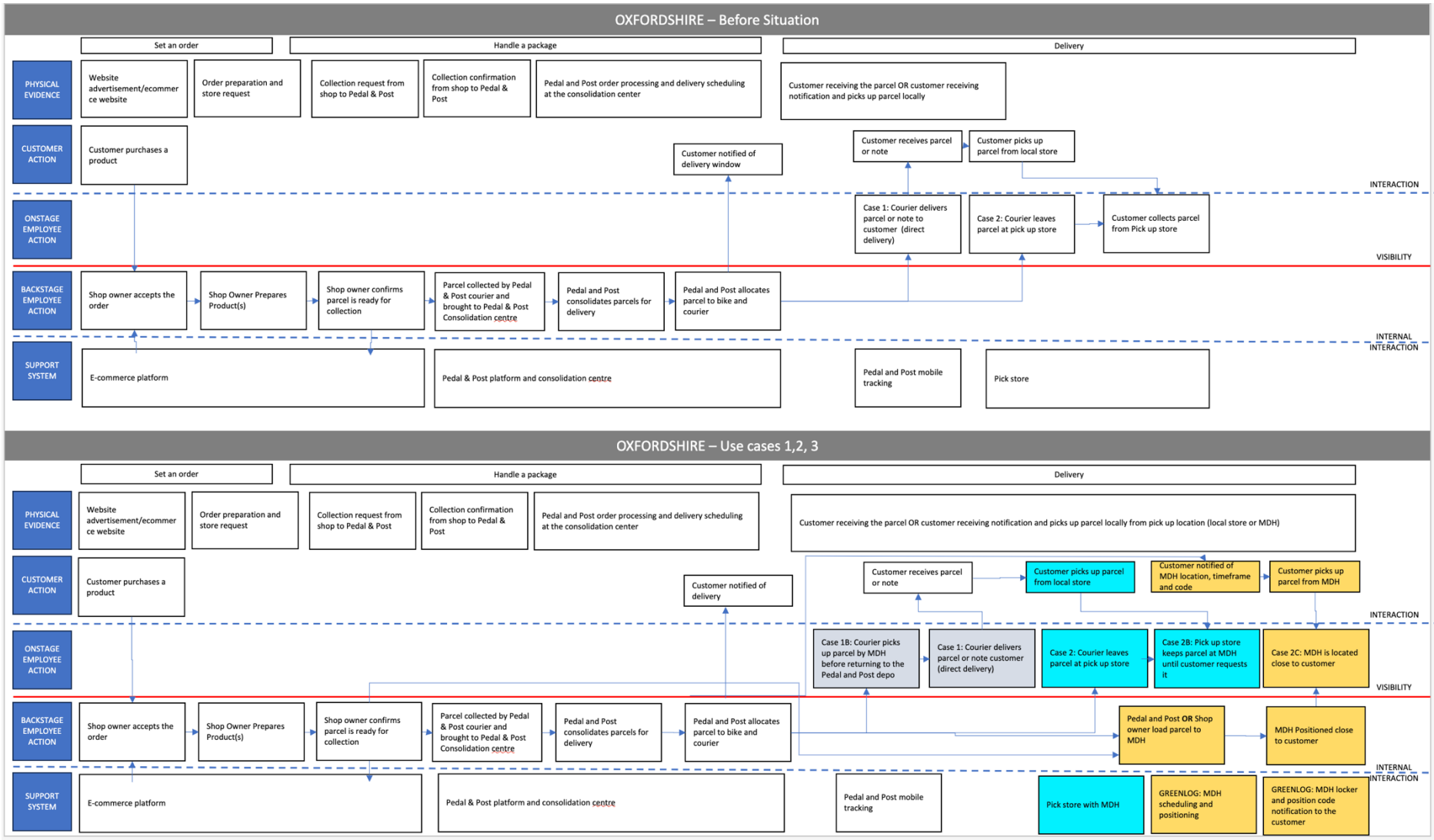

Figure 18: Oxfordshire Blueprint

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3.5 Flanders Co-creation Workshop

3.5.1 Co-creation Workshop

The GREEN-LOG Co-Creation Workshop, held in Flanders, Belgium on February 6 and 9, 2024, brought together stakeholders from Ghent, Mechelen, and Leuven to discuss the development of a Logistics as a Service (LaaS) platform as part of an initiative to revolutionize urban logistics. The workshop delved into the added value and value propositions of sustainable logistics solutions, focusing on the benefits of implementing LaaS in these cities. Seen as crucial for managing the complexities of urban logistics, LaaS promises to enhance stakeholder collaboration, improve communication, and offer dynamic pricing and nudging strategies, thereby aligning with local freight policies and optimizing delivery efficiency, speed, and quality. Despite its potential, the workshop identified several challenges, including logistical hurdles like varying shipping costs and locker capacity issues, as well as sustainability concerns and the practicalities of hub implementation. The discussion underscored the importance of establishing clear regulatory frameworks, fostering cross-sector collaboration, and meeting consumer expectations. Innovative non-financial incentives such as gamification and tailored communication strategies were proposed to encourage stakeholder engagement and support the transition to more sustainable logistics practices. As the sessions concluded, stakeholders remained optimistic about LaaS's ability to transform urban logistics, emphasizing ongoing collaboration and innovation to achieve a more sustainable and efficient urban future.

The agenda of the Flanders workshop can be found in Annex A (A4. Flanders).

3.5.2 Use Case

The Flanders LL consists of one use case, the same for the three cities involved.

Use case: Last-mile Logistics as a Service
In Flanders Belgium, GREEN-LOG is leading an initiative to implement, analyze, and monitor innovative urban logistics solutions that integrate existing innovations within urban settings. Specifically, the core objective is to establish a functional LaaS platform. This platform aims to utilize urban logistics data to efficiently connect demand with supply.

The use case focuses on three cities: Mechelen, Leuven, and Ghent. Despite each city having unique logistics needs, the geographical proximity of approximately 50 km apart and a combined area of about 400 sq-km necessitates considering the region's nebular structure. This structure enables delivery tours that incorporate stops across all three cities. A significant challenge is the historical nature of these cities' centers, which adds complexity to urban logistics. There is a concern that a proliferation of city-specific logistics rules could undermine efficient urban distribution, highlighting the urgent need for harmonized logistics policies and measures across the cities.

Nudging and dynamic pricing are pivotal aspects for LaaS. Regarding dynamic pricing, stakeholders noted that while sustainable deliveries are often more costly, implementing dynamic pricing in a free market requires careful consideration of rule-setting and relies heavily on extensive data.

3.5.3 User Journey

The LaaS platform is designed to benefit a wide range of users, i.e. bike courier managers, local authorities, local shopkeepers, and private consumers.

Bike courier managers are poised to benefit significantly from this initiative. By receiving demands that seamlessly integrate into their existing routes, they can optimize drop density, thereby conducting more business in less time. Additionally, the LaaS platform promises to unlock new business opportunities, enabling them to expand their operations and profitability.

Local authorities are provided with a powerful tool for urban planning and policy-making. The platform offers a comprehensive overview of goods movement, facilitating the implementation of data-driven policies. Furthermore, it supports the promotion of alternative, more sustainable delivery options to citizens, aligning with broader environmental goals and enhancing urban livability.

For local shopkeepers, the LaaS platform offers unprecedented control over their delivery options. It enables them to select shippers that meet their specific service levels, ensuring that their products reach consumers through reliable and compliant delivery services. Moreover, it empowers them to educate their customers about the societal costs of different delivery options at the point of sale, promoting more sustainable consumer behavior and supporting the growth of their e-commerce platforms.

Private consumers stand to gain a deeper understanding of the environmental impact of their delivery choices. The platform provides detailed insights into the emissions saved by selecting specific delivery options, fostering a sense of pride and encouraging the continuation of sustainable behaviors. Additionally, it highlights the benefits of choosing no-rush delivery options, further emphasizing the role of consumer choice in reducing emissions and vehicle movements in urban areas.

3.5.4 Service Blueprint

In the Flanders Living Lab, the focus is on parcel delivery from local e-commerce platforms to customers. The process begins with a customer purchasing a product online. The shop owner prepares and confirms the order, which is then collected by a Logistics Service Provider (LSP). The LSP generates a QR code and prepares the parcel for delivery. The first mile involves the collection of the parcel by the LSP, which then uses the “we.deliver” platform for label creation and routing. The parcels are then delivered to customers, with detailed tracking and notifications provided at each step to ensure transparency and efficiency.

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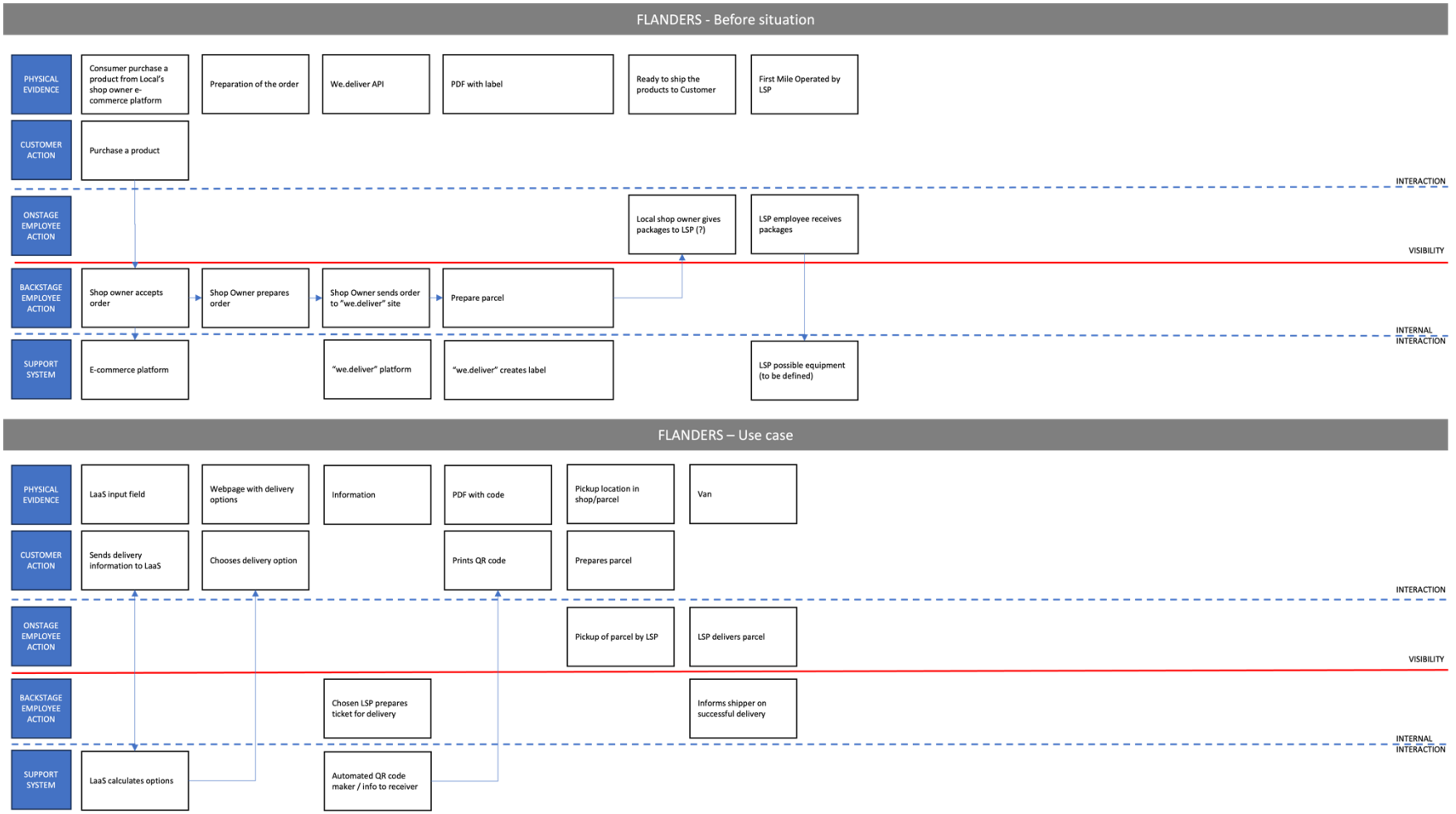

Figure 19: Flanders Blueprint

3.6 Athens

3.6.1 Co-creation Workshop

The GREEN-LOG workshop in Athens, organized by ACS SMSA and UAEGEAN, convened stakeholders to deliberate on enhancing parcel distribution within the city with sustainable and efficient methods. The workshop started with an icebreaker from the UAEGEAN, which set the stage for an in-depth discussion on the challenges of online purchasing, such as reliability issues, inconvenient delivery points, and the lack of late-night delivery options. The dialogue extended to the specifics of Athens' pilot site under the SUMP, exploring the integration of the GREEN-LOG strategies with the city's goals for establishing low-emission zones. Stakeholders considered various logistical options including the use of vans, mobile depots, and bicycles, while also assessing safety and infrastructure challenges that might necessitate alternative solutions such as containers and lockers. The potential for using the ACS SMSA headquarters as a starting point was discussed alongside considerations of cost-effectiveness and capacity. Challenges with courier companies and regulatory permissions for moving parcels to lockers were also debated, with white labelling for vans proposed as a solution. The workshop concluded with a consensus on the need for ongoing dialogue with courier companies to forge robust partnerships and ensure the success of Athens' sustainable parcel distribution initiatives.

The agenda of the Athens workshop can be found in Annex A (A5. Athens).

3.6.2 Use Case

The Athens LL consists of 2 use cases.

Use case 1: Shared Micro-consolidation center, lockers and white label fleet
This use case has at its core the Klauthmonos parking facility, operated by DAEM, which has been repurposed into a MCC. Here, at noon each day, two prevailing logistics companies ACS SMSA and FedEx[11] converge to deposit their parcels, totaling between 60 to 80 packages destined for the historic area. The MCC serves as the heart of the operation, where the parcels are temporarily housed before being entrusted to a white label electric vehicle. This vehicle, emblematic of the initiative's dedication to zero emissions, weaves through the streets of Athens with a singular mission: to deliver these parcels to their recipients in the most sustainable manner possible. A key component of this seamless operation is the integration of GREEN-LOG's Bring Your Own Device (BYOD) component, which equips the white label scheme with the necessary equipment. This technology ensures real-time tracking and management of deliveries, enhancing the reliability and efficiency of the service.

[11] Short name for "FedEx Express Greece". From now on the name FedEx will be used.

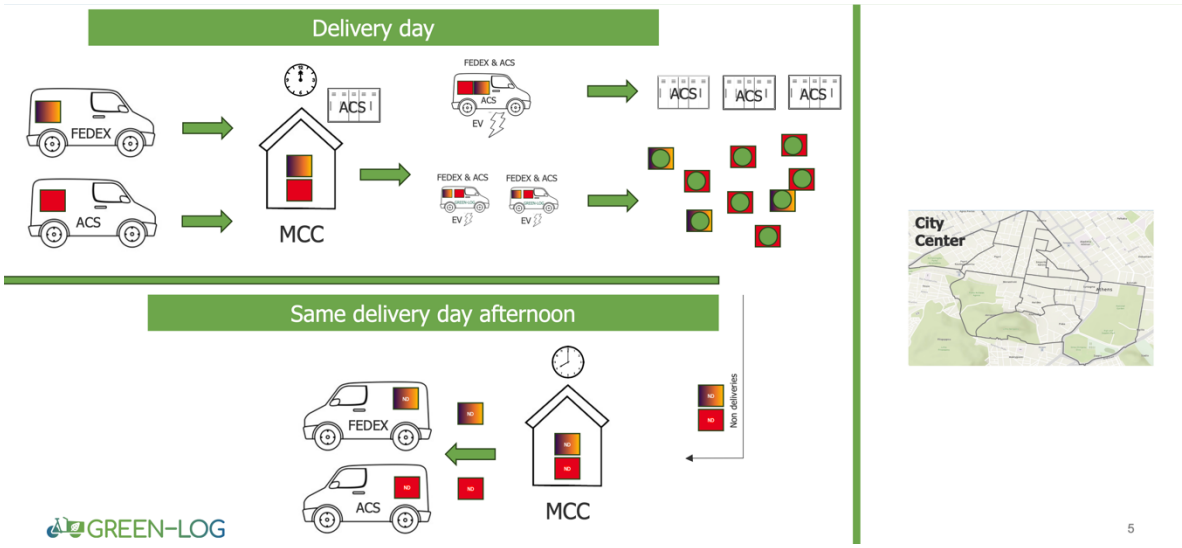

Figure 20: Athens use case 1 illustration

In the afternoon, the electric vehicle returns to the MCC, carrying any undelivered parcels, which are then picked-up by ACS SMSA and FedEx. This ensures that no parcel is left overnight, maintaining the integrity of the delivery process and preparing for the next day's cycle.

In parallel to the aforementioned operational workflow is the integration of smart lockers, a strategic initiative by ACS SMSA. Located within the premises of the MCC at Klauthmonos parking lot, but also at Varvakeios parking lot, the smart lockers represent a pivotal enhancement to the delivery process, offering recipients unparalleled flexibility in parcel collection. The convenience of picking up parcels at one's leisure addresses the dynamic needs of Athens' residents and visitors, ensuring that the rhythm of city life is uninterrupted by the logistics of parcel delivery. Specifically for ACS SMSA, the same vehicle that breathes life into the MCC with daily parcel deliveries also serves a dual purpose by feeding the smart locker with parcels. This efficient use of resources underscores the initiative's commitment to sustainability, reducing the need for multiple delivery attempts and thereby minimizing the carbon footprint. After stocking the smart locker, the vehicle continues its journey, distributing parcels to other smart lockers in the area, weaving a network of convenience and efficiency across Athens.

Use case 2: Delivery with Mobile Depot

The essence of this use case lies in the transformation of the delivery process through the introduction of a white label electric vehicle, not just as a transporter of parcels, but as a mobile depot itself. This e-vehicle, powered by the commitment to zero emissions, embarks on a daily journey through the city, making strategic stops at locations previously identified and provided by DAEM. These stops are not random but are carefully selected to maximize accessibility and convenience for the residents and businesses of Athens.

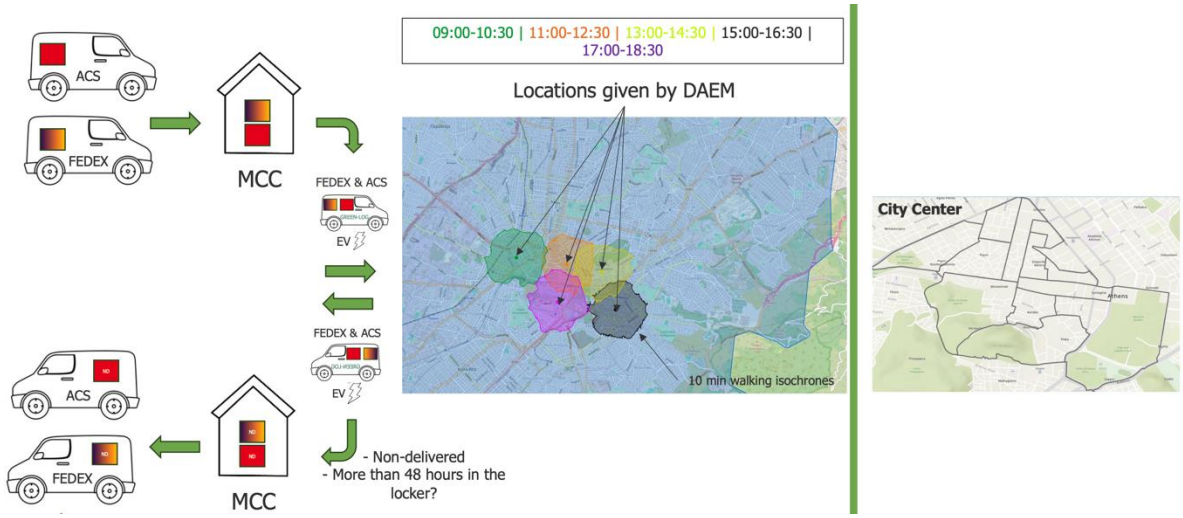

Figure 21: Athens use case 2 illustration

Upon reaching these designated locations, the mobile depot parks for a duration of X minutes (to be decided based on data analysis that will take place in the context of the "Day-to-day demand prediction module" developed by UoW), creating a temporary hub of activity. This window of time allows recipients to collect their parcels directly from the vehicle, thereby eliminating the need for a fixed smart locker infrastructure.

Taking as an example the identification of five suitable locations, the process is as follows. The moving depot visits the locations for 30' with this order A-B-C-D-E-A-B-C-D-E. This scenario could come up as more efficient because the depot will visit the same location twice giving more choices (and thus flexibility) to the recipients.

In this case also, the proposed stops and the routing will be identified by the "Day-to-day optimisation module" that will be developed by the AUEB team. Next day shipment's data will be sent to AUEB and UoW by ACS SMSA and FedEx, the day before.

The "Delivery with Mobile Depot" use case is a testament to the flexibility and adaptability of urban logistics solutions. By leveraging the mobility of the electric vehicle, the Athens LL is able to provide a delivery service that is highly responsive to the needs of the community. This model addresses several challenges associated with urban deliveries, such as traffic congestion, limited parking spaces, and the environmental impact of traditional delivery methods. Moreover, it represents a significant step forward for a more inclusive delivery system. By moving away from fixed delivery points and embracing a mobile solution, the service becomes more accessible to individuals who may not have been adequately served by traditional or static models. This approach democratizes access to parcel delivery services, ensuring that more residents can benefit from the convenience it offers.

3.6.3 Service Blueprint

In Athens, a white-label electric vehicle serving as a mobile depot for parcel distribution is utilised. Drivers from ACS and FedEx deposit parcels at the Mobile Consolidation Center (MCC), with some parcels placed in smart lockers. The mobile depot drives to designated locations, enabling recipients to collect their parcels during scheduled stops. Software for planning and routing ensures efficient distribution, and notifications are sent to recipients before the mobile depot's arrival. This system facilitates convenient parcel retrieval, leveraging smart lockers and mobile depots to enhance delivery efficiency in the urban environment.

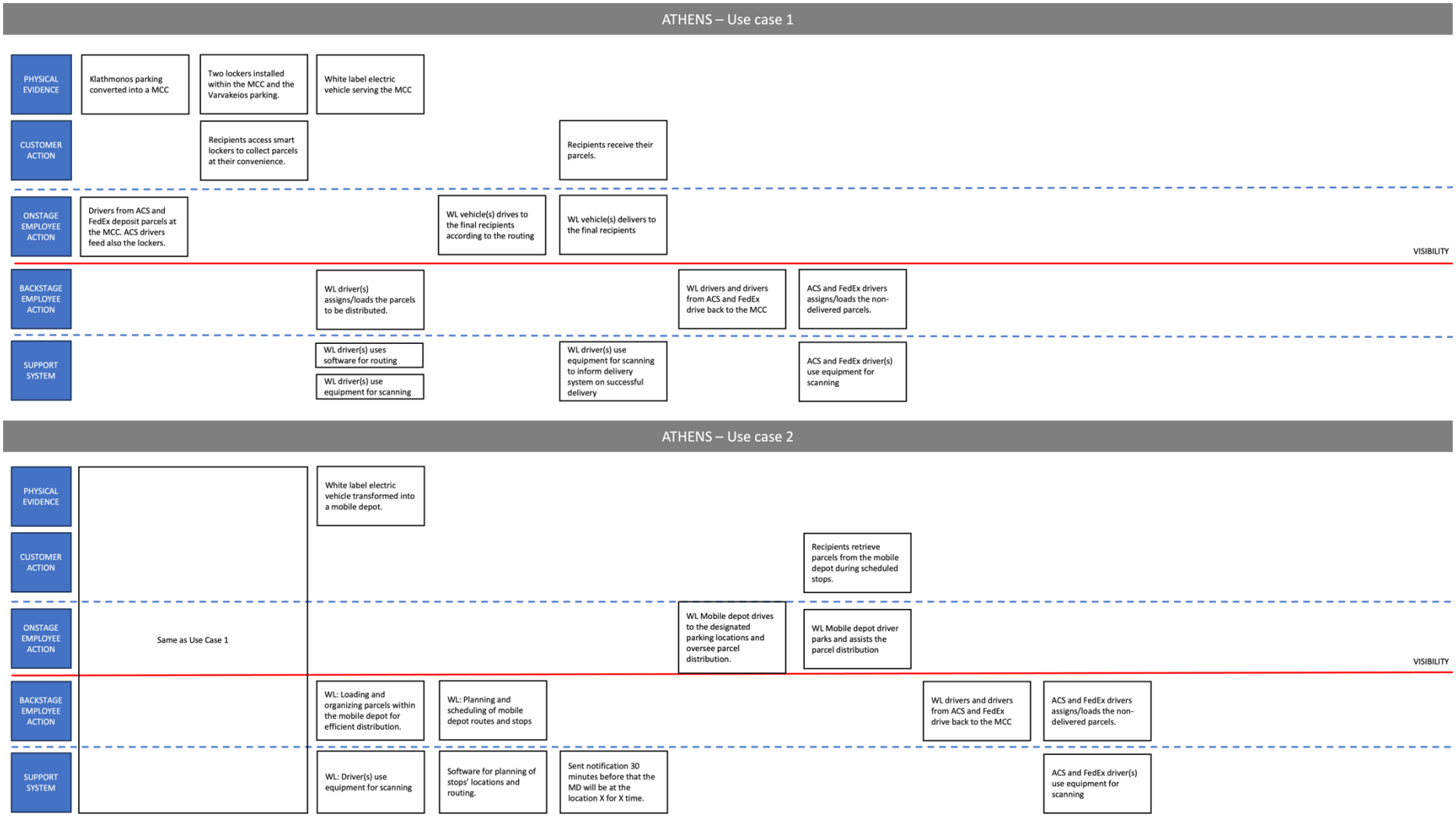

Figure 22: Athens LL Blueprint

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4. Conceptual Architecture and Design Approach

In M12, the GREEN-LOG Conceptual Architecture was delivered, representing a high-level/conceptual framework that defines the system's structure and interactions between components ensuring the seamless and efficient fulfilment of needs arisen from use cases and LL requirements.

Analytically, the GREEN-LOG Digital Control Tower serves as the operational hub, coordinating real-time and predictive logistics activities (Figure 23). Around this core component are others such as the GREEN-LOG Data Space for comprehensive data storage and management, the GREEN-LOG marketplace, intuitive user interfaces, and dynamic operational modules that support efficient planning and execution. This architecture leverages predictive analytics and real-time data processing to optimize delivery routes, manage day-to-day demands, and implement dynamic pricing strategies. Overall, the GREEN-LOG system aims to enhance the efficiency, reliability, and sustainability of urban logistics networks.

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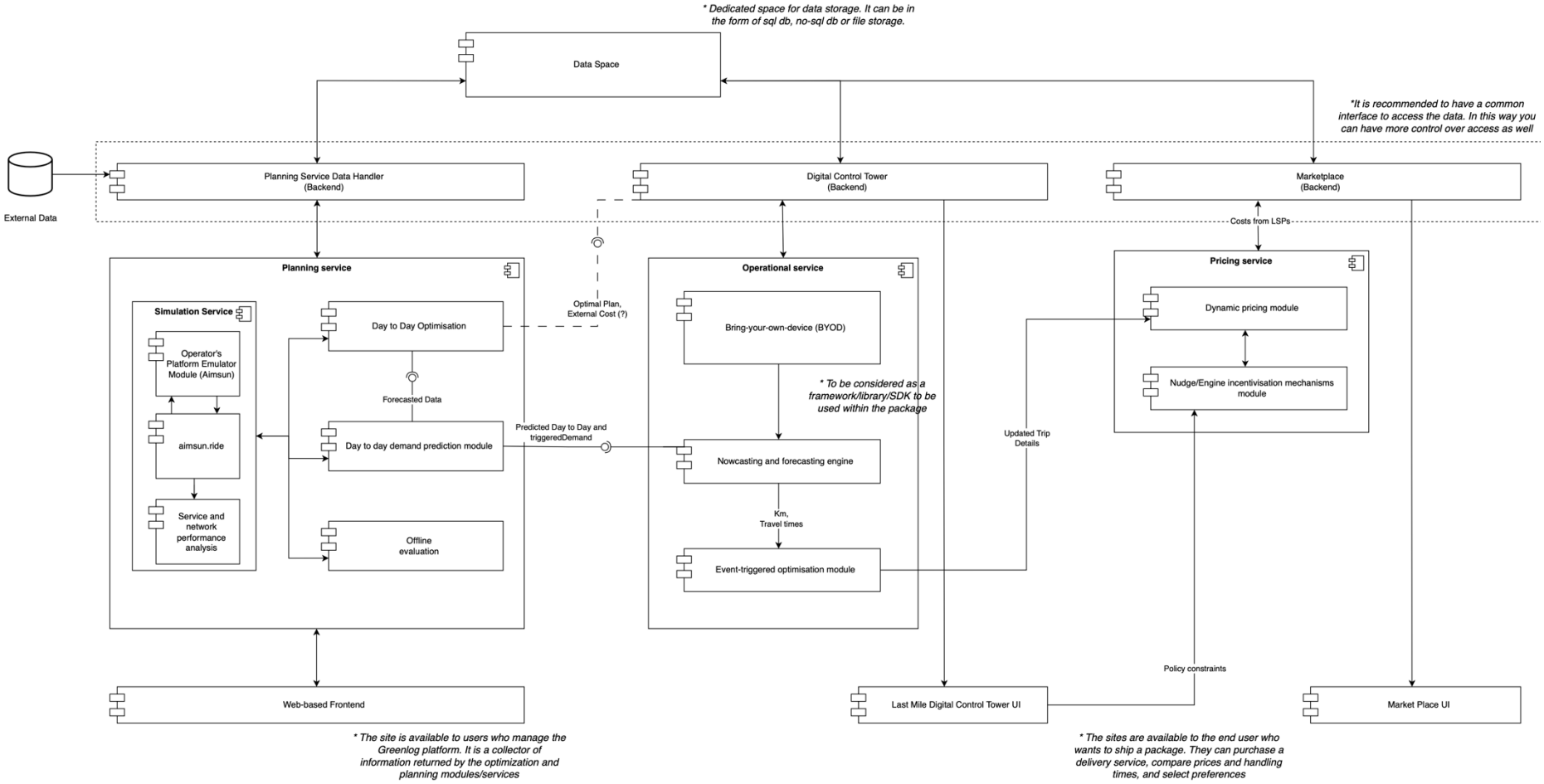

Figure 23: GREEN-LOG Conceptual Architecture

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The GREEN-LOG conceptual architecture is organized into three macroblocks, each of which is associated with an offered service, namely the planning, operational, and pricing service. More specifically:

- Planning Service: Includes all the components that manage the optimization of the deliveries' planning and routing for logistics providers, based on predictive and simulation algorithms.
- Operational Service: Includes all the components supporting LSPs during the delivery operations, such as providing rerouting capabilities or other functionalities to make the service more efficient.
- Pricing Service: Encompasses components related to dynamic management and incentive pricing.

The macroblocks directly or indirectly exchange data with each other and user interfaces; furthermore, they also interface with the Data Space via dedicated Back-ends that manage the accesses. The Data Space, in addition to data storage, is used to save external data, provided for example by LSPs, which can be used as inputs to the architecture components [REF-28]. Below each component is elaborated:

Digital Control Tower (Backend): This component serves as the central hub for managing and monitoring all logistics operations. It integrates data from T3.1 to T3.4, enabling real-time and forecast-based decision-making. The components that the Digital Control Tower integrate support both day-to-day optimization tasks and long-term planning strategies.

Data Space: The Data Space is critical for housing all operational, planning, and forecast data. It supports various database types (SQL, NoSQL) and file storage systems, ensuring flexible and scalable data management.

Web-based Frontend and Last Mile Digital Control Tower UI: These user interfaces provide access points for different stakeholders. The web-based frontend allows end-users to interact with the service directly—for instance, by comparing prices and selecting delivery preferences—while the Last Mile Digital Control Tower UI offers logistic managers real-time insights into operations and optimization outcomes.

Planning and Operational Services: These services form the core of the logistics operations, with components like the planning service data handler and the operational service module. They handle everything from route planning to day-to-day demand forecasting and dynamic pricing adjustments, ensuring optimal logistics efficiency.

Nowcasting and Forecasting Engine: This engine plays a pivotal role in predicting day-to-day demand and adjusting plans accordingly. It uses advanced predictive analytics to forecast future conditions and demands, enabling proactive adjustments to logistical operations.

Event-triggered Optimization Module: This module provides real-time optimization capabilities triggered by specific events or conditions, enhancing the responsiveness of the logistics system to unforeseen changes or urgent demands.

Marketplace (Backend): Acting as a platform for interaction between LSPs and users, the marketplace facilitates the comparison of costs and services, helping users to make informed choices based on updated trip details and provider offerings.

Simulation Service and Operator's Platform Emulator Module: These tools are used for performance analysis and testing of logistics scenarios. By simulating different operational

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conditions and network performances, they assist in refining strategies and predicting outcomes before full-scale implementation.

Dynamic Pricing and Incentivization Modules: These modules adjust pricing in real-time based on various factors like demand intensity and operational costs. They also include incentivization mechanisms to encourage desired behaviors among users and operators.

5. Cooperative Business Models for City Logistics

5.1 Business Ecosystem and Organizational and Governance Structures

Achieving the ambitious visions set out by the LL cities through the use cases described in this deliverable, the LLs have been organized in a partner level that goes far beyond the scope of delivering the single business plan explained below. The cities with their respective use cases will adopt a holistic approach to address city and region-specific transportation challenges and especially last mile services where a variety of solutions will be needed to achieve transformative change. Therefore, the involvement of multiple actors including – public administrations, private sector, knowledge providers, civil society, and citizens – is essential to ensure shared objectives the successful delivery of its goal. Thus, every LL has taken the approach of in-depth cooperation and collaboration between an array of stakeholders. They are those who a) develop solutions, b) test, c) manage or d) those who use the GREEN-LOG solutions. This facilitates the delivery of co-created demand-driven solutions.

The business ecosystems of the GREEN-LOG LLs are comprised by various stakeholders who are interested in delivering the respective to each LL services. The organizations rely on each other for value creation and this interdependence promotes collaboration and partnership between different segments like the citizens and the technology providers, through co-creation activities. This in turn produces dynamic relationships that are constantly in development. Alliances, partnerships, and cooperation agreements have been developed in the different LL in order to promote the technology or shape policy towards the services promoted.

The power of the ecosystem lies also in its ability to share resources between organisations with different technology and infrastructure. Sharing or exchange information, know-how and technology empowers the business service to become more sustainable and efficient.

Governance is defined by the Organisation for Economic Co-operation and Development (OECD) as “the exercise of political, economic and administrative authority necessary to manage a nation’s affairs” [REF-05]. Good governance is therefore a subset of governance, wherein public resources and problems are managed effectively, efficiently and in response to critical needs of society. For the GREEN-LOG partners, the governance structure for each LL refers to the means and roles defined to allow for the smooth delivery of the business plan, while fostering collaboration. Each LL has a set of **key actors** who are the core partners and are responsible for the leadership and coordination of the ecosystem’s activities while ensuring the service abides to the highest standards. The core partners are the primary actors for producing and delivering the service while establishing monitoring, performance, and evaluation mechanisms as well as a framework to collaborate with the **partnership members**. The latter are the involved stakeholders, who maybe not be directly involved in the delivery of the service but who are indispensable in the application of the service ensuring its success. In this group, we can find industry players, municipalities, academic and research institutions as well as partners from the GREEN-LOG consortium who provide information, knowledge, or technology for the service delivery.

Finally, there is the category of the **wider partners,** who are informed about the service and consist of the potential collaborators when the service expands geographically or develops technologically further. It includes policy makers, authorities, municipalities, citizens of different groups, funding agencies, as well as other EU project consortia who can benefit from the exchange of information or can build on further cooperation.

5.1.1 Ispra Business Ecosystem

The Business Ecosystem of ISRPA is a network of interlinked companies that dynamical interacts for the production and delivery of the service. As partnership members we have Yape and Measy technical teams (under the umbrella of e-Novia) who are responsible for the innovative last mile delivery with robots and carbo bikes. The GREEN-LOG Platform technical team, who undertake the multimodality of the delivery and the technical aspects, as well as the Ispra site services and data analysts, who monitor the implementation of the delivery system, analysing the results and users' feedback. As key actors we find the final users who will utilize the service of ordering and accept deliveries, the canteen management and workers who will be managing orders and loading the delivery assets as well as the riders delivering the orders. In the wider partnership we find the larger customer segments which can include local authorities and municipalities.

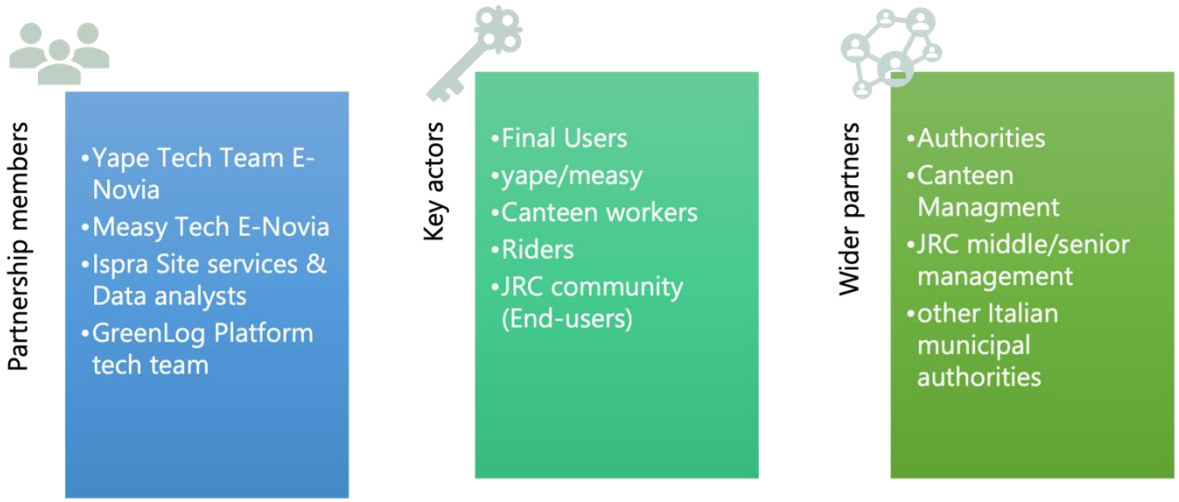


Figure 24: Ispra Business ecosystem

5.1.2 Barcelona Business Ecosystem

The Barcelona Business Ecosystem operates with a structured collaboration framework designed to foster innovation and sustainable urban logistics solutions. At its core, the LL involves key stakeholders such as ATM, FGC, VANaPED, who play pivotal roles in driving the lab's initiatives forward. These core members are supported by EUT, Factual, Mosaic and AIMSUN, contributing expertise and technological support. The LL's efforts are further enriched by the involvement of entities such as Central City Commerçe, FGC station management, Terrassa Municipality, and logistics service providers (e.g. Geever), who potentially will complement the delivery, ensuring a comprehensive approach to addressing urban mobility challenges. Additionally, a wider network of informed partners, including GREEN-LOG Partners, Barcelona Municipality, various funding agencies, the Taula Sector Logístic SIMMB, and other relevant EU projects (URBANE) will stay abreast of the lab's progress and findings.

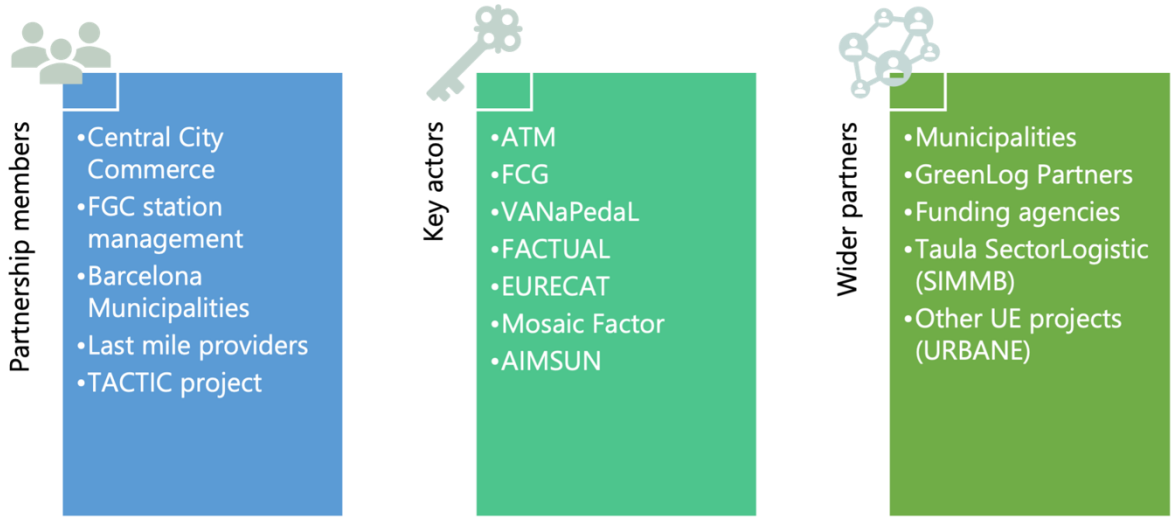


Figure 25: Barcelona business ecosystem

5.1.3 Oxfordshire Business Ecosystem

The goal of the Oxfordshire LL Ecosystem is the contribution to the zero-emission last-mile delivery, by setting up a service for the narrow medieval streets of the Oxford city centre and supporting deliveries outside the ring road. This meets with the targets set by the OCC aligning with the Local Transport and Connectivity Plan Policy 50. With an increase in parcel delivery as well as the population of Oxford, the need for a decarbonized delivery solution has been imperative. Pedal & Post, the zero-emission last-mile delivery provider, will provide 30 e-cargo bikes and couriers, teaming up with FEED, a local SME with experience in Food & Drink innovation and delivery, and will be supported by OCC, modelling company AIMSUN and the University of Wolverhampton. The LL will also establish Micro-Consolidation Hubs at Park & Ride sites leased by the council and develop a new Mobile Delivery Hub.

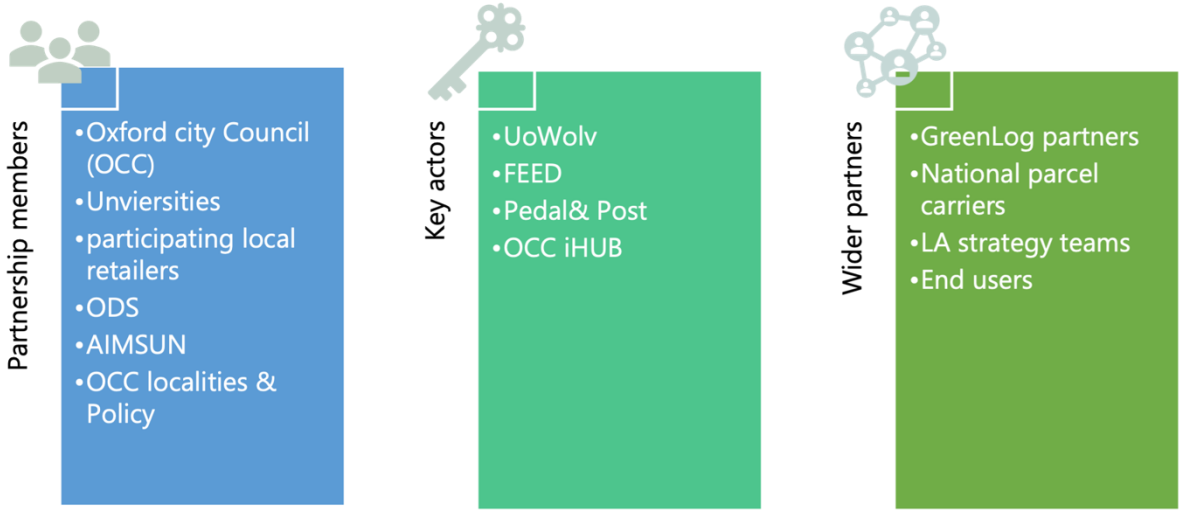


Figure 26: Oxfordshire business ecosystem

5.1.4 Flanders Business Ecosystem

The Business ecosystem of Flanders LL aims to deliver an innovative LaaS platform which will unlock new business opportunities and enable partners to expand operations and profitability. The geographical coverage includes Leuven, Ghent and Mechelen. It includes various categories of stakeholders, including shop owners, local authorities, IT partners, cycle and non-cycle logistics operators, and organizations representing shop owners alongside a dedicated delivery platform for local shops known as "wij.leveren." This core group is further supported by general cargo operators and specialized last-mile providers, such as bike carriers, ensuring a wide-ranging and effective delivery network. The LL's structure extends to involve various associations and organizations, including shopkeepers' associations, retailers organizations, and a broad spectrum of community members such as consumers, citizens, residents, and service companies. This involvement ensures that the lab's initiatives are grounded in the real-world needs and preferences of both the business community and the general public. Additionally, the lab keeps a wide range of stakeholders informed, including those in real estate, city development, and various interest organizations like TLV, Febetra, and Comeos. Civil organizations, such as the Belgian Cycle Logistics Federation and Klimaan, a civil cooperation focused on climate action, play a crucial role in supporting the lab's objectives.

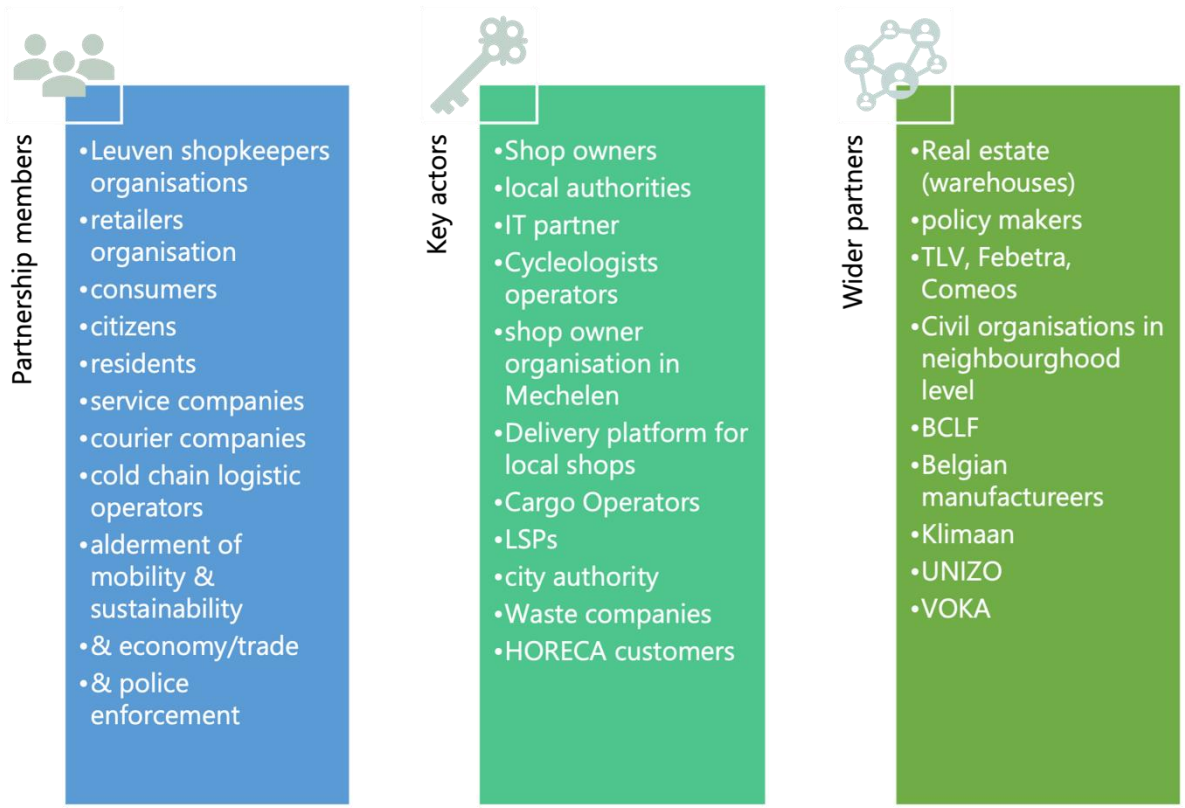


Figure 27: Flanders business ecosystem

5.1.5 Athens Business Ecosystem

At the heart of the Athens Business Ecosystem, we find the key actors who include the LSPs ACS SMSA and FedEx, alongside DAEM, the IT company of the Municipality of Athens. The involvement layer expands to include Frontier, the AUEB, the UAEGEAN, and other partners who are developing modules directly relevant to the use cases. This collaborative effort ensures that the LL benefits from a wide range of expertise, from technological innovation to

academic insights. Furthermore, the ecosystem structure extends to keeping citizens, businesses, and recipients informed about its activities and progress.

Figure 28: Athens business ecosystem

5.2 Sustainable Business Model Canvas

5.2.1 Sustainable Business Model Canvas – Overview

Transport organizations need to develop a sustainable business model to survive in today's competitive environment. "A business model articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value. [...] It's about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers" [REF-06]. With a well-defined business model, organizations are able to specify what customers need, what customers want, and how organizations can best meet those needs and get paid for doing so [REF-07].

A business model is useful as it represents a company's/organisation's core strategy for profitably doing business. A business model canvas illustrates the company's business model, as a snapshot at a given point in time in a qualitative manner, and pinpoints key aspects in individual block. GREEN-LOG adopts and adapts the Osterwalder's business model canvas together with the Sustainability as a key element Canvas to expose the rationale of how the LL use cases create and deliver value last mile deliveries. The proposed business models aim at creating value for all the partners by combining different kinds of value, not only accounting the financial return on investments but also societal and environmental impacts.

The business model canvas is a strategic management tool for developing new or verifying existing business models. It can be explained by nine building blocks, including customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. However, GREEN-LOG has examined an additional two building blocks those of Eco-Social Benefits and Eco-Social Costs, to capture the sustainability footprint (externalities) of the proposed solutions.

Table 1: Eleven Building Blocks of the Sustainable Business Model Canvas

	Building Blocks	Definitions
1	Key partnerships	This building block describes the network of suppliers and partners that make the business model work.
2	Key activities	This building block describes the most important things a company must do to make its business model work.
3	Key resources	This building block describes the most important assets required to make a business model work.
4	Value Propositions	This building block describes the bundle of products and services that create value for a specific Customer Segment.
5	Customer relationships	This building block describes the types of relationships a company establishes with specific customer segments.
6	Channels	This building block describes how a company communicates with and reaches its customer segments to deliver a value proposition.
7	Customer Segments	This building block defines the different groups of people or organisations the enterprise aims to reach and serve.
8	Cost Structure	This building block describes all costs incurred to operate a business model.
9	Revenue streams	This building block represents the cash a company generates from each customer segment (costs must be subtracted from revenues to create earnings).
10	Eco-Social Costs	This building block describes all the costs incurred for operating the business on an environmental and societal level.
11	Eco-Social Benefits	This building block describes all the benefits accumulated for operating the business on an environmental and societal level.

5.2.2 Ispra Sustainable Business Model Analysis

The analysis of the Business Model Canvas sections provides a detailed breakdown of each component, highlighting how they collectively contribute to the overall success of the Ispra LL service delivery, outlined in the Ispra's use case: Next generation last mile delivery integrating delivery robots and cargo bikes.

KEY PARTNERS

The key partners of the Ispra LL are the partners who will contribute effectively to the delivery of value proposition. It includes the Yape and Measy Tech teams, under the umbrella of e-Novia who are responsible for the innovative last mile delivery with robots and carbo bikes. The GREEN-LOG platform technical team, who will undertake the multimodality of the delivery and the technical aspects, as well as the Ispra site services and data analysts, who will monitor the implementation of the delivery system, analysing the results and users' feedback. The canteen management who will be managing orders and loading the delivery assets.

KEY ACTIVITIES

The process is meticulously planned to ensure efficiency and satisfaction. Customers place their orders through an online booking system accessible only to JRC employees and to the canteen management, selecting their meals and preferred delivery times. On the day of delivery, they are notified via email when their order is about to arrive. The joy of receiving a

meal is as simple as opening the Yape droid's compartment, retrieving the lunch box, and enjoying a delicious meal. Behind the scenes, the canteen operators and the Yape and Measy teams work to ensure a smooth operation. The canteen prepares and packs the orders, which are then loaded onto the Measy cargo bike and transported to the exchange point. Here, the Yape droids take over, each assigned to specific deliveries based on an efficient algorithm that considers proximity, route length, battery status, and user preferences.

KEY RESOURCES

The tangible and intangible resources, required to make the Ispra LL work, are the Yape droid and the Measy cargo bike, which will be used primarily for carrying and delivering the order to the customer. Then the GREEN-LOG Platform will integrate the Fleet Management system which is designed to offer a multimodal service, handling order placements and service/ technical requirements. Finally, the pre-notation system will be used to collect the orders, to verify that the payment has been done and to confirm to the user that the order has been processed.

VALUE PROPOSITIONS

Ispra's innovative delivery system aims to transform the way lunch is served to its community, offering access to a restricted area with an unparalleled delivery punctuality because of the multimodality of the delivery means. The responsiveness to delivery due to the proximity of the canteen, guarantees happy customers for a same day order and delivery. In addition, customers don't need to walk to the canteen sparing time in travel and queing and instead can trust a green brand to deliver a warm meal.

CUSTOMER RELATIONSHIPS

The relationship with the customers will be established a few months before the start of the service through a targeted communication plan that aims to involve the user, advertising the green brand and the advantages deriving from using the service (with the support of WP5). The customer will then be able to exploit contact channels for supporting requests with all the key partners involved in the delivery:

- Canteen, for questions about the order.
- JRC Management, for questions such as on payment and the booking system.
-

CHANNELS

Ispra use case will use the appropriate channels, including marketing, distribution and sales channels which are critical for customer experience. The value proposition will be promoted to its targeted customers through different channels in efficient and cost-effective ways including physical advertisement on site; the project's website; Social media; e-Newsletters, brochures and banners; Interactive events/workshops/conferences; Training webinars; Media advertisements; Videos and Blog posts; Meetings and joint site visits; Direct contacts and negotiations; and Local community groups and other involved partners and third parties.

CUSTOMER SEGMENTS

To develop an effective business model, Ispra has identified which customers will serve. At the moment (June 2024), the customers will be users from the Ispra site which amount to approximately 200 people. However, potential customer segments extend to other city municipalities with the final beneficiaries to be the citizens**.**

COST STRUCTURE

The costs of the structure will be mainly related to the costs of the implemented delivery

service, vehicles maintenance, salaries of the delivery operators (cargo-bike riders, Yape's control room operators, technical assistance support operators), marketing and communication, software maintenance and updates and periodic re-mapping of the delivery area.

REVENUE STRUCTURE

The potential future revenues for the Ispra LL could mainly come from:

- Fees on the single delivery
- Fees on the usage of the delivery system implemented by Yape, and so the usage of the robots.

ECO-SOCIAL COSTS

The Ispra LL has not identified any potential harm that will incur on the environment or the society from the use of this service. The charging of the droid and the bike use green energy hence no environmental footprint. On the societal level, a possible bottleneck is the lack of training and learning of human / Robotics interaction, as well as decisions on policy and road infrastructure in order to allow droids to move and transport goods.

ECO-SOCIAL BENEFITS

Understandably, the Ispra LL is a fine example of a green brand as the use of green energy for charging and movement of the Yape and Measy mean less congestion and decarbonization. If this example is adopted by other municipalities or groups, the benefits on the environment will be tremendous. Furthermore, on a societal level, it pushes for the adoption of greener means and instead of JRC employees using their car to travel to the canteen, they can use the delivery service for a fully decarbonized solution.

5.2.3 Barcelona Sustainable Business Model Analysis

Use case 1: Multi-Modal delivery (cargo bikes, e-scooters and e-vans) without rail.
Use case 2: Multi-Modal delivery using public transport (Public bikes with rail).
Use case 3: Multi-Modal delivery (cargo bikes with rail): Robot replaces rider on the train.

KEY PARTNERS

Key partners of the Barcelona business model, include VANaPED who will trial new tools in conjunction with its vanapp24h.eco portal, aiming to optimize its fleet and rider resources for increased revenue at marginal cost. The Rail Service Operator, FGC and ATM (mobility authority) are focused on analyzing and leveraging public transport, including trains, to revolutionize last-mile delivery. The focus of their work will be data collection and meaningful insights so that they can foster collaborations between automated solutions, such as robotics, and public transportation, thereby enhancing the understanding of urban logistics dynamics. EUT, the robotics developer, will attempt to apply mobile robotics in train stations and wagons and in collaboration with FGC focus on setting up the PoC of the robot prototype.

ATM has supplied data to AIMSUN and AUEB and liaison with the Municipality of Terrassa (4 stations outside Barcelona city) and a local LSP.

AIMSUN (modeling tools developer), contributes to this ecosystem by modelling scenarios supporting planning tools development. Last, Mosaic Factor (IT mobility developer), offers "bring your own device" as an approach for collecting valuable (including event registration for model validation and other) data to refine the functionality and efficiency of multi-modal delivery options. The Rider APP that VANaPED uses for parcel handling (Shipday) could

collect some of this and Radio Frequency Identificator (RFID) could be trailed for registration of multiple parcels at stations, on trains.

KEY ACTIVITIES

The key activities for the first use case **Multi-Modal delivery (cargo bikes, e-scooters and e-vans) without rail** include setting up an environmentally sustainable delivery system by leveraging zero-emission vehicles like cargo bikes, e-scooters and e-vans. The aim is to interface the Plan Tool being developed by AIMSUN / AUEB with the portal that VANaPED is developing to handle delivery service orders. The target area served by FGC rail services has been defined; post codes of the Sant Gervasi and Gracia districts. Since the number of orders for receiver locations in the target area is – currently - low, the Plan Tool generates a random set of receiver locations (10 for rider rucksack scenario). A key function of the tool will be the identification of those locations that are reachable within a defined walking catchment of the destination train station.

The Plan Tool will generate delivery route plans for the two modes (cargo bikes and e-vans) and the direct parcel transportation from the depot to the end-user the consumer will be demonstrated using event registration tools to compare predicted delivery times with actual ones. As the volume of portal parcel orders grows, we aim to integrate real orders into the route plans.

In this business model, the choice of vehicle will be determined based on the volume and dimension of the parcel as well as the route conditions anticipated, ensuring optimal delivery efficiency and minimal environmental impact. In the second use case **Multi-Modal delivery using public transport (public bikes with rail)** it is intended that public transport should be employed to deliver the parcels without the involvement of the LSP's own vehicle fleet.

This service can – potentially- reach further a wider geographical region than the limited range options of cargo bikes, e-scooters and e-vans. The parcels are transferred from the depot to the rail network by dispatch riders either on-foot or using public bikes to the first rail station at Plaça de Catalunya. From there the parcels travel further into the country. The third use case **Multi-Modal delivery (cargo bikes with rail): Robot replaces rider on the train** suggests that the parcels can be uploaded and offloaded on the train by a robot. This is still at the PoC level. However, such an achievement would mean reducing labor costs, increasing safety in the working environment and efficiency. For the functionality of this case, lockers would need to be incorporated in the train stations where LSP only deposits parcels in first train station and then the robot offloads the parcels in lockers at the destination stations (with onward delivery by another LSP or collection at the locker).

KEY RESOURCES

The physical resources for this business model include the rail services, e-scooters, bikes and e-vans as well as the hub space for handling the parcels and vehicles. The Plan Tool will initially produce delivery routes for the mode alternatives for simulated parcel orders. The pilot will use rider applications and smart phone devices- possibly RFID – to register parcel handling events. Integration with the portal[12] will be needed to move from simulated to real-life parcel orders.

The teams of all key partners involved are important in delivering the service, as well as the riders and the e-van drivers and LSP workers and drivers.

[12] www.vanapp.24h

Financially, there are costs of rider dedication when travelling by train. For the city-based pilot these may be offset by benefits such as the capacity to deliver without investing in an expanded fleet. But, for any pilot with extended rail travel, subsidies are likely to be needed to offset the involvement of a 2nd LSP.

VALUE PROPOSITIONS

The value proposition of this service is trifold. Firstly, there is a fostering of collaboration and cooperation between different LSPs as well as the train authorities which will ultimately bring wider coverage by reaching other customers further inland, more efficient and time accurate deliveries, as well as less congestion and improvement of air quality and noise. Secondly with the promotion of local commerce, the green branding assists in lowering the emissions in different zones and promoting greener options for transportation and delivery. While the Vanapp.24h portal drives sales to customers, the revenue will be increasing for local businesses supporting the local economy. Lastly, with the incorporation of robotics loader and off loader in the train station, the manual work needed for this becomes obsolete, leading to less accidents and more efficient procedure.

CUSTOMER RELATIONSHIPS

Customer relationships for end-users can be achieved through personal assistance at the vanapedal24h website in addition to phone and e-mail. It will add to the last of dedicated personal assistance as well as automated customer services. The LSPs can be reached through ATM the public authority that can advertise the service through its website and on public information days. A further marketing campaign will be undertaken through the Van-A-Pedal 24h portal.

CHANNELS

The channels which will be employed to reach the potential customers include direct contact with the users through market / commerce associations as well as local market owner associations. The local authority ATM is leading on the involvement of municipalities beyond the City of Barcelona. This is the way that LSPs will be approached to – hopefully – extend the pilot to the regional hinterland. A marketing campaign including social media posts, newsletters, YouTube videos will promote the pilot.

CUSTOMER SEGMENTS

There are three customer segments in this business model. The first is the end-user the recipient of the parcel. There is the LSP which collaborates with the train authorities and lastly the Local shop owners who promote commerce especially close to the train stations of the FCG line. Further municipalities and LSPs need to become involved to extend the service beyond the city limits.

COST STRUCTURE

Regarding expenses, costs like energy, travel tickets, and promotion are the variable costs, that need a flexible cost management and good resource optimization, while fixed costs like salaries, rent, utilities, and maintenance are necessary for operational stability and resource allocation. The LL finds a balance between keeping expenses under control and providing value to clients through cutting-edge services.

REVENUE STRUCTURE

The Barcelona LL demonstrates both cost-driven and value-driven strategies. Revenue streams are the fees for delivery services (Same-Day, Next-Day, by parcel size and frequency of demand) that are paid by local businesses.

ECO-SOCIAL COSTS

The costs on the environment and the society for the delivery of this service include the possibility of accidents with the cargo bikes or the promotion of unnecessary traffic demand for example for food deliveries. The vehicle batteries also have an impact on the environment both for their production and life-cycle. Use case 3 can pose some issues on the substitution of labour work from persons to robots that can lead to further job cuts. The business partners will seek further ways to employee workers if this would be the case.

ECO-SOCIAL BENEFITS

With the introduction of greener last mile delivery options like e-scooters, cargo bikes and e-vans the city will see a change in the emissions, noise, and air quality. Less traffic means more safety for pedestrians and a more liveable city for the citizens. Also, by the use case 2 with the rail delivery more areas will be reached providing thus better service to inland populations which might have been restricted before in terms of delivery options and times. The service currently provided by VANaPED is extending its city centre operation to cover the whole of the city of Barcelona. Other LSPs will be needed to extend the service to the rest of the region.

5.2.4 Oxfordshire Sustainable Business Model Analysis

Use case: Last-mile Logistics as a Service

KEY PARTNERS

The Key partners of the Oxfordshire Business Model include the Pedal & Post, the zero emission last-mile delivery provider that provides 30 e-cargo bikes and couriers, teaming up with FEED a local SME which provides Food and Essentials E-delivery. Under the aegis of the OCC, and aligning with the zero-emissions policy put fourth, the Oxfordshire County Council is a dynamic and strategic policy partner. AIMSUN and UOW will provide the modelling and academic expertise needed for this work.

The consortium will create three key innovations:

1) MDH which will be based on a 4-wheeled EAV cargo bike to support the delivery service, and experiment with remote and autonomous operation, as well as transforming it to mobile delivery lockers. Lead: FEED, support, PEDAL, OCC, UOW, AIMSUN
2) A Micro-Consolidation Centre, that will be modular and movable, deployed at a location outside the city centre, in an existing transport hub, such as a Park & Ride. This will enable transition from vehicle to bike-based deliveries. Lead: OCC, support P&P
3) An online e-commerce platform to enable local small traders to aggregate their deliveries for bike couriers within the historic Oxford location. Lead: P&P, support FEED, OCC

These three elements will work together to create greater value. For example, the Local Retailers inside the ZEZ and the covered market in the city centre will collaborate with the LSP to load the MDH when it arrives. AIMSUN and UoW provide modeling and simulation support, as well are refining the business cases, value proposition and integration with the GREEN-LOG platform.

KEY ACTIVITIES

For the MDH, this includes design, technical developer, needs and priorities discovery, procurement and testing the technical aspects. Define and trial the MDH use cases, including defining use cases, metrics, co-design through workshops. For the MCH, which includes

design, securing of land, development of site, licensing. Design and develop the online platform, including routing, booking, and placement.

For the online platform: understand the needs and drivers for to participate in the platform. Trial the platform with all local stakeholders, establish branding, onboard them, and receive feedback. Finally, for the whole system: Integrate the platform with the MDH, MCH and P&P operations; Validate and Verify the whole system; Evaluate the trials across key objectives and business assumptions and understand and act on policy implications for OCC to the local area.

The inspiring project aims to decongest a highly populated historic centre by giving the streets back to the pedestrians rather than the delivery vehicles. The delivery service will increase capacity of individual couriers by reloading in the fields. It will offer LSP route optimization with remote reloading and an option for extra storage at shops that act as parcel collection points.

Also, the shop-owners will gain buy-in while there will be a means to understand when a shop has reached its capacity and needs more space. On that occasion, there will be a cost incentive for shop keepers to store parcels in the defined portable delivery lockers at the defined collation of the MDH. For the customers, collection from the MDH will be made an option during their checkout from the delivery platform.

KEY RESOURCES

The resources needed for the successful execution of this business plan include the 30 e-cargo bikes from Pedal & Post as well as the 4-wheel EAV cargo bike which will act as both a delivery means and a storage facility in the MDH.

In addition, the technical team comprised by the data and mechanical engineers will be contributing to the delivery service. The MDH and MCH will be key resources developed and evaluated through the project. Also, the Micro consolidation hub and the land that will be leased by the council are also considered resources.

Finally, the e-commerce platform (developed through this project) will facilitate delivery and collection services as well as payment options.

CUSTOMER SEGMENTS

Customers of the proposed service include the end-user who is a resident and will be the parcel recipient. Also, the public authority who has policies to decarbonise local transport, improve safety, air quality and active transport. Furthermore, the Logistics provider and the courier are both from Pedal & Post in this project (FEED might provide the technology to multiple suppliers).

VALUE PROPOSITIONS

The project suggests considerable value for the parcel recipient, the LSP and the Shop owners involved in this partnership.

The parcel recipient will not need to be home during the delivery window to receive the parcel, and they will benefit from cheaper deliveries, higher reliability, and improved customer experience. Thanks to the solution, they will benefit from improved air quality, safety, and transport conditions locally.

The service providers will offer more parcel collection locations as options and lower parcel delivery costs. The LSP will increase its capacity of parcel deliveries and efficiency. The service will provide better future planning through optimizing recommendations like route,

number of bikes, and resource management, contributing to reduced time on the road and better branding opportunities.

The courier provider will have the opportunity to use the MDH to reduce operational costs through autonomous and/or remote operations.

Last, the shop owner will have better customer satisfaction in receiving packages in time and will the extra storage. Additionally, they might get more orders through the online platform.

CUSTOMER RELATIONSHIPS

The suggested relationship with the parcel recipient involves autogenerated texts from parcel carriers, a confirmation text after having received parcel and an alert text for the arrival day and estimated time of parcel. For the LSP, there will be more customer data available contributing to a better analysis of business and amelioration of the service.

For the shop-owner it is indented to approach through co-creation workshop, and at the 'talk of the town' quarterly meetings, as well as 1 to 1 engagement for assessing individual need and through the platform.

CHANNELS

The channels to promote these relationships for the customer (parcel-recipient) will be through social media, local press, brochures/information leaflets, word of mouth, and through targeted outreach to groups that receive the greatest number of parcels like university dorms and hospitals.

The parcel recipients will have better awareness through texts from parcel carriers: a confirmation text after having received the parcel and an alert text for the arrival day and estimated time of the parcel.

For the local shop owners who are also an end user the approach will be made through the talk of the town quarterly meetings, the business services of the city council as well as 1 to 1 conversations. They can also be approached through the chamber of commerce, as well as local and regional conferences and events.

For the LSP, there will be more customer data available, contributing to a better analysis of business and amelioration of the service. The LSP will be approached through salespersons.

For the shop owners, co-creation workshop and at the 'talk of the town' quarterly meetings, as well as 1 to 1 engagement for assessing individual needs will build lasting engagement. Pedal and Post will hold the relationship directly with the shop operators, and FEED will liaise with P&P.

All of the above categories will benefit from a marketing campaign, including a video for social motivation.

COST STRUCTURE

There are numerous costs that need to be defined and explored through this project. These include:

Capital and operational costs of the MDH: this includes development (EAV, remote and self-driving operation, remote operations centres and staff, connectivity and insurance costs). Capital and operational costs of the MCH: land rent, development costs, utilities, staff, insurance. Capital and operational costs of the platform: development and support costs, hosting and operators, third-party provider costs (e.g. card payments)

These are the key marginal costs on top of the normal BAU operations of the partners, such as the delivery fleet costs from P&P. There are also additional promotion (marketing and sales) costs associated with the solution.

REVENUE STRUCTURE

There are multiple revenue structures for the different partners:

- Pedal and Post's revenue is per parcel delivery, and thus increasing capacity has a direct link with increasing revenue.
- OCC's benefit is linked to the reduced cost of congestion, improved safety and reduced emissions.
- FEED's revenue might be through licensing the technology and concept.

The overall offer can also generate new income opportunities for the partners, including:

- Commissions on sales through the online platform.
- Advertising fees from MDH or platform ad placements.
- Subsidies from the local authorities.
- Subscription from shop owners.

ECO- SOCIAL COSTS

Although the service aspires to meet the goals of zero-emission there is still the cost of energy production in the charging of bicycle as well for their production.

The MDH will move in considerably low speed and will also occupy pavement space or parking. There might be less jobs if autonomous operations are used.

The same for the MCH in occupying space that might be used for other purposes like parking. The HGV will also create some noise and might pose some safety concerns when delivery to the MCH.

There will also be capital carbon costs from the development of the MDH and MCH, and energy costs for the online platform and MDH autonomous stack.

ECO- SOCIAL BENEFITS

Despite the above eco-social costs, the service will provide imperative environmental benefits by reducing emissions, especially in the historic centre of Oxford, while increasing the zero-emission delivery capacity because of the e-cargo bikes. This will, in turn, improve the air quality and reduce congestion, as well as improve safety in the city's much-visited and highly populated medieval streets. The MDH will be able to move to less affluent and more remote areas for periods of time, increasing access to them.

5.2.5 Flanders Sustainable Business Model Analysis

Use case: Last-mile Logistics as a Service

KEY PARTNERS

The Flanders LL comprises diverse categories of stakeholders, including shop owners, local authorities, IT partners (Frontier, Factual, MOBY, etc.), cycle logistics operators, and organizations representing shop owners in Mechelen, alongside a dedicated delivery platform for local shops known as "Wij.Leveren." in Leuven This core group is further supported by general cargo operators and specialized last-mile providers, such as bike carriers, ensuring a wide-ranging and effective delivery network.

KEY ACTIVITIES

The key activities of the Flanders LL revolve around the establishment of a functional LaaS platform. The use case focuses on three cities Mechelen, Leuven and Ghent and aims to provide a service to all three despite the diverse logistic needs. The platform will utilize urban logistics data to connect demand and supply including sustainable logistics services, warehouse space and specific vehicle types. It will offer different delivery options to shop keepers and end consumers, as well as decision will be based on dynamic pricing, delivery time, vehicle and quality of label of LSP. The aim of this platform will be to steer deliveries by automatically apply business rules set by the city authorities: for example, the LaaS will be able to nudge shop keepers and end-consumers towards choosing more sustainable delivery options. To nudge the LSPs to conduct more sustainable delivery offerings, branding opportunities---such as given the label of 'green delivery' or 'child-friendly delivery', could be offered. It will also include city-specific hard measures on its nudging mechanism to improve sustainability of the deliveries.

KEY RESOURCES

The key resources include the LaaS platform and the integrated nudging tool, the dynamic pricing calculator as well as the business rules database which will include policy rules and recommendations. The resources of the human capital (delivery workers) and tangible assets (e.g. cargo bikes, vans, parcel lockers) of the LSPs engaged and cities are also crucial. There will be an operational rules database and an external calculation tool.

VALUE PROPOSITIONS

Bike courier managers are poised to benefit significantly from this initiative. By receiving demands that seamlessly integrate into their existing routes, they can optimize drop density, thereby conducting more business in less time. Additionally, the LaaS platform promises to unlock new business opportunities, enabling them to expand their operations and profitability. Local authorities are provided with a powerful tool for urban planning and policy-making. The platform offers a comprehensive overview of goods movement, facilitating the implementation of data-driven policies. Furthermore, it supports the promotion of alternative, more sustainable delivery options to citizens, aligning with broader environmental goals and enhancing urban livability.

For local shopkeepers, the LaaS platform offers control over their delivery options. It enables them to select shippers that meet their specific service levels, ensuring that their products reach consumers through reliable and compliant delivery services. Moreover, it empowers them to educate their customers about the societal costs of different delivery options at the point of sale, promoting more sustainable consumer behavior and supporting the growth of their e-commerce platforms. Private consumers stand to gain a deeper understanding of the environmental impact of their delivery choices. The platform provides detailed insights into the emissions saved by selecting specific delivery options, fostering a sense of pride and encouraging the continuation of sustainable behaviors. Additionally, it highlights the benefits of choosing no-rush delivery options, further emphasizing the role of consumer choice in reducing emissions and vehicle movements in urban areas.

CUSTOMER RELATIONSHIPS

The key to maintaining the relationships with the shop owners and end consumers is ensuring the service level of deliveries with the use of the LaaS. For the LSPs, it's crucial to ensure the safety of the information they share upon engaging in the LaaS. In terms of the city authorities, the management of the license of the LaaS is the most important factor in the relationship.

CHANNELS

Communication and marketing of the LaaS platform will be achieved through workshops with the Business ecosystem shareholders, as well as a detailed communication campaign which will include newsletters, magazine, social media and website access. Furthermore, reports featuring data sources for shop keepers will inform them about their customers as well as evaluation sessions and automated mailings. One to one visits to shareholders and end-users is considered effective but very time consuming.

CUSTOMER SEGMENTS

The customers for the LaaS platform include local shop owners and their end-users the consumers. The LSP's since there will be offered more efficiency and more business opportunities per km, waste companies, and citizens benefiting in wider regions. The city authorities, who will hold and pay for the license for the use of the LaaS, could be able to charge a fee for the LSPs, the shop owners or the consumers to join the LaaS.

REVENUE STRUCTURE

Potential revenue may come from EU funding or Flemish funding towards the running of the LaaS. The users of the LaaS, such as shop keepers and e-commerce consumers, may pay a fee for the service they want to use, or a subscription feel for the LaaS.

ECO-SOCIAL COSTS

Impact of the increase of cargo bikes on safety and how legislation has to change that determined the road cargo bikes may use.

ECO-SOCIAL BENEFITS

The considerable benefits of the service on the environment and the society are noteworthy. The use of the LaaS will promote safer more liveable places with less vehicles for the same number of parcels, less congestion and better air quality. With less noise pollution and less congestion cities it promotes quality in the daily interactions with delivery services. In addition, the fact that the consumer has more options for a greener delivery promotes the sustainable consumer behaviour leading to a more aware and responsible society altogether.

5.2.6 Athens Sustainable Business Model Analysis

Use case 1: Shared Micro-consolidation center, lockers and white label fleet
Use case 2: Delivery with Mobile Depot

KEY PARTNERS

The key partners to deliver both uses cases (use case 1: Shared micro-consolidation center, lockers and white label fleet and use case 2: Delivery with Mobile Depot), are the prominent LSPd ACS SMSA and FedEx, alongside DAEM, the IT company of the Municipality of Athens.

KEY ACTIVITIES

The Athens business model offers a distinguished sample of sustainability in last mile deliveries, especially in historic busy city centers. First, it aims in establishing a Micro-consolidation Center at the Klauthmonos parking facility operated by DAEM. The MCC serves as the heart of the operation for both ACS SMSA and FedEx which deposit their parcels before they are entrusted to a white label electric vehicle. Then a green electric vehicle carries parcels through Athens historical center streets. The vehicle is integrated with the GREEN-LOG's BYOD (bring your own device) component that ensures real-time tracking and management of deliveries. Any undelivered parcels are returned to the MCC and collected by the logistics companies. In addition, the service provides the integration of smart lockers in the

Klauthmonos and Varvakeios parking lots offering end users flexibility in collecting parcels. Secondly, an electric vehicle acts as a mobile depot with predefined strategic stops where conveniently residents and businesses of Athens can collect their parcel for a timeframe of 60-90 minutes in each location.

KEY RESOURCES

The key resources include physical, intellectual and financial assets. The fleet to feed the MCC activities (shared deliveries and lockers) is owned and managed by the LSPs. Additionally, a white label third party green vehicle will be provided by the LSPs to serve the common operations. The MCC as well as the PDAs or any other supportive devices, constitute the physical assets. In addition, the intellectual include the data ODs, routing, delivery data such as number of parcels, weights, and final destinations, that can be utilized for better planning and calibration of the service. Financial assets include the funding provided by the GREEN-LOG project, as well as a 30% contribution from the LSPs. The employees of the companies (Drivers) as well as insurance and licenses are also important resources.

VALUE PROPOSITIONS

The true value of the Athens' business model is the establishment of a zero-emission delivery scheme within the center of Athens. What makes the project more important is the collaboration between the stakeholders for the successful implementation of the sustainability aspect of the logistic solutions. The Joint delivery system from multiple LSPs ensures the reduction of costs and externalities such as congestion, environmental emissions, noise and air quality. The white label electric vehicle offers green and reliable deliveries through the streets of Athens and acts as mobile depot that allows for flexible collection times.

CHANNELS

The customer segments will be reached and informed through advertisements in social media, website, newsletters, bulleting boards, billboards of all the involved core partners, as well as physical advertisement (boards, posters etc) in the MCC and the parking lot of Varvakeios.

CUSTOMER SEGMENTS

The customer segments include the Last Mile delivery providers, the shop owners and local businesses, the final recipients- citizens and the citizens of other municipalities and regions in Greece.

COST STRUCTURE

The strong cost structure is necessary to maintain these revenue sources. This LL appears to be more of a combination of cost-driven and value-driven approach. This covers employees' costs, insurance coverage, staff training, IT maintenance and updates, fleet purchase and maintenance, future space procurement, safe storage facilities, cloud services, and promotional efforts.

REVENUE STREAMS

In the case of Athens, the revenue streams are diverse and include a range of different sources, such as commissions on delivery revenues, sales of additional modules, data selling, provision of advertising space on the MCC's fleet, license fees for a potential future marketplace platform, and consulting services for initiatives of a similar nature. These provide the most to all partners and optimizes the possible revenue.

ECO-SOCIAL COSTS

The business model poses some safety concerns because of the lack of security in the locations chosen. This will be mitigated with security roll-ups and a general innovation taken up by DAEM. Because of the uniqueness of the project, with the collaboration of two prominent LSPs ACS SMSA and FedEx but also the municipality authorities, there might be some administration complexities. In addition, the electric vehicle would have limited functionality during extreme weather conditions like heat or rain.

ECO-SOCIAL BENEFITS

Consequently, the environmental and social benefits of this project are multi-fold. The service aspires to reduce delivery milage and time by having a MCC where both LSPs can deposit parcels for a consequent white label green vehicle delivery. This will reduce noise and congestion as well as noise within the historic center of Athens. It will also require less public space as the collaboration guarantees a consolidation of deliveries. The project contributes to the low emission zones and addresses the climate change crisis in a responsible and sustainable manner.

5.2.7 Section with BMCanvases

In the following pages, the business model analysis performed in the previous sections is summarized in the form of Business Model Canvases.

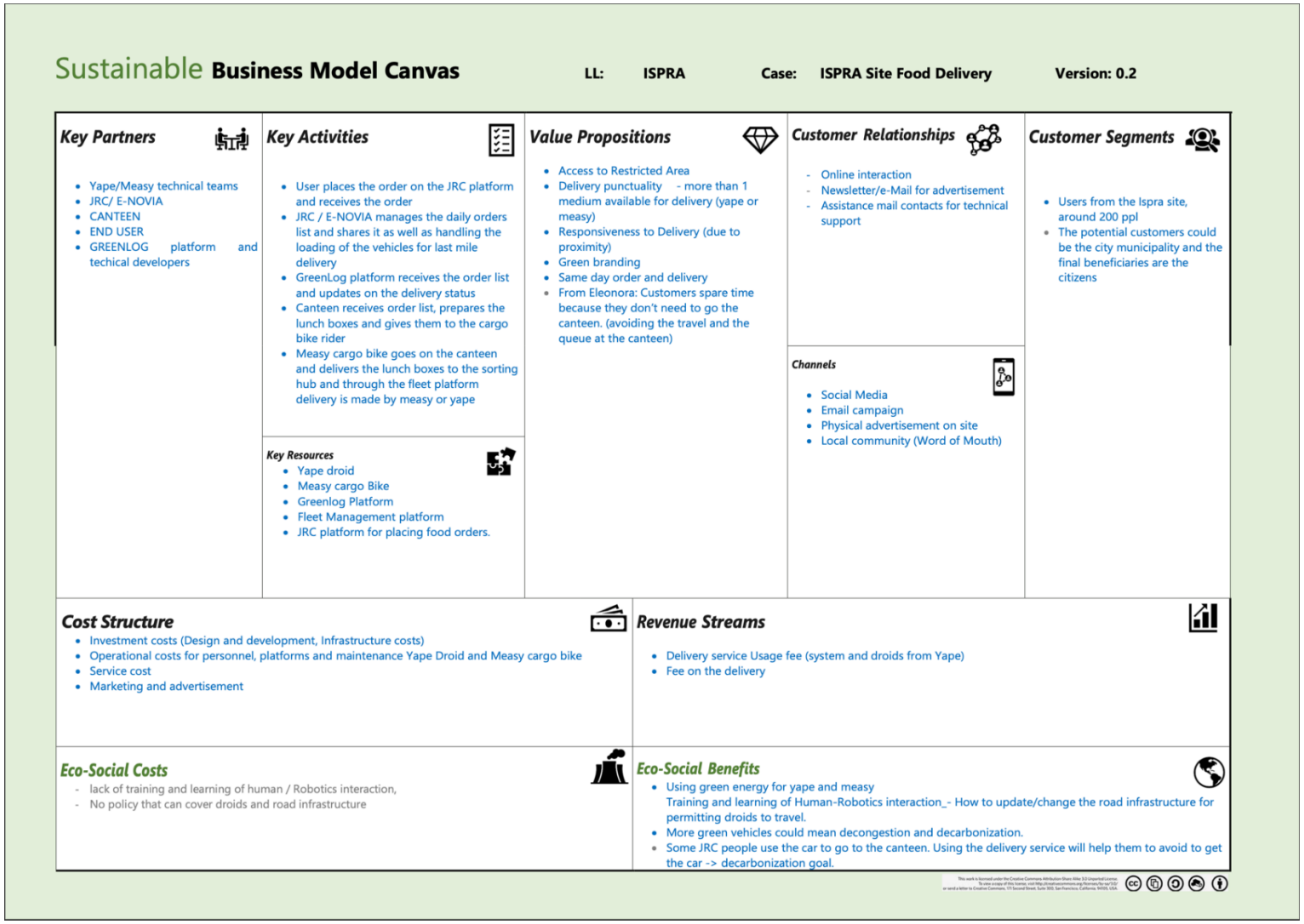


Figure 29: BMC Ispra

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

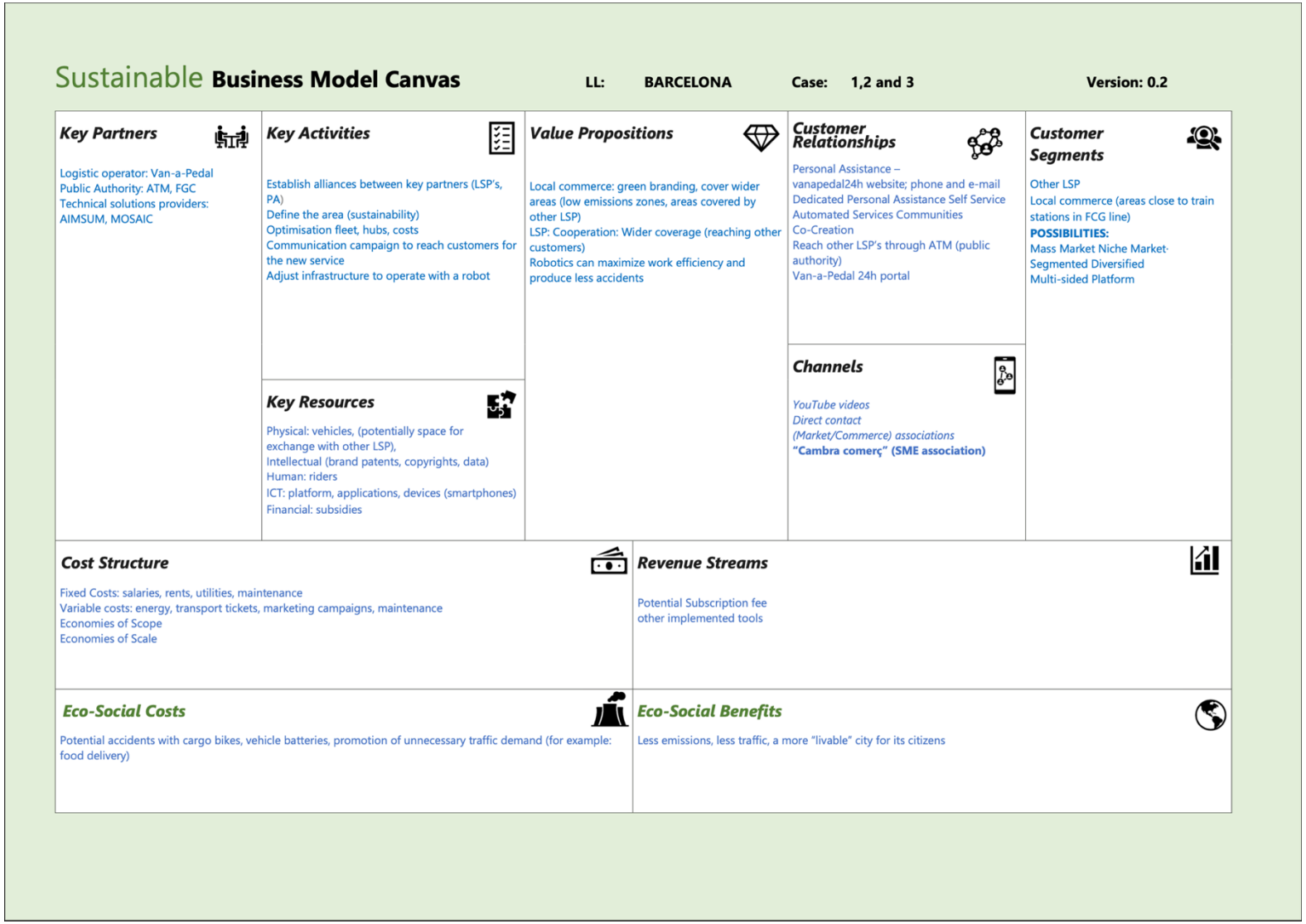
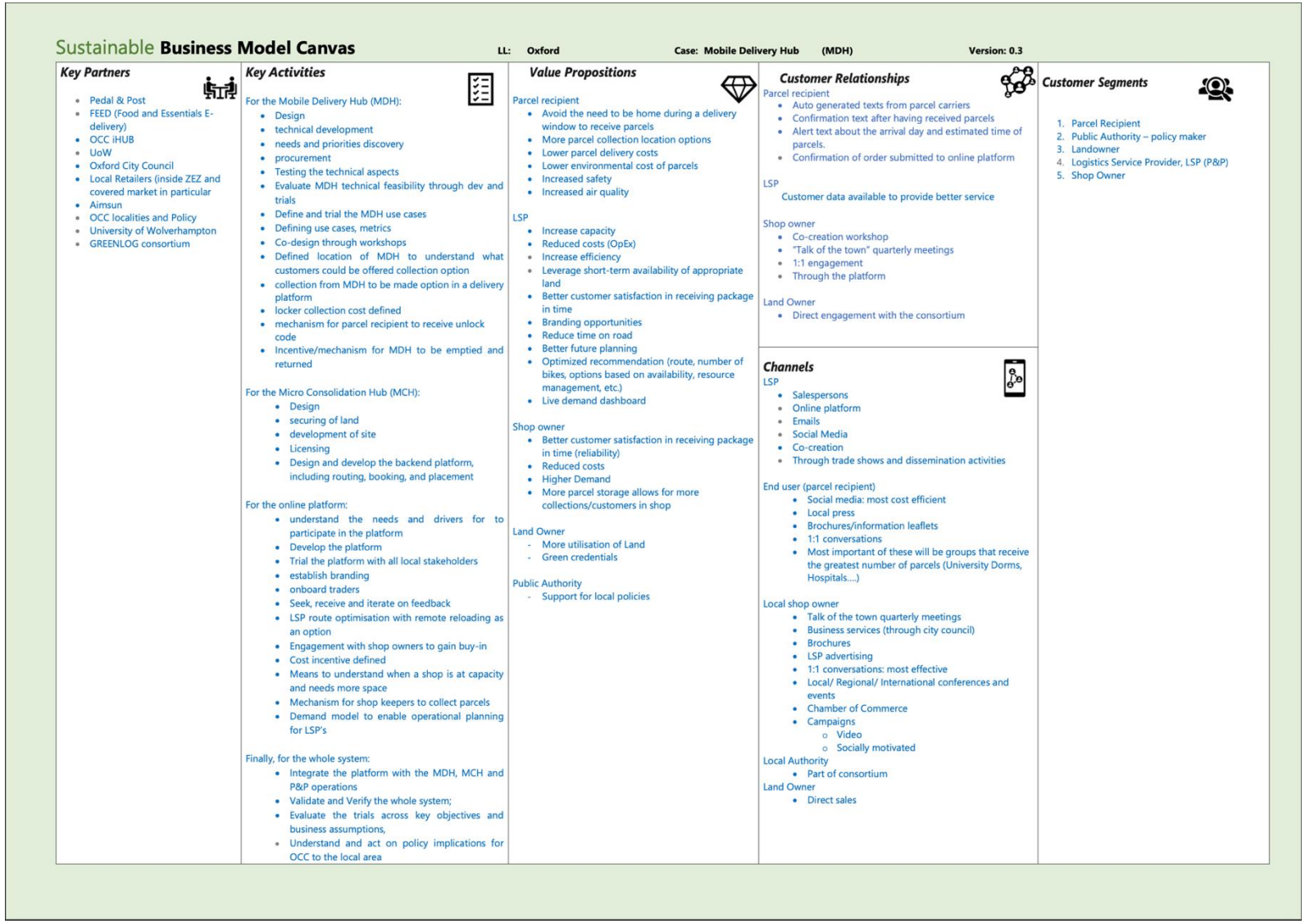


Figure 30: BMC Barcelona



Sustainable **Business Model Canvas**

LL: Oxford **Case:** Mobile Delivery Hub (MDH) **Version:** 0.3

Key Partners

- Pedal & Post
- FEED (Food and Essentials E-delivery)
- OCC iHUB
- UoW
- Oxford City Council
- Local Retailers (inside ZEZ and covered market in particular
- Aimsun
- OCC localities and Policy
- University of Wolverhampton
- GREENLOG consortium

Key Activities

For the Mobile Delivery Hub (MDH):

- Design
- technical development
- needs and priorities discovery
- procurement
- Testing the technical aspects
- Evaluate MDH technical feasibility through dev and trials
- Define and trial the MDH use cases
- Defining use cases, metrics
- Co-design through workshops
- Defined location of MDH to understand what customers could be offered collection option
- collection from MDH to be made option in a delivery platform
- locker collection cost defined
- mechanism for parcel recipient to receive unlock code
- Incentive/mechanism for MDH to be emptied and returned

For the Micro Consolidation Hub (MCH):

- Design
- securing of land
- development of site
- Licensing
- Design and develop the backend platform, including routing, booking, and placement

For the online platform:

- understand the needs and drivers for to participate in the platform
- Develop the platform
- Trial the platform with all local stakeholders
- establish branding
- onboard traders
- Seek, receive and iterate on feedback
- LSP route optimisation with remote reloading as an option
- Engagement with shop owners to gain buy-in
- Cost incentive defined
- Means to understand when a shop is at capacity and needs more space
- Mechanism for shop keepers to collect parcels
- Demand model to enable operational planning for LSP's

Finally, for the whole system:

- Integrate the platform with the MDH, MCH and P&P operations
- Validate and Verify the whole system;
- Evaluate the trials across key objectives and business assumptions,
- Understand and act on policy implications for OCC to the local area

Value Propositions

Parcel recipient

- Avoid the need to be home during a delivery window to receive parcels
- More parcel collection location options
- Lower parcel delivery costs
- Lower environmental cost of parcels
- Increased safety
- Increased air quality

LSP

- Increase capacity
- Reduced costs (OpEx)
- Increase efficiency
- Leverage short-term availability of appropriate land
- Better customer satisfaction in receiving package in time
- Branding opportunities
- Reduce time on road
- Better future planning
- Optimized recommendation (route, number of bikes, options based on availability, resource management, etc.)
- Live demand dashboard

Shop owner

- Better customer satisfaction in receiving package in time (reliability)
- Reduced costs
- Higher Demand
- More parcel storage allows for more collections/customers in shop

Land Owner

- More utilisation of Land
- Green credentials

Public Authority

- Support for local policies

Customer Relationships

Parcel recipient

- Auto generated texts from parcel carriers
- Confirmation text after having received parcels
- Alert text about the arrival day and estimated time of parcels.
- Confirmation of order submitted to online platform

LSP

Customer data available to provide better service

Shop owner

- Co-creation workshop
- "Talk of the town" quarterly meetings
- 1:1 engagement
- Through the platform

Land Owner

- Direct engagement with the consortium

Channels

LSP

- Salespersons
- Online platform
- Emails
- Social Media
- Co-creation
- Through trade shows and dissemination activities

End user (parcel recipient)

- Social media: most cost efficient
- Local press
- Brochures/information leaflets
- 1:1 conversations
- Most important of these will be groups that receive the greatest number of parcels (University Dorms, Hospitals....)

Local shop owner

- Talk of the town quarterly meetings
- Business services (through city council)
- Brochures
- LSP advertising
- 1:1 conversations: most effective
- Local/ Regional/ International conferences and events
- Chamber of Commerce
- Campaigns
  - Video
  - Socially motivated

Local Authority

- Part of consortium

Land Owner

- Direct sales

Customer Segments

1. Parcel Recipient
2. Public Authority – policy maker
3. Landowner
4. Logistics Service Provider, LSP (P&P)
5. Shop Owner

Figure 31: BMC Oxford

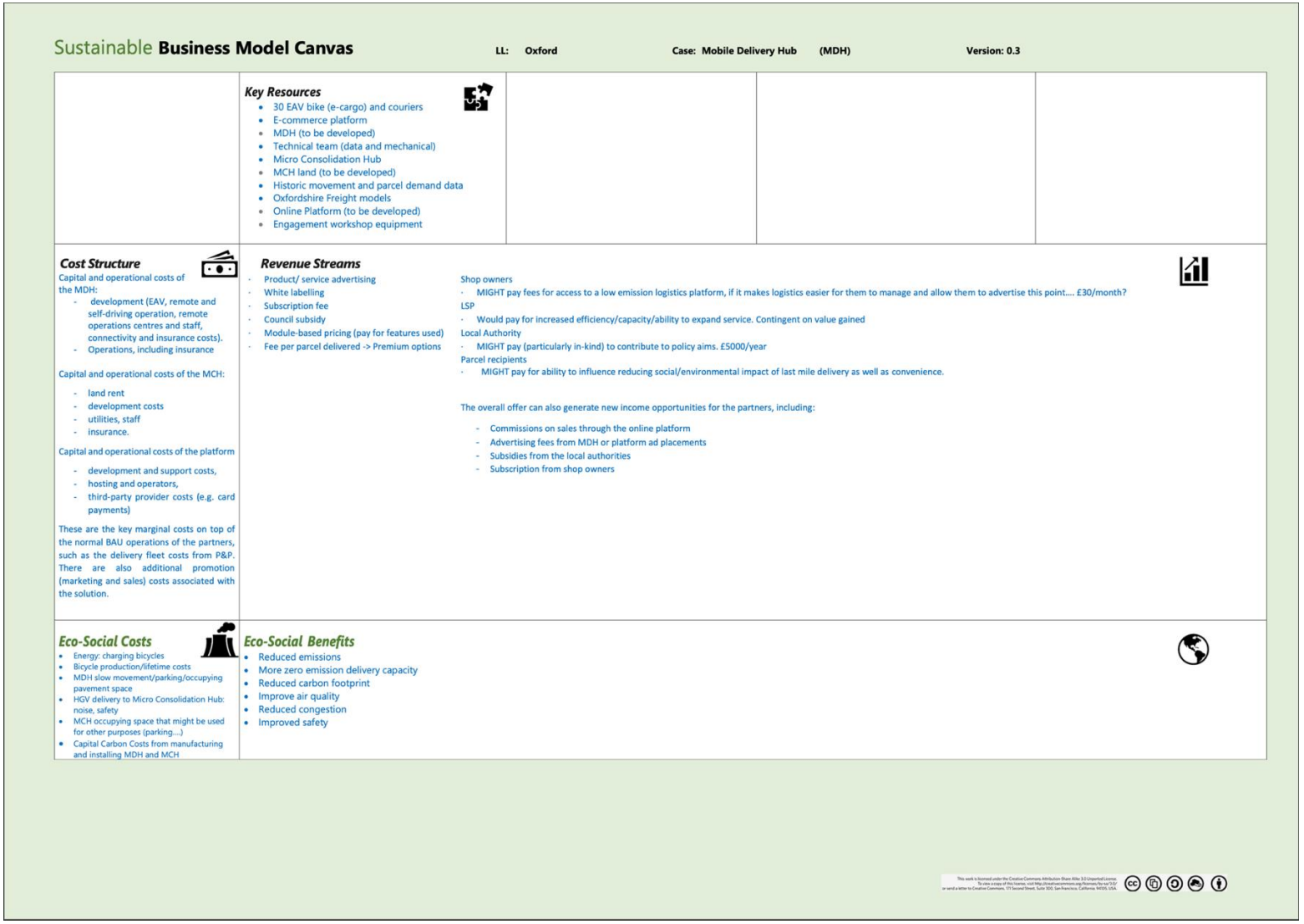


Figure 32: BMC Oxford

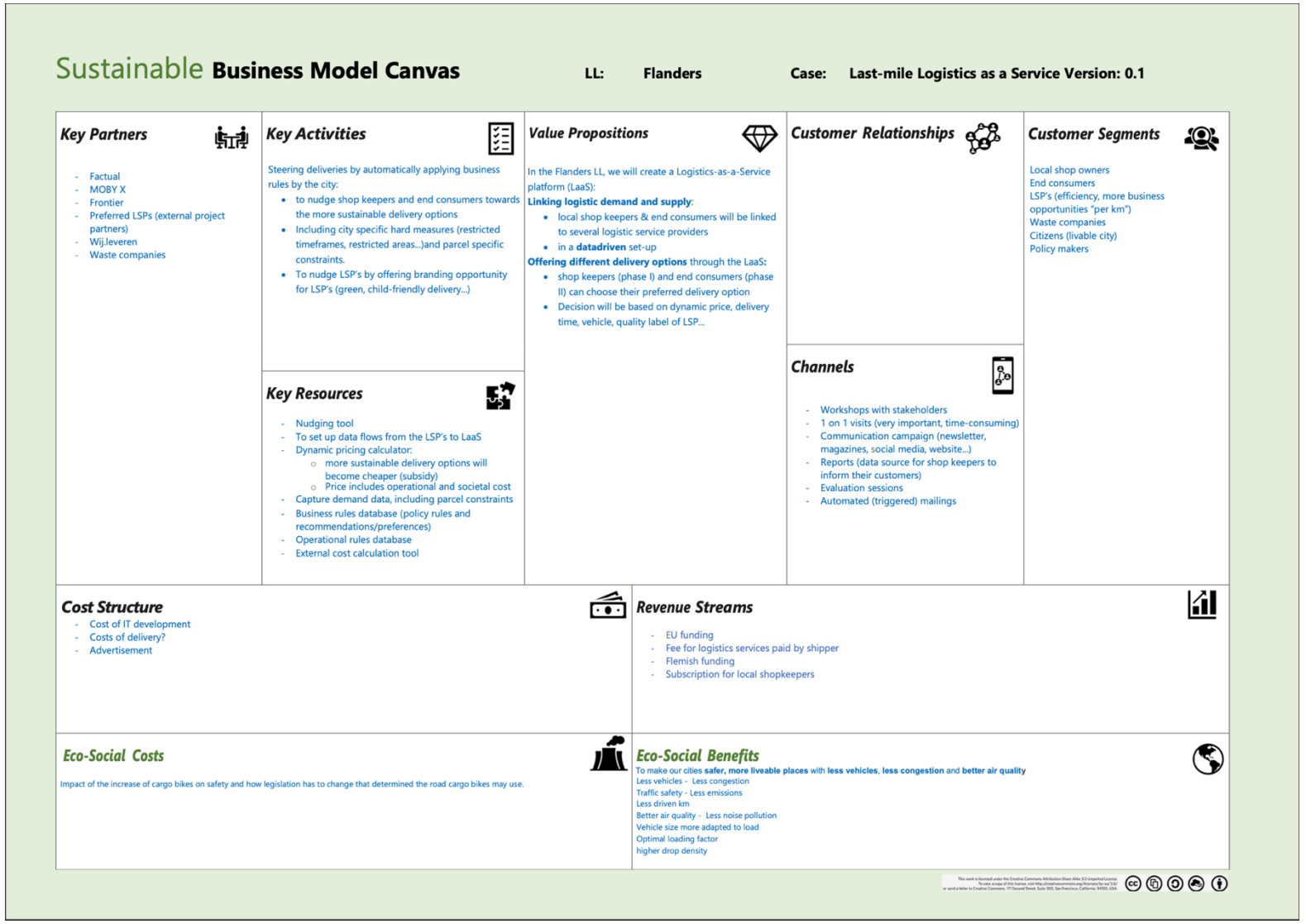


Figure 33: BMC Flanders

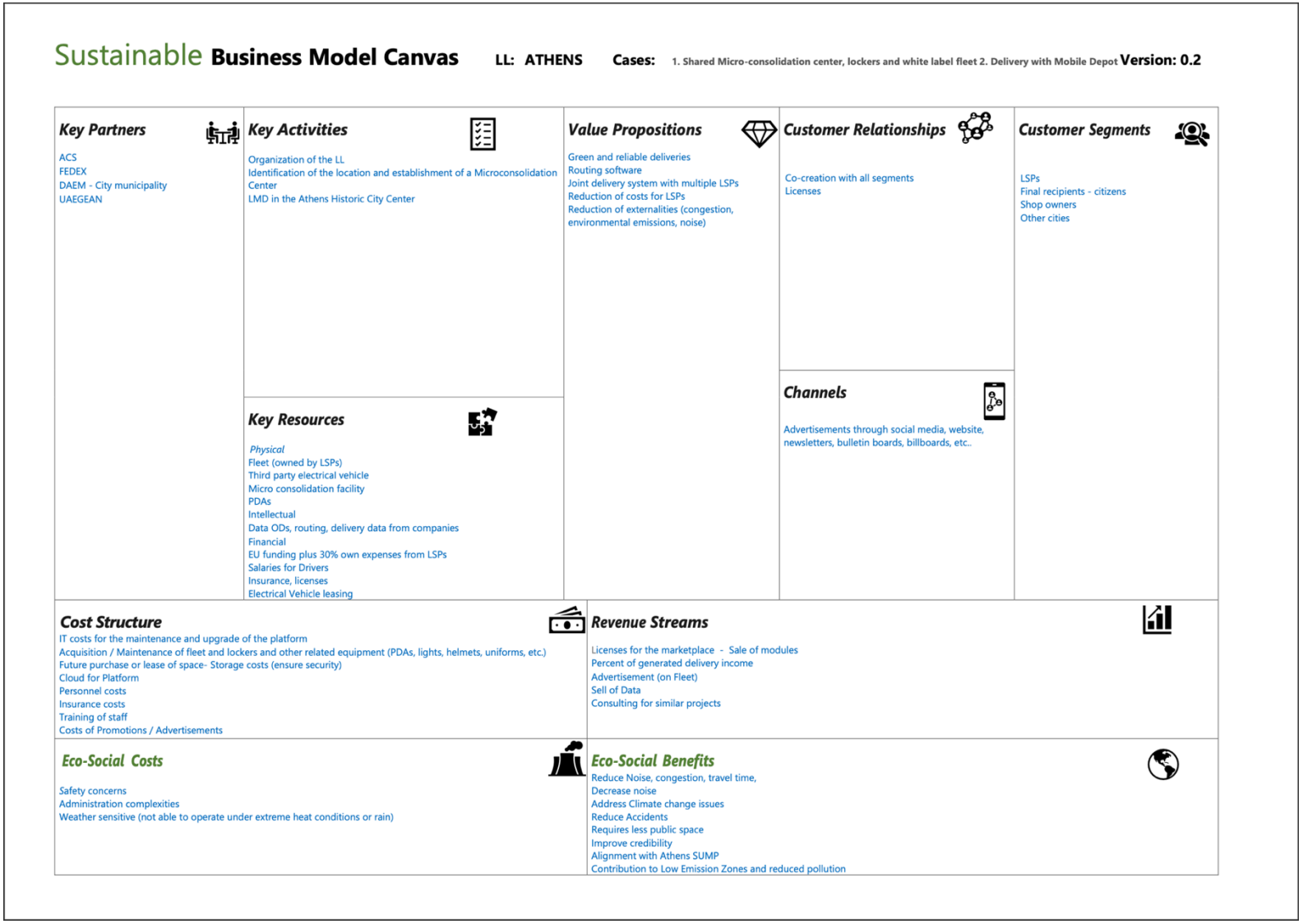


Figure 34: BMC Flanders

5.3 Identified Barriers and Opportunities, and Market Trends

5.3.1 Market Trends

Rapid growth of e-commerce: E-commerce has experienced unprecedented growth, with sales tripling from 2014 to 2020 and expected to reach $5.4 trillion in 2022. This growth is fueled by societal changes and technological advancements, leading to an increased demand for last-mile transport solutions. Besides, The Covid-19 global pandemic has accelerated e-commerce growth, shifting consumer purchasing habits and increasing demand for faster at-home deliveries [REF-08]. This has placed immense pressure on courier companies to service higher volumes of home deliveries seamlessly. Urbanization might further fuel growth, as e-commerce usage tends to be higher in urban areas [REF-09].

Technological advancements in delivery: New technological developments enable new delivery services, improving the e-commerce user experience and trust. Same-day and instant delivery services, out-of-home deliveries, tracking allow for innovative technology-driven business models in the last mile.

Challenges and need for sustainable solutions: The surge in e-commerce presents challenges to urban ecosystems, including increased traffic volume, emissions, and congestion. In addition, the problems are taking place in residential areas that did not see much freight traffic before. To counteract these challenges, interventions and new delivery methods focused on green last-mile delivery solutions are being explored, such as the use of cargo bikes, shared urban micro-consolidation centers, and emerging technologies like autonomous vehicles and delivery droids [REF-10].

Requirement for regulatory frameworks: While various solutions are being developed, the full potential of green last-mile delivery solutions has yet to be fully exploited. This requires, however, clear regulatory frameworks that support the installation of these solutions. Yet, a paradigm shift is needed to deploy interventions effectively, as freight management at city administrations is still very limited compared to passenger mobility management.

5.3.2 Opportunities & Barriers

In Section 3.2.3 of GREEN-LOG Deliverable 1.1 [REF-03], the literature review provided a comprehensive analysis of the barriers, opportunities, and challenges associated with the implementation of innovative logistics solutions. This review synthesized findings from various studies, offering a theoretical foundation for understanding the broader landscape of urban logistics and autonomous delivery systems. In contrast, the opportunities and barriers identified from the LLs given below present a more practical perspective.

ISPRA LL

OPPORTUNITIES: The main opportunity for the Ispra LL pilot lies in its pilot setting within a campus—a closed system that is ideal for facilitating scalable operations of autonomous delivery. Being within this closed system ensures seamless testing of designed deliveries without encountering interactions with other vehicles. Additionally, the technology intended for use in the pilot is already established, eliminating the need for the development of new technologies or platforms. This streamlines the testing process, saving valuable time and resources required for pilot implementation.

BARRIERS

Technological adaptation concerns: Users may face difficulties interacting with the robot, they might also fear the risk of being scammed via QR codes when ordering. Meanwhile, users may lack confidence in their digital skills, fearing they may be unable to use the robot service smoothly and effectively. For canteens and restaurants, the new approach of integrating orders on digital platforms may generate operational difficulties.

Public perception: Some individuals question the allocation of public funds towards implementing a robotic solution in the canteen.

User reluctance: Customers may prefer traditional methods of accessing food, such as walking to the canteen, visually inspecting food options in person, and bringing food from home. The solution will be difficult to endorse to these users. Besides, there are communication barriers between users and the canteen staff, as well as concerns about disruptions caused by new technologies.

BARCELONA LL

OPPORTUNITIES: The Barcelona LL presents an opportunity to enhance the sustainability of freight transportation within the public transport network. Given the relatively small scale of the transport operator, there is potential to utilize passenger railway services as efficient freight corridors, facilitating the transportation of packages for both direct and inverse logistics. Additionally, leveraging metro stations as logistic hubs offers a chance for freight companies to consolidate shipments. The existing infrastructure of metro stations can be harnessed to optimize urban freight logistics, further contributing to sustainability efforts.

BARRIERS

Coordination issues: Effective coordination among stakeholders (rail transport operator and LSPs) might be difficult to achieve, as all parties involved must be willing to embrace comprehensive solutions for successful implementation.

Resource constraints: Implementation of the solution requires significant time and financial investment, especially since there will be a period before the full effects of the changes are realized.

Commitment from Freight Operators: Traditional LSPs may struggle with freight tracking and face brand image challenges due to industry consolidation, whereas cargo bike operators may be reluctant to share information about their niche market and core business.

OXFORDSHIRE LL

OPPORTUNITIES: In Oxford's LL, the most significant opportunity lies in the long-standing collaboration between the LSP and city authorities. This partnership, built on shared experiences and mutual understanding, facilitates efficient decision-making and seamless execution of pilot demonstrations. Besides, Oxford is able to drive sustainability in the last mile by exploiting its status as a hub for Electric Vehicle (EV) and Connected Autonomous Vehicle (CAV) technology, which contributes greatly to the pilot's implementation. Companies like Oxbotica, Arrival, and StreetDrone, which are headquartered in the area, are pioneering autonomous last-mile delivery solutions. As a result, a key contributor to this vibrant ecosystem is Oxford's provision of world-class testing facilities for CAV technologies.

BARRIERS

Operational barriers: The Oxford LL will operate off-peak hours to mitigate risks, yet there might be difficulties in optimizing operations during the off-peak hours. Besides, whether the autonomous vehicle systems could be adapted to the complex road networks remains concerning. The reliability and scalability of operations could be challenging as well: identifying suitable parking locations, parcel size limitations, and the inconvenience of accessing the mobile delivery hubs in busy or adverse weather conditions.

Security and reliability concerns: Difficulties in ensuring on-time deliveries and vehicle reliability (tracking the right recipient). Risks associated with non-human interaction or cyber remote operation, such as potential parcel or vehicle theft, privacy issues, and vandalism.

User reluctance: Reluctance of shop owners to leave their stores unattended to retrieve deliveries from the mobile hub. Persuading customers about the safety and security of parcel pickup, providing clear information about pickup locations, and ensuring data security and privacy.

Accessibility concerns: Potential limitations for people with mobility impairments, lack of human support, and concerns about inclusivity.

FLANDERS LL

OPPORTUNITIES: In Flanders LL, opportunities abound in two primary areas. Firstly, the three-city framework allows for diverse experimentation and innovation in LL design. Secondly, the existing technological infrastructure facilitates the seamless integration of the GREEN-LOG platform. Ghent, Mechelen, and Leuven, despite sharing similar challenges in the "last mile" logistics, each possess unique characteristics that drive distinct testing priorities within the LaaS mechanism. Leuven, for instance, focuses on improving local shopkeepers' logistical choices, whereas Mechelen targets at nudging e-commerce consumers' behaviors. Ghent, on the other hand, prioritizes enhancing the sustainability of last-mile waste collection trips. Consequently, the LaaS initiative will undergo three distinct pilot demonstrations, ensuring a broad spectrum of potential impacts from various last-mile scenarios. Additionally, leveraging the existing last-mile logistics platform "Wij Leveren," utilized by local businesses and logistics providers, facilitates the seamless adoption of the GREEN-LOG platform across the cities. Integration of the two platforms is simplified through the incorporation of Wij Leveren's functions into the overall GREEN-LOG platform.

BARRIERS

Complexity of LaaS mechanism: The implementation of LaaS may further complicate the last mile, as many constraints of deliveries will be generated due to the dynamic pricing and nudging initiatives. Besides, the dynamic pricing of different LSPs' services will make the less attractive ones reluctant to stay on LaaS. Operational limitation of parcel locker capacity generates inconvenience for users, and the additional cost of using it may also cause resistance. Moreover, the dominance of Bpost in lockers makes it questionable for collaboration among different couriers.

User mindset: Retailers might be reluctant to use the "no next-day" delivery option (ie. choosing a longer and hence more sustainable delivery option) as they feel pressured to meet the customers' demand. The choice of "no next-day" delivery is also not always optimal because retailers usually would not want to store an item longer than necessary. Consumers, on the other hand, have the common mindset that delivery is 'free', thus potentially resistant to paying for different options. Besides, although there's a willingness among consumers to pay more and wait longer for environmentally friendly delivery options, there's skepticism regarding the actual sustainability of the proposed solutions.

Regulation barriers: There are some concerns regarding regulatory practicalities such as the track & trace mechanisms and legal compliance pose barriers.

ATHENS LL

OPPORTUNITIES: Within the Athens LL, a collaborative environment fosters cooperation among public authorities, supply chain service providers, residents, and customers. By actively involving both public and private stakeholders, the experimentation with various solutions—like shared MCCs, communal logistics hubs, and zero-emission delivery—becomes feasible. Stakeholder engagement not only allows for the co-creation and

implementation of the LL but also harnesses a diverse array of resources, expertise, and perspectives, enhancing the effectiveness of solutions and optimizing their potential impact.

BARRIERS

User reluctance: Customer preferences may favor traditional delivery methods, leading to low interest in alternative modes. Whereas LSPs may face operational difficulties in implementing changes due to rigid structures or processes. Besides, cost considerations may hinder the willingness of stakeholders to invest in new technologies or infrastructure.

Legal barriers: Legal regulations or requirements may hinder the implementation of new methods or technologies.

Collaboration among stakeholders: Different stakeholders may have conflicting interests or lack willingness to collaborate effectively. Data sharing, information system integration, and infrastructure sharing among LSPs may be difficult due to technological incompatibilities, competition and security concerns. Moreover, the collaboration solution may impact the presence or operations of LSPs in specific geographical areas, leading to resistance or concerns.

5.4 Revenue Streams and Cost Structure

In the case of Athens, the revenue streams are diverse and include a range of different sources, such as commissions on delivery revenues, sales of additional modules, data selling, provision of advertising space on the MCC's fleet, license fees for a potential future marketplace platform, and consulting services for initiatives of a similar nature. These provide the most to all partners and optimizes the possible revenue. However, at the same time a strong cost structure is necessary to maintain these revenue sources. This LL appears to be more of a combination of cost-driven and value-driven approach. This covers employes costs, insurance coverage, staff training, IT maintenance and updates, fleet purchase and maintenance, future space procurement, safe storage facilities, cloud services, and promotional efforts.

The Barcelona LL demonstrates both cost-driven and value-driven strategies. Revenue streams include the dynamic pricing approach and fees for paying memberships of customers. Regarding expenses, costs like energy, travel tickets, and promotion are the variable costs, that need a flexible cost management and good resource optimization, while fixed costs like salaries, rent, utilities, and maintenance are necessary for operational stability and resource allocation. The LL finds a balance between keeping expenses under control and providing value to clients through cutting-edge services.

The Flanders LL adopts a value-driven approach that focuses on sustainability and innovation in order to enhance urban logistics. The cost structure includes investments in IT development, delivery costs, and advertising, highlighting the value-driven approach of the LL and the importance of technological advancement, efficient operations, and visibility. These investments highlight the value-driven strategy used in this LL, aiming to increase service quality, customer satisfaction, and expand customer base. Revenue streams include funding from the EU and the Flemish government, as well as costumers' fees for the provided services. The use of a subscription model for local shop owners further underscores that this LL aims to create value for the stakeholders by offering tailored services that will increase the efficiency of their deliveries.

The Oxfordshire LL adopts a value-driven approach and focuses on innovation, sustainability, and collaboration. The major costs involved are related to system maintenance investments,

CAV vehicle procurement and insurance, land use, and promotional activities. These are necessary for the operational efficiency and the future expansion of the Oxfordshire LL and demonstrate the partners desire to provide high-quality services to customers ensuring environmental and social sustainability. A diverse revenue streams is composed, underscoring the LL's increased potential viability. Multiple revenue sources, such as advertising, white labeling, subscription fees, module-based pricing, and premium option, are identified. Furthermore, the implementation of a potential fee on shop owners, LSPs, local authorities, and parcel recipients in order to access to services, increases even more the LLs levels of self-preservation.

The Ispra LL adopts an approach, with of both cost-driven and value-driven approaches. The costs in this case include investment in design and development, as well as infrastructure costs. These reflects the LL's commitment to technological advancement and service improvement. Furthermore, existing operational costs for personnel, platforms, and maintenance of the Yape Droid and Measy cargo bikes are of high importance and should not be oversights. On the revenue side, the LL demonstrates the ability to use multiple revenue streams. Specifically, usage fees and subscription fees, grants from donors and advertising are some of the most important revenue sources.

5.5 Cooperation Agreements and Arbitration Models

Extensive research has highlighted the value of successful partnerships as an organizational model, and the potential challenges that may rise. In today's era, with ever-increasing business needs and internationalization of activities, no business or organization can act efficiently completely alone. Cooperating and developing agreements with other companies or organizations is essential for the viability of each partner. Cooperation agreements is a legal instrument that formalizes the relationships developed within a partnership [REF-11].

The collaboration between corporations and research institutions is a crucial step in the progress of innovation and technology [REF-12]. The significance of cooperation between Logistics Service Providers has been analyzed, revealing significant benefits for the quality of services and the profitability of partners [REF-13; REF-14]. Challenges and competition in global markets, the shorter life cycle of new emerging products, and the increased customers' expectations highlight the importance of collaborations between shipping and supply chain companies.

Previous studies have shown that previous cooperative experiences between the partners leads to better outcome of the agreement (REF-15; REF-12). Every collaboration and partnership are built to satisfy specific goals and objectivities. A successful collaborative agreement is based on clear definition of objectivities [REF-15], that enables clear segmentation of partners' responsibilities, along with shared objectives and targets [REF-12]. Researchers have shown an indirect influence of clear definition of objectives on success through trust for research organizations, and through commitment and conflict for firms. At the same time, a clear and direct relationship has been observed between clear definition of objectives and global satisfaction of firms. Furthermore, partners' reputation is considered a significant factor towards successful cooperative agreements [REF-12; REF-15; REF-16]. Reputation is characterized as the history of partners' behavior prior the collaboration which indicates its trustworthiness [REF-17]. The greater the reputation the higher the possibilities for a continuing reliable collaboration.

Previous cooperation experience and reputation are factors with a significant social component that could help increase trust levels between the different partners during the first

stages of an agreement [REF-16; REF-17]. Trust is another important component of successful partnerships and agreements [REF-12]. Trust is defined as the likelihood of one party committing to fulfilling its responsibilities, behaving predictably, and fairly negotiating [REF-18]. Trust is vital for successful cooperation between firms and research organizations and increases the chances of the relationship to survive and further develop [REF-19; REF-20; REF-21]. It's important to highlight that acting opportunistic will result in damaging the trust levels that have been built through the collaboration and create obstacles to a successful long-term partnership [REF-17]. Dependence on the other hand shows a positive effect on trust, indirectly increasing success [REF-12].

Moreover, the careful selection of the most suitable arbitration model for each case stands as a crucial factor for the effectiveness of the cooperation agreement. Conflicts may arise within an agreement, and arbitration models ensure that all disputes are resolved, and the partnership is secured. Arbitration models provide the cooperation with a specific framework that can be used to resolve possible obstacles and conflicts. Different types of arbitration models provide parties with different frameworks they can use to resolve disputes outside of traditional court systems and provide them with increased flexibility and efficiency. Some of the most well know arbitration models are ad-hoc arbitration and self-administered arbitration; [REF-22].

Ad-hoc arbitration: An ad hoc arbitration model is characterized by an agreement where parties opt for arbitration without detailed specifications. In such instances, the process relies on the law of the chosen jurisdiction to support various arbitration proceedings.

Self-administered arbitration: Self-administered arbitration, typically empowers parties to perform the arbitration independently, without significant involvement from the arbitral body unless specifically requested by the parties. Despite this autonomy, various arbitral bodies, offer comprehensive sets of rules and procedures for parties to adopt in their arbitration. However, even in self-administered arbitration, the appointing of the tribunal remains a fundamental service often provided by arbitral bodies.

Another important practice, suitable for resolving wide range of disputes is the hybrid, two-stage alternative of Med-arb model [REF-23]. In a med-arb model, parties initially agree on the process itself and state the binding nature of the outcome. Next, they engage in negotiation facilitated by a mediator to resolve their dispute. The mediator employs traditional mediation techniques, to assist parties in exploring potential solutions collaboratively. However, if mediation procedure fails to achieve to find a solution, or if some unresolved issues persist, the process transitions seamlessly to arbitration. In this phase, the mediator may transition into the role of arbitrator and promptly issue a binding decision based on their assessments. Moreover, Final Offer Arbitration (FOA), also known as “Baseball Arbitration model” is a public process that is used exclusively for economical disputes. If the parties of the collaboration are unable to resolve their conflict through mediation, FOA can be activated [REF-24]. Each party submits an offer, and the arbitrator selects the one they consider more appropriate for settlement [REF-25]. These final offers usually outline the terms and conditions that the respective party believes are fair and reasonable for the settlement they propose. Other models are Advisory Arbitration, in which a committee of arbiters are responsible to compile the final settlement decision [REF-26], and Expert Determination, in which parties submit the dispute to one or more experts on the specific topic and they are responsible to resolve the matter [REF-27].

To ensure the efficiency and legality of all the operations it is crucial to identify the cooperation agreements and arbitration models that will be used in each GREEN-LOG LL. Cooperation

agreements outline the terms and conditions of the partnerships, specifying the responsibilities, rights, and obligations of each entity. These will provide clarity and transparency between the partners while at the same time it works as a mitigation mechanism for potential disputes.

Similarly, arbitration models establish mechanisms for resolving conflicts efficiently outside of the traditional court systems. By identifying appropriate arbitration models, the GREEN-LOG consortium ensures that any disagreements arising from these partnerships can be resolved fairly and with minimal disruptions. Overall, clear identification of cooperation agreements and arbitration models strengthens the legal framework of the project.

5.5.1 Athens

Some of the most important conflicts that may arise for Athens LL are related to the operational aspect of the pilot. Differences in operational procedures and protocols between ACS SMSA and FedEx could create disputes in handling and management of parcels within MCC. Furthermore, privacy issues regarding clients' data may arise. Additionally, conflicts regarding the ownership of the data collected during parcel delivery operations, are of high importance. The key partners in this pilot may have divergent opinion on who should own the collected data, how this data should be used, and how someone could access the data. Such incidents could lead to significant disagreements over data ownership and each partner's responsibilities. Moreover, in case one party believes that the other is not following properly the legal requirements, disputes could arise due to potential legal and reputational consequences. The selection, approval, and preparation of the location for the creation of MCC could become an important potential conflict. Different stakeholders may have different opinion regarding the ideal location for the MCC. In addition, the governance model and the operational conditions of the MCC could create divergent opinions between the partners. Each partner may have different expectations regarding the equipment of the MCC and the entity that should assume the financial responsibility. Another important area for possible conflicts during the Athens LL is the resource allocation. Possible disagreements between the two operators over allocation of vehicles, manpower, and infrastructure could increase competition and lead to failure of the synergy. Finally, the branding of the venture could result in significant conflicts.

To address the above conflicts, white label cooperative agreements will be signed between the key partners of the Athens LL. Generally, a white label involves one party providing goods or services to another party, which then resells them under its own brand. In the case of Athens LL this will be slightly modified. ACS SMSA and FedEx are the logistics providers that will cooperate with the city of Athens to introduce the concept of MCC in the city. The two operators will employ an external subcontractor as a white label service provider. The agreement will clearly state the role of each partner, who will be responsible to make sure the fleet is safe and properly maintained and whose responsibility is the creation of the MCC. Additionally, before the agreement is signed, all the partners will participate in meetings and workshops to establish what equipment the MCC should have, and the decision will be described in detail in the cooperative agreement. Furthermore, the cooperative agreement will outline the procedures and protocols to be followed, and data ownership will be clarified.

5.5.2 Barcelona

The Barcelona LL is going to implement innovative operational models that will enhance the last-mile delivery services for the suburban areas of Barcelona. The most important conflict in the Barcelona LL is the trial/experiment of the robots for obtaining the necessary proof of concept. The trial is characterized by various technological and regulatory issues that need to

be resolved to integrate robotic solutions into the pilot. Another important issue that may arise for the Barcelona LL is related to the extension of the trials beyond the Barcelona City to Terrassa city. Such action is possible to result in new conflicts regarding the allocation of resources and management between the two pilots. Furthermore, it is possible for conflicts to arise between last-mile delivery operators and municipalities, regarding the use of infrastructure. Potential conflicts may arise over the performance and efficiency of the logistic service providers. Low performance will result in dissatisfaction of the customers, leading to negative feedback to the local owner and to the creation of tension within the partnership.

A Collaborative Agreement is necessary for this LL. Such legally binding agreement between last-mile delivery operators, public transport authorities, and all the core partners of the pilot is necessary for the smooth completion of the project. In this way participants enable collaboration and negotiation between the parties. The agreement will clearly state:

- what the collaboration is about
- how each party is related to the pilot
- how the parties work together
- who is responsible for managing and securing the data that will be obtained from the pilot.

In this case, a flexible ad hoc arbitration model is more suitable, to allow the parties to be able to customize the arbitration procedures according to the specific needs of each conflict. Ad hoc arbitration provides a structured framework for resolving disputes while at the same time all parties are obliged to follow the laws and regulations of the government.

5.5.3 Flanders

The Flanders LL aims to implement and evaluate the performance of a LaaS platform in three cities (Ghent, Leuven, and Mechelen) in Flanders a region of Belgium. The main conflict that arises from this case is related to the overall revenue and the dynamic pricing feature of the scheme. Disagreements over the revenue allocation between the partners, and the implementation of dynamic pricing models for the delivery services to the customers could appear. This possible tension between the LSPs could compromise the viability of the project, and for this reason the partners must find solutions. Additionally, possible external partnerships could create important conflicts. If the LSPs try to negotiate and achieve a partnership within the LL cities outside of the pilot context, high significance conflicts will arise. Furthermore, each external partner needs to conduct a different agreement with the city, leading to possible conflicts regarding the level of equality and fairness on the agreements. Establishing several service level agreements (SLAs) may lead to conflicts over performance and responsibilities. Another important possible conflict that could arise is related to the flat fee for operational costs, which could create dispute regarding fairness and sustainability. Finally, significant attention should be given on data ownership, access, and privacy conflicts.

By addressing these conflicts through open dialogue and mediation, stakeholders set the grounds for a beneficial collaboration for all parties. The cooperation agreements that will be singed will provide clear terms and protocols for the successful implementation of the Flanders LL. Based on the complexity of the Flanders LL and the involvement of various stakeholders, multiple cooperation agreements are required. Separate agreements are needed for each city to address their specific needs, while multiple service level agreements are necessary for partnerships with external entities. Each agreement will outline the rights, responsibilities, and obligations of each stakeholder, address revenue allocation, explain the dynamic pricing modeling, set flat fee for operational costs, describe the data handling process and the responsible partner to handle and ensure data privacy and fair access to it, as well as the terms of partnership with external entities. Furthermore, the agreements will set indicators to

ensure that high performance standards are met, and that the desired eco-social benefits are met. In the case of the Flanders LL, in which multiple stakeholders and complex conflicts are identified, a flexible ad hoc arbitration model is recommended. This model allows the customization of the arbitration procedures according to each unique case, while all are responsible to oblige to the laws of the chosen jurisdiction.

5.5.4 Oxford

The fourth living-lab of GREEN-LOG platform aims to develop a freight model for sustainable last-mile delivery solutions in Oxfordshire. In this case study, two are the the main conflicts identified. The increased cost for shop owners, in order to provide delivery services, and the fact that the MDH will block cycle path for cyclists, causing delays and risks. Especially in the case of the MDH, the dispute may arise between the local authorities and the residents who rely on the cycle path for safe and efficient travel. This will lead to another dispute between the partners responsible to implement and operate the vehicle and the local authorities, who will be pressured by the publics concerns. As for the increased cost for shop owners to provide the delivery services, this could create tension between retailers and delivery operators and lead to an overall increased failure risk of the marketplace. Another important conflict that could arise from this LL is between the delivery operators that will decide to participate in the Marketplace. Operators competing over the same customers could create tension over pricing, quality, and efficiency. Last but of equal importance, is the possible conflicts that could arise over data ownership. OCC may seek full control over the collected data, AIMSUN may also require unobstructed access to the available data, while at the same time retailers may express concerns regarding the collected data.

All the above conflicts highlight the complexity of the proposed LL, due to the interaction of multiple partners and factors. Finding a balance between all the concerns mentioned above require a collaborative problem-solving approach. For this a cooperation agreement and an arbitration model that involve all stakeholders are conducted. A robust cooperation agreement, which will involve all parties, except the retailers, will be developed. The agreement will clarify each partners rights and obligations and provide solutions for the main conflicts the partnership thinks could create obstacles to the successful implementation of the LL. The first agreement will describe the relationship between the key players of the development of LL, while a second cooperation agreement will be created between the partners related to the operation of the systems and the retailers. This will ensure that the cooperation agreements are signed between the parties that have a direct collaboration in this LL. Furthermore, the agreement will clearly state who is responsible to secure the privacy of the data, which parties have access to which data, and what is the procedure that a partner (or an outside entity) will have to follow to gain access to data. An ad-hoc arbitration model will be chosen for resolving disputes in this case. This type of model provides flexibility to partners to customize the arbitration process according to their specific needs and increases confidentiality and privacy. In this type of arbitration, the parties agree to resolve their conflicts without specific arbitration rules and rely on the laws of the chosen jurisdiction.

5.5.5 Ispra

The fifth, and last, LL regards the demonstration of Yape droids and Measy cargo bikes for food delivery within the JRC in Ispra, Italy. In this case study, the main conflict arises from the increasing number of people that may decide to place an order for cold food, instead of visiting the center's canteen for warm food. This could be a significant challenge for the canteen's management, due to limitations in resources and increased waste of food. Additionally, decreased food quality, miscommunication, and delivery delays, could increase the number

of customers complaints, increase customers' dissatisfaction and increased conflicts between the canteen management and the delivery operators. Finally, an important aspect that could rise important disputes is financial arrangements. Possible disagreements between the canteen and the delivery operators over revenue and service fees could lead to venture failure.

A clear agreement that will cover all aspects of possible arising conflicts is essential for a smooth cooperation between the parties. In this case, the cooperation agreement involves 3 partners, the canteen and the delivery operators (Yape and Measy). The agreement will clarify each partners rights and obligations, with the canteen being responsible for preparing the lunch boxes, and the 2 delivery operators responsible to deliver the food to customers. The canteen is tasked with the responsibility to ensure the quality and preparation of the food and the delivery operators are given the responsibility to efficient delivery of the orders in the condition the condition provided by the canteen. Furthermore, the agreement will provide solutions for the main challenges the partnership may encounter, ensuring that potential conflicts are addressed effectively. An order management system will be described in the cooperation agreement to help regulate the ordering and the delivery system. Furthermore, the allocation of resources will be addressed and guidelines on resource allocation and utilization for optimization will be described. A customer feedback mechanism will be described in order to maintain food and service quality, while in addition conflict resolution mechanisms will be presented. A Med-arb (Mediation-Arbitration) model is the most suitable option for resolving disputes in this case, since the parties have the option to resolve their issues through mediation, and in case of negotiations failure they can activate an arbitrator. This model ensures the viability of the cooperation agreement as it allows parties to openly discuss their concerns and explore new solutions as a team. In this case, JRC will serve as the mediator and the arbitrator facilitating the conflict resolution. JRC is the ideal choice to serve as both the mediator and arbitrator, since it's a reputable research institution with various expertise. The conflict resolution strategies will include collaborating, competing, compromising, avoiding, and accommodating.

6. Conclusions

The GREEN-LOG project has achieved notable advancements in the domain of sustainable urban logistics, particularly focusing on urban mobility challenges and the co-creation of innovative logistics solutions. Through rigorous analysis of urban contexts and current mobility patterns in Ispra, Barcelona, Oxfordshire, Flanders, and Athens, the project identified critical factors influencing urban freight and service demands. These factors include city layout, population density, existing transportation infrastructure, regulatory frameworks, economic activity, and technological readiness. The interplay of these elements significantly shapes the efficiency and sustainability of urban logistics operations.

Utilizing continuous stakeholder engagement and iterative workshops, the project developed and refined practical, scalable logistics concepts based on the OODA paradigm. In this direction, the activities of Task 1.3 were instrumental in defining use cases tailored to the unique logistics landscapes of each city. The co-creation workshops held in each Living Lab were pivotal, facilitating the collection of diverse stakeholder insights and fostering collaboration among local governments, research institutions, and logistics professionals. This collaborative approach ensured the proposed solutions were both innovative and contextually relevant. For example, Ispra's use case focused on integrating autonomous droids and cargo bikes for last-mile delivery, while Barcelona explored multi-modal logistics that combined cargo bikes, e-scooters, e-vans, and rail transport. Oxfordshire developed innovations in e-cargo bike logistics, Flanders worked on a LaaS platform, and Athens implemented shared micro-consolidation centers and mobile depots to enhance parcel distribution efficiency in its historic center.

Task 1.4 examined cooperative business models and GREEN-LOG services, highlighting the importance of multi-actor collaboration and the establishment of robust cost structures and revenue streams. The task utilized the Osterwalder methodology, to align stakeholder interests and resolve conflicts through well-structured cooperation agreements and decision support systems.

Moreover, the defined use cases demonstrated innovative last-mile delivery solutions for all pilots. These pilots not only illustrated the potential for reducing urban congestion and emissions but also underscored the value of integrating advanced technologies and public transport systems into urban logistics frameworks.

Key findings from the GREEN-LOG project emphasize the critical role of sustainable urban logistics, continuous stakeholder engagement, and iterative co-creation processes in developing effective and scalable solutions. The project provides valuable recommendations for future city logistics planning and implementation, advocating for the adoption of green delivery options and the continuous enhancement of urban freight systems. The outcomes of the GREEN-LOG project serve as a comprehensive blueprint for cities aiming to improve their urban logistics frameworks, ensuring environmental sustainability and enhancing the quality of urban life.

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Appendix A – Co-creation workshops agendas

A.1 Ispra

Co-funded by the European Union

Project Acronym:	GREEN-LOG
Project Number:	101069892 (HORIZON-CL5-2021-D6-01 - Innovation action)
Project Full Title:	Cooperative and Interconnected Green delivery solutions towards an era of optimized zero emission last-mile Logistics

GREEN-LOG

AGENDA OF MEETING

T1.3 Co-creation Workshops

Ispra Workshop: Co-Creating Next-Generation Last Mile Solutions

Date	29-09-2023
Place	Ispra, Italy
Status - version, date	Final, 26-09-2023
Dissemination level	PU - Public

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1 Agenda

Friday, September 29, 2023

Time (Local)	Session	Presenter
09:45 – 10:00	**REGISTRATION - COFFEE**	
10:00 – 10:45	**Meeting opening** • Welcome • Tour de table on motivation of participants • Warm-up / Ice breaker • Agenda Overview • Presentation of the GREEN-LOG project • Presentation of the LL journeys embarked so far	UAEGEAN / HALM
10:45 – 12:15	**Ispra demonstration** • Presentation of the solutions to be tested (15') • City use case(s) - Typical user (60') • Q&A from the stakeholders about the solutions demonstration (15')	e-Novia, UAEGEAN
12:15 – 12:45	**LUNCH**	
12:45 – 14:00	**Group discussions with focus on the use case(s)**	e-Novia & participants
14:00 – 14:30	**Discussion Outcomes** • Presentation of results	Participants
14:30 – 14:45	**Closing remarks, next steps and feedback**	UAEGEAN

A.2 Barcelona

Co-funded by the European Union

Project Acronym:	GREEN-LOG
Project Number:	101069892 (HORIZON-CL5-2021-D6-01 - Innovation action)
Project Full Title:	Cooperative and Interconnected Green delivery solutions towards an era of optimized zero emission last-mile Logistics

GREEN-LOG

AGENDA OF MEETING

T1.3 Co-creation Workshops

Barcelona Workshop: Co-Creating Multi-modal Parcel Deliveries

Date	16-11-2023
Place	EURECAT, C/ Bilbao, 72 08005 Barcelona
Status - version, date	Final v3.0, 13-11-2023
Dissemination level	Public

1 Agenda

Thursday, November 16th, 2023

Time (Local)	Session	Presenter
09:15 – 09:30	**REGISTRATION**	
09:30 – 10.00	**Meeting opening** • Welcome • Tour de table on motivation of participants • Warm-up / Ice breaker • Agenda Overview • Presentation of the GREEN-LOG project • Presentation of the LL journeys embarked so far	UAEGEAN, HALM
10:00 – 10:45	**Barcelona demonstration** • Presentation of the solutions to be tested • Q&A from the stakeholders about the solutions demonstration	VANaPEDAL
10:45 – 11:45	**Session 1: Smaller groups discussion** • A) Incentivising the Last Mile • B) SUMP plans & GREENLOG survey	VANaPEDAL, Group Moderators
11:45 – 12:15	**COFFEE / LUNCH**	
12:15 – 13:15	**Session 2: Intro to challenges & KPIs** • Feedback & Challenges • Value proposition and KPIs identification	Group Moderators, UAEGEAN
13:15 – 14:00	**Final statements, next steps** • Presentation of results and wrap-up	Group Moderators, UAEGEAN

A.3 Oxfordshire

Co-funded by the European Union

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AGENDA OF MEETING

T1.3 Co-creation Workshops

Oxfordshire Workshop: Co-Creating Cargo-Bikes and Self-Driving Delivery Vehicle Integration for Next-Generation Delivery

Date	01-12-2023
Place	Westgate Collaboration Space 2nd Floor Oxford Westgate Library (formerly Oxfordshire County Library) 228, The Westgate, Queen St, Oxford OX1 1PE
Status - version, date	Final, 30-11-2023
Dissemination level	Public

1 Agenda

Friday, December 1st, 2023

Time (Local)	Session	Presenter
09:45 – 10:00	**REGISTRATION - COFFEE**	
10:00 – 10:45	**Meeting opening** • Welcome • Participants' motivation for zero-emission last mile delivery • Warm-up / Ice breaker • Agenda Overview • Presentation of the GREEN-LOG project • Presentation of the Living Lab journey so far	UAEGEAN, HALM
10:45 – 12:15	**Oxfordshire demonstration** • Presentation of the solutions to be tested • City use case(s) – Typical user • Q&A from the stakeholders about the solutions' demonstration • KPI identification	OCC, UAEGEAN
12:15 – 12:45	**LUNCH**	
12:45 – 14:00	**Group discussions with focus on the use case(s)** • Micro Delivery Hub aspects and challenges • Value proposition	OCC, UAEGEAN, Participants
14:00 – 14:15	**Final statements, next steps** • Presentation of results and wrap-up	UAEGEAN

A.4 Flanders

Co-funded by the European Union

Project Acronym:	GREEN-LOG
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AGENDA OF MEETING

T1.3 Co-creation Workshops

Flanders Workshop: Co-Creating Logistics-as-a-Service (LaaS) Solutions

Workshop (Part 1)	Day 1, February 6 2024	
	GENT Stadskantoor Woodrow Wilsonplein 1 9000 Gent	**LEUVEN** Professor Van Overstraetenplein 1 3000 Leuven
Workshop (Part 2)	Day 2 – February 8 2024 Universiteit Antwerpen, Prinsstraat 13 2000 Antwerpen	
Status - version, date	Draft v0.2, 05-02-2024	
Dissemination level	Public	

Workshop 1: Local shop owners & end consumers

The workshop with local shop owners and end consumers will be **in Dutch**. We will deliver a report of the workshop in English.

1 Agenda

Day 1 - Tuesday, February 6, 2024

Time (Local)	Session	Presenter
18:30 - 18:45	• Welcome (+ drinks) • Tour de table on motivation of participants • Agenda overview • Fingerfood (5' + continued)	Cities' project managers + VIL/UA representative
18:45 – 19:20	• Urban logistics in a liveable city: figures, challenges, measures, pilot projects (10') • Group discussion: which (other) logistic challenges are shop owners and consumers facing? And what opportunities are there (bundling?): centralising pick-up/delivery on same day(s), bundling solution for recurring "difficult" pick-up/delivery days. (20') • KPI evaluation (5')	Cities' project managers + VIL/UA representative
19:20 – 19:35	• Presentation of the GREEN-LOG project: goals, LaaS concept, dynamic pricing model and extra nudging possibilities (15')	Cities' project managers + VIL/UA representative
19:35 - 20:15	• Group discussion on dynamic pricing: how to set and organise a fair price for sustainable deliveries, willingness to pay, who (shipper, consumer, LSP) pays more for unchanged behaviour, who pays less for changed behaviour (20') • Group discussion on nudging: how to nudge good behaviour apart from financial advantage (communication tools, reserved loading zones, labels, credit system) (20')	Cities' project managers + VIL/UA representative
20:15 – 20:30	**Conclusions, next steps, thanks**	Cities' project managers + VIL/UA representative

Workshop 2: logistic service providers

Day 2 - Thursday, February 8, 2024

Time (Local)	Session	Presenter
14:00 - 14:15	• Welcome (+ drinks) • Tour de table on motivation of participants • Agenda overview • Fingerfood (5' + continued)	Cities' project managers + VIL/UA representative
14:15 – 14:50	• Urban logistics in a liveable city: figures, challenges, measures, pilot projects (10') • Group discussion: which (other) logistic challenges are shop owners and consumers facing? And what opportunities are there (bundling?): centralising pick-up/delivery on same day(s), bundling solution for recurring "difficult" pick-up/delivery days. (20') • KPI evaluation (5')	Cities' project managers + VIL/UA representative
14:50 – 15:05	• Presentation of the GREEN-LOG project: goals, LaaS concept, dynamic pricing model and extra nudging possibilities (15')	Cities' project managers + VIL/UA representative
15:05 - 15:45	• Group discussion on dynamic pricing: how to set and organise a fair price for sustainable deliveries, willingness to pay, who (shipper, consumer, LSP) pays more for unchanged behaviour, who pays less for changed behaviour... (20') • Group discussion on nudging: how to nudge good behaviour apart from financial advantage (communication tools, reserved loading zones, labels, credit system...) (20')	Cities' project managers + VIL/UA representative
15:45 – 16:00	**Conclusions, next steps, thanks**	Cities' project managers + VIL/UA representative

A.5 Athens

Co-funded by the European Union

Project Acronym:	GREEN-LOG
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AGENDA OF MEETING

T1.3 Co-creation Workshops

Athens Workshop: Co-Creating Multi-stakeholder collaborations for shared Micro Consolidation Centers

Date	16-2-2024
Place	ACS Company Headquarters Petrou Ralli 36-38, Egaleo Room Delphi Athens, Greece
Status - version, date	Final v1.2, 10-2-2024
Dissemination level	Public

1 Agenda

Friday, February 16th, 2024

The workshop will be held in Greek.

Time (Local)	Session	Presenter
09:45 – 10:00	**REGISTRATION**	
10:00 – 10.20	**Meeting opening** • Welcome • Tour de table on motivation of participants • Warm-up / Ice breaker • Agenda Overview • Presentation of the GREEN-LOG project	UAEGEAN, INTRA
10:20 – 12:20	**Session 1: Athens demonstration** • Co-creation of city use case(s) - User stories • Data provision	ACS, UAEGEAN
12:20 – 12:40	**COFFEE / LIGHT LUNCH**	
12:40 – 13:40	**Session 2** • Value proposition • KPIs identification & evaluation	UAEGEAN
13:40 – 14:00	**Final statements, next steps** • Q&A from the stakeholders • Presentation of results and wrap-up	UAEGEAN