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DECARBOMILE

Decarbonise last mile logistics

D5.1 GENERIC BUSINESS MODEL FOR LAST-MILE DELIVERY

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Nature of the Deliverable		
R	Document, report	X
DEM	Demonstrator, pilot, prototype	
DATA	Data sets, microdata, etc.	
OTHER	Software, technical diagram, etc.	

Dissemination Level		
PU	Public, fully open and automatically posted online	X
SEN	Sensitive, limited under the conditions of the Grand Agreement	
CI	Classified information: RESTREINT UE (Commission Decision 2015/444/EC)	
	Classified information: CONFIDENTIAL UE (Commission Decision 2015/444/EC)	
	Classified information: SECRET UE (Commission Decision 2015/444/EC)	

Quality procedure			
Date	Version	Reviewers	Comments
January 25th	V1	Living Labs	Minor adaptations and additions in the Use-Case specific results
February 10th	V2	CAPIT, MIGROS	Adjustments for readability in the methodology section, cross-references, and overall formatting

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PROJECT SUMMARY

Gathering 31 partners from 10 different countries, DECARBOMILE aims to trigger an unprecedented improvement of the green last mile logistics in Europe. To reach that goal, DECARBOMILE relies on a strong experience of decarbonising urban logistics through European initiatives such as CIVITAS. Partners will build upon all previous results to develop improved delivery methods, tools and methodologies, and implement them across Europe. The solutions developed in DECARBOMILE will demonstrate the full potential of decarbonised last mile logistics in 4 living labs (in Hamburg – Germany, Istanbul – Turkey, Logrono - Spain, and Nantes –France), and 4 satellites (Getafe - Spain, Ghent – Belgium, Sarajevo - Bosnia and Herzegovina and Tallinn - Estonia) will be involved at a smaller scale to test and study the solution in their own local contexts.

OBJECTIVE AND EXECUTIVE SUMMARY OF THE DELIVERABLE

Task 2.5: Validation of the suitability of business model with local stakeholders (M19-M24; CBS, IT, CARA, ID4CAR, UBC, RCXB, HAM, NANTES, RCXB, LGN, IMM, LIHH, TUHH)

Task 2.5 was focused on two main parts. First, the identification of the stakeholders' interests and validation of the suitability of the developed Business Models (BMs) through interviews, workshops, and site visits and second the assessment of the suitability of the BM. For this part CBS, IT and TUHH developed an interview guideline to clarify open questions around the defined BM and confirm interest and suitability of the defined services. The interviews were held online by IT and CBS with all Use-Case (UC) relevant stakeholders. Building on these insights, CBS visited each Living Lab in October 2024 to run local workshops finalising aspects such as time to market, operational risk assessment and long-term perspective.

For the second aspect of the task, Hamburg led the documentation of the BM suitability assessment process. Since the BMs were co-created and adjustments for their suitability were done constantly, the final step was to document how the BMs were adjusted to fit the local stakeholders, and the Living Lab's needs.

Task 5.1: Definition of the most suitable hubs' side services and use cases (M7-M12; IT, CBS, CARA, RCXB, LIHH, DPDHL, INT)

Building on the inspiring projects and initiatives collected among the consortium partners in the frame of the WP1, task 5.1 aimed at defining possible services to be implemented in each use case to bring added value and strengthen the business models. Through co-creation with the local actors in each of the Living Labs (LLs) needs (linked to the WP2 workshops) of the external stakeholders were collected and analysed to propose relevant added-value services.

The second main activity of this task is the cost-benefit analysis (CBA), meant to evaluate the economic, social, and environmental gains and expenses for each use case. This heavy evaluating process is done through cost sheets, tailored for each of the experimentations to be implemented, and will still be ongoing after the end of the WP5. The cost sheet tool allows us to have the overview for each use case on the baseline situation of the stakeholders involved (current operations and costs and revenues linked), the planned operations which should be implemented during the use cases and the actual operations implemented (assessed after the experimentation). This tool is not only useful for the WP5 to assess the economic viability of the experimentations but also is used as a planning tool for the WP7 and will serve as a reference situation for the evaluating process of the WP8.

Task 5.2: Living labs business models elaboration (M13-M24; CBS, IT, HAM, NANTES, IMM, LGN, TLN, GETAFE, SARA, UBC, ID4CAR, CARA, RCXB, LIHH, DPDHL, OHB, INT)

Task 5.2 was covering two aspects. First, CARA and IT developed a state-of-the-art framework for business models in the last-mile logistics sector. Therefore, relevant practices and experiences already implemented in European cities that include business models that can be adapted to the LLs were collected. Based on a relevant selection of projects, interviews were conducted to collect challenges and lessons learned to be taken into consideration.

Finally, CBS supervised the development of the Use-Case business models based on the added-value services identified in T5.1. Utilising a series of workshops, meetings and interviews, CBS together with the Living Lab stakeholders defined the value propositions and designed the sustainable business model canvas. The suitability of the models was assessed in collaboration with T2.5 during local visits and workshops.

Task 5.3: Elaboration of public/private governance models for logistics hubs in the living labs (M19-M30; DPDHL, IT, HAM, IMTA, RCXB, TMTX, NANTES, LGN, IMM, LIHH, CBS, OHB, INT)

The focus of Task 5.3 was the uniform organisation and presentation of the respective activities in the Living Labs, based on the key activities defined in the business models. To this end, DPDHL designed a model for defining responsibilities within the respective projects to link these with roles to be defined appropriately. Care was taken to keep the representation as simple as possible and to keep the corresponding responsibilities open in their design to map the very different processes depending on the Living Lab in a meaningful way. This also allowed to have standard governance models with role types not specifically linked to local actors, for a better replicability potential of the use cases in different environments. A RACI matrix was chosen as the basic model to combine both objectives.

Subsequently, the formulation and design of responsibilities were developed in joint workshops with all LLs. Follow-up workshops were held to ensure that the responsibilities reflected all aspects of the respective use cases. The roles available in the living labs were then defined and subsequently linked to their respective responsibilities as part of the RACI matrix. Finally, the RACI matrices created in this way were checked in a final workshop to ensure that all links were plausible.

As a result, Task 5.3 generated a standardized governance model for all living labs (with RACI sheets for each use case) to create a simple overview of all partners involved and their respective responsibilities in the project. A continuation and adaptation of the respective overviews is necessary in the event of further changes and adjustments to the activities on site but is no longer part of T5.3.

ACKNOWLEDGEMENT

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More information on the project can be found at https://www.decarbomile.eu

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DECARBOMILE PARTNERS

Acronym	Organisation Name
IT	Interface Transport
HAM	Free Hanseatic City of Hamburg
ITS	ITS World Congress
LGN	Logroño Municipality
NANTES	Nantes Municipality
IMM	Istanbul Metropolitan Municipality
TLN	Tallinn Municipality
GETAFE	Getafe Municipality
GISA	Development agency of Getafe
SARA	Sarajevo Canton
TUHH	Technical University of Hamburg
CBS	Copenhagen Business School
CAPIT	Capillar IT
TMTX	Transmetrics
GGI	Genegis GI
NGS	New Generation Sensors
ITA	Ita Innova
IMTA	Institut Mines Télécom Atlantique
SCU	Sivas Cumhuriyet University
MIGROS	Migros
TRI	Les Triporteurs Nantais
OHB	Training Centre for Wood and Construction
INT	Intelligent Parking
LIHH	Logistics Initiative Hamburg
UBC	Union of Baltic Cities
CARA	CARA European Cluster for mobility solutions
ID4MOBILITY	ID4MOBILITY
FLEX	Fleximodal
RCXB	Red de Ciudades por la Bicicleta
EQY	Euroquality
DHL	Deutsche Post DHL

GLOSSARY

Abbreviation	Description
BM	Business Model
BMC	Business Model Canvas
CBA	Cost-Benefit Analysis
CEP	Courier, Express & Parcel
CM	Consortium Meeting
HHRR	Human Health Risk Resources
ICT	Information and Communication Technology
IMM	Istanbul Metropolitan Municipality
LGN	Logroño Municipality
LL	Living Lab
LSP	Logistic Service Providers
MCC	Micro Consolidation Centre
NANTES	Nantes Municipality
PPP	Public-Private Partnership
RACI	Responsible, Accountable, Consulted, Informed
RPM	Regional Platform for Mobility
SBMC	Sustainable Business Model Canvas
SULP	Sustainable Urban Logistics Plans
SUMP	Sustainable Urban Mobility Plans
TBD	To be defined
TL	Turkish Lira
UC	Use-Case
UCC	Urban Consolidation Centre
VPC	Value Proposition Canvas
WP	Work Package
WS	Workshop

INTRODUCTION

Deliverable **D5.1 Generic Business Model for Last-Mile Delivery** will address the work of Work package (WP) 5: Crowd intelligence for green last mile which ran from March 2023 (M7) to February 2025 (M30) and included three Tasks. Additionally, T2.5 was included in this Deliverable. By leveraging real-world Use Cases across four **Living Labs** (LLs)—Hamburg, Istanbul, Logroño, and Nantes—this deliverable provides an insight into the process and results of developing a sustainable business model for last-mile logistics.

Table 1: A brief overview of the key activities carried out in WP5

Timeframe	Task	Topic
June 2023	T5.1	PESTEL Analysis
July 2023	T5.1	First CBA draft
September 2023	T5.1	ADDED VALUE SURVEY development
September 2023	T5.2	Kick Off BM Development
September 2023	T5.2	Value Proposition Canvas Workshop
October 2023	T5.2	Kick Off Business Model State of the Art
November 2023	T5.2	Internal BM workshop with each LL
December – March 2024	T5.2	BM state of the art literature review and Interviews
January – June 2024	T5.1	Added Value Survey
February – June 2024	T5.2	BM development
May 2024 – February 2025	T5.1	CBA development and adaptations
May 2024	T5.3	Kick Off RACI Sheet development
June-September 2024	T5.3	Defining Responsibilities
June-July 2024	T2.5	Development Interview guideline
August-September 2024	T2.5	Interviews with Use-Case Stakeholders
September – December 2024	T5.3	Assigning Roles and Responsibilities
October 2024	T2.5	Local Workshops and Site visits

The document combines theoretical and practical insights, beginning with an introduction to methods and frameworks such as the **Sustainable Business Model Canvas** (BMC) and the **RACI** sheet which facilitated co-creation with diverse stakeholders. This is followed by a state-of-the-art review of business models in the last-mile logistics sector. The review is contextualised within broader European urban logistics trends. It highlights challenges, opportunities, and transferable practices.

The focus of **D5.1** is on presenting the Living Lab-specific results, which introduce the business models developed around the use cases. These results delve into details such as time to market, economic viability, and governance frameworks, while also reflecting on challenges encountered and potential mitigation strategies. Finally, the concluding chapter summarises the key findings, generalising the use-case-specific insights to provide a guideline for future initiatives to reference and adapt. Building up on the BM developments presented in this deliverable, T8.2 will introduce a generic Business Model for last-mile delivery which will be presented in D8.3.

1 METHODOLOGY

The methodology section presents the tools and methods that have been applied to gather, analyse, and develop the sustainable business models, including the CBA and governance models. The tools, which are widely used in both research and industry, assisted the process of developing the use cases and the possible business models that can be applied to secure their market establishment. The activities began with the **Value Proposition Canvas** (VPC) as a key tool to define and align stakeholder needs with the proposed services. To co-create the VPC, CBS facilitated a series of **workshops** (WS) with the LLs. These workshops provided an interactive platform where local stakeholders could share their challenges, needs, and expectations.

Following the completion of the VPC, CBS utilised the **Sustainable Business Model Canvas** (SBMC) to build on the identified value propositions. **Online workshops** were organised with the LLs by CBS to develop the SBMC collaboratively. To validate and refine the proposed BM, CBS along with project partners conducted **interviews** with key stakeholders for all the use cases. These interviews provided deeper insights into the practical suitability of the finalised models.

The last step involved on-site visits to the LLs regions, where CBS organised a final series of **workshops** to complete the business model co-creation process. By integrating tools like the VPC and BMC with participatory methods such as workshops, interviews, and on-site visits, this methodology ensured a comprehensive and inclusive approach to BM development. Each step was designed to foster collaboration, validate findings, and tailor solutions to the specific needs of the LLs and their respective use cases.

1.1 VALUE PROPOSITION CANVAS (VPC)

The **Value Proposition Canvas** is a strategic tool that helps businesses clearly define how their products or services align with customer needs. By identifying target customer segments and understanding their pains, gains, and desires, the VPC enables businesses to craft tailored value propositions, improving product-market fit and overall customer satisfaction.

As emphasized by Osterwalder and Pigneur (2011), the VPC helps companies understand customer needs, ensuring that their products and services align with what people actually want. This makes it a natural starting point for developing a strong **Business Model Canvas (BMC)**. By first working through the VPC, the Living Labs could clearly identify their customer segments and the specific benefits they provide. This foundation ensures that key elements of the BMC—such as revenue streams, customer relationships, and delivery channels—are built around real customer needs rather than on assumptions (Osterwalder & Pigneur, 2010 & Foss & Saebi, 2017).

By mapping out customer problems and matching them with tailored solutions, the LL could further prioritize the most impactful offerings and refine their strategies early in the process. This makes the entire use-case and business model definition more coherent, customer-centric, and, consequently more effective.

Additionally, starting with the VPC also improves internal alignment. It provides a structured way to communicate customer insights across teams, or in this case across the Living Labs, ensuring that different stakeholder all support the same value-driven goals. This alignment not only strengthens the business model but also increases the likelihood of its market success (Seidel & O'Mahony).

By integrating the VPC at the start of the BMC development process, businesses can create models that are both strategically solid and deeply rooted in customer needs. This approach makes it easier to design a business that is adaptable, competitive, and capable of long-term success.

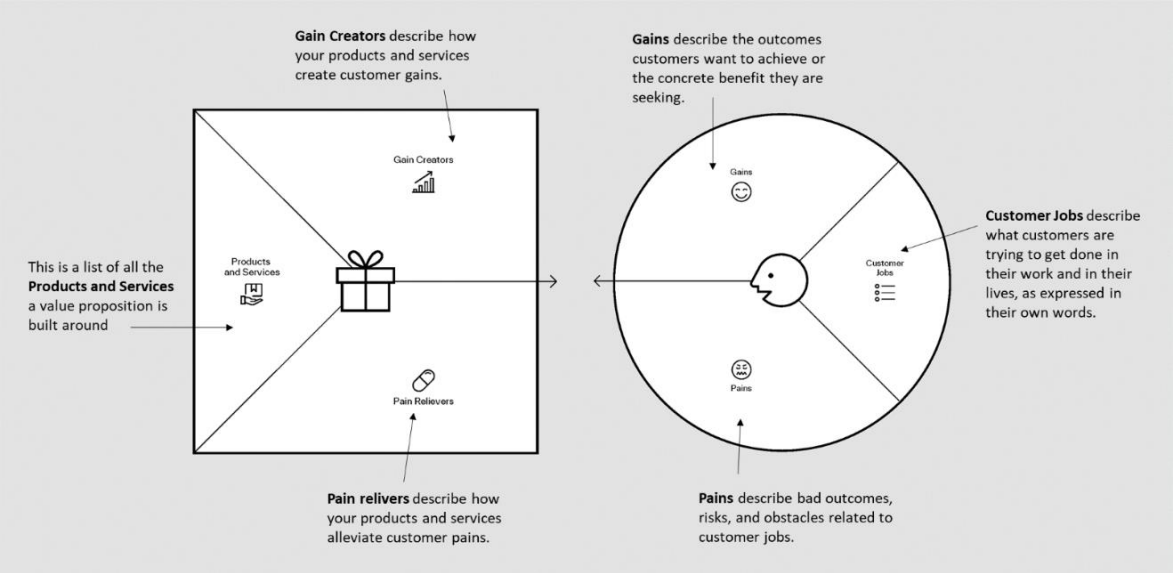

Figure 1: Value Proposition Canvas, Source : Osterwalder & Pigneur (2010)

VPC Co-Creation workshops with the Living Labs

During the Consortium Meeting 3 (CM3) event in Hamburg, which took place on 29th September, CBS conducted a workshop to introduce the Value Proposition Canvas. After a brief overview of its components, Consortium members gathered in their Living Lab groups to brainstorm the value the current Use Case offers to future customers. The focus of the brainstorming was primarily from the municipality's perspective—specifically, what value the municipality can provide to help develop and support the use cases. Some examples of the activities can be seen in Figure 2.

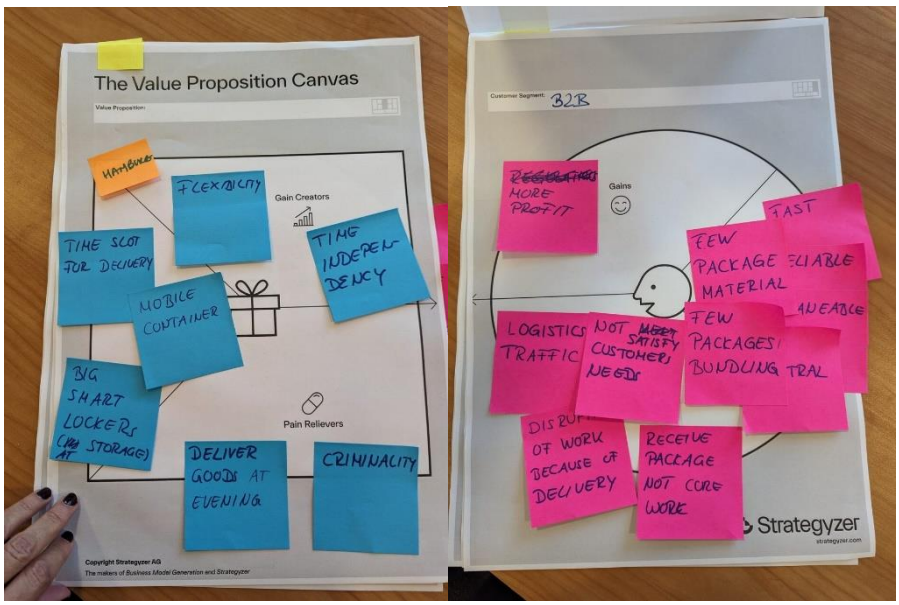

Figure 2: Example: WS Results Hamburg

Following the workshop, CBS compiled the results and documented them on SharePoint (Figure 3).

After CM3, the LLs worked on finalising their Value Proposition Canvas based on the feedback received. CBS facilitated this process by offering bilateral meetings to support the finalisation. The completed canvases were reviewed with the LLs and served as the foundation for developing the business models.

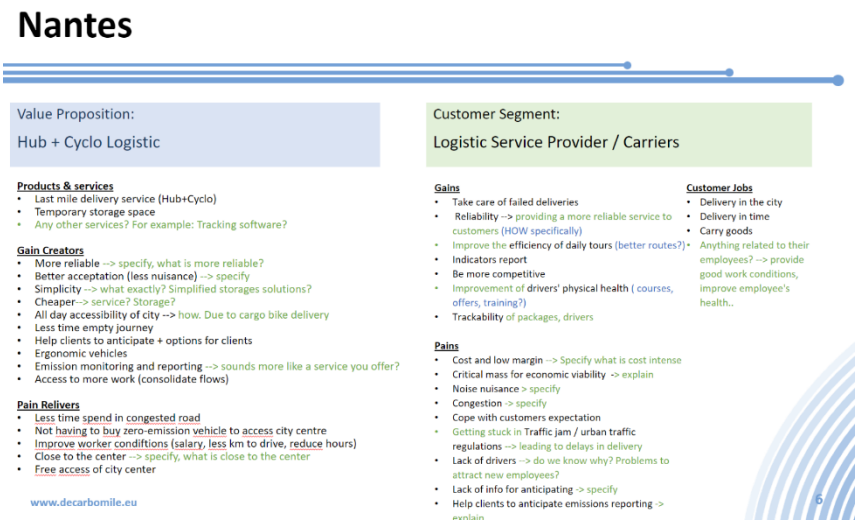

Figure 3: Example of digital version with review comments (green)

Challenges & Learnings

Participants found it challenging to adopt the perspective of municipalities and differentiate between the services/products provided by the municipalities and those offered by project partners. This distinction was further complicated by the incomplete definitions of some Use-Cases, making it difficult to elaborate on certain aspects in detail. To address these challenges, CBS facilitated additional meetings with the Living Labs to co-create the **Value Proposition Canvas**. These sessions provided targeted support in refining the value propositions and aligning them with the specific roles and offerings of the municipalities.

1.2 Sustainable Business Model Canvas (BMC)

The Business Model Canvas (BMC) is a strategic management template tool for defining and identifying the essential business components of a working business model. After being first proposed by Osterwalder in 2005, the template underwent additional development to become the Business Model Canvas that we use today (Osterwalder, 2005; Parry, 2014). The BMC, is widely regarded as an effective and versatile tool for developing business models because it offers a clear, structured, and flexible approach that promotes innovation, enhances alignment, and supports strategic decision-making.

At its core, the BMC breaks down a business into essential elements such as value propositions, customer segments, key activities, and revenue streams (Osterwalder & Pigneur, 2010). This structured approach makes it easier to define and co-design a business since one can focus on one part at a time building up on each other. Another key strength of the segmentation is its modularity—businesses can adjust individual components without disrupting the overall framework. This flexibility is particularly valuable in fast-changing markets, where companies must adapt quickly to new technologies and customer needs. It is also beneficial in projects where use-case definitions evolve over time, allowing for continuous refinement of the business model (Chesbrough, 2007).

Beyond structuring business strategy, the BMC also serves as a blueprint for organizing operations. By providing a visual overview of the business model, it helps teams identify risks, opportunities, and

areas for improvement. This makes it easier to refine strategies, make informed decisions, and stay competitive (Teece, 2010).

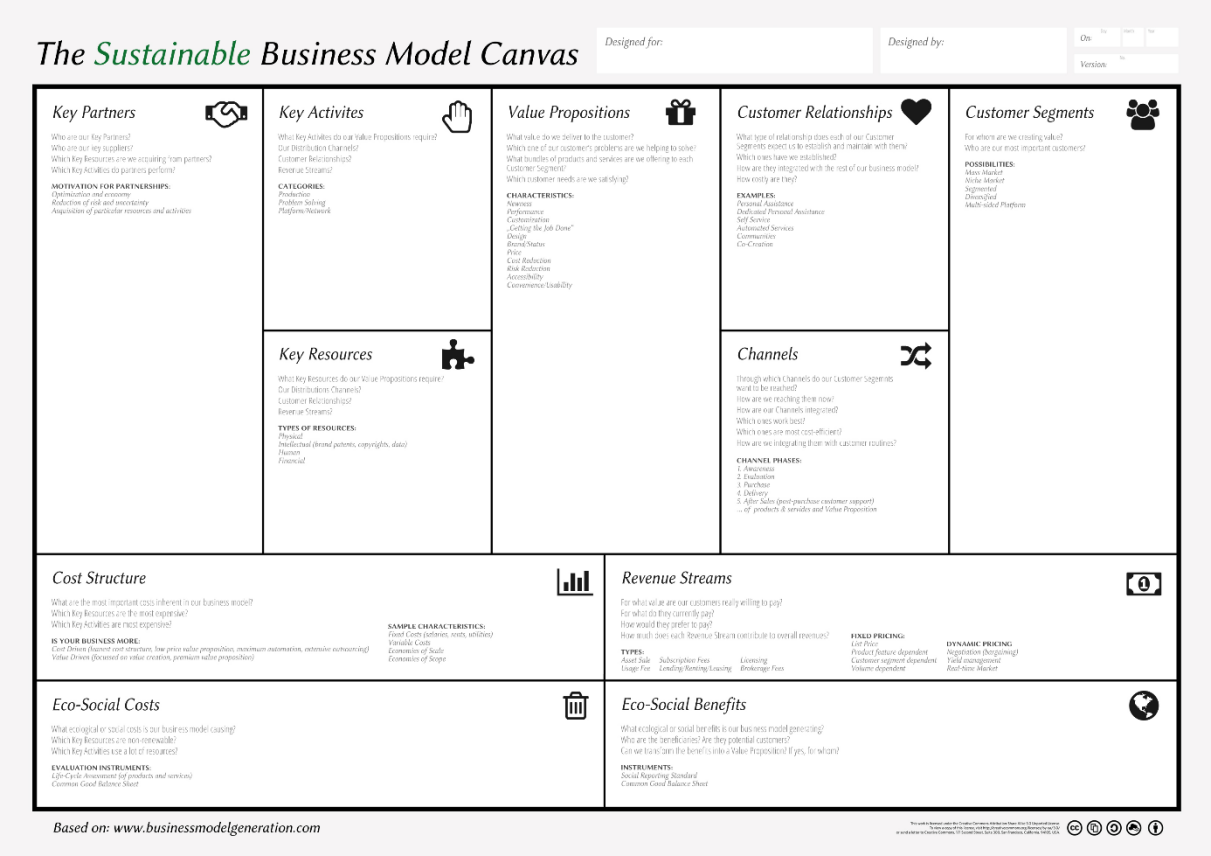

Figure 4: The Sustainable BMC, Source: STRATEGYZER

Business model development process

Once the Value Proposition Canvas was finalized, CBS organised individual online workshops with each LL to initiate the development of the Sustainable Business Model Canvas in November 2023. The workshop focused on three key objectives: (1) **Reviewing** the Value Proposition Canvas and **connecting** it to its role in the Business Model, (2) **Introducing** the Business Model Canvas and its components, and (3) **Co-creating** the first draft of the Business Model with LL partners on MIRO.

For the WS, the Canvas was clustered in four key categories (see Figure 5) and a template was provided on MIRO to be collaborative filled in with post its by the LL stakeholders.

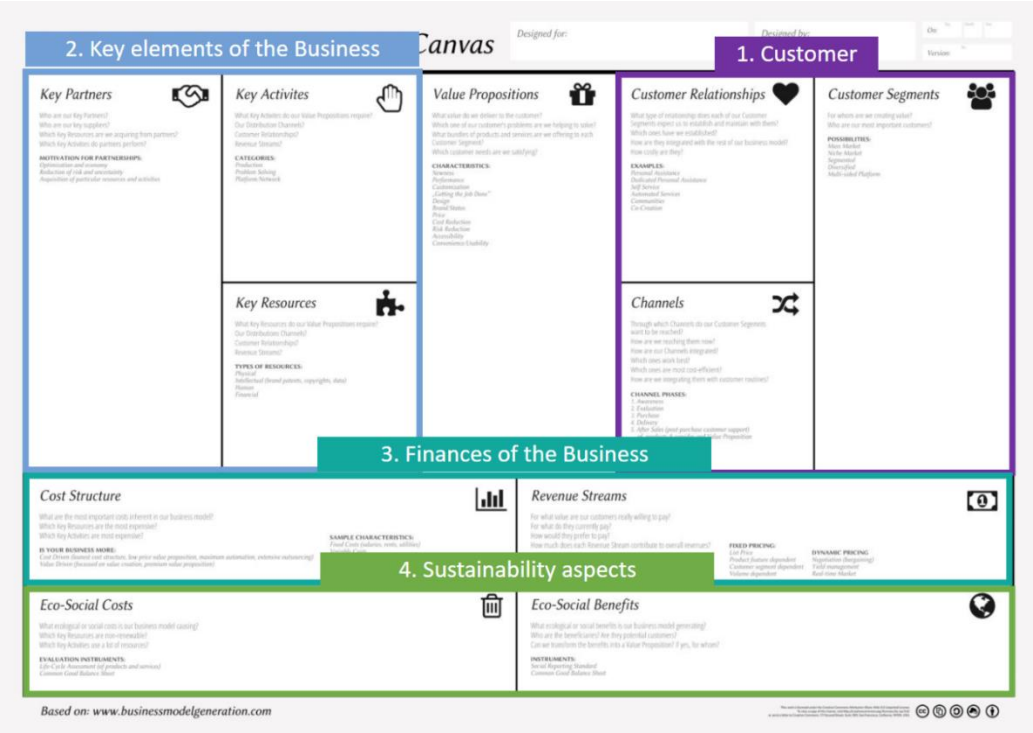

Figure 5: SBMC template used in WSs

The initial workshop concentrated on the municipalities' perspective, aiming to identify a potential business model for them. This focus was driven by two factors: first, some Living Labs had not yet identified all stakeholders for their projects; and second, municipalities were seen as the most stable stakeholders for sustaining the long-term implementation of the businesses. The results of the workshops were the first versions of the BM-Canvas which were then transferred from MIRO (Figure 6) to a PPT presentation.

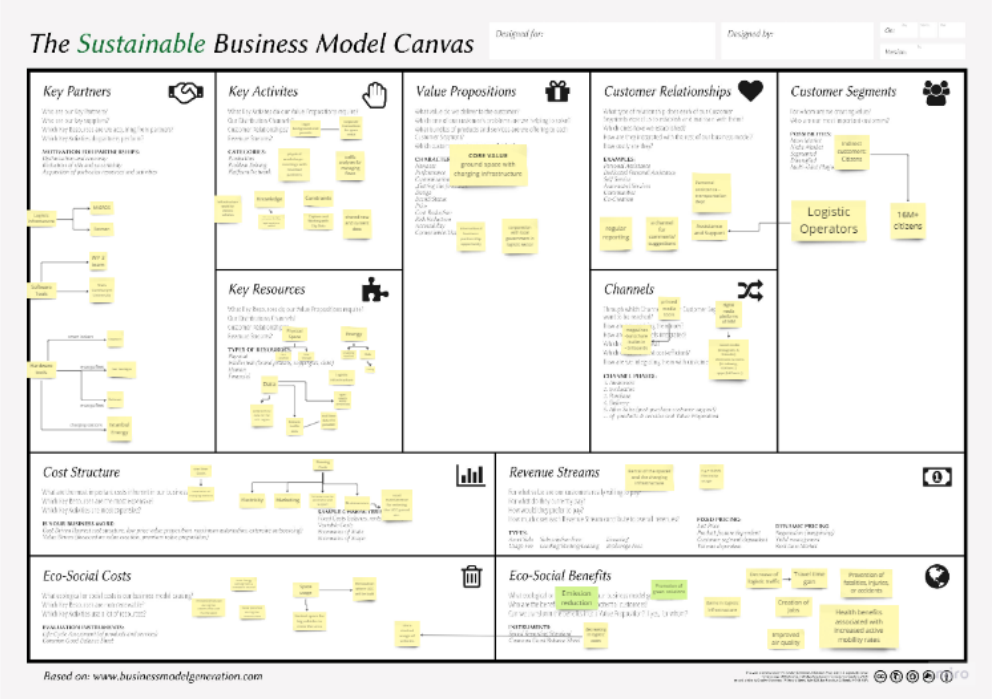

Figure 6: Example of the co-creation BMC draft on MIRO

Following these aspects, CBS began developing the Use-Case-specific Business Model, incorporating all stakeholders relevant to the Use Case. After the first workshop, CBS created a draft of the Business Model and prepared initial visuals (Figure 7) to highlight the key aspects of the identified business.

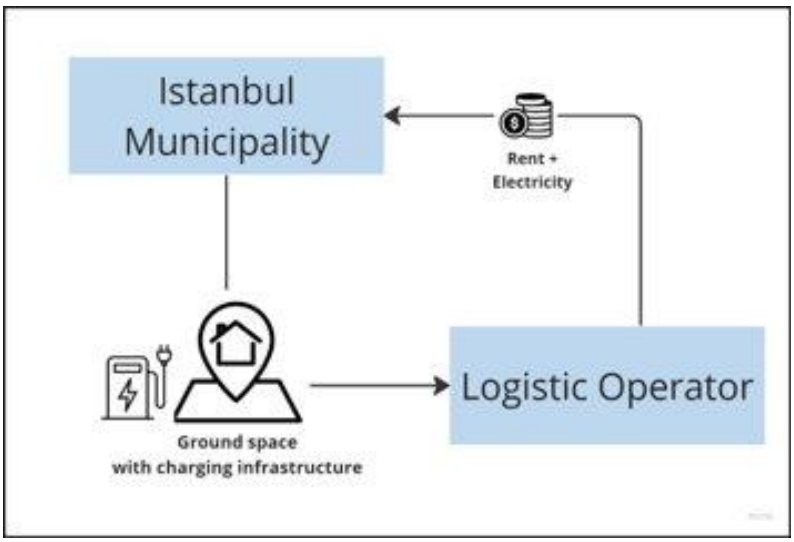

Figure 7: Example BM visual for Istanbul Municipality

Over the next year, the Use Case definitions in the Living Labs evolved, requiring frequent updates. To stay aligned with these changes, CBS participated in biweekly Use-Case follow-up meetings, ensuring continuous co-creation of the Business Model while supporting the Living Labs with their Use-Case definitions.

1.3 INTERVIEWS

In August and September 2024, CBS and IT conducted interviews with all Use-Case relevant stakeholders in each Living Lab to check the suitability of the finalised BM. To prepare for these interviews, CBS developed fact sheets that provided an up-to-date status of the Use Case definition, governance model, Business Model Canvas, and cost structure (Figure 8).

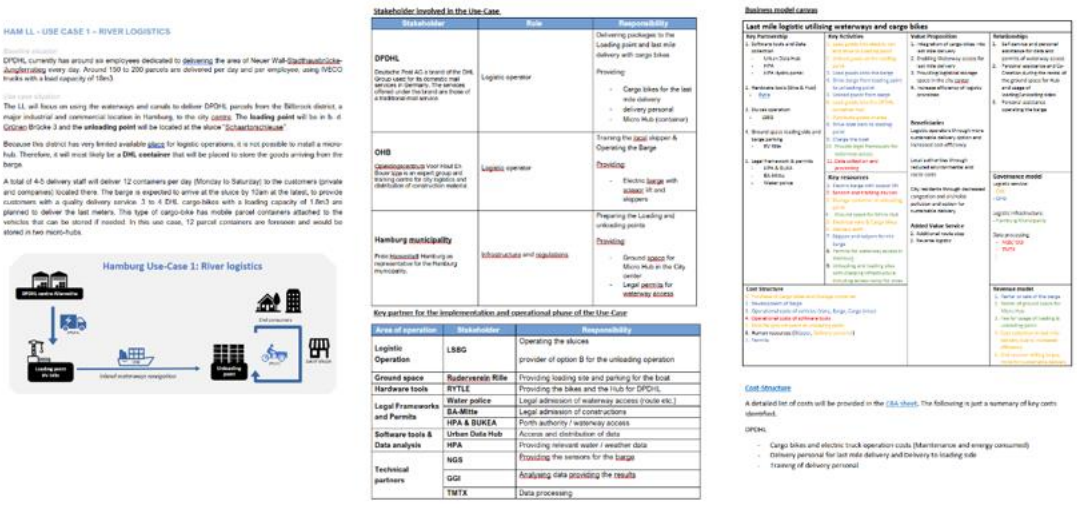

Figure 8: Example Factsheet for Hamburg Living Lab with Use-Case description, Governance model and BM

CBS, IT, and TUHH collaborated to develop a structured interview guideline, addressing open questions while elaborating on the suitability of the Use Cases with the stakeholders. The process involved a series of meetings between April and June 2024 to design a methodological approach for gathering detailed information, ensuring consistency across all Use Cases. The guideline focused on evaluating the Use Case functionality and stakeholder satisfaction while giving each key stakeholder the chance to flag issues or concerns. Additionally, the interviews were used to clarify the roles of the technical partners including the use of tools and sensors. The final interview guideline included the following questions:

1. What challenges do the use cases address for you and what added value will it provide/are you hoping to get out of it?
2. Are there any additional features or services you believe should be included in the business model to better serve your needs in the context of the identified use-case?
3. Are there any concerns from the municipality's side regarding the functionality of the current BM/Use-Case?
4. What factors do you believe are most critical for the success of this business model? (What outcomes do you expect the municipality to consider a success? What outcome would symbolise a failure of the Use-Case?)
5. How do you assess the economic viability of the Use-Case for the municipality? / Are there any concerns regarding the economic viability? If yes, what concerns do you have?
6. How do you assess the scalability of the current Business model?
7. Would you be interested in implementing the Use-Case in the long term? (If not: What is hindering you from implementing it in the long term? What factors would be important for you to consider for a long-term implementation?)
8. How do you envision the partnership with xx during the Implementation period? (How do you envision your role, what potential benefits are you hoping to gain and are there any concerns regarding collaboration?).

The Interviews were conducted from the end of August until the end of September 2024. IT covered the Living Lab Nantes and CBS covered Istanbul, Hamburg and Logroño. The interviews were conducted online, and an interview reporting template was utilised to take contextual notes. The recordings of the interviews were then utilised to add to these notes to finalise the interview abstract and then utilised to finalise the BM development.

Due to ongoing negotiations with stakeholders in Nantes and Logroño and continuous developments in the Use-Case definitions, some of the stakeholder interviews could not be arranged. In Nantes, only NANTES and TRI were interviewed. This was due to the Use-Case definitions and the stakeholder commitment still pending, and thus the municipality decided that it would not be beneficial for the collaboration to reach out to the external stakeholders for an interview like that. In Logroño, RIOFARCOs commitment to the project and Use-Case 1 & 2 was still pending and therefore no interviews could be arranged. Jimeno Tagus was also reached out, but they could not reply in time to include the results in the deliverable. Table 2 gives an overview of the interviews conducted.

Living Lab	Use-Case	Stakeholder	Responsible partner	Interview date
Hamburg	**Water logistic**	DPDHL	CBS	Wednesday, 28th August 10-10.30 am
		OHB		Tuesday, 24th September 11.30-12 am
		HAM		Friday, 2nd August 1-2pm
Istanbul	**Use-Case 1 & 2**	MIGROS	CBS	Thursday, 15th August 1-2pm

Living Lab	Use-Case	Stakeholder	Responsible partner	Interview date
	Use-Case 3	**IMM**	CBS	Friday, 16th August 2-3pm
		MIGROS	CBS	Thursday, 15th August 1-2pm
		ILETMEN	IMM + CBS	Tuesday, 13th August 1-2pm
Logroño	Use-Case 1	**LGN**	CBS	Friday, 2nd August 10-11am
		DHL	LGN + CBS	Answers by E-Mail
		RIOFARCO	LGN + CBS	Pending commitment to project
	Use-Case 2	**LGN**	CBS	Friday, 2nd August 10-11am
		DHL	LGN + CBS	Answers by E-Mail
		RIOFARCO	LGN + CBS	Pending commitment to project
	*Reverse Logistic	Jimeno Tagus	LGN + CBS	Not available
	*Community Service	RIOFARCO	LGN + CBS	Pending commitment to project
	Use-Case 3	**LGN**	CBS	Friday, 2nd August
Nantes	Use-Case 1.1	Tout en Vélo	Nantes + IT	Pending commitment to project
		HEPPNER	Nantes + IT	Pending commitment to project
	Use-Case 1.2	TRIPORTEUR FRANCAIS	IT	Monday, 5th August
	Use-Case 2	**NANTES**	IT	Thursday, 8th August
		CHAMBER OF COMMERCE	Nantes + IT	Interviewed during workshop
	Use-Case 3	**NANTES**	IT	Thursday, 8th August
		TRIPORTEUR FRANCAIS	IT	Monday, 5th August
Technical Partners	All Use-Cases	GGI, NGS, INT, TMTX	IT & CBS	Wednesday 9th October 10-11am

Table 2: Overview of interviews - In yellow external stakeholders which are not part of the Consortium

Overall, the interviews indicated that the developed Use-Case definitions and the Business Model built upon them were interesting for the use-Case stakeholders and seen as feasible, thus no major changes needed to be made. Specific results will be presented in **chapter 4** Living lab-specific results at the end of this Deliverable. Additionally, most Stakeholders showed interest in a potential long-term implementation of the Use-Cases after a successful trial period.

1.4 WORKSHOPS AND SITE VISITS

The interviews were followed by local visits (Table 3) where CBS conducted a final WS to wrap up the BM-Co creation process, focusing on aspects like operational risks, time to market and long-term perspective.

Living Lab	Use-Case	Participants	Side visits & Workshop date
Hamburg	**Use-Case 1**	DPDHL, HAM, OHB, CBS, TUHH	21st-22nd October
Istanbul	**Use-Case 1 & 2** **Use-Case 3**	MIGROS, IMM, ILETMEN, CBS	31st October – 1st November
Logroño	**Use-Case 1,2 &3**	LGN, INT, CBS, RCXB	29th October
Nantes	**Use-Case 1**	-	-

	Use-Case 2	Nantes Metropole, IT Transeco / syndicat des transporteurs ID4MOBILITY CCI (logistique urbaine, pat. immobilierà Boite à vélo	8th October
	Use-Case 3	Nantes Metropole, Les Triporteurs Français, SAMOA, DBSxTRI, IT, CBS	8th October

Table 3: Overview of Workshops and Site Visits in LLs

The workshop included three activities (Figure 9) that focus on different times of the Use-Case lifecycle starting at the Use-Case implementation phase, which the Living Labs are currently in and going over the operational phase of the Use-Case to the afterlife after the project DECARBOMILE.

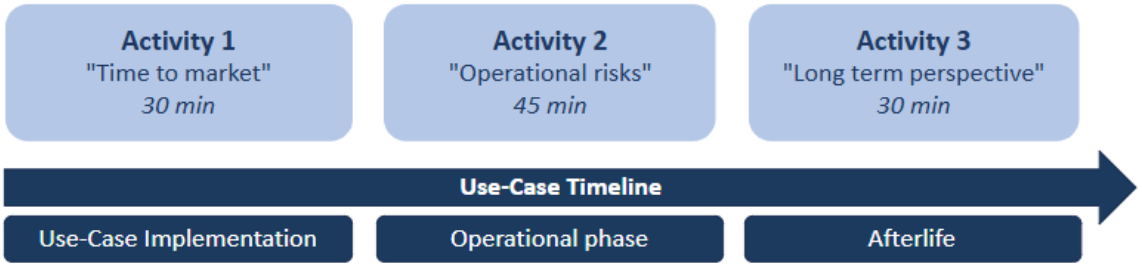

Figure 9: Activities conducted during the WSs

The first activity "Time to market" reflected on the Use-Case implementation time by defining how varied factors influence the implementation timeline of the Use-Case. Time to market was defined as: the time required to implement a developed use-case concept and make it fully operational for customers.

The following factors were utilised to reflect on the time to market in each of the Use-Cases:

1. ***Infrastructure availability:*** To what extent can the Use-Case utilise existing urban/logistic infrastructure?
2. ***Regulatory approvals:*** Are there significant legal or regulatory approvals needed and how complex and time-consuming are these processes?
3. ***Partnerships and Stakeholders:*** Do you have the necessary team and how well do stakeholders' timelines aligned with the Use-Case needs?
4. ***Equipment Integration:*** Does the Use-Case involve integrating new or complex equipment that needs time-intensive development & testing?
5. ***Resource Availability:*** Are skilled personnel, equipment, or materials readily available to support the development and launch? Could shortages create delays?
6. ***Costs and Finances:*** Do you have the financial resources necessary to keep your Use-Case on track?
7. ***Environmental & Geographical Factors:*** Do factors like weather, geography, or location-specific issues impact the Use-Case development or deployment timelines?

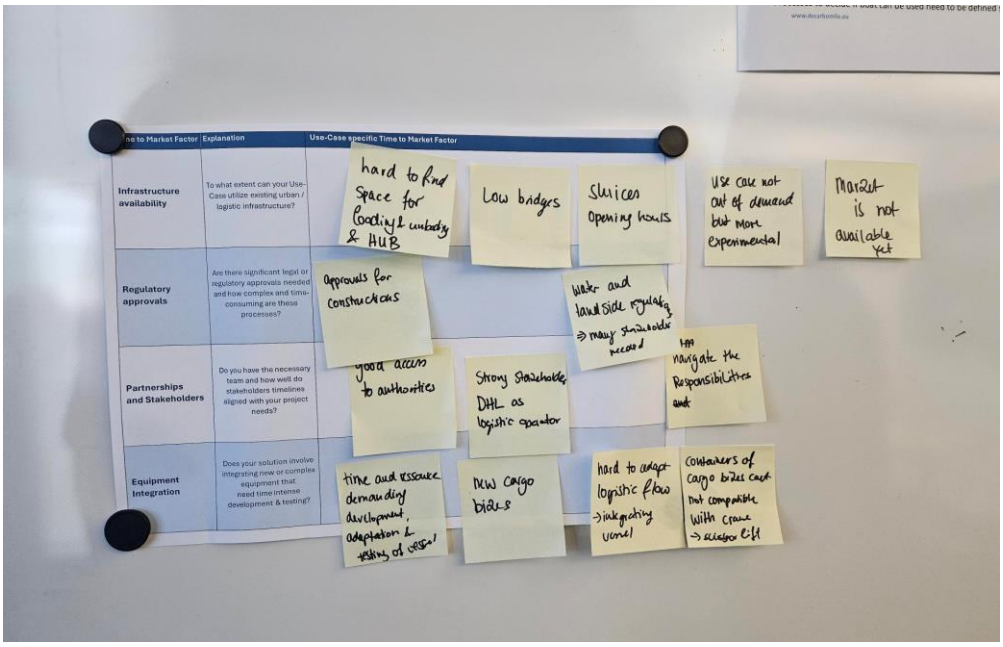

Figure 10: Example of the Time-to-Market exercise in HAM

The goal of this activity (Figure 10) was not only to put a perspective on the implementation time of the Use-Cases but also to provide some sort of comparability between the Living Labs and their Use-Cases through identifying the individual framework they were developed in.

The second activity (Figure 11) paid attention to the operational phase of the Use-Case by reflecting on potential operational risks that could be encountered. Operational risks were defined as problems that could disrupt daily operations, such as issues with people, equipment, processes, or systems. The participants were held on to brainstorm together which risks they could encounter during the Use-Case operation and to note them down on Post-its.

Figure 11: Operational Risks Activity in HAM

After a team brainstorm collecting all potential risks, a likelihood impact scale (Figure 12) was utilised to cluster the risk and single out the key risks to focus on first. Herby, stakeholder discussed and compared different risks identified. Afterwards, mitigation strategies were identified and discussed, focusing on the High impact and High likelihood risks.

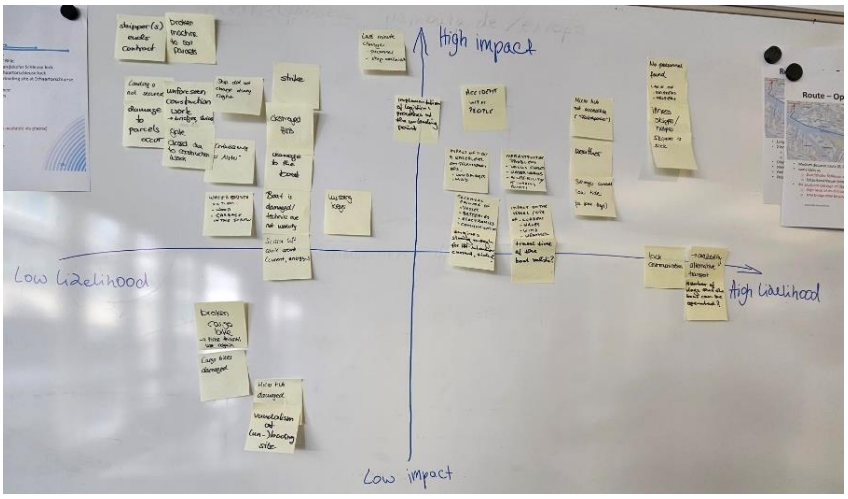

Figure 12: Example: Impact likelihood scale activity

The third activity (Figure 13) was focused on the time after the project officially ended and was used to identify hindering factors and necessary conditions for a long-term Use-Case implementation. The long-term perspective was hereby defined as: The outlook on the future integration and operation of the Use-Case after the project ends. The overall conversation point was to determine whether a long-term implementation of the Use-Case is realistic and why. During the activity, the stakeholders individually brainstormed hindering factors and necessary condition and noted them on Post-its. After that, all points were presented and collected while the group discussed each point and finalised the formulation of necessary condition.

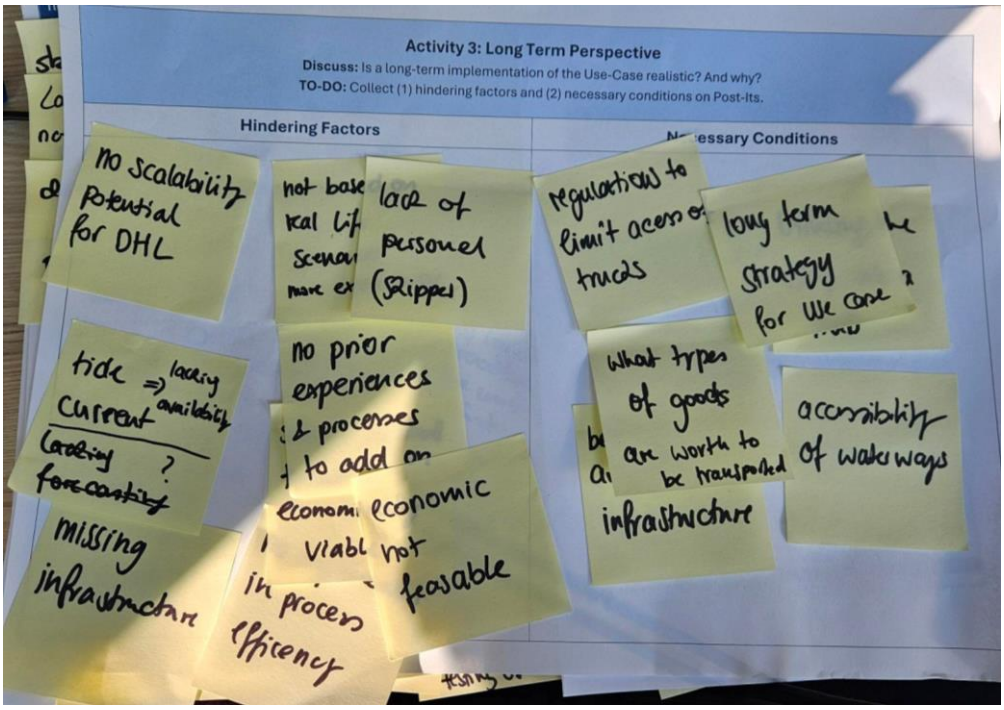

Figure 13: Example: Filled in Template for Activity 3 "Long-term perspective"

1.5 Business Model Suitability Assessment

Part of T2.5 was to ensure the suitability of the developed Business models with the Living Labs. To kick off that aspect of the task, HAM and CBS conducted a workshop (Figure 14) with all Living Lab leaders, TUHH and LIHH. The workshop's goal was to identify and discuss factors linked to the

suitability of the Use-Cases and their Business model which could later be transformed into a guideline for evaluation. The following factors were identified:

1. Alignment with Local Needs: Does the business model address key needs or challenges identified by the community & local stakeholders?
2. Governance Model: Have roles and responsibilities been clearly defined and allocated among the partners?
3. Partnership Objectives and Outcomes: To what extent does the BM involve local stakeholders (for higher sustainability)
4. Regulatory Compliance: Does the business model comply with relevant local regulations and legal requirements? Are there any potential legal or regulatory barriers that need to be addressed?
5. Economic Viability: Is the business model financially sustainable in the local market context?
6. Environmental and Social viability: Does the business model provide needed environmental and social benefits to the community?
7. Long-Term Impact and Scalability: What are the potentials for long-term implementation and partnerships and does the BM provide opportunities for scalability?

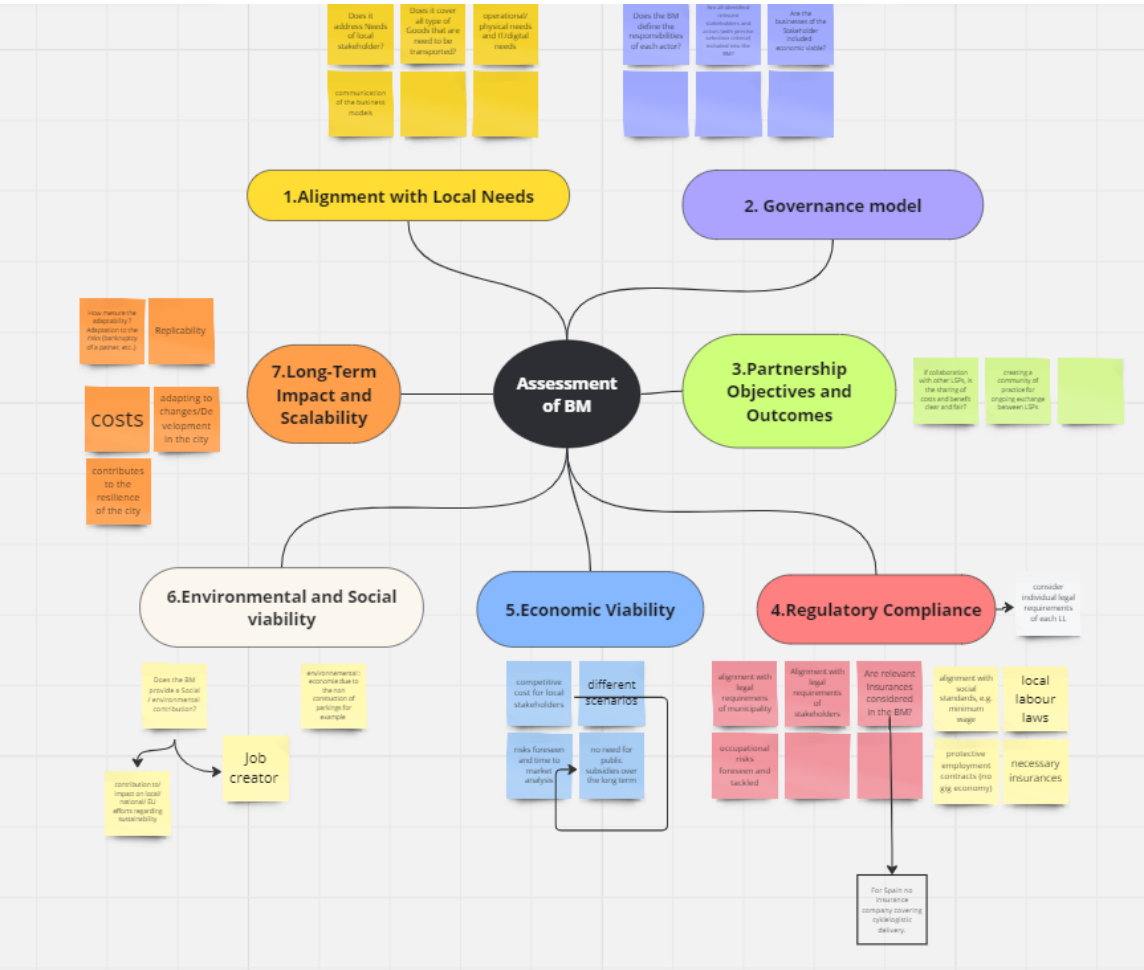

Figure 14: Outcome Kick-off Workshop for the Business model assessment on April 19th, 2024 (MIRO)

In October, following the finalization of the Use-Case definitions and Business Model development in the Living Labs, CBS and HAM conducted a follow-up meeting to discuss the suitability assessment process. During this meeting, it became evident that the suitability assessment was an ongoing process rather than a single-step check at the end of development.

The Business Models were co-created through a continuous iterative process, including interviews and feedback sessions conducted by CBS to gauge feasibility, stakeholder interest, and alignment with the LLs' requirements. This approach highlighted the interconnected nature of UC definitions and Business Models—changes or adaptations in one directly influence the other. In essence, the BM summarises the UC definition, incorporating elements such as the governance model and cost structure. Many aspects which were previously mapped have thus already been covered, for example: The Governance model has been co-created in T5.3 and there were several feedback and follow-up meetings to evaluate its suitability. The regulatory compliance of the Use-Cases has been tracked in T2.4 under the lead of LIHH and its work continued in WP7. The interviews conducted in connection with T2.5 reflected on the general coverage of stakeholder needs, economic viability as well as the long-term and scalability aspects. Due to this, it has been decided that each Living Lab will provide a short overview of the adaptation process to give the reader a better understanding of the process of the suitability assessment and the following alignments that have taken place. The results can be found in **chapter 3.**

1.6 Governance Model

The need for a governance model for the respective use cases arises from the complexity of the respective projects; in all use cases, either new logistics processes are implemented for the respective region, or the bureaucratic and legal effort is particularly high due to current hurdles. At the same time, there is a requirement to establish a modern IT infrastructure in all use cases, which increases the complexity of interfaces in the processes and brings other project partners into play. Therefore, in addition to providing a detailed description of the onsite processes for defining the entire process chain, all living labs have to create an overview. This overview should allow both project partners and external parties to understand which aspects of the project are carried out, by whom, and in what way.

Governance models are essential when multiple partners work toward a common goal. When several individuals are involved in an activity, it is necessary to define roles and responsibilities to ensure efficiency. Clear task organisation helps prevent duplication of work, ensures key processes are completed, and safeguards against information loss. It also provides management with confidence that the process chain is functioning smoothly.

A standardised model is typically needed when a process becomes too complex for a single person to oversee or when multiple partners contractually agree on their respective activities. In such cases, defining responsibilities clearly is crucial for achieving project objectives.

Governance models are diverse and usually adapted to the individual organisation. For example, the governance model always makes a statement about the approach and philosophy of an organisation, such as the degree of hierarchical order or the proximity of management to the value-creation process. What they all have in common, however, is the focus on the people responsible along the process chain. As a rule, underlying detailed process descriptions take on the role of subordinate models, which define the specific activities below the level of responsibility.

A well-implemented governance model thus ensures:

- Acceptance: All those involved are aware of their respective responsibilities,
- Transparency: So that all participants are aware of the responsibilities of all others,
- Repeatability of the process chain: as uniformity of activity has been established,
- Personnel efficiency: suitable personnel can be assigned specific responsibilities.
- A governance model alone does not typically improve process efficiency. It lacks a detailed overview of individual process steps and procedures.

For this project, the governance model must allow for a high level of adaptability due to the evolving processes and shifting responsibilities. With many partners involved in each use case and multiple actors contributing to individual processes, simply assigning responsibilities is not enough. A more detailed representation is required, though without the need for an extensive process description.

Additionally, the governance model should also map the sub-project organisation during both the implementation and operational phases. It should maintain consistency across these phases, as responsibilities shift significantly between partners. To meet these requirements, the RACI matrix model was selected (Jacka & Keller, 2009).

The RACI matrix links an organisation's responsibilities to the corresponding roles in a two-dimensional matrix. This connection is determined by how a role relates to its assigned responsibility:

Table 4: RACI Matrix

R	Responsible
A	Accountable
C	Consulted
I	Informed

R=Responsible means that the role has ultimate responsibility for the respective responsibility. However, this does not necessarily mean that the role is also responsible for the actual implementation.

A=Accountable represents all roles that are entrusted with the specific implementation of the responsibility. A=Accountable are all persons actively working on the responsibility but are not R=Responsible.

C=Consulted establishes the link between a responsibility and an advisory role. The corresponding role does not make decisions but provides expertise or data to R=Responsible to make informed decisions within the responsibility.

I=Informed includes all roles that need to be kept up to date on the activities and events within a responsibility. As a rule, the management of a process chain must be informed about all responsibilities. Upstream and downstream responsibilities must also be informed.

Other categories such as **V=Verify**, **P-Preparation** or **S=Supervision** were not included to increase the complexity of the matrix. As the processes of the use cases are new but not overly complex, a basic matrix was agreed upon.

In the finalised form, responsibilities (links), roles (top) and connections (matrix) are then included as shown in Figure 15.

Responsibility Description	Parcel Carrier	HUB-Manager	Skipper	Barge-Manager	Sluice Operator	LL-Team	Q-Controlling	Logistics Operator
Carrying out of the Barge-Route from Grüne Brücke to Stadthausbrücke	I		R	A	C			
Providing the necessary personnel for the Barge-Route				R		C		
Opening and closing of the necessary floodgates on the Barge-Route					R	A		
Providing and managing the necessary infrastructure for loading and and anchoring the Barge			A	R		I		
Deciding whether the boat is driving on the current day and which route the Barge will take.	I		R		C	I	I	I

Figure 15: Example of finalised RACI sheet (part)

The RACI model offers both clarity and flexibility. It provides a detailed view of responsibilities, displaying all assigned roles within a single line. At the same time, it allows for an overview of each role's involvement in the process chain. It also helps identify key roles and determine whether certain roles are unnecessary if they have no assigned responsibilities.

The main challenge of the RACI model is breaking down established processes into clear responsibilities and assigning existing participants to specific roles.

Responsibilities should not be overly detailed, as the goal is not to create a full process description. However, they must still be clear enough to provide a solid understanding of each activity. Additionally, each responsibility must be reviewed to ensure it remains necessary and up to date. The RACI matrix should be adapted as the organisation evolves to maintain relevance.

At the same time, roles must be clearly defined. In a governance model, roles should be assigned to individuals rather than to activities or sub-organizations. This prevents instability in case of personnel changes. Furthermore, a single role should not be shared by multiple individuals performing different tasks. If this occurs, the role must be divided accordingly.

To maintain both well-defined roles and meaningful responsibilities, these two aspects should be developed separately. The final step is linking them together to complete the RACI matrix. Once established, all assigned roles must be informed of their responsibilities to ensure clarity and alignment (Jacka & Keller, 2009).

1.7 Added side services Benchmark and Survey

As a first step and building on the inspiring projects and initiatives collected among the consortium partners in the frame of WP1, a benchmark of added-value side services was conducted. Defining eight categories of services, this benchmark helped have a clear overview of the services which would most likely be included into the future use cases business models. For each category of service (consolidation centres, parcel lockers, hub-associated services, river logistics, cycle-logistics, autonomous vehicles, reverse logistics and digital tools), benefit for the users, challenges in the implementation and lessons learned were detailed.

Then, to develop relevant side-services to be associated with the core use cases already defined, it was crucial to consider both the needs of the local stakeholders implicated in the use cases and to have a good understanding of local economic contexts in all Living Labs. Thus, expertise from the local clusters part of the project's consortium (CARA, RCxB, LIHH) was sought, to adapt the surveys to the local contexts. For the Istanbul Living Lab, no local cluster is part of the consortium, so the help of the municipality was asked as well.

Before elaborating on the different questions, a preliminary analysis of each use case was made, based on the benchmark of added-value services established beforehand (in the T5.1 too). The result was a

selection of the most appropriate added-value services based on each use case's specific objectives and stakeholders involved (see ANNEXES). The surveys were then designed to validate this preliminary analysis and shared with local stakeholders identified as end users of the use cases (logistics service providers, economic actors and associations).

The surveys were different between the four Living Labs, but followed the same structure:

1. Presentation of the use case
    a. Interest of the respondent in the use case
    b. Already implemented strategy for green last-mile deliveries by the respondent
    c. Upcoming strategies to be implemented in the next 2 years by the respondent
2. Presentation of the added-value services identified as of interest
    a. Level of interest of the respondent
    b. Added value for the respondent in their internal strategy
    c. Potential integration in the respondent's current business model
    d. Potential challenges for implementation
    e. Other service(s) of interest not mentioned

Once the responses were collected, data was analysed to highlight for each use case the most appreciated added-value services and consider other propositions that may have emerged. Analysis of the benefits and challenges brought by each of the added-value services was also conducted for a better understanding of the needs and challenges faced by the respondents (see ANNEXES).

The results of these analyses were then utilised in the co-creation process of the business models for each use case (T5.2).

One limit faced in this process was the evolution of the use cases in the same timeframe as this analysis. As use cases were not finalised when the surveys were sent, some incoherences occurred between the added-value services foreseen as relevant in the preliminary phase and the actual added-value services included in the final business models.

Apart from this issue, having feedback from the local stakeholders on the benefits and challenges linked to each of the services proposed is an interesting insight to have and can be useful for the replication phase of the project.

1.8 Cost-Benefit Analysis

Enabling a social cost-benefit analysis (CBA or SCBA) for transport projects appear as one of the main tools to be used to evaluate the potential social, environmental, and economic benefits of an initiative (Boardman and Pearson Education, 2014). In the context of the DECARBOMILE project, it was decided to use a specific type of CBA, combining *ex-ante* and *ex-post* analysis. This combination of two assessments, one before the experimentations and one at the end of the implementations allows to have an additional analysis based on the comparison of the two situations. Another value for the project is that this tool is preparing the work for the evaluations of the use cases to come in the WP8, defining a baseline (or reference situation) for each stakeholder involved.

Operationally, two outputs were defined for this cost-benefit analysis. First, a high-level analysis of the project's expected costs and revenues, based on the current state of the use case definition, knowing that the Grant Agreement expected this task to be done in parallel with the use case definition work (T2.2.2), between month 7 and 12 of the project.

Then, based on a collective agreement and to provide the local stakeholders with a useful planning tool, we elaborated the cost sheets, and an Excel table detailing for each of the use cases revenues and costs (for the baseline, the planned use case, and the implemented operations). This Excel tool was co-created following an iterative process, to be tailored to the use cases and the needs of the stakeholders involved in each of them.

1.8.1 HIGH-LEVEL CBA

To perform this high-level analysis, a literature review was conducted to familiarise with the concept of the CBA and especially to understand the methods to monetise social and environmental impacts (air quality, congestion, noise pollution, etc.). Two main documents served as a basis for our analysis: the CINEA guidance on Economic Appraisal for CEF-T transport and the OECD guide "Cost-Benefit Analysis and the Environment" (CINEA, 2022; OECD,2018). Based on these two documents, we were able to provide for the four Living Labs high-level cost-benefit analyses that would serve as starting points for the cost sheets to come. Regarding the method to input monetary values on social and environmental impacts, it was decided to use the ratios established by the Handbook on the external costs of transport (Van Essen et al., 2019), written by the European Commission.

Additionally, a PESTEL analysis was established to serve as the Political, Economic, Social, Technological and Legal context in which this CBA would be embedded.

Political: The current armed conflict in Ukraine is heavily impacting the supply of energy, including electricity, in Europe[1]. As DECARBOMILE is mainly focusing on green deliveries, made with electric vehicles in most cases, it raises several concerns about the energy source to be used and the extent to which it can be local and sustainable. In addition, during the four years of the project, political changes need to be anticipated and considered. In 2023, national and regional elections took place respectively in Türkiye and Spain which led to changes in the DECARBOMILE partners in the municipality teams. This can represent a risk to the success and impact of the project and has to be considered. On a more positive side, the European Commission is strongly encouraging European cities to develop their Sustainable Urban Mobility Plans (SUMP), with some focus on urban logistics. Dedicated Sustainable Urban Logistics Plans (SULP) are also being developed in some cities. This demonstrates the willingness of public authorities to start focusing on this point.

Economic: Linked to the political situation mentioned above, the rise of energy prices (increase in global household expenditure of between 2.7% and 4.8%)[2] due to the armed conflict in Ukraine can be a hindrance to the project since almost all the vehicles used are electric. High inflation (up to 10% in January 2023 across the European Union)[3] is also impacting European countries and the manufacturing price for products and equipment to be used and developed within the project. On the other hand, digital tools and logistic supply chain optimisation tend to lead to economic and financial improvements[4]. This is where DECARBOMILE can demonstrate economic viability, using innovative methods that have not yet been exploited to their full potential by stakeholders in the sector. For example, the use of the Physical Internet and the creation of a common marketplace for DECARBOMILE is a significant added value from the project.

Socio-cultural: Despite people being aware of the climate crisis today and trying to adapt their consuming habits towards more sustainable behaviours, the environmental impact of urban logistics remains a sector hard to grasp for citizens. It will be key for the project to popularise and communicate well about the social benefits that will induce from the use case implementation, to incite people to try new ways of deliveries when ordering online. Indeed, with greener and more sustainable last-mile logistics schemes, citizens would benefit from less congestion in the city centre, and less related air and noise pollution, thus improving their quality of life. Concerning the labour market and the "uberisation" of employment, especially in the goods delivery sector, it appears that delivery activities

[1] "EU energy security and the war in Ukraine: From sprint to marathon" briefing, EU Think Tank, Feb 2023

[2] "Russia-Ukraine war has nearly doubled household energy costs worldwide – new study", World Economic Forum, Feb 2023

[3] « Le taux d'inflation en Europe », Toute l'Europe, June 2023

[4] « How the "physical internet" could revolutionise the way goods are moved », Horizon - The EU Research & Innovation Magazine, Feb 2021

can be very insecure[5]. To counter this, cycle-logistics companies are springing up to offer more stable and safer working conditions to bike couriers[6].

Technological: Manufacturing electric vehicles, and alternative energy vehicles in general, is a growing and innovative sector, like the intermediate vehicles sector (type of vehicles between the bicycle and the car). Following the benchmark conducted in WP4, many innovative solutions already exist and more will continue to follow. For example, FLEXIMODAL is offering innovative vehicles (including a lifting system) and trailers (refrigerated, etc.) that can be put on tricycles or bicycles, which they are manufacturing, too. Moreover, the cycle-logistics sector is expanding (see above), inducing new solutions for cargo-bike deliveries that can carry heavier and bulkier packages.

Environment: Urban logistics is an under-popular sector, but its externalities have a wide impact on society. For example, urban freight is responsible in France for 25% of CO2 emissions in 2022 (according to the French Ministry of Ecological Transition). With the ongoing and pressing climate crisis, it is necessary to find solutions to minimize global warming and air pollution, two side effects of the massive use of thermic vehicles. As already mentioned, the increasing awareness of climate change and the need to change our behaviours is positive for DECARBOMILE which is advocating for new ways of doing urban logistics, in a greener way. Logistics operators and end-users are invited to actively participate in the development of the project to allow them to invent new ways of consuming and transporting goods.

Legal: In response to the health issues associated with poor air quality and the problem of exceeding regulatory limits for concentrations of fine particles and nitrogen dioxide (NO2), several European countries have set up Low Emission Zones (LEZs). Access to these zones is restricted to certain types of vehicles, depending on their atmospheric pollutant emission standards or the presence of pollution control equipment. In France, LEZs will be mandatory for cities with more than 150,000 inhabitants in December 2024, following the passing of the Mobility Orientation Law in 2019. This legal framework is closely linked to political orientation, where countries and the European Union are working to implement some changes.

With the context laid down, the high-level analysis was based on the added-value services benchmarked in task 5.1, following the use case definition development.

Added value service	Type of costs		Type of benefits
New Consolidation centre	Rent Additional load break (time, space, staff)	Maintenance, workforce, energy consumption	Mutualisation of flows
Services to the hub	Space in the hub		Revenues linked to new activities (like storage, bike repair, training, etc.)
River logistics	Adapted equipment (barge, ramp, lift, etc.) Additional load break (time, space, staff)		Environmental benefits (pollution, congestion) Massification potential
Autonomous vehicles	Equipment Software development		Optimisation of the operations and less workforce needed

[5] "Gig Economy Project: Co-op Cycle – Uberisation and presumption of employment: the government challenges its own coherence", Brave New Europe, May 2023

[6] "Delivering Good Work: Labour, employment and wellbeing in London's cargo bike sector", C. Couve and al., Jan 2023

Added value service	Type of costs		Type of benefits
Cycle-logistics	Equipment (cargo bikes) Potential additional load break (time, space, staff)		Environmental benefits Financial benefits when it is faster than traditional deliveries Access to restricted areas
Digital tools	Development		Optimisation of the operations
Parcel lockers	Rent of the space Equipment Software development		Independent access 24/7 Prevent fail deliveries
Reverse logistics	Adapted equipment		Optimisation of vehicles Environmental benefits

Table 5: High-Level CBA

Additionally, Living Lab-focused analyses were provided at a high-level stage, presented below in the dedicated sections (see Living lab-specific results).

1.8.1.1 Cost Sheets

As previously mentioned, the costs sheet is a tool that details for the baseline, planned and actual situations the cost and revenues supported by the different stakeholders involved in each use case. The *baseline* column is supposed to reflect the current operations of the logistic operators (how are they currently delivering the area targeted by the use case?). This baseline is essential to understand the current business model for each use case and to calculate (in WP8) performance KPIs. The *planned* column can be used as a planning tool by the stakeholders and a decision support tool, to test different prices for their services and see if economic viability is obtained (see balance section). The *actual* section will be used to monitor these costs based on the reality of the use cases. Following this structure, the cost sheet is then split into six different sections, described below.

Operations

This section (Figure 16) outlines the operations planned for implementation within the use case. It provides a breakdown for each operator involved, covering the number of staff, types of services offered, unique selling prices, and potential hardware and software costs.

DETAILS ON THE OPERATIONS	BASELINE	PLANNED	ACTUAL
Operator 1:	**Reference situation; date:**	**Before the use case**	**After the use case**
Number of employees			
Total number of food delivery unit per month			
Unit selling price for food delivery			
Total number of mail delivery unit per month			
Unit selling price for mail delivery			
Total number of express delivery unit per month			
Unit selling price for express delivery			
Total number of reverse logistics operations per month			
Unit selling price for reverse logistics operations			
Total number of deliveries to parcel lockers per month			
Unit selling price for parcel lockers delivery (different from another delivery ?)			
Total number of goods / sqm² stored per month			
Parcel / smq² unit monthly rental fee for storage service			
Total number of bike rent or repair services per month			
Unit selling price for cargo-bikes rental and repair service			
Load break cost (TBC)			
Hardware tool used			
Software tool used			

Figure 16: Details of Operations

Vehicles

This section (Figure 17) is dedicated to last-mile vehicles used and planned for the use cases. It will be especially useful to calculate the environmental benefits brought by the use cases (thanks to the shift to zero-emission vehicles) and validate the environmental KPIs of the WP8. This section also examines the same information for each operator, considering every type of vehicle used.

DETAILS ON THE VEHICLES	BASELINE	PLANNED	ACTUAL
Operator 1:	**Reference situation**	**Before the use case**	**After the use case**
Vehicle type n°1	*select option*	*select option*	*select option*
Number of said vehicle			
Euro emission standard	*select option*	*select option*	*select option*
Energy used	*select option*	*select option*	*select option*
Vehicle gross weight (t)			
Average energy consumption of the vehicle /100km (litre or KWh or kg)			
Average distance traveled per vehicle per delivery round (km)			
Average number of delivery rounds per vehicle per day			
Or if available: amount of energy used per vehicle per delivery round (litre or KWh or kg)			
Average quantity of goods transported when leaving the hub per vehicle per delivery round (t)			
Average quantity of goods collected during the delivery (if any)			
t*km	0	0	0

Figure 17: Details on the vehicles

Revenues

This section (Figure 18) is dedicated to the revenues from logistics services provided by the logistics operators involved in the use cases. The baseline situation is put in grey as this is sensitive information to be shared among the use case participants. However, we have collected bilaterally the total annual turnover generated by each stakeholder and have their approval to use it to compare the economic situation before the experimentation with the situation post-experimentation (see *Balances* section).

DETAILS ON THE REVENUES (€)	BASELINE	PLANNED	ACTUAL
Operator 1:			
MONTHLY TURNOVER	**Reference situation**	**Before the use case**	**After the use case**
Linked to food delivery		- €	- €
Linked to mail delivery		- €	- €
Linked to express delivery		- €	- €
Linked to reverse logistics operations		- €	- €
Linked to deliveries to parcels lockers		- €	- €
Linked to storage service		- €	- €
Linked to cargo-bike rental and repair service		- €	- €
Linked to other services		*to fill if needed*	*to fill if needed*
TOTAL TURNOVER GENERATED		- €	- €

Figure 18: Details on the revenues

Costs

This section (Figure 19) provides the most detailed breakdown, outlining all expenditure items related to the use cases. Like the other sections, it includes the baseline, planned situation, and actual situation. However, for the baseline, only the total investment and operation costs are included, as these figures are sensitive for the logistics partners.

DETAILS ON THE COSTS (€)	
BASELINE	
Operator 1:	**Reference situation**
TOTAL INVESTMENT COSTS	
TOTAL COSTS INCURRED (/month)	

Figure 19: Details on the costs

For the planned and actual situations, it is separated in three parts: the *investment costs*, the *main use case costs*, and the *added-value service(s) costs*. For each use case, the items have been linked to the types of operations implemented. Blue lines (see Figure 20) represent a cost category, linked to one type of operation, such as "*loading*" or "*last mile deliveries*" for example. Additionally, this section

allows to make the difference between the costs covered by the project's funding and the costs to be covered by the local partner. Thus, this table helps local stakeholders organise and share costs when needed (for example in the case of shared hub or mutualised deliveries).

DETAILS ON THE COSTS (€)

PLANNED

*In order to calculate the investment cost, please make sure to take into account the amortisation based on the time the equipment will be used during the use case only

	Before the use case				
INVESTMENT COSTS	Financed by DECARBOMILE (€)	Partner	Investments from local actors (€)*	Partner	**TOTAL**
purchase of LML vehicles					0
puchase of the IT system (sensors, ...)					0
infrastructure investments					0
implementation of electric charging stations					0
OPERATING COSTS (MONTHLY)	Financed by DECARBOMILE (€/month)	Partner	From local actors (€/month)	Partner	**TOTAL**
Barge delivery					
human resources (skipper)					0
onboard operations					0
maintenance of the boat					0
energy consummed					0
training					0
Loading					
cost for the use of premises					0
energy consummed by the premises					0
human resources (operations management, supervisions,...)					0
Unloading					
maintenance of the handling equipment					0
human resources (operations management, supervisions,...)					0
load break costs					0
Last mile deliveries					
human resources (cariers)					0
energy consummed by the vehicles					0
maintenance of the vehicles					0
Transversal costs					
insurances					0
maintenance on pedestrian pier offshore + onshore					0
communication					0
human resources (administration, accounting, substitution for staff shortage, etc.)					0
taxes					0
other					0
ADDED-VALUE SERVICES OPERATING COSTS (MONTHLY)	Financed by DECARBOMILE (€/month)	Partner	From local actors (€/month)	Partner	**TOTAL**
Digital tools					
informatical support					0
software licenses					0
Storage space					
cost for the use of premises					0
maintenance of the storage spaces					0
Charging stations					
maintenance of charging stations					0
TOTAL COSTS GENERATED	0		0		0

Figure 20: Details on the costs – Planned

DETAILS ON THE COSTS (€)

ACTUAL

*In order to calculate the investment cost, please make sure to take into account the amortisation based on the time the equipment will be used during the use case only

	After the use case				
INVESTMENT COSTS	Financed by DECARBOMILE (€)	Partner	Investments from local actors (€)*	Partner	**TOTAL**
purchase of LML vehicles					0
puchase of the IT system (sensors, ...)					
infrastructure investments					0
implementation of electric charging stations					
OPERATING COSTS (MONTHLY)	Financed by DECARBOMILE (€/month)	Partner	From local actors (€/month)	Partner	**TOTAL**
Barge delivery					
human resources (skipper)					0
onboard operations					0
maintenance of the boat					0
energy consummed					0
training					0
Loading					
cost for the use of premises					0
energy consummed by the premises					0
human resources (operations management, supervisions,...)					0
Unloading					
maintenance of the handling equipment					0
human resources (operations management, supervisions,...)					0
load break costs					0
Last mile deliveries					
human resources (cariers)					0
energy consummed by the vehicles					0
maintenance of the vehicles					0
Transversal costs					
insurances					0
maintenance on pedestrian pier offshore + onshore					0
communication					0
human resources (administration, accounting, substitution for staff shortage, etc.)					0
taxes					0
other					0
ADDED-VALUE SERVICES OPERATING COSTS (MONTHLY)	Financed by DECARBOMILE (€/month)	Partner	From local actors (€/month)	Partner	**TOTAL**
Digital tools					
informatical support					0
software licenses					0
Storage space					
cost for the use of premises					0
maintenance of the storage spaces					0
Charging stations					
maintenance of charging stations					0
TOTAL COSTS GENERATED	0		0		0

Figure 21: Details on costs - Actual

Social and Environmental Impact

This section of the cost sheet (Figure 22) is focused on monetising the transport externalities to assess the potential indirect monetary benefits linked to the use case implementation. In this section, the baseline situation will be compared with the actual one so it will be used especially for the WP8 assessment. Monetary benefits related to air pollution, climate change, noise pollution, congestion, and road risk were evaluated based on the guidelines from the *Handbook* on the External Costs of Transport (European Commission, 2019).

Thanks to the ratios defined in the Handbook, the monetary impacts are calculated automatically based on the t*km covered by each type of vehicle (calculated in the "*details on the vehicles*" section). The greater the transport externalities, the higher the cost. Thus, this section allows to compare the baseline with the use case implementation (actual) and to calculate a balance that should be positive thanks to the low-emission vehicles used and the optimisation of deliveries.

SOCIAL AND ENVIRONMENTAL IMPACT	BASELINE	ACTUAL	
The data presented here came from the Handbook on transport externalities costs, commisioned by the European Commission as part of the IMPACT study. Elaborated by a team of scientific and experts, the Handbook provides a methodology on how to estimate the transport externalities costs, as well as some **ready-to-use data**. Each figure presented and used in this cost sheet represents the **average external costs of transport in all EU-countries, for each category of externalities**.			
Transport externalities*	Reference situation (€-cent/tkm)	Use case situation (€-cent/tkm)	Balance (€-cent/tkm)
Air pollution*	#N/A	#N/A	#N/A
Climate change*	#N/A	#N/A	#N/A
Noise pollution*	#N/A	#N/A	#N/A
Congestion*	#N/A	#N/A	#N/A
Road risk*	#N/A	#N/A	#N/A
Air pollution (p.57, table 16): Impact costs caused by the emission of transport related air pollutions: health effect (due to inhalation of air pollutants), crop losses, material and building damages (due to pollution of surfaces and corrosion processes) and biodiversity loss			
Climate change (p.78, table 25): Costs associated with all of the effects of global warming: sea level rise, biodiversity loss, water management issues, more and more frequent weather extremes and crop failures			
Noise pollution (p.97, table 35): unwanted sounds of varying duration, intensity or other quality that causes physical or psychological harm to humans			
Congestion (p.113, table 43): impedance that vehicles impose on each other, as the traffic flow approaches the maximum capacity of the network			
Road risk (p.45, table 8): social costs of traffic accidents that are not covered by risk oriented insurance premiums			

Figure 22: Social & Environmental Impact Cost Sheet

Balances

Finally, the last section (Figure 23) of this cost sheet is the *balances*, one for each logistics operator and one for the overall use case. Based on the previous costs and revenues sections, and including the social and environmental impact section, this final part of the document assesses the economic viability of the use case but also at the level of the logistics operators. This section can help the logistic operators to define their pricing strategy, to reach economic viability.

BALANCE FOR THE OPERATORS	BASELINE	PLANNED	ACTUAL
Operator 1	**Reference situation**	**Before the use case**	**After the use case**
Turnover	- €	- €	- €
Costs	- €		
Social and environmental cost or revenue			#N/A
Profits	- €	- €	#N/A
Operator 2	**Reference situation**	**Before the use case**	**After the use case**
Turnover	- €	- €	- €
Costs	- €		
Social and environmental cost or revenue			#N/A
Profits	- €	- €	#N/A
BALANCE FOR THE USE CASE	**BASELINE**	**PLANNED**	**ACTUAL**
USE CASE	**Reference situation**	**Before the use case**	**After the use case**
Turnover	- €	- €	- €
Costs	- €	- €	- €
Social and environmental cost or revenue			#N/A
Profits	- €	- €	#N/A

Figure 23: Balance cost sheet

A key challenge encountered with this tool was the extensive data required to complete the document. Gathering figures from multiple sources, including partners outside the consortium, proved difficult due to limited accessibility. Additionally, the tool's complexity made it challenging for some partners to engage with, requiring time to explain its purpose and encourage usage. As of this deliverable's writing, the baseline situations for most use cases are nearly complete, while the estimation of planned costs and benefits remains ongoing.

In conclusion, the cost sheets can be summarized with the following visual:

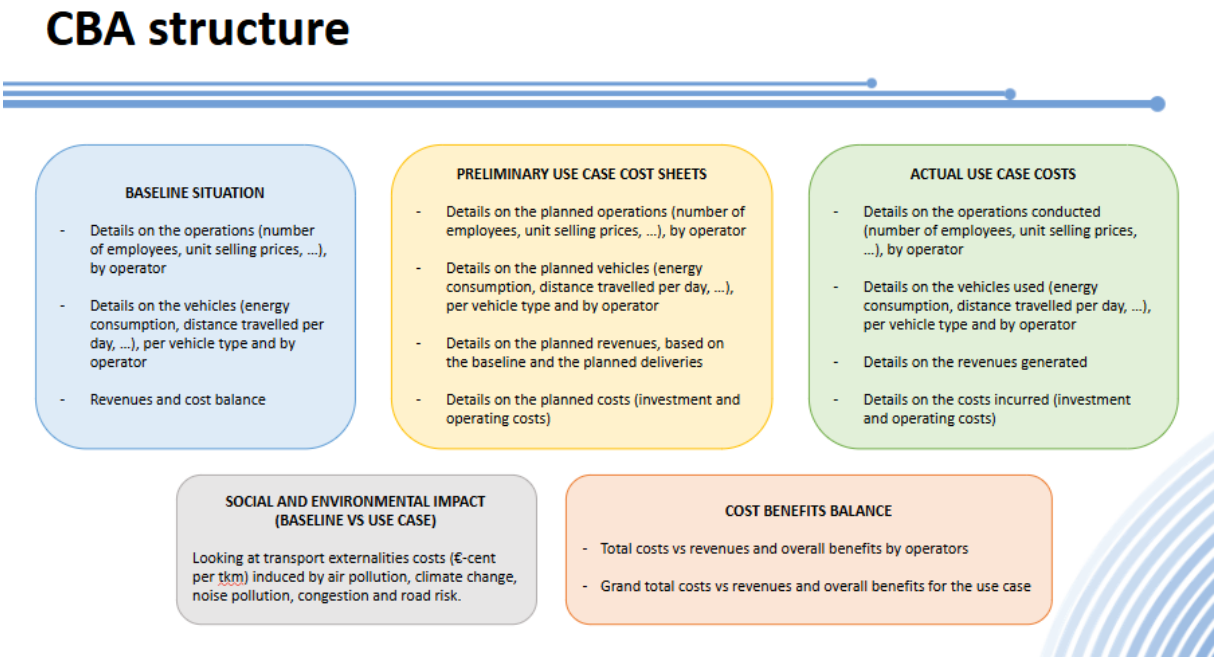

Figure 24: Cost sheets structure (source: IT)

1.9 Business model State of the art

To begin the state-of-the-art business models, the first step was to define the categories of interest for the DECARBOMILE's living labs:

- Boat delivery
- Consolidation centres
- Containerization
- Cycle-logistic
- ICT tool development
- Online platform for LSP (Logistic Service Providers)
- Smart lockers

Through the literature review, many different articles detailing economic models, lessons learned, and challenges faced were analysed. These articles allowed us to have a first overview of the most important topics to consider when defining business models for last-mile deliveries.

To conduct a relevant and efficient article search, keywords were used linked to the categories of interest defined earlier like: sustainable urban freight transport, business model cycle-logistic, modelling and evaluating, logistics system, mutualization logistic, economic issue, collaborative delivery, etc. For each type of practice, several keywords were entered into search engines. For example, "mutualization" was searched via synonyms such as "mutual sharing", "pooling", "collaboration," "joint utilisation," etc.

These keywords allowed us to search articles in several databases, firstly into the Zotero database dedicated to the DECARBOMILE project (about 750 articles), and secondly directly online (using Google Scholar for example).

Additionally, the projects' benchmark elaborated in WP1 was used as a source of information on innovative projects, to gather lessons learned and challenges faced in the implementation. Detailed

sheets outlining these projects were thus completed thanks to the literature review and the experience of the project's partners.

Erreur ! Source du renvoi introuvable. presents the results of the preliminary literature review, defining for each of the seven categories of interest the type of business models associated, and the already existing projects linked that could add interesting insights on the business models implementation.

VALUE PROPOSITION	BUSINESS MODEL ASSOCIATED	INTERESTING PROJECTS
Consolidation centre	Public grants for municipality and municipality funds	RATP bus depot SOGARIS City Depot Ephemeral hive UPS Hamburg Urby Urban Logistic Hotel Locowest
	Tender process and rental of the hub and self-sufficient infrastructure (solar panels to power the facility)	
Cycle-logistics	National and regional grants	BcKlet (w/ Urbike) Adabis MARES City Changer Cargobike CityLog Triporteurs Français Ulaads
	Private funds	
	Municipality public funds	
	Partnership w/ e-commerce company	
ICT tool dev	Public grant	Lead Logico Hanselbloc Geo-BT Roots-on-wheel iConect IDEA Barcelona data City Lab
	Funded project	
	Licensing	
	Public grant for research and private investment	
	Selling the solution developed	
Smart lockers	Renting of the equipment to e-commerce site and low rental fee to instal equipment in front of supermarkets (private space)	Kargopark Pick-up Box DeBuren parcel locker
Containerization	Renting/selling of the solution developed	Ze Combi Cluster 2.0 Last Kilometers Logistic
	Funded project for research	
Online platform for LSP	Funded project	Gisa Storm Cargomatic and Ontruck CULT CoLiVri CityLine
	Municipal funds	
Boat delivery	Private investor	Avatar Solar Ship River'TRI
	Funded project	

Table 6: Literature review results (source: CARA and IT)

Although all projects initially seemed interesting for the use cases of the living labs, the list was refined to retain only the most relevant projects for which information on their setup and economic model was available. Also, the projects involving a Public Private Partnership (PPP) received special attention.

The second step of this literature review involved complementing the findings with interviews to provide more concrete insights. The distribution of interviews was managed by IT and CARA, based on existing contacts and prior knowledge of the projects.

To obtain results allowing comparison between the interviews, an interview guide was developed (available in the ANNEXES). To facilitate contact, standardized email templates describing the request were drafted. 16 companies were contacted for interviews and had positive outcomes of 13. **Erreur ! Source du renvoi introuvable.** presents the dates of the interviews.

Project	Interview partner	Date
AVATAR	OHB	27/03/2024
CityLog	LIHH and GC group	14/02/2024
CoLiVri	CRC services	20/03/2024
De Buren parcel lockers (Surflogh project)	Municipality of Drenthe	01/03/2024
HLU – Urba logistic Hotel	LPA	25/03/2024
LDK – Last Mile Logistic	Opal Research	22/03/2024
Locowest	Locowest	05/03/2024
Pick-up Box	Renault Trucks	31/01/2024
Project LEAD	SPL Lyon Confluence	31/01/2024
Triporteur Français	Triporteur Français	14/02/2024
Ulaads - Bremen	Umwelt Bremen	13/02/2024
Ullads – Groningen	Groningen	06/02/2024
Urby	La Poste	13/02/2024

Table 7: Interview tracker for the literature review

The structure of the interview was each time slightly adapted to the services proposed by each of the companies interrogated, but the same structure was followed:

1. Business model structure
    a. Value proposition and added-value services
    b. Governance model associated
2. Economic structure
    a. Subsidy received
    b. Viability of the model
    c. Necessary investments
3. Collaboration
    a. Mechanisms to share costs and benefits
    b. Communication methods used
4. Sustainability in the business model
    a. KPIs and means of evaluation
5. ICT tools
6. Commercial risks and time-to-market
    a. Risks foreseen
    b. Risk management
7. Conclusion
    a. Scalability
    b. Lessons learned

A summary of each project was written in the corresponding sections of the literature review and allowed to draw general conclusions on business models definition.

Furthermore, to assist the decision-makers of the living labs, the conclusions from the state of the art were compiled, with the details on the challenges encountered, lessons learned, and benefits for each

category (consolidation, innovative transportation mode, digital collaboration, PPP). These sheets were designed clearly and concisely to help future readers make decisions (Figure 25).

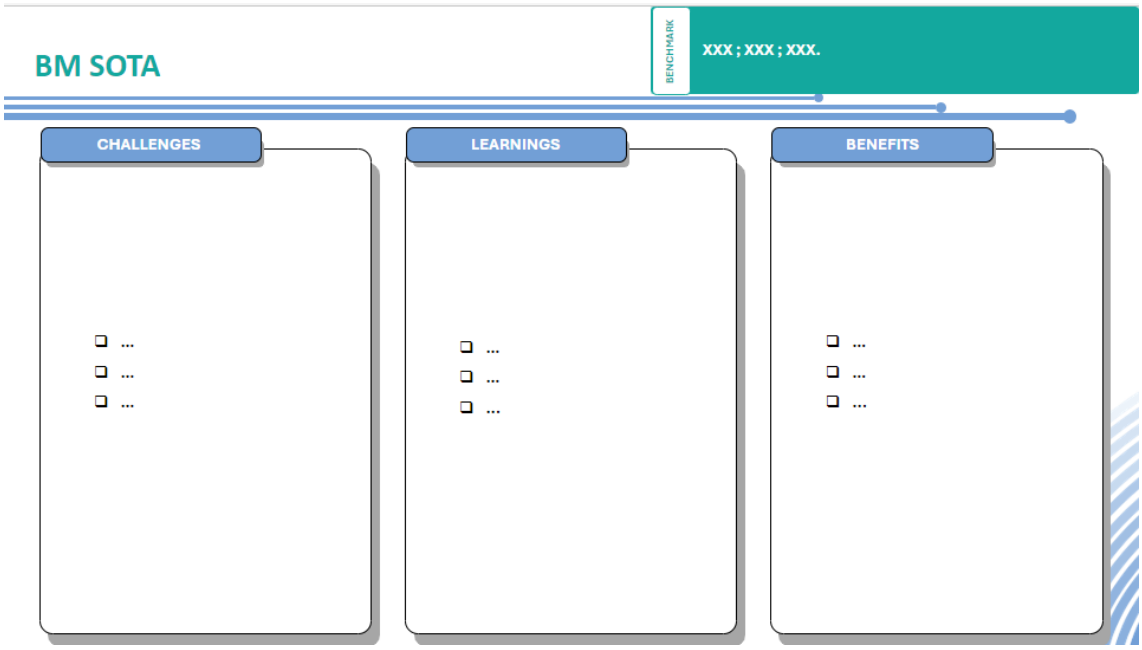

Figure 25: Template to present the conclusion of the literature review (source: CARA)

2 BUSINESS MODEL STATE OF THE ART

Following the Grant Agreement and the work carried out within WP2, Work Package 5 - Crowd Intelligence for Green Last Mile - aims to define sustainable and profitable models for last-mile logistics for the living labs. Task 5.2 specifically focuses on "Living Labs Business Models Elaboration." The goal is to prospect widely on best practices to co-design economic models, enriching them with success factors and challenges from other experiences. Finally, these learnings should enable the living labs to develop their business model for the use cases to be implemented

2.1 INTRODUCTION

In the face of escalating environmental concerns and the imperative to mitigate climate change, the business landscape is undergoing a profound shift toward decarbonisation. This document explores the state of the art in decarbonised last-mile logistics business models, examining existing literature to identify the practices carried out in the last years in the pursuit of sustainable and collaborative delivery systems.

For the definition of the existing business models, we have leveraged the extensive resources (about 750 scientific publications) of the Zotero database that was created by the DECARBOMILE's consortium.

After the examination of the scientific documents, an identification of the most relevant ones was made, taking into account the following criteria: applicability to the practical aspects of the last mile delivery, alignment with the objectives of the deliverable (e.g. the definition of the existing business models) and the content of the discussion/conclusions (paying particular attention to those documents which explained the controversies of each business model, aiming at having a nuance, deep vision of them). Those aspects regarding author credentials and the source were not considered, as they were already considered during the elaboration of the Zotero database. From this identification, several key challenges to viable business model establishment in the last-mile logistics ecosystem came out: safety issues, cybersecurity, stakeholders' hesitation regarding data sharing, etc.

Based on this analysis, some questions appeared: *how can innovative last-mile logistics effectively navigate the challenges outlined in the literature? What strategies can be employed to develop and implement decarbonised business models that are both environmentally performant and commercially viable for all stakeholders, including municipalities?* **Our hypothesis posits that a comprehensive understanding of these challenges will pave the way for innovative, sustainable solutions.**

Among the different approaches to decarbonised last mile logistics, our emphasis on **collaborative business models** stems from the recognition that addressing environmental challenges requires collective efforts, as well as from the analysis of the sector trends and its drivers, led by Amazon[12]. The analysis of the company's income statements over the years unveils a full-stack business model with seven verticals whose viability is supported by two main pillars: the monetisation of digital infrastructure (Amazon Web Services, AWS) and of supply chain infrastructure (Third party sellers services, also known as "Fulfilment"). In both cases, the strategy is to foster the mutualization of the company's assets, to gain the edge of decarbonized last mile by coordinating several action lines:

- Shared digital, that drives companies' profits.
- Shared logistics, involving diverting the companies' largest investment towards logistics, to increase assets efficiency and densify demand:

  - Focused on capillary last mile: building its physical network of mix-uses urban shops/hubs around food commerce, while securing (1) HHRR Human Health Risk Resources (by fostering best employees' entrepreneurship with the Delivery Service Partner program), (2) access to EV (through Rivian with Daimler partnership), and (3) access to RnE (main promotor worldwide of clean generation)
  - Developing its own hubs and warehouses network
  - Sharing those resources with sellers in and out its ecommerce (and imposing a fee to those Amazon sellers that do not use the company's logistics capacities)
  - Sharing customers portfolios with other sellers to densify logistics demand (opening Prime to them and allying with Shopify)
  - Promoting economic incentives (based on cost savings by mutualizing) in exchange of customers data to cope with new regulations (Amazon Shopper panel)
  - Sharing its standards to ease traceability compliance.
- Lobbying for labour and data regulations

Likewise, by focusing on collaboration (one of the five pillars of the DECARBOMILE project), we aim to unravel the synergies and complexities inherent in shared sustainability initiatives, contributing to a holistic understanding of how businesses can collaboratively advance the decarbonization agenda while improving its competitiveness according to market.

To start with, Osterwalder, Pigneur and Tucci, 2005, provide a general definition for business models: "A business model is a conceptual tool containing a set of objects, concepts, and their relationships to express the business logic of a specific firm. Therefore, we must consider which concepts and relationships allow a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences". In the case of collaboration, the literature review also highlights the following conditions for it:

- Economic interest (two or more parties working together to the benefit of both or all parties),
- Coercive factor (in the paper *Platform-based business model for sustainable last mile delivery*, the authors give the example of cities that will build UCCs and offer a new service model to service providers that benefits both parties equally. Thus, providers will have no choice but to join UCC if they want a service.)
- Trust.

On the economic interest, the literature review already performed and published in D1.1 redemonstrated that horizontal collaboration can reduce last-mile logistics costs with a small number of deliveries by up to 4.16 % and with a large number of deliveries by 24.84%.

Following this approach to collaboration, the state-of-the-art has the objective to draw lessons learnt from the current business models (BMs) that enable logistics providers to perform transportation and logistics activities more efficiently by adopting some level of collaboration. Elements such as shared urban consolidation centres, platform-based virtual collaboration through data cooperation and incentives, sharing economy, and the use of innovative last-mile vehicles were thus analysed.

2.2 State of the Art

Table 8 presents a list of relevant projects and initiatives that were elaborated within the State of the art and their relation to the DECARBOMILE project.

Project name	Brief description of project	Relationship to DECARBOMILE
Urby	Urby is a logistic service provider which focuses on flow mutualisation near the city-centres and delivery with green vehicles (electric vans or cargo-bikes).	Model of cycle-logistic innovant consolidated in urban logistics spaces.

Project name	Brief description of project	Relationship to DECARBOMILE
Urban Logistics Hotel – Lyon	The ULH was created to offer a new logistic space for urban logistics and last-mile delivery in the city centre of Lyon. The structure is composed of two buildings with a total area of 29'800 sqm and is located on the Edouard Herriot port.	An example of UCC relevant and multimodal (road, river, rail, cycle).
Locowest	Locowest is the first logistic coworking space in France.	Innovative model economic of sharing warehouse.
Surflogh	In a rural area of the province, three parcel lockers, white-branded, were put to provide locals with pick-up points for their deliveries.	Acceptability of inhabitants as a new service of the municipality.
Pick-up Box	Mobile parcel lockers autonomous and modulable.	A complete solution without load break, and a new service for inhabitants.
Triporteurs Français	Triporteurs Français is a company proposing services of cycle-logistics for last-mile deliveries, mostly for B2B delivery.	Testing new innovative vehicles that can interested LL and proposing flexible deliveries in cities were the geographical constraints
Ulaads	Is a European project in which a trial for cargo-bike sharing was tested in the city of Groningen.	Example of cycle-logistics which can be replicate in the LL.
CityLog	Last-mile delivery with cargo-bikes for construction sites.	A concrete use case model for cycle logistics
AVATAR	Is an Interreg project which consists in transporting construction materials with an autonomous and zero-emissions barge on inland waterways.	Project multimodal and a use case of river logistic and reverse logistic (wastes).
River'TRI	Is an experimental river recycling service located in Lyon	A model of income economic for municipality thanks to river logistic, and a strong PPP.
Last Kilometre Logistics - LDK	Two uses cases: freight tram and freight barge, one in Montpellier, one in Toulouse (France).	Project which studies BMs, and two experiments in collaboration with local authorities.
Amsterdam Intelligent Data Exchange Alliance (IDEA)	By validating the planned road works, using live data (from floating car data), IDEA generates a high quality, real-time data feed for road works.	Project led by a municipality, improve the quality of the data and the capacity of take decisions.
Barcelona data City Lab	Development of a tool, it was made possible to assess the maximum surplus of solar energy generated from municipal buildings and public spaces in relation to the maximum impact on the spending of households in a situation of energy poverty.	Tool to aid decision and increase concretely the quality of life thanks to data sharing. Example of role and responsibility of each stakeholder.

Project name	Brief description of project	Relationship to DECARBOMILE
GISA Platform	Online platform, managed by Getafe municipality, will serve as an intermediary between sellers in Getafe and customers, and proposing delivery with cycle-logistics.	An example of project monitoring by the municipality
Lead	Designs and develops a simulation-based impact assessment environment and a Digital Twin Model, for evaluating alternative city logistics strategies.	Tool to aid make decision for the municipality with different scenario. An example of project with different scale of data sharing.
Logico	The aim of the project is to create a platform to help locate where to put primary and secondary hubs to minimize time and distance travelled.	Tool to aid make decision for the municipality for the location of UCC
Roots-on-Wheel	This solution acquires real-time data from NGS devices installed onboard and allow the users to track their vehicles.	Example of a use case of tracking vehicles and optimisation of emissions.
Cargomatic and Ontruck	Cargomatic is a Platform as a Service (PaaS): it operates as a platform connecting shippers with carriers, acting as an intermediary to facilitate transactions and optimise logistics processes.	A win-win situation between network participants and customers.
CULT	Creating collaboration between shippers to bundle their freight and mutualise the resources to minimize the negative externalities of urban logistics.	ICT tool and software for collaboration, tested in different cities with their own characteristics.
CoLiVri	It proposes three types of digital support via algorithms: tracking, operations optimisation, and flow mutualisation.	Help to support tactical and strategical decision making.
CityLine	Foster the development of a regional wide platform enable to connect cycle logistics operators in different cities with shippers with addresses to deliver across all those cities.	Example of non-successful collaboration and the share of data between shippers and carriers

Table 8: List of the projects analysed for the literature review

2.3 Conclusion

In summary, successful projects often owe their achievements to effective public-private partnerships (PPPs) in logistics. These collaborations combine governmental regulatory frameworks and infrastructure with private sector expertise and investment. Various types of PPPs exist, including service and management contracts and joint ventures tailored to specific needs. In urban logistics, PPPs play a vital role in regulatory frameworks, consolidation centre creation, smart city platforms, and vehicle availability. Revenue models within PPPs include usage fees, data services, advertisement, and real estate development, illustrated by projects like London's Ultra Low Emission Zone and Maasvlakte 2 in the Netherlands. These collaborations represent a joint commitment to building sustainable and resilient logistics ecosystems for urban development.

Regarding consolidation, the document explores three complementary types of consolidation structures: urban consolidation centres (UCCs), shared warehousing, and parcel lockers. UCCs, strategically located in densely populated areas, facilitate efficient last-mile delivery using smaller, green vehicles like cargo bikes. Shared warehousing reduces costs by mutualizing resources among carriers, offering flexibility and efficiency. Parcel lockers, situated in city centres or residential areas, provide consumers with convenient pick-up options. UCCs play a pivotal role in the supply chain by optimising delivery plans, utilising cleaner vehicles, and reducing environmental impact. However, their implementation faces financial challenges, including equitable cost-sharing mechanisms and the need for transparent collaboration among stakeholders. Overcoming these barriers is crucial for the success of UCCs and other urban logistics collaborations, emphasizing the importance of clear communication and fair distribution of benefits.

Innovative transportation modes offer promising avenues for greener deliveries, with cycle-logistics emerging as a key solution for last-mile challenges. The potential to replace a significant portion of motorized trips with bicycle transport underscores its viability and benefits, including reduced traffic congestion, noise, and enhanced flexibility. Projects like MARES have demonstrated the economic validity and demand for cycle-logistics, emphasizing the importance of public support and strategic partnerships in advancing this model. CAPIT's findings emphasize the necessity of a customer-centric approach and the importance of balancing demand and supply factors for sustainable last-mile systems, setting the stage for DECARBOMILE's methodology. Beyond cycle-logistics, exploration into river logistics and containerization further expands the repertoire of greener delivery options. While challenges such as initial investment costs exist, municipal support and collaborative efforts hold the potential to overcome these barriers and pave the way for a more sustainable urban logistics landscape.

Finaly, on digital collaboration, the document showcases the different possibilities that can be achieved thanks to digital tools and collaboration. The Freight Share Lab Platform (FSLP) project for example, illustrates efficient transportation task performance through platform-based collaboration and gain-sharing models. Collaboration in freight logistics includes vertical, horizontal, and multilateral approaches, tailored to various coordination structures and activities. DECARBOMILE aims for equitable, horizontal collaboration, distinguishing between exclusive-focused and opportunistic collaborations. Success relies on robust technical infrastructure, emphasizing data sharing and digital tools. Data Spaces, supported by the European Commission, promote fair data exchange, essential for DECARBOMILE's framework. Digital tools for urban logistics include infrastructure management, marketplace mutualization, and services for operators, fostering agility and sustainability. Dynamic operation tools integrate real-time data, while network orchestration platforms like Logistic-as-a-Service (LaaS) optimise resources. Overall, digital integration signifies a strategic shift towards responsive, sustainable urban logistics, driving innovation and efficiency.

3 BUSINESS MODEL SUITABILITY

As part of Task 2.5, HAM was responsible for assessing the suitability of the WP5 BMs with local stakeholders and their respective networks. Given the co-creation approach employed in defining UCs and BMs, part of this assessment was inherently carried out during the UC definition phase. This ensured that each UC aligned with the legal, social, and environmental frameworks of the respective LLs while also adapting to the needs and constraints of stakeholders. CBS finalised the suitability assessment through the Use-Case stakeholder interviews conducted in August–September 2025.

To document this co-creation process, each LL has summarised key adaptations made during the first half of the project. This report outlines these adaptations, focusing on the following guiding questions:

- What changes and adjustments were implemented to ensure that the Use Case/Business Model fits the Living Lab's needs?
- What challenges did the LLs encounter that led to BM adaptations? (e.g., in Hamburg, changes in routes, loading/unloading sites, vessel adaptation, etc.)

3.1 HAMBURG LL

During the first half of the project, valuable insights emerged, particularly regarding testing different implementation options. Several unforeseen challenges and framework conditions that were not initially considered or known have surfaced, having had a significant impact on the planning and execution of the project.

One of the key aspects that has proven essential for the project's success is ensuring a stable supply chain and timely deliveries. These factors have greatly influenced the adaptations made throughout the project.

Changes to the Original Use Case

Initially, the project envisioned three separate use cases:

1. Courier, Express & Parcel (CEP) deliveries,
2. Trade and industrial retail supply,
3. B2B transport focused on small and medium-sized enterprises (SMEs).

However, the project's scope has been narrowed down to UC 1, focusing on CEP deliveries. This decision was driven by several factors:

- Time and delivery constraints from the partner DPDHL,
- Limited compatibility with the other use cases,
- The need for stable, daily availability of DPDHL routes.

As a result, the TOP Mehrwert was excluded from the DECARBOMILE UC due to the high delivery demands placed by DPDHL.

Reduced Transport Flexibility

Transport flexibility has further been limited by e-vessel construction changes and loading and unloading site adjustments. The e-vessel was originally designed for the low-current channels of the Elbe River but now needs to navigate stronger tides and currents on the main northern branch, requiring more propulsion power. Tide-dependent water levels and mooring site conditions also required a scissor lift installation, reducing cargo space and leading to the decision to focus solely on UC1.

Changes to the Loading and Unloading Sites

Several adjustments were made to the loading and unloading sites:

- Loading Site: The original site was chosen for its proximity to the water. However, it had to be moved to a rowing club leased from the city to accommodate the e-barge charging station, making it publicly available.
- Unloading Site: Relocated due to lack of e-bike access at the original business district site. While the new site is more accessible for the vessel, it is farther from retail shops. As a result, DPDHL now delivers to private customers, but B2B deliveries are no longer viable.

Route Adjustments and Operational Constraints

Intermediate stops were removed for support and timing, limiting service to only DPDHL. Safety rules also prevent using the vessel as a mobile UCC, as only trained skippers can be onboard.

Lack of a Neutral Hub Manager

At present, no neutral hub manager is overseeing the project. While it could theoretically be the city taking on this role, no such manager is available. As a result, DPDHL is responsible for organizing the hub, and no other competitors are included in the current use case.

Focus on Operational Stability and Pilot Phase

All these changes were implemented to enhance the operational stability and punctuality of the project. These aspects are crucial, given the high demands placed on the reliability of the vessel. Therefore, no other delivery companies are currently involved in the project. Moreover, the project is limited to a pilot phase, with expansion requiring Elbe River crossings to bypass mobility bottlenecks and compete with land transport.

3.2 ISTANBUL LL

The DECARBOMILE project aimed to transform urban logistics in Istanbul through consolidation centres, alternative vehicles, and digital tools. While the initial plans were ambitious, implementation revealed unforeseen challenges that required adaptations.

Urban Consolidation Centres (UCCs) and Micro Consolidation Centres (MCCs)

Initially, UCCs and MCCs were planned for high-traffic districts Beşiktaş, Kadıköy, or Fatih to centralise last-mile deliveries and reduce emissions. However, budget constraints, delays in securing permissions, and site limitations led to later-than-expected location decisions, reducing the expected sustainability benefits (reduced vehicle mileage and more efficient delivery routes).

Deployment of Alternative Vehicle Types

Alternative vehicle deployment faced setbacks due to limited charging infrastructure, weather conditions, and Istanbul's hilly terrain. Adjusting fleet management systems also took longer than planned, delaying the transition to low-emission vehicles and requiring a temporary hybrid approach.

Stakeholder Involvement and Coordination

Stakeholder coordination proved more complex than anticipated. Some logistics operators were reluctant to adopt shared consolidation models, and smart parcel lockers -initially a key feature- were not widely used due to incompatibility with instant delivery services. To maintain engagement, the project shifted focus to solutions tailored to partners like MIGROS, limiting the implementation of large-scale networks.

Utilisation of Digital Tools and Algorithms

Digital tools such as predictive algorithms required extensive data preparation and testing, delaying their integration. Compatibility issues with historical data slowed progress, preventing the full realization of cost and efficiency gains within the original timeline.

Adjustments in Location Selection and Operational Constraints

Location selection and operational constraints further complicated implementation. While the initial sites were chosen for their central locations and proximity to major traffic hubs, they presented practical challenges once implementation began. Some initial sites lacked e-bike access or required costly modifications, forcing relocations to less optimal locations and reducing last-mile efficiency. Although these new sites allowed the project to move forward, they were not as close to retail areas or major transit points as originally planned.

Lessons Learned and Moving Forward

Despite these challenges, the project has provided valuable insights into urban logistics in a complex metropolitan environment: flexibility in planning, stronger early stakeholder engagement, and realistic timelines for digital tool integration. While implementation diverged from initial plans, the adaptations made have paved the way for more sustainable urban logistics in Istanbul.

3.3 LOGROÑO LL

Initially, the project proposal envisaged several use cases to be investigated, leaving room to identify other potential use cases during the co-creation process. In particular, the following use cases were originally mentioned:

- Integration of local retailers in the last mile logistic system, easing their competition against big e-commerce platforms.
- Parcel delivery with cargo bikes and e-vehicles connected with T&T&M tools and combined with smart lockers.
- Reverse logistics with local retailers.
- Fresh and frozen food green delivery for hotels, restaurants and bars.
- Train-cycles and bus-cycles intermodality, given the proximity of the intermodal hub.

Through co-creation with external stakeholders, implementation options have been assessed and adapted to the local needs and available support, resulting in three defined use cases:

1. Micro Hub for Cargo Bike Logistics: Goods are consolidated for last-mile delivery by cargo bikes, with secure cycle parking. A test will run with DHL and an association with a shared cargo bike.
2. San Blas Market UCC: The municipality will hire a last-mile cargo bike service, manage UCC storage, and test reverse logistics with recycling company Jimeno Tagús. This service targets fresh food market merchants and local retailers, with a planned DHL test.
3. Smart Lockers Network: Provides delivery points and temporary storage for local retailers and shoppers.

These use cases, with adaptations, align with initial plans, except for train-cycle and bus-cycle intermodality, which proved unfeasible due to timing and lack of support.

Urban Consolidation Centre

The initial UCC site at the old bus station was discarded due to a new public use. After evaluating alternatives, the underused and recently renovated San Blas Market was chosen.

Micro Consolidation Centre

Two planned micro hubs were merged into one for more space, introducing the concept of a nano hub. A planned food and beverage consolidation hub will now be tested at the UCC instead.

Smart Lockers

Due to strong retailer interest, three smart locker modules will be installed in commercial areas rather than the micro hub as initially planned.

External Stakeholders

T&T&M tools

Cargo bikes will test T&T&M tools, but fewer than expected due to data-sharing concerns in the competitive logistics sector. Low retailer digitalisation also posed challenges.

Stakeholder Involvement & Commitment

Securing external support has been difficult, especially in selecting UCC and MCC operators, prompting discussions on greater involvement. However, smart locker testing was adapted to meet retailer needs.

Lack of Cargo Bike Logistics Operators

One of the key weaknesses for the Use-Cases is not having a cargo bike operator in Logroño. The LL aims to solve that with a public tender after identifying potential stakeholders that need a small boost to enter this business, during in the co-creation process.

3.4 NANTES LL

During the first two years of the DECARBOMILE Project, Nantes faced challenges in defining its Use Cases. Aligning them with public policies led to key adaptations.

Initially, three use cases were planned:

1. UC1: shared hub in pedestrian area for parcels & construction materials: MCC at Parc des Chantiers with two sub-use cases.
2. UC2: Bus depot for temporary parcel storage.
3. UC3: Mobile Hub using parking spaces for fresh products and beverages.

UC1: A site visit on 05/12/2023 determined that delivery density (approximately 7 trucks and 1 LCV/ hour) in “Ile de Nantes” (Parc des Chantiers) was too low to justify an MCC. Space regulations were already effective in reducing truck traffic, leading to a shift toward leveraging existing logistics hubs with innovative processes.

UC2: Bus depots are too far from the centre, making logistics inefficient. Alternative delivery methods have since proven more cost-effective. Additionally, limited night storage space further complicated feasibility.

UC3: The company Pomona did not pursue this use case, likely due to other priorities. Additionally, storing the bikes in a city-centre parking or reloading them onto trucks at day’s end could be challenging and could require more space than expected.

The challenges outlined led to adaptations in the UCs, resulting in:

- Leveraging existing logistics hubs and processes.
- Hybrid logistics station
- Container in public space.

The first is active with Tout en Vélo / Heppner and Triporteurs français, while a scientific partner analyses vehicle tracker data. UC2 is delayed until summer 2025 due to a lack of a hub manager. UC3 is exclusively operated by Triporteurs. A contract with the space owner and the TRI is being finalised to allow container modifications, set to arrive in spring, with implementation planned for April- May 2025.

These changes have delayed the project but are essential for its success. The priority remains a strong experimentation phase, with long-term scaling depending on external partners.

4 LIVING LAB-SPECIFIC RESULTS

This section presents a comprehensive analysis of the outcomes of WP5 derived from each use case, offering insights into their strategic, operational, and economic dimensions. Totally there are four Living Labs: Hamburg, Istanbul, Logroño and Nantes. Each Living Lab has between one to three Use-Cases. For each Use-Case, the results of the following aspects will be summarised:

1. Added Value survey results (T5.1)
2. Value proposition (T5.2)
3. Time to market (T5.2)
4. Sustainable Business model Canvas (T5.2)
5. Success Factors (T5.2)
6. Operational Risks (T5.2)
7. Long-term perspective and scalability potential (T5.2)
8. Governance model (T5.3)
9. Cost structure including reflection on economic viability and revenue models (T5.1 & T5.2)

Reading the results, it is important to consider that despite the efforts of unifying the results across the Living Labs and their Use-Cases, region-specific challenges can lead to noticeable differences in the comprehensiveness and details of certain aspects. This is due to variations in the levels of stakeholder access and engagement and differences in the overall Use-Case development progress. As introduced in the methodology section, several results are building up on information gathered in stakeholder workshops, where despite utilising the same tools, outcomes are never guaranteed. Additionally, it is important to mention that the process of defining the Use-Cases and developing the Business model is dynamic and not finalised until the actual implementation phase. Therefore, the results in Erreur ! Source du renvoi introuvable. give an insight into the status of M30 of the DECARBOMILE project. Finally, the integration of ICT tools was still not fully decided on at the time of the BM development. Therefore, the current BM will not reflect on the business opportunities of the ICT tools in detail. Within WP6, the data cooperation canvas will be utilised to bridge that gap.

Use-Case	Brief outline of process	Stakeholder	Resources
Hamburg			
Waterlogistics	The Use-Case will utilise the waterways and canals from the Billbrook district, a major industrial and commercial location in Hamburg, to the city centre. Parcels will be stored in a DHL container at the unloading side and distributed by electric Cargo-bikes.	HAM Municipality Logistic Operator Barge operator Technical Partners	Electric Barge Electric Cargo bikes Micro Hub (Container) Charging Infrastructure Sensors & Software
Istanbul			
Enhancing logistic operation with ICT tools	MIGROS will use 100m² of a 482m²-hub to store products and will operate instant deliveries with electric cargo bikes. The Use-Case will utilise demand forecasting and optimisation algorithms to increase the planning efficiency of MIGROS deliveries.	Logistic Operator Technical Partners	Hub / Store Sensors & Software Electric Cargo Bikes Charging Infrastructure
Urbane Consolidation Centre	There will be an installation of a UCC with two separate parts for consolidating logistic flows of two operators. Last mile logistic will be carried out with electric cargo bikes covered by each logistic operator themselves. Added Value Service: Installation of Smart lockers / Parcel lockers at a nearby Bus-Station.	IST Municipality Logistic Operators Technical Partners	Urban Consolidation Center Electric Cargo bikes Charging infrastructure Sensors & Software
Logroño			
Logistics Consolidation	A micro-hub will be installed near the old town at Parking Revellin for logistic operators and distributors to store parcels. The parcels will be delivered to end-consumers and	LGN municipality Logistic operators	Micro Hub Electric Cargo bikes Charging Infrastructure Sensors & Software

Use-Case	Brief outline of process	Stakeholder	Resources
	shops by electric cargo bikes. The micro-hub will provide storage and charging for the cargo bikes.		
Urban Consolidation centre	The UC is focused on consolidating flows from the local market San Blas, with the creation of a consolidation centre in its basement. Different logistic operators will bring and store their parcels in the basement of San Blas market. Consolidation would be done on the ground floor (25smq² available) and the last mile delivery will be covered by a cycle-logistic operator with electric cargo bikes. Added Value: Reverse logistic for collecting recycling and trash from restaurants with the Cargo bikes to be temporarily stored at San Blas Hub until pick-up.	LGN municipality Logistic operator Cycle logistic operator Local shops at San Blas market Recycling operator	Micro hub with lockers Electric cargo bikes Charging Infrastructure Sensors & Software
Smart Lockers	Logroño will install smart lockers at different locations in the city centre. The lockers will serve two main functions. First, they will provide storage for citizens to store their bags or shopped goods while visiting the city or going to a restaurant. Second, they will allow local shops to sell goods outside of opening hours by utilising smart lockers as self-service pick up stations. Shops can store the goods purchased online to be picked up by citizens.	LGN municipality Smart locker provider	Ground space Smart lockers Software
NANTES			
Cargo bikes implementation	In this UC, two different ways will be used to amplify cargo bike deliveries. First, the existing Micro Hub from TRI at Rue des Olivettes will be utilised to test trackers and sensors attached to new cargo bikes. The gathered data will feed into ICT tools to increase delivery efficiency. Second, Tout en Vélo utilises the SOLILAB, at Ile de Nantes as a consolidation hub for shipments from Heppner and other suppliers. This enables optimised last-mile delivery via cargo bikes, improving urban logistics efficiency.	Logistic Operator Logistics Service Provider Cycle logistic provider Infrastructure provider Technical Partners	Micro-Hub Cargo bikes Sensors & Software
Temporary Micro Hub	A logistics station will serve as a temporary micro hub for urban logistics. From the station, last-mile deliveries will be conducted using cargo bikes. There are three different user scenarios: (1) Residents within proximity to the logistics stations will be able to rent bikes and trailers for personal use. (2) Craftsmen who work in the city but live outside Nantes will be able to park their vehicles at the logistics station. (3) Logistics companies will be able to drop off goods at secure lockers in the morning hours.	Nantes Municipality Logistics Operators Technical Partners Local Craftsmen Residents Space owner	Ground Space Smart Lockers Cargo Bikes Sensors & Software Security Equipment Charging Infrastructure Cycle Repair Tools
Consolidation Hub	Two repurposed shipping containers will be utilised as a consolidation hub. The containers will be modified to operate using solar panels installed on their roofs. Two containers will be used as a storage space and a third and smaller one as a social space. It will be installed at the former Marché d'Intérêt National (MIN) at Ile de Nantes.	Logistics Operator NTN Municipality Space owner (SAMOA)	Ground Space Containers / HUB Cargo Bikes Charging Infrastructure

Table 9: Overview of the use-case in the living labs

Reviewing the BM-results, it is important to take the different frameworks of each Living Lab into account, especially highlighting the different baselines they were starting off from.

Hamburg: In the Hamburg Living Lab, the key stakeholder and logistic partners are part of the consortium, and the Use-Case was mapped quite early on. Additionally, while mapping potential added value services, the LL focused on one Use-Case and its minimal viable business, making it easier to oversee the definition. The core challenge is that there is no existing logistical infrastructure for water logistics which was balanced with DHL as a strong logistical partner providing the delivery infrastructure to build the use-case within. During the interviews, the DHL partner stated that DHL's

scale and processes bring both advantages and challenges to the use-case. While DHL ensures stable traffic flow, its strong labour unions and internal regulations limit flexibility. For instance, there are strict guidelines regarding data sharing, which prevents sharing certain information that could have benefited the project. This constraint is seen as a dealbreaker and suggests that a smaller logistics provider might have been more flexible in this use-case.

The Public-Private Partnership (PPP) proved to be highly beneficial for all stakeholders by fostering connections and facilitating meaningful exchanges between the private and public sectors. A key success factor of the project was therefore the close cooperation between DHL, the city, and other key stakeholders. During the interviews, DHL highlighted that the project enabled them to expand its network and establish valuable contacts, such as with the Authority for Economy and Innovation (BWI). Through this partnership, DHL was able to engage in constructive discussions on logistics-related issues. The mutual learning facilitated by this exchange of perspectives has also been a significant benefit. For example, DHL provided city authorities with valuable insights into the scale of its delivery operations and the challenges posed by certain restrictions. Conversely, city authorities were able to better understand the critical role that logistics providers play in urban infrastructure. This closer cooperation has strengthened the relationship between public authorities and logistics providers, highlighting the value of collaboration in addressing urban logistics challenges.

Istanbul: Like Hamburg, Istanbul's Key stakeholders are part of the consortium. Nevertheless, in UC3 they also included external stakeholder. In Use-Case 1&2 the LL is utilising preexisting infrastructure and logistic processes from Migros, thus exploring how ICT tools can be utilised to enhance a business model. The business can therefore be seen as an added value service.

Use-Case 3 is about establishing new logistic infrastructure through the construction of a new consolidation centre in the city, the logistic operations are again utilising preexisting infrastructures. Additionally, the Use-Case will start with the minimum viable consolidation for the test phase and consider mapped possibilities for expanding the consolidation after a successful trial. Here the PPP between IMM and the logistic partners MIGROS and Iletmen did play a key role. Iletmen mentioned during the interview that the impartial and supportive stance of Istanbul municipality gave them the needed reassurance and security to participate in the project. For IMM, the Use-Case helps to promote and highlight the potential that a PPP brings to the private sector. IMM states that the Use-Case will show private operators that it is beneficial to work with the municipality and that they can receive support. Thus, spread the knowledge since most private operators are not familiar with that the municipality can take a role or can make their operation much better with the help of the experts for example.

Logroño: In LGN-Living Lab it was more difficult to design the Use-Cases and related Business models since they are building on limited preexisting infrastructure. While INT is providing a strong partnership for setting up new logistic infrastructure, other important stakeholder, especially for the logistic operations are not part of the consortium making it harder to cooperate. The first Business models is designed to add an additional value to DHL's preexisting logistic service through implementing a micro hub and Cargo bikes. Due to limited experiences with consolidating last mile logistic flows all BM aim to focus on the minimum viable business. In Use-Case 2 the key challenge is that neither established partnerships or strong experiences logistic partner nor logistic infrastructure is available, thus the business is building from scratch. Especially the lack of last mile operators is a challenge since this Use-Case is combining the launch of logistic consolidation while also trying to implement the utilisation of Cargo bikes for the last mile delivery.

Finally, the Use-Case 3 is a great example of how despite limited partnerships and resources, cities can implement last mile logistic alternatives. The usage of smart lockers to offer storage for citizens and tourist combined with the possibility for shops to utilise them as pick up / out of business hour sales point provides a great ground structure that can be upscaled and complemented through cargo bike implementation.

Nantes: In Nantes, the Living Lab demonstrates how municipalities can actively shape urban logistics by repurposing existing infrastructure and fostering collaboration between private operators. The three use cases explore different strategies for integrating cargo bikes and micro hubs into the city's logistics ecosystem, highlighting the potential of sustainable last-mile solutions. The TRI hub and the ancient MIN logistics station can provide real-world testing grounds for innovative cargo bike tracking and flow consolidation, demonstrating the feasibility of scalable, low-emission alternatives. Additionally, the consolidation hub, designed with solar-powered containers, underscores the importance of energy-efficient solutions in urban logistics.

A key takeaway from Nantes is the municipality's role as both a facilitator and a regulatory supporter, enabling private logistics operators to test and refine their services within an optimised urban framework. The use cases emphasize the importance of shared infrastructure, multimodal logistics, and public-private cooperation in creating a more resilient and adaptable urban logistics network. While challenges remain, particularly in securing long-term financial models, the Living Lab in Nantes illustrates how cities can leverage existing assets and partnerships to transition toward more sustainable, efficient, and socially responsible urban logistics systems.

With this background in mind, following the results for each of the Use-Cases in detail.

4.1 Hamburg - Use case 1

The LL will focus on using the waterways and canals from the Billbrook district, a major industrial and commercial location in Hamburg, and the city centre. The **loading point** will be in b. d. Grünen Brücke 3 and the **unloading point** will be located at the sluice "Schaartorschleuse".

A total of **4-5 delivery staff** will deliver 12 containers per day (Monday to Saturday = 6 days a week) to the customers (private and companies) located there. The barge is expected to arrive at **the unloading point** by 11am at the latest (leaving the warehouse around 8am), to provide customers with a quality delivery service. **3 to 4 DHL cargo-bikes** with a loading capacity of 1.8m3 are planned to be delivered to the Neuer Wall area. This type of cargo-bike has mobile parcel containers attached to vehicles that can be stored if needed. In this use case, **12 parcel containers** are foreseen and would be stored in **two micro-hubs** (DHL containers) at the unloading side.

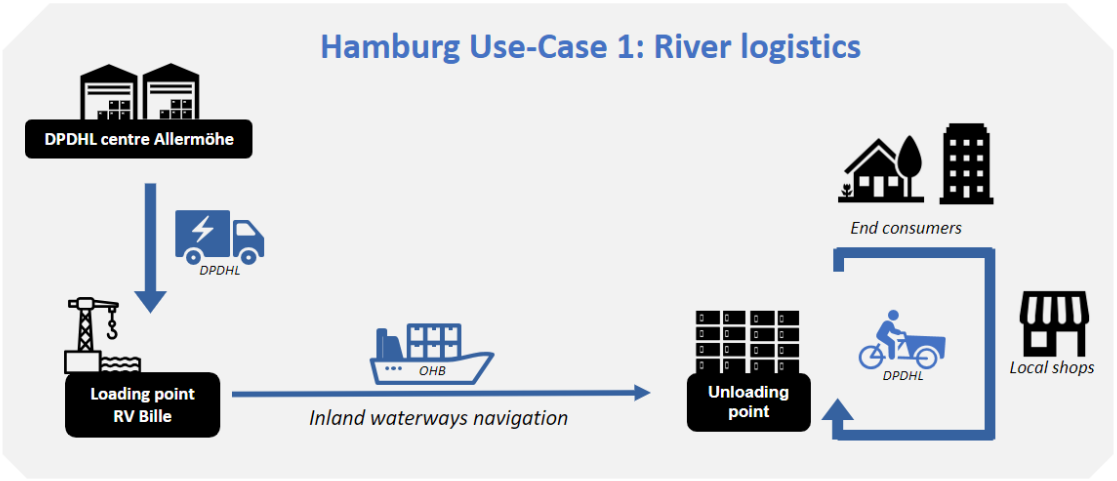

Figure 26: Hamburg: Use-Case 1: River logistics

Hamburg discussed different added value services that could be implemented in the Use-Case. First, to utilise the return trip of the barge for other purposes once all the containers have been brought on land and into the micro hub. For example, offer laundry and delivery services for the hotels and businesses in the area or collect waste and bring them in recycling centre.

Second consideration is about **adding one or several additional stops with micro consolidation centre** or **parcel lockers as pick-up and return point** along the route of the barge (that can be extended as well) to enhance the area for cargo bike deliveries. All these considerations were co-created with the local partners, and notably through a survey sent which resulted in the definition of the most interesting services to be added (Figure 27)

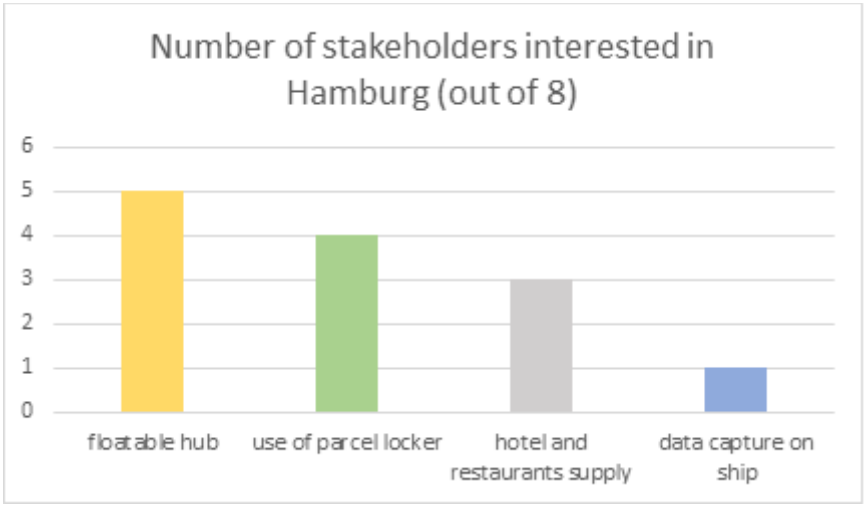

Figure 27: Level of interest of the local stakeholders in the added-value services (source: IT)

Due to the experimental nature of the use case and the inability to utilise preexisting logistic infrastructure, the Living Lab decided to first focus on the minimum viable use-case and leave added value services for potential future implementations. During the interviews in September, HAM stated that given that the project is already ambitious and challenging to implement, it is advisable to concentrate on the core goals of the use case, rather than expanding into additional side-services at this early stage. This will help streamline efforts and ensure that the key objectives, such as optimising logistics and utilising waterways efficiently are met.

Value Proposition

For the Hamburg municipality, the Use-Case provides the opportunity to focus on the decarbonization of logistics, specifically the transport of goods into the city. A major challenge in Hamburg is traffic congestion, particularly related to logistics operations, thus shifting goods transport from roads to waterways provides a chance to improve logistic efficiency. Additionally, waterways were historically used for transporting goods into the city. The use case aims to explore and test the viability of reintroducing waterways for inner-city logistics, a concept that has not been utilised for over a century. New innovative solutions like this support Hamburg's status as a forward-thinking harbour city with modern logistics capabilities. For DPDHL, the use-case presents an opportunity to explore alternative routes that bypass Hamburg's heavily congested roadways, where approximately 10% of deliveries to distribution centres are delayed due to traffic. The project offers the benefit of assessing the feasibility of waterway logistics while the close cooperation with the municipality has enabled DPDHL to expand its network and clarifying legal requirements and identifying the relevant authorities for future collaboration. Finally, OHB hopes that the testing of a new vessel will provide a baseline for future projects and developments in water logistics.

4.1.1 Business Model

Time to market

The time to market for the Use-Case in Hamburg is estimated to be 1-2 years, driven by several interconnected factors. Developing and constructing the necessary infrastructure is time-intensive,

particularly in a city where space for loading and unloading hubs is scarce, and existing facilities, such as low bridges and limited sluice operating hours, create logistical hurdles. Utilising waterways for logistics within the city is a new concept with no recent precedents to rely on. This introduces a high level of uncertainty and complexity, similar to starting a new venture with numerous challenges and hurdles. Regulatory approvals add complexity, with numerous small, localized regulations and fragmented responsibilities requiring significant time to navigate and coordinate among stakeholders.

Adapting equipment to Hamburg's unique conditions has also proven demanding. The river poses significant navigation difficulties due to factors such as tidal variations, unpredictable weather conditions, and the presence of other waterborne traffic. These complexities need to be carefully managed to ensure safe and efficient operations. Therefore, the vessel requires extensive modifications like doubling of its engine power and higher railings due to the strong currents and winds in Hamburg. Finally, the cargo bikes and their containers needed custom solutions, like a scissor lift, to integrate smoothly into existing operations. The vessel is full of electronics, making it more complex to sail and potentially requiring more of an engineer as a skipper. This adds to the already existing resource limitations, including a shortage of skilled personnel like skippers and delays in acquiring materials, which further slows the process. High costs—driven by unforeseen regulatory requirements, technical complexities, and expensive materials like aluminium—add another layer of difficulty.

Finally, environmental, and geographical factors, such as unpredictable weather and the need to transport the vessel from Ghent to Hamburg, compound the delays. The vessel is developed in Ghent by OHB which increases the difficulty of testing it on side. It is estimated that the transportation costs of the vessel are around 27000 Euros.

Nevertheless, the Living Lab brought together all necessary stakeholders, establishing strong partnerships that provided critical expertise and access to resources enabling a quicker development. DHL, as an experienced logistics operator, contributed its established processes, equipment, and personnel, while Bezirksamt Mitte played a key role in navigating regulatory approvals, supporting the adaptation of loading, and unloading sites.

Operational risks

For the Hamburg Use-Case several operational risks could be identified, each with varying degrees of likelihood and impact. Effectively managing these risks will be crucial to ensure smooth implementation and a successful use case operation.

Low Likelihood & High Impact Risks include rare but potentially disruptive events. For instance, the sudden departure of a skipper could lead to significant operational delays due to the difficulty of finding qualified replacements. To mitigate this risk, it would be ideal to have a backup skipper available or potentially partnering with a local maritime training institution. Similarly, equipment issues—such as malfunctions with the vessel, scissor lift, or sorting machines—pose serious threats to the continuity of operations. Therefore, OHB already identified the need to have an engineer on side to monitor the operations. External disruptions, like parcel damage, destruction of the hub, or unforeseen construction causing closures of sluices or bridges, could also result in substantial delays. Even minor oversights, such as misplaced keys to the MicroHub or cargo bikes, may lead to temporary interruptions. A robust incident response plan, including backup equipment and predefined alternative routes will support operational resilience.

High Likelihood & High Impact Risks: More likely risks such as illness among boat personnel, can halt operations entirely. To mitigate this, cross-training personnel to perform multiple roles could ensure continuity in the event of unexpected absences. Technical failures and adverse weather conditions, such as strong currents, low tides, or high winds, could threaten the vessels operation. Utilising real-

time weather forecasting models and predictive analytics will enable better planning and provide a 24-hour buffer to adjust operations. Additionally, establishing a backup vessel or alternative transport options will minimize downtime caused by severe conditions. Due to the location of the MicroHub issues such as cars blocking the entrance could hinder DHL from accessing it. It is therefore advised to arrange designating restricted parking zones near the hub, supported by clear signage and ensure a close cooperation with the local authorities. Finally, extended boat travel times and communication breakdowns could lead to inefficiencies in the operational process. OHB aims to mitigate that by implementing GPS tracking systems and redundant communication channels to ensure real-time monitoring and uninterrupted coordination of the vessel.

Low Likelihood & Low Impact Risks are less severe but still worth addressing. Occasional vandalism, such as minor damage to cargo bikes or the MicroHub, is unlikely to derail operations but could incur repair costs. Installing security cameras, lighting, and protective barriers will deter vandalism, while insurance policies can cover repair costs efficiently.

Summarised, the key operational risk for the Hamburg Use-Case is related to the time sensitive delivery service of DHL. While the pre-use-Case delivery process can serve as a backup plan, DHL will need at least 24h to prepare the truck operations to replace the vessel in case of a malfunction or weather insufficiencies. The unpredictability of the weather and limited experiences with operating the vessel in Hamburg are highly influential factor for the reliability of the operation. The goal will be to utilise forecasting models to enable planning at least 24h ahead, providing a certain level of predictability that is needed.

Business model canvas

Last mile logistic utilising waterways and cargo bikes

Key Partnership

1. Data collection
   - Urban Data Hub
   - HPA
   - HPA Hydro portal
2. Software tools
   - GGI
   - TMTX
3. Hardware tools
   - Rytle (bike)
   - NGS (Sensors)
4. Sluices operation
   - LSBG
5. Ground space loading side and barge parking
   - RV Rille
6. Legal framework & permits
   - HPA & BUKA
   - BA-Mitte
   - Water police

Key Activities

1. Load goods into electric van and drive to Loading point
2. Unload goods at the loading point
3. Load goods onto the barge
4. Drive barge from loading point to unloading point
5. Unload goods from barge
6. Load goods into the DPDHL container hub
7. Distribute goods in area
8. Drive boat back to loading point
9. Charge the boat
10. Provide legal framework for waterway access
11. Data collection and processing

Key resources

1. Electric barge with scissor lift
2. Sensors and tracking devices
3. Storage container at unloading point
4. Ground space for Micro Hub
5. Electrical vans & Cargo bikes
6. Delivery staff
7. Skipper and helpers for the barge
8. Permits for waterway access in Hamburg
9. Unloading and loading sites with charging infrastructure including access ramp for bikes

Value Proposition

1. Integration of cargo-bikes into last mile delivery
2. Enabling Waterway access for last mile delivery
3. Providing logistical storage space in the city center
4. Increase efficiency of logistic processes

Beneficiaries

Logistic operators through more sustainable delivery option and increased cost-efficiency

Local authorities through reduced environmental and social costs

City residents through decreased congestion and air/noise pollution and option for sustainable delivery

Added Value Service

1. Additional route stop
2. Reverse logistic

Relationships

1. Self-service and personal assistance for data and permits of waterway access
2. Personal assistance and Co-Creation during the rental of the ground space for Hub and usage of loading/unloading sides
3. Personal assistance operating the barge

Governance model

Logistic service:

- DHL
- OHB

Logistic infrastructure:

- Hamburg Municipality

Data processing:

- NGS/ GGI
- TMTX

Cost Structure

1. Purchase of Cargo bikes and Storage container
2. Development of Barge
3. Operational costs of vehicles (Vans, Barge, Cargo bikes)
4. Operational costs of software tools
5. Rent for ground space at unloading point
6. Human resources (Skipper, Delivery personal)
7. Permits

Revenue model

1. Rental or sale of the barge
2. Rental of ground space for Micro Hub
3. Fee for usage of loading & unloading point
4. Cost reduction in last mile delivery due to increased efficiency
5. End receiver willing to pay more for sustainable delivery

ICT-Tool integration:

There will be an integrated tracking system on the barge (OHB) combined with additional sensors (NGS) to track GPS, temperature & humidity. The ICT tools being developed in Hamburg include the T&T&M system, which will oversee the movement of goods on the electrical barge, and real-time transportation monitoring specifically designed for tracking the travel of OHB electrical vehicle. Finally, there is potential to utilise a forecasting and route optimisation tool to adapt the routing based on changing weather conditions, improving predictability of operations.

Table 10: Hamburg - BMC

Environmental costs: adaptation of the loading and unloading side will most likely utilise dry concrete to level out the parking space for the Hub and build a ramp to load / unload the boat. These constructions will be removed after the optional phase of the project and need to be discarded.

Social Costs: Construction at the unloading side will lead to additional noise and air pollution for citizens in the area. The loading side is not in a residential area thus there are little limitations expected to citizens life during the construction phase.

Success factors

For Hamburg Municipality, the central success factor is the **reliability of the logistics chain**, ensuring that the service can operate consistently without significant disruptions. While the duration of the pilot (e.g., 2-4 months) is less important, proving the reliability of operations over this period is key. Additionally, demonstrating **scalability**—the ability to expand or replicate the solution in other contexts—is crucial for its long-term viability and impact.

For OHB, environmental conditions like **tides, currents, and wind** are critical determinants of success. Unfavourable weather could disrupt vessel operations, highlighting the importance of forecasting and planning. Success also hinges on the **efficient preparation of loading and unloading sites**, ensuring they are well-managed and safe for personnel. The **human factor**, including proper training and safety measures during operations, is vital to maintain smooth and secure processes.

For DPDHL, **operational stability and punctuality** are prioritized as primary indicators of success. This refers to **timely deliveries** on at least five of six operational days per week and **boat reliability**, ensuring it is unavailable for no more than one day per week. Maintaining a **stable supply chain** across five traffic days is essential, as frequent reliance on the backup plan (trucks) would undermine the project's goal of reducing congestion and noise pollution.

Long term & scalability perspective

The Hamburg Use-Cases key value is seen in it providing an experimental feasibility study. A long-term implementation of the Use-Case is currently not planned. This is due to several limitation factors which go back to a lack of scalability potential and high operational costs.

1. **Limited loading capacity of the vessel:** The ship's small capacity makes it uneconomical for DHL's large-scale operations. The vessel handles only a small number of packages with significant logistical effort.
2. **Lack of competitiveness with conventional methods**: Using electric trucks requires less (specialised) personnel, fewer regulatory hurdles, and have fewer environmental limitations, such as tides or waterway regulations. Additionally, it offers a simpler, more reliable, and therefore safer option for logistic transport. Since there are currently no operational restrictions, like a regulation from the city that only allows certain vehicles (e.g., cargo bikes) on specific streets, there is no direct need for DHL to implement the Use-Case.
3. **High operational costs**: The vessel is associated with significant labour expenses. A comparable solar-powered boat project in Berlin incurs monthly operational costs of approximately €90,000, much of which is subsidized by the city to make it feasible for a private business. Moreover, the current labour plan for last-mile delivery is 1.4 to 1.5 times more labour-intensive than conventional methods, further increasing operational costs.
4. **Skilled personnel shortage:** There is a lack of qualified skipper in Hamburg leading not only to higher labour costs, but the absence of scalable recruitment strategies also makes a long-term operation difficult to sustain.
5. **Experimental Nature:** The Use-Case is primarily exploratory, with no foundational experience in Hamburg for last-mile waterway logistics or the ability to build up on existing infrastructure or processes which limits its readiness for real-world applications. Additionally, HAM points

out that due to the project's timeline constraints the implemented solution, especially the routing does not reflect the most economically feasible or realistic for long-term use.

6. **Limited Ecological and Efficiency gains:** The environmental benefits are minimal since DHL already utilises electric vans to transport their parcel into the city. The barge doesn't offer a sufficient replacement of vehicles to provide improvements in process efficiency or carbon reduction.
7. **The concept of MICRO HUB is unsuitable**: The micro hub solution is not practical for DHL's core courier, express, and postal services. The infrastructure and operational needs for those services are too large to scale effectively using this model. With 150,000 parcels daily and assuming each microhub handles 2,000 parcels, about 75 microhubs would be needed. With currently around 20 microhub locations in the city it would mean a need to quadruple the number of sites which would significantly increase traffic instead of reducing it, contradicting the goal of cutting down on emissions and traffic congestion.

Nevertheless, based on these learnings there were options mapped, that although they could not be explored during the project, could ensure that the core concept of utilising waterway logistics in the inner city of Hamburg becomes feasible.

1. **Vessel as floating delivery HUB:** In this scenario, a larger vessel would serve as a Hub and cargo bike storage. The parcels would be loaded on the vessel outside of the city and the delivery personnel would prepare the cargo bikes on the boat during transportation. The boat would stop at several unloading sides for the deliveries to take place and offer a smart locker pick-up option for customers.
2. **Vessel as floating Hub**: LIHH highlights that a boat that could also function as a permanent or semi-permanent logistics hub, would significantly increase the appeal of this solution. Space for logistics hubs in large cities is scarce, so a boat functioning as both a transport and storage solution could help address this issue.
3. **Vessel for transporting construction materials:** The use-case could also be reimagined for other industry than parcel deliveries. It could be particularly useful for bulk materials or delivering construction materials to urban construction sites.
4. **Co-Usage of waterway transport**: DHL could benefit from being a secondary player within waterway logistics. For example, in Schwerin, trams were used to transport deliveries to specific areas, which could be an interesting model for similar logistics in cities with extensive waterway networks utilising ferries for example. Integration into a city's infrastructure could offer a more sustainable and permanent solution for couriers and logistics services like DHL.
5. **Autonomous vessel operation:** Another interesting scalability factor for DHL would be autonomous driving, which is currently prohibited in the Hamburg harbour. If allowed, it could significantly affect the business model's scalability by reducing the reliance on expensive human labour for boat operation.

4.1.2 COST-BENEFIT ANALYSIS

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Taking into account the sensitivity of financial figures, here is a recap **Erreur ! Source du renvoi introuvable.** of the costs supported by each of Hamburg's partners.

Partner	Costs Covered
DPDHL	- Cargo bikes and electric truck operation costs (maintenance and energy consumed) - Delivery personal for last mile delivery and delivery to loading side - Training of delivery personal - Costs for the MicroHub Container (rent for ground space, preparation of space, transport and installation of container, security measurements)
OHB	- Development of the Barge (development and material costs) - Delivery of the Barge from Ghent to Hamburg (Energy consumed, Skipper, Permits) - Operating the Barge (Skipper for the boat, Maintenance of the boat, Energy for charging)
HAM	- Development and construction costs of Loading and unloading side - Maintenance of waterway infrastructure - Local Skipper salary - Training and Hiring process for the skipper - Permits for operating the boat / using the sluices - Rent of the boat parking as well as loading and unloading side ground
NGS/ GGI / TMTX	- Sensors (Development and material costs, shipment to Hamburg) - Installation and maintenance of Sensors - Personal costs for Data analysis - Software needed

Table 11: Cost-Befenit analysis

The economic viability of the Hamburg Use-Case is a key concern, particularly due to the high costs associated with staffing and operational challenges. Overall, the stakeholders define the use-case as **not economically viable**. It is important to note that HAM has expressed scepticism about the ability of this use-case to provide meaningful insights into broader economic viability. Due to its experimental nature and it potentially not reflecting the most realistic real-life scenario, the focus should be shifted more towards analysing specific elements of the process (such as unloading and final delivery) and testing the technical feasibility of the scenario, rather than delivering a comprehensive assessment of its real-world performance and scalability.

A critical issue is the availability and cost of skippers, associated to the high investment costs needed to develop the last-mile delivery barge, which has been constructed specifically to meet the challenges of the Hamburg waters. The project currently requires two skippers, one Belgian (with the barge expertise) and one German (with the local language and canals expertise), with combined monthly costs amounting to €25,000. Additionally, around €250,000 were needed for the barge construction. This raises questions about how to sustain the number of staff needed for regular operations in a cost-effective manner. As already explained, the use-case is not planned for a large enough scale to be viable and is not able to be scaled up by the testing company. Therefore, DHL concludes that the use-case is not economically viable for them. LIHH addresses a need for substantial support from the city or public sector to make the use-case viable for the private sector.

4.1.3 Governance Model

Stakeholders involved in the Use-Case

Stakeholder	Role	Responsibility
DPDHL Deutsche Post AG a brand of the DHL Group used for its domestic mail services in Germany. The services offered under the brand are those of a traditional mail service.	Logistic operator	Delivering packages to the Loading point and last mile delivery with cargo bikes Providing: - Cargo bikes for the last mile delivery - delivery personal - Micro Hub (container)
OHB Opleidingscentrum Voor Hout En Bouw Vzw is an expert group and training centre for city logistics and distribution of construction material.	Logistic operator	Training the local skipper & Operating the Barge Providing: - Electric barge with scissor lift and skippers
Hamburg municipality Freie Hansestadt Hamburg as representative for the Hamburg municipality.	Infrastructure and regulations	Preparing the Loading and unloading points Providing: - Ground space for Micro Hub in the City center - Legal permits for waterway access

Table 12: Stakeholder involved in the Hamburg UC

Key partner for the implementation and operational phase of the Use-Case

Area of operation	Stakeholder	Responsibility
Logistic Operation	**LSBG**	Operating the sluices provider of option B for the unloading operation
Ground space	**Ruderverein Bille**	Providing loading site and parking for the boat
Hardware tools	**RYTLE**	Providing the bikes and the Hub for DPDHL
Legal Frameworks and Permits	**Water police**	Legal admission of waterway access (route etc.)
	BA-Mitte	Legal admission of constructions
	HPA & BUKEA	Porth authority / waterway access
Software tools & Data analysis	**Urban Data Hub**	Access and distribution of data
	HPA	Providing relevant water / weather data
Technical partners	**NGS**	Providing the sensors for the barge
	GGI	Analysing data providing the results
	TMTX	Data processing

Table 13: Key partners Hamburg LL

As the Hamburg use case is heavily dependent on the availability of a suitable boat, there is a strong focus on this around implementation. Most of the actual processes for the last mile are already established and are therefore a highly consolidated responsibility. The remaining responsibilities focus on the management and supply of the boat as a means of transport.

Utilising the RACI sheet (**Erreur ! Source du renvoi introuvable.**) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Parcel Carrier (DHL), responsible for the final delivery of parcels
- Hub Manager (DHL), responsible for the organization of parcels at the hub location

- Skipper (OHB), responsible for carrying out the parcel transport with the barge
- Barge Manager (OHB), responsible for providing the necessary infrastructure for the barge and the skipper
- Sluice operator (HPA/LSBG), responsible for opening and closing the sluices on the delivery route
- LL team, responsible for the implementation phase and scientific monitoring
- Q-Controlling (DHL), responsible for the administrative monitoring of the delivery process
- Logistics Operator (DHL), responsible for daily management tasks in the delivery process
- Order Picker (DHL), responsible for the organized loading of parcels into the delivery containers

	Responsibility type	Responsibility Cluster	Responsibility Description	Parcel Carrier	HUB-Manager	Skipper	Barge-Manager	Sluice Operator	LL-Team	Q-Controlling	Logistics Operator	Order Picker
Implementation Phase	Core		Providing of logistic infrastructure for Last Mile Delivery		R				C	A		
	Management	Hub	Intstallation of Micro-Hub		A				C	R	I	
	Management		Ensuring regulatory requirements for the implementation are met						R	C	C	
	Core		Training delivery staff	A	R					C		
	Support	Hub	Prepare the physical space for the UCC /Hub						A	R	C	
	Management		Setting up contracts between DHL and OHB				A		I	I	R	
	Core	Barge	Getting the Barge to Hamburg Port				R		A			
Operational Phase	Core	Barge-Route	Carrying out of the Barge-Route from Grüne Brücke to Stadthausbrücke	I		R	A	C				
	Support	Barge-Route	Providing the necessary personnel for the Barge-Route				R		C			
	Support	Barge-Route	Opening and closing of the necessary floodgates on the Barge-Route					R	A			
	Support	Barge-Route	Providing and managing the necessary infrastructure for loading and and anchoring the Barge			A	R		I			
	Management	Barge-Route	Deciding whether the boat is driving on the current day and which route the Barge will take.	I		R		C	I	I	I	
	Core	Last Mile	Delivering the Parcels to the customer on the last mile	R	A					C		
	Support	Last Mile	Providing the necessary personnel for the last mile delivery		R					A		
	Support	Last Mile	Providing and managing the necessary infrastructure for the last mile delivery		R					A		
	Core	Preparation	Delivering sorted Containers to the Startingpoint of the Barge-Route	I						A	R	
	Core	Preparation	Sorting the parcels into the correct containers	I						A		R
	Core	Preparation	Shipping of empty containers back to the sorting center after the last mile delivery	I						A	R	
	Support	Customer Relationship	Handling Customer Complains and Advice	C	A	A	A		I	R	A	A

Figure 28: RACI Sheet Hamburg UC

4.2 Istanbul Use Case 1&2

Use case 1 will focus on testing optimisation algorithms and new vehicles (e-cargo bikes), based on a data collection from MIGROS operations in the selected area and dedicated ICT tools development. Two "waves" are designed for that purpose: First, based on the existing instant deliveries, data will be collected and analysed to develop tailored forecast and optimisation tools. Finally, the ICT tools developed will be used to ease the integration of cargo bikes in daily operations and allow the equipment to be used in its most efficient way.

In the use case, MIGROS will use a 481sqm hub to store products and operate **instant deliveries with cargo-bikes**. Deliveries with motorbikes or small trucks will not be excluded, in case the 10 cargo-bikes planned in the use case are not sufficient for the coming orders. **The hub is in KADIKÖY (Caferağa Mah. Sakız Gülü Sok. NO:31/B), in a current MIGROS store and has a store picking online operation model.**

The Use-Case (Figure 29) will utilise demand **forecasting and optimisation algorithms developed in the first wave** to increase the planning efficiency of MIGROS deliveries with the 10 new e-cargo-bikes. The forecast target is the daily number of orders, and the forecasting horizon is from 2 to 4 weeks. Additionally, the delivery vehicles will be equipped with sensors to enable real-time transportation monitoring and reporting and to possibly introduce load optimisation and dynamic routing solutions.

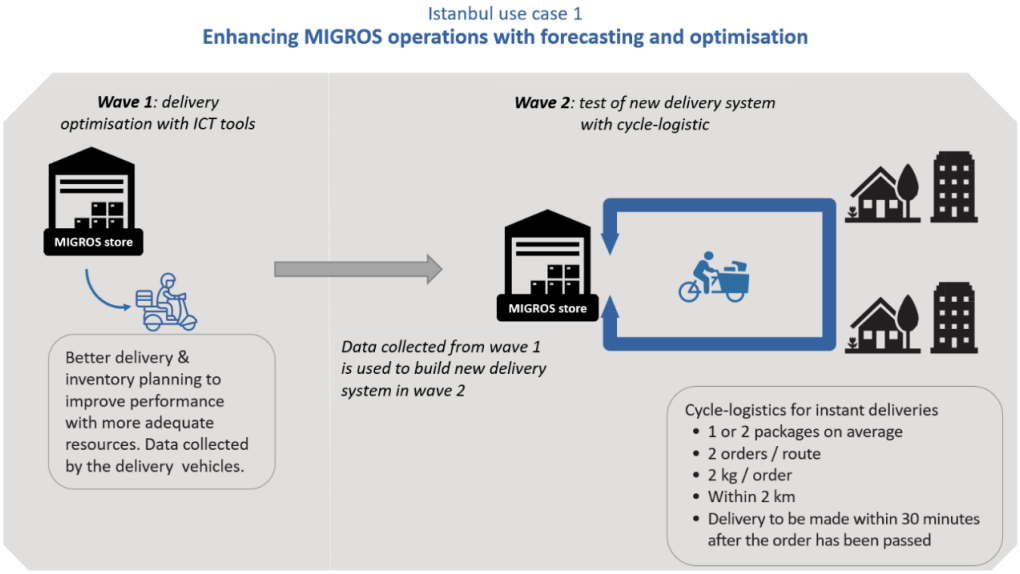

Figure 29: Istanbul Use-Case 1 : Enhancing MIGROS operations

Use case 2 (Figure 30**)** will test the implementation of a load pooling tool developed by SCU to optimise delivery tours and operations by filling trucks to their highest capacity whenever possible. In the use case, MIGROS will use the store of "Meydan AVM MMM Migros", which operates time-slot deliveries with thermic LCVs.

Figure 30: Istanbul Use-Case 2: Enhancing MIGROS operations with load pooling

The added-value services to be potentially implemented in the use cases were discussed with the main stakeholder involved, MIGROS, and a survey was filled-in to identify the most relevant ones. Figure 31 presents the results of the survey.

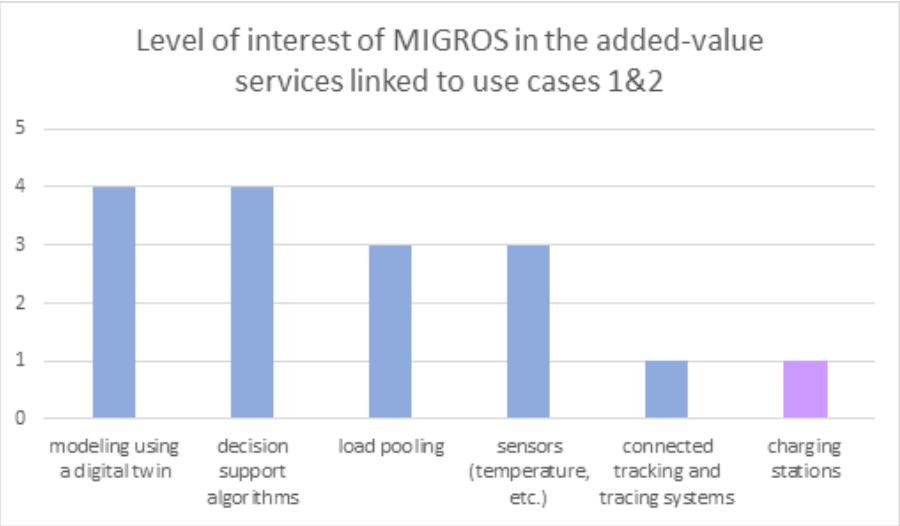

Figure 31: Level of interest of MIGROS in added-value services

*We can see that the most interesting services are **modelling using a digital twin** and **decision support algorithms.** These services are digital solutions currently under development by the technical partners of the project, to add them to the use case 2.*

Quoting "If demand forecast result is acceptable for our business according to know how etc. We will implement these results to our source planning (number of vehicle and shifts of carrier)."

Due to the instant delivery model which requires quick reactivity on the deliveries, **smart lockers implementation was not discussed.**

Value Proposition

There are two key values that the Use-Case is providing to MIGROS. First is the environmental aspect. MIGROS is interested in reducing carbon emissions and pollution using e-cargo bikes, making their last-mile delivery environmentally friendly. Therefore, this project aligns with their sustainability goals and is expected to positively influence customer satisfaction. Finally, by implementing ICT tools that can forecast order numbers over 2-4 weeks, Migros aims to optimise in-store and delivery resources, leading to improved cost efficiency. Additionally, the purchasing and maintenance cost of electric bikes compared to motorbikes is lower, so it is expected to be more cost-efficient.

4.2.1 Business Model

Time to market

The time to market for this use case is influenced primarily the development and integration of ICT tools, the availability of resources, and the gradual adaptation of operations to the new system. While most of the physical and operational infrastructure is already in place, the timeline is mainly determined by the phases of data collection, tool development, and integration.

The success of this use case relies heavily on accurate demand forecasting and optimisation algorithms. For optimal forecasting results, data of best a full operational year is needed to account for seasonal variations, holidays etc. Since MIGROS was able to share historical data the data collection period could be significantly lower.

The most time-intensive aspect of the project is the creation of ICT tools, including forecasting models and optimisation algorithms. This development phase involves rigorous testing to ensure that the tools can accurately predict daily order volumes and optimise delivery routes. Additionally, the integration of sensors on delivery vehicles for real-time transportation monitoring adds another layer of complexity to this phase. After the development the newly developed ICT tools need to be integrated in MIGROS existing software system.

The integration of 10 e-cargo bikes into MIGROS operations requires some adjustment, particularly training for staff to familiarize them with the new vehicles and processes. However, MIGROS's experienced personnel and established logistics operations make this a relatively smooth process, minimising delays in full-scale implementation.

Business model Canvas

<table>
<tr><td colspan="4">Last mile logistic with Cargo bikes utilising route optimisation tools</td></tr>
<tr><td>Key Partnership
1. Software tools and Data collection
- GGI
- IMT
- GGS
- TMTX

2. Hardware tools
- NGS (sensors)</td><td>Key Activities
1. Development and Maintenance of Software
2. Development and Maintenance of Sensors
3. Logistic Service: Loading bikes and delivering goods

Key resources
1. Micro Consolidation centre
2. Human resources for delivery service
3. Data
4. Software tools
5. Sensors
6. Equipped electric Cargo bikes</td><td rowspan="2">Value Proposition
1. Integration of cargo-bikes into last mile delivery
2. Increased efficiency in LML process through optimisation algorithms

Beneficiaries
Logistic operators through more sustainable delivery option and increased cost-efficiency

Local authorities through reduced environmental and social costs

City residents through decreased congestion and air/noise pollution and option for sustainable delivery</td><td>Relationships
Software applications:
- Self Service
- Customer support

Governance model
Logistic service:
- MIGROS

Data analysis:
- GGI
- NGS</td></tr>
<tr><td colspan="2">Cost Structure
1. Purchase of Cargo Bikes
2. Development of Software tools
3. Purchase of Sensors for real life tracking
4. Operational costs of delivery vehicles
5. Operational costs of Software tools & Technical Service
6. Human Ressources</td><td>Revenue model
1. Cost reduction in last mile delivery due to increased efficiency
2. End receiver willing to pay more for sustainable delivery
3. Usage fee for software tools and data analysis</td></tr>
<tr><td colspan="4">ICT Tool integration:
Sensors at cargo bikes to enable real-time transportation monitoring and reporting. Part of the UC is the testing optimisation algorithms and new vehicles based on MIGROS data to later utilise demand forecasting and optimisation algorithms to increase the planning efficiency of MIGROS deliveries. Additionally, dynamic routing solutions to optimise delivery paths, load optimisation techniques to enhance freight efficiency & load pooling strategies for delivery consolidation aim to enhance logistic efficiency can be applied. Finally, digital city models can be utilised to simulate and analyze urban logistics.</td></tr>
</table>

Table 14: Business model canvas Istanbul UC1&2

Success Factors

For MIGROS the success of this Use-Case will be measured by the reduction in carbon emissions and customer perception of MIGROS' environmentally friendly initiatives. Additionally, they hope to decrease delivery costs through the utilisation of forecasting models, route optimisation and load pooling. One critical factor to determine the success will be the performance of the electric bikes and the real-life costs between gasoline and electric vehicles, depending on energy prices and maintenance. Connected to that is the satisfaction of the customer for delivering orders on time, especially with the potentially slower cargo bikes, compared to with motorbikes.

Operational Risks

Since the Use-Case minimally disrupts the regular logistics process, the operational risks are relatively low. However, certain risks, while unlikely, could have significant impacts. For example, if the developed forecasting and optimisation tools fail to perform under real-world conditions, it could lead to inefficient route planning, delayed deliveries, and negatively affect customer satisfaction. To mitigate this, continuous monitoring of tool performance with fallback options will be essential. Additionally, e-cargo bikes may experience performance inefficiencies or even failures due to battery issues, breakdowns, or adverse weather and terrain conditions, particularly during peak demand. In such cases, a hybrid delivery model using traditional vehicles and implementing regular maintenance

schedules for the bikes will help minimize disruptions. Another risk is the potential inefficiency of the load pooling tool if it is not calibrated properly, which could lead to suboptimal vehicle capacity usage and higher operational costs. On the other hand, high likelihood, high impact risks include unpredictable disruptions such as traffic congestion, road closures, or accidents, which could delay delivery times and negatively affect customer satisfaction and operational KPIs. To manage this, real-time traffic data and dynamic adjustments to delivery schedules will be critical. Additionally, low-impact risks such as malfunctioning bikes, broken equipment, or failure of the charging infrastructure may occasionally occur, but they are expected to have a minor effect on operations, with routine checks and preventive measures in place to minimize such issues.

Long term perspective and scalability potential

MIGROS expressed their interest in long-term implementation if the project is successful. Additionally, they mentioned a possibility of expanding the Use-Case. MIGROS sees potential in scaling up e-bike use if the performance proves reliable. If successful, they could replace more scooters with e-cargo bikes in the future. During the interview they stated: *"It is inevitable that we are going to use the electrical vehicles, so this project can be the first step of that. As soon as there is a wider offer on cargo bikes and their range, charging capacity etc. is sufficient it will get more common, and we can enlarge our operations."*

4.2.2 Cost-Benefit Analysis

Building on the cost structure proposed in the Business model, the cost sheet for this use case details the different expenses and the partners responsible (**Erreur ! Source du renvoi introuvable.**) for the financial support. Considering the sensitivity of financial figures, here is a recap table of the costs supported by partners involved in the Istanbul LL.

Partner	Costs Covered
MIGROS	- Purchase of cargo-bikes - Monthly rent of the store - Human resources for hub management and carriers
NGS/ GGI	- Sensors (Development and material costs) - Installation and maintenance of Sensors - Personal costs for Data analysis - Software needed
SCU	- Installation of the load pooling tool

Table 15: Costs and responsible partners Istanbul UC1&2

This use case brings concrete ecological and economic benefits to the company thanks to minor investments on new zero-emissions vehicles and digital optimisation tools. With the use case being based on the existing operations of MIGROS, the additional costs are not significant: changing their equipment is costing few but bringing tangible benefits. For example, the cost for one e-cargo bike is €1,400 + 100€ for bike equipment. Considering the 60-month timeframe for depreciation the 18 months of the project will cover the cost of 420€ per bike. Because the cargo-bikes will be purchased for this use case while also being used for the use case 3, this investment cost will be twice profitable. This use case is planned to be economically viable.

4.2.3 Governance Model

Stakeholder involved in the Use-Case

Stakeholder	Role	Responsibility

MIGROS Retailer and LML provider	Logistic infrastructure, vehicles, operation and distribution service	Operate the last mile delivery service with electric cargo bikes Providing: - the Micro Consolidation Centre - Subcontractor with Logistic vehicles & Delivery personal - Data
NGS (New generation Sensors)	Technical partner	Provide sensors for real life tracking
GGI (Genegis GI)	Technical partner	Provide software for real time data tracking

Table 16: Stakeholder involved in the Istabul UC1&2

For Use Case 1, the focus is on the new operating resources, which are intended to collect data for process optimisation in practice. Accordingly, the implementation phase is focussed on testing and preparing the necessary infrastructure.

During the implementation of the use case, several roles have to make ad hoc decisions. In addition, the previously implemented infrastructures must be maintained and preserved. The data collected is also analysed.

Utilising the RACI sheet (Figure 32 to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Carrier (Paket Taxi), for the delivery of goods on the last mile
- In Store Collector (Migros), for the compilation of the goods parcels on the last mile
- Store e-commerce supervisor (Migros), for maintaining the micro hub and controlling outgoing goods
- Last Mile Food delivery Company (Paket Taxi), for the provision and maintenance of the bicycles used on the last mile
- E-Commerce Operations Team (Migros), responsible for analysing the current processes
- e-commerce IT team (Migros), responsible for distributing all collected data to the correct partners
- Project Team, for the overall support of the use case
- Store Manager (Migros), responsible for the hub in collaboration with the e-commerce supervisor
- Legal Team (Migros), installation of the Hub
- ICT-Tool Partners (NGS), evaluation of the collected KPI's

	Responsibility type	Responsibility Cluster	Responsibility Description	Carrier	In store collector	Store e-commerce supervisor	Last mile food delivery company	E-commerce operations team	E-commerce IT team	Project team	Store manager	Legal team	ICT tool partners
Implementation Phase	Core	Micro Hub	Providing of logistic infrastructure				R	A		I			
	Management	Micro Hub	Intstallation of Micro-Hub			R		C		I		R	
	Support	Micro Hub	Installation of Sensors				R			C			
	Support	Micro Hub	Integration of ICT tools, softwares and applications					C	R	I			
	Support	Micro Hub	Testing of logistic resources (sensors, bikes, etc.)				R	I		I			
	Management	Micro Hub	Ensuring regulatory requirements for the implementation are met					R		A			
	Support	Micro Hub	Prepare the physical space for the Micro Hub			R		A		I	R		
	Support	Micro Hub	Training delivery staff				R	I		I			
	Management	Micro Hub	Setting up contracts							R		C	
Operational Phase	Core	Micro Hub	Managing ingoing and outgoing supplier deliveries in the Micro Hub			R					A		
	Core	Micro Hub	Collecting orders from store shelves		R	A		I			I		
	Support	Micro Hub	Providing necessary utilities for the Micro Hub			R		C		I	R		
	Support	Micro Hub	Providing e-bikes, necessary equipment and staff for bike delivery				R	A		I			
	Support	Micro Hub	Providing charging station for e-bikes				R	A		I			
	Support	Micro Hub	Maintenance of the logistic resources				R	A		I			
	Management	Micro Hub	Scheduling order collectors' shifts		I	R		A			C		
	Management	Micro Hub	Decision about the forecasts of future orders for better inventory			I		R	C	I	I		
	Core	Last Mile	Cyclelogistic operations (Delivering Orders with e-cargo bikes)	R		A	I	I	C		I		
	Management	Last Mile	Decision about the Route for delivery run	R		A	I		C				
	Management	Last Mile	Decision about the forecasts of future orders for better source planning			I	I	R	C	I	I		
	Management	Last Mile	Measuring KPIs from sensors on the e-bikes							I			R
	Support	Last Mile	Daily data sharing process between technical partners and Migros					A	R	I			

Figure 32: RACI sheet Istanbul UC1&2

4.3 Istanbul Use-Case 3 – Urban Consolidation Centre

In this Use-Case IMM will build a 500sqm urban consolidation centre at a parking area of 5,213 m². The place, which is co-owned by IMM, is currently being used by a subsidiary company for parking use. The company would free the space for the DECARBOMILE pilot. IMM plans to build **two prefabricated structures** of around 100/200m² each, with two entrances for both operators. Since the space is owned by IMM, no rent would be asked to operators during the timeframe of the project, which will allow the acquisition of the consolidation centre to be covered by the DECARBOMILE budget.

Identified operators to share the hub are:

- **MIGROS** (for their e-commerce operation with over 3 000 Stock Keeping Units),
- **Iletmen**, who provides last-mile distribution services to other companies such as Aras Kargo and Hepsijet (multi-partner distribution may include e-commerce, chain markets and restaurants).

MIGROS' daily distribution will be carried out using **electric cargo-bikes** purchased with project funding (and used previously in the use case 2), while **Iletmen** will operate their **own fleet** in this consolidation centre.

This UCC is located near a **MIGROS** store, which operates time-slot deliveries. Hence, this UCC will be considered as a dark store, for **instant deliveries** only and will not compete with the existing operations of MIGROS in the area.

As another matter of attention, priority will be given to **women's employment in the Iletmen fleet** that will be used in this use case.

MIGROS and Iletmen, are the two stakeholders that will share the UCC in this use case and they both responded to the survey. Figure 33 presents the three side services linked to this use case which were evaluated.

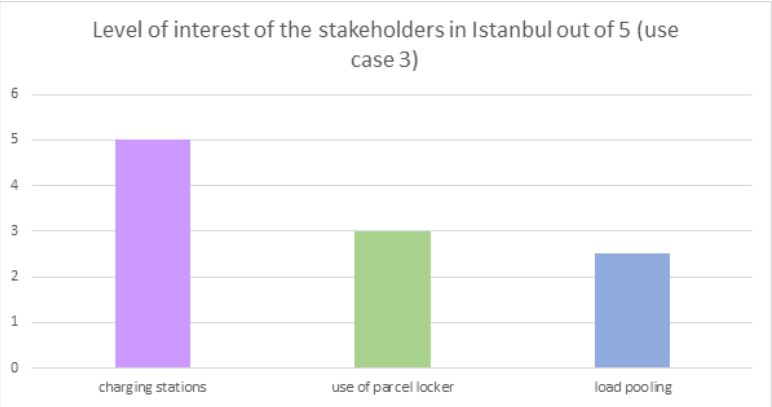

Figure 33: Level of interest of local stakeholders in added-value services

Iletmen's level of interest for the side services foreseen is high (worst ranking was 4 out of 5 for the level of interest concerning load pooling). They will help in the realisation of the pilot by **providing cargo-bikes, software, and distribution.**

They are less interested in the load pooling digital tool as they are already planning to use **tools for vehicle routing,** real time delivery tracking, proof of delivery, reverse logistics operations and location-based customer segmentation analyses.

On **MIGROS** side, it is different because they are evaluating the **parcel lockers as unusable** (they are operating instant delivery, which is not in coherence with the lockers concept). Also, they are ranking their level of interest in **load pooling** as 1 out of 5 for the same reason as parcel locker: their instant deliveries are only concerning one client at the time (or max two) and load pooling would not work for this type of operation.

Still, the charging stations and parcel lockers will be implemented, since they are bringing additional value for the users of the shared hub and for the end-consumers.

The **smart lockers** provided by IMM will be located near the bus stop at the consolidation centre (details TBD). The possibility of having **solar-powered smart lockers** was discussed. Kargo Park (smart locker provider) can also design cabinet columns based on the needs expressed by the operators and can include an option for smart lockers to recharge the battery of the cargo bikes. In addition, IMM would provide a **charging infrastructure** (details TBD) for e-delivery vehicles which will be shared by all actors.

Figure 34: Possible charging station structures to be installed in the area, based on the needs identified

At a later stage, we can envision to have the operators sharing the hub also sharing fleet and mutualising deliveries, even though it was not presented in the survey.

Value Proposition

For the third Use-Case, the same value propositions as in the previous ones apply for MIGROS. The reduction of emission through the implementation of Cargo bikes as well as the enhancement of efficiency and targeted cost-reduction. Additionally, the UCC will serve as MIGROS ' first standalone dark store for instant deliveries. This will allow MIGROS to test managing operations without combining them with offline stores.

ILETMEN specializes in last-mile delivery services and operates across Istanbul, delivering for various logistics companies such as Hepsi Burada and Aras Cargo. The company hopes that the use-case will help showcase ILETMEN's logistics capabilities on a global scale. By participating, ILETMEN can demonstrate and leverage its established software and hardware infrastructure, showing its expertise in managing distribution networks. Overall, the project aligns with ILETMEN's goal of enhancing logistics efficiency, particularly through consolidation centres and improving the delivery processes.

IMM highlights, that since around 20 million people are living in Istanbul, there is limited to no physical empty space. Thus, for the municipality the goal is to provide something compact or shared to consolidate different private logistic operators. With the carbon emission in mind, IMM is trying to find a solution to optimise logistic processes in terms of optimising the usage of space and reducing the CO2 emissions. Additionally, the Use-Case helps to promote and highlight the potential that a Public-Private Partnership brings to the private sector. It will show private operators that it is beneficial to work with the municipality and that they can receive support. Thus, spread the knowledge since most private operators are not familiar that the municipality can take a role or can make their operation much better with the help of the experts for example.

4.3.1 Business Model

Time to market

The estimated time to market for the Use-Case is 1-2 years, primarily driven by the time required to scout an appropriate location and construct the Urban Consolidation Centre (UCC). Several interlinked factors influence this timeline.

Identifying a suitable location for the UCC was particularly challenging due to the city's dense geography and limited available space. These factors, coupled with the logistical difficulties of establishing a new UCC in a constrained urban area, add complexity to the implementation timeline.

Establishing the UCC is time-consuming, since no existing structure is available for adaptation and thus a new facility needs to be constructed. While a suitable parking space for the UCC has been secured, it requires preparation, including cleaning, implementing security measures such as fences and

blockages, and ensuring functionality for operations. Moreover, the smart lockers need to be developed and customized to suit the specific requirements of the operators. While the municipality already employs smart lockers, further customization and deployment will be necessary. Additionally, the presence of buses currently occupying the parking lot introduces a logistical hurdle. Due to financial constraints faced by the owner, these vehicles cannot be removed immediately, though the issue is expected to resolve over time.

Obtaining regulatory approvals presents a complex challenge. Part of the designated parking space belongs to the municipality, requiring alignment with multiple stakeholders to secure the space for the UCC. Furthermore, regulatory requirements for the physical structure of the UCC are yet to be defined, adding to the uncertainty. Approval must be obtained from several district departments, necessitating clarification and identification of the relevant entities, which could extend the approval timeline.

While all logistics partners are onboard and committed to collaboration, a construction partner has yet to be identified. Securing a contractor who can deliver the structure within the predefined budget of €60,000 is essential to progress.

The successful integration of equipment is a crucial aspect of the Use-Case. MIGROS plans to acquire 10 e-bikes, which will require testing and personnel training. Nevertheless, as their current fleet consists of motorcycles, the adaptation process should be quick. Additionally, the ICT tools developed for the Use-Case are expected to be integrated into MIGROS operations and existing tools smoothly. Since ILETMEN, will continue using their existing vehicles, no additional adaptations will be necessary, and existing processes can be utilised. In summary, vehicles and skilled personnel are already available for both logistics' operators, ensuring a strong foundation for operations once the UCC is constructed and regulatory clearances are in place.

All operational costs are covered by the participating operators and the project, but the €60,000 budget for UCC construction is limited, requiring a more time-consuming search for a construction partner, which can build the UCC with the budget available. Additionally, fluctuations in currency value pose a financial risk that could impact procurement and construction costs.

Sustainable Business model Canvas

Urban Consolidation Centre with Cycle Logistic

*Added Value smartlocker

Key Partnership

1. Hardware tools
   - TBD (Cargo Bikes (+e-vans or scooters))
   - TBD (pre fabricated structures for UCC)
   - Istanbul Energij (Charging stations)
   - Kargopark (*Smartlockers)
   - NGS (sensors)
2. Software
   - TMTX
   - GGI
   - SCU
   - IMT
3. Legal Framework
   - IMM

Key Activities

1. Providing the space for the UCC
2. Providing the UCC structure
3. Delivery of goods to the UCC
4. Distribution of goods from the UCC
5. Parking / charging the bikes
6. *Operating the Smartlockers

Key resources

1. Ground space for UCC with charging infrastructure
2. UCC
3. *Ground space with Smartlocker
4. Electric Cargo bikes
5. Logistic service & delivery staff
6. Sensors and software tools to operate hub and cargo bikes

Value Proposition

1. Providing logistical storage space in a dense area
2. Increased efficiency due to consolidation of logistic operators in a strategic position
3. Integration of cargo-bikes into last mile delivery
4. Offer of charging station and *smart lockers

Beneficiaries

Logistic operators through more sustainable delivery option and increased cost-efficiency

Local authorities through reduced environmental and social costs

City residents through decreased congestion and air/noise pollution and option for sustainable delivery + *smart lockers

Added Value Service

*Smartlockers at the Bus-Station

Relationships

1. Personal assistance and Co-Creation during the rental of the ground space for UCC
2. Self Service operating the UCC
3. *Self-Service operating Smartlockers

Governance model

Logistic space and infrastructure:

- IMM
- MIGORS

Logistic service operations:

- MIGROS
- ILETMEN

Sensors & Software tools:

- NGS
- TMTX

Cost Structure

1. Development & Construction of UCC
2. *Development & Construction of smartlockers
3. Purchase of Cargo bikes
4. Operational costs of delivery vehicles
5. Rent for UCC
6. Human Resources
7. Permits

Revenue model

1. Cost reduction in last mile delivery due to increased efficiency
2. End receiver willing to pay more for sustainable deliver
3. Renting the UCC to other logistic operators
4. Usage fee for software tools and data analysis
5. Usage fee / rental of equipment (charging stations, smart lockers)

ICT-Tool integration:

Sensors at cargo bikes will enable real-time transportation monitoring and reporting. Additionally, the data offers the utilisation of load optimisation and dynamic routing solutions as well as demand forecasting and optimisation. Finally, a load pooling solution will optimise the delivery flow and minimize the costs of operations. Sensors in UCC will be used to track and control room temperature in the cooled fresh food areas.

Table 17: Sustainable Business Model Canvas Istanbul UC3

Success Factors

During the interviews, the operators were highlighting various aspects of a successful implementation. IMM aims for a long-term use of the consolidation centre and supporting infrastructure by the private sector. Thus, the continuous operation at the consolidation centre after the projects end will demonstrate the practical value and viability of the initiative. The municipality also hopes to demonstrate the benefits of a public-private partnership to kickstart further processes with other private companies in the city to increase efficiency especially regarding the use of space.

MIGROS defined the reduction in carbon emissions as a leading success factor leading to a hopefully enhanced customer perception of the company's environmentally friendly practices. Additionally, the

increased efficiency in terms of costs and delivery performance are key success factors. Thus, effective cost reduction in deliveries, enabled by better forecasting and the use of e-bikes and reliability and cost-efficiency of cargo bikes, particularly compared to gasoline vehicles in factors like energy prices, maintenance, and bike performance are essential. Finally, the smooth collaboration with ILETMEN is considered as vital factor to consider further steps towards shared operational spaces or an even more consolidated logistic process.

ILETMEN is hoping to be able to demonstrate the value of the project to third-party logistic companies, thus the attractiveness of the model to other cargo companies is a key factor. High participation and engagement were therefore defined as a clear success factor.

Operational Risks

Low Likelihood but High Impact risks: Istanbul's topography is quite demanding for vehicles due to its steep hills. The change from scooters to electrical bikes poses the risk of inadequate battery or overall vehicle performances for the deliveries, which could threaten MIGROS customers satisfaction. Therefore, testing the vehicles and planning with a hybrid concept to utilise the scooters as backup plan if needed is recommended. Human accidents represent another critical concern, emphasizing the importance of comprehensive safety training and carful development and introduction of operational protocols. Although the space will be divided so that each operator has their own space, it is important to stablish a clear framework for roles and communication channels to help maintain operational efficiency and mitigate the risk of interferences and operational conflicts. Finally, it was mapped that a clear waste management strategy is needed to avoid delivery waste and recyclables blocking the area and that the availability and functionality of the charging stations needs to be monitored to avoid delays in operations due to charging issues. Due to the socio-economic conditions in the area around the Use-Case location, the risk of vandalism and theft was mapped. This can partially be mitigated through the guard and existing cameras belonging to the parking space at the entrance of the area but should be also considered during the construction of the UCC. Both operators declared to think about restricting delivery time especially after 8pm to protect their drivers and equipment. Due to the multiple uses of the space and the increased traffic in the area where the UCC is located, blocked entrances due to accidence or falsely parked cars are considered a potential risk. Having two ways of access to the UCC was discussed as potential risk management strategy.

High Likelihood and High Impact risks: ILETMEN mapped the risk of receiving goods that exceed the weight or volume limits of their delivery vehicles as well as the absence of delivery drivers due to their reliance on Uber drivers. Both risks should be considered during the communication with the drivers and planning of the supply distribution. Both operators highlighted the need to clearly define the delivery area to prevent goods needed to be delivered outside designated areas which could exceed the vehicles capacity and lead to inefficient or delayed delivery processes.

Low likelihood and low impact risks: As mentioned before the terrain in Istanbul is quite challenging and could limit the speed and range of the electric bikes. Having a hybrid fleet with scooters as backup will be a great way to mitigate that. The malfunctioning of equipment like, bikes, batteries or software tools needs to be taken into consideration, planning for regular maintenance and spare parts for high likelihood repairs. Finally, due to the new vehicles and new processes, customers could receive their goods outside the scheduled delivery window. It is recommended to establish a clear line of communication around the trial for the Use-Case with the customers aiming to ease the tension in case of delays.

High likelihood and Low impact risks: Traffic congestions around the area of the UCC pose the risk of delivery delays. It is therefore aimed to schedule deliveries outside peak hours to ensure a smooth process. Finally, the order capacity and the weight of the e-bikes could lead to a less efficient delivery scenario. MIGROS normally delivers two orders per scooter and might just be able to deliver one with the e-bike. Nevertheless, this will be navigated with adapted route and order scheduling.

Long term perspective and scalability potential

All key stakeholders—IMM, MIGROS, and ILETMEN—expressed interest in maintaining long-term operations of the UCC. However, several hindering factors and necessary conditions must be addressed to ensure sustainability and scalability.

As potentially hindering factor was the shared ownership of the parking space defined. IMM owns only a quarter of the site, requiring coordination with other property owners for continued use. It was therefore flagged that the space currently housing the UCC might be repurposed for other projects, potentially disrupting its use as a consolidation centre.

Necessary conditions:

ILETMEN is fully committed to implementing the use-case long-term, as it aligns closely with their business objectives and growth strategy. For MIGROS, the UCC is situated in a high-demand area, making it a strategically valuable asset. If the use case demonstrates operational success in terms of efficiency, cost-effectiveness and customer satisfaction, MIGROS is interested in continuing the operation. However, the decision will also depend on the alignment of the UCC with its logistics goals. IMM's preference is for MIGROS and Iletmen to continue operating the UCC post-project. The municipalities willingness to continue the Use-Case depends on the private sector's commitment to negotiate feasible rental terms. If MIGROS opts out, IMM plans to maintain flexibility in repurposing the facility for alternative municipal needs. Long-term operations may necessitate extended or renewed permits from both the municipality and district authorities.

Regarding the scalability, the following options were mapped:

1. **Increase size of UCC and/or include additional operator**

   ILETMEN highlights, that the UCC holds significant scalability potential, particularly through expanding the consolidation centre's capacity to handle larger delivery volumes. While MIGROS is open to scaling the UCC and sharing the space with operators from different sectors, it is reluctant to share with direct competitors in the grocery industry due to the highly competitive market in Istanbul.

2. **Replication of the UCC**

   IMM views the UC as a model that can be replicated in other parts of Istanbul. This would help optimise urban logistics, reduce redundant private hubs, and increase overall efficiency.

3. **Smart locker for instant delivery**

   In the current Use-Case the smart lockers are not viable for MIGROS instant delivery. However, if a smart locker would be placed in a high traffic residential or office area, MIGROS could imagine utilising smart lockers as delivery options for their customers.

4. **Increase level of logistic consolidation**

   Finally, the UCC could increase its level of consolidation. The current Use-Case is starting with a shared space approach but keeps the deliveries separated. Future approaches could aim for consolidated logistic flows. MIGROS points out that instant deliveries are not suitable for logistic collaboration: "*Collaboration centres are very OK for the normal parcel delivery or other delivery options like foods, but for the grocery, especially in 30 minutes or 20 minutes delivery, it's not a good option because we can only serve to our own customers in time, nothing more including other parcels or combining them.*"

4.3.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the

sensitivity of financial figures, **Erreur ! Source du renvoi introuvable.** presents the costs supported by each of the Istanbul's partners.

Partner	Costs Covered
IMM	- Installation of charging station - Installation of parcel locker
MIGROS	- Purchase and operation of cargo-bikes - Installation of the UCC - Human resources for hub management and carriers - Permits
Iletmen	- Rent of the UCC
NGS/ GGI	- Purchase of the trackers - Management of the data

Table 18: Costs and partners responsible Istanbul UC3

All stakeholders are optimistic about the economic viability of this use-case. Both logistics operators involved are experienced and will utilise a preexisting logistic system that has a proven economic viability. ILETMEN's delivery model has already achieved a competitive cost of 19-20 TL per parcel in Turkey, demonstrating its ability to sustain profitability even as operations scale. Sharing the UCC costs between two operators significantly reduces operational expenses. For MIGROS, the adoption of e-bikes is anticipated to yield substantial cost savings. Compared to traditional delivery vehicles, the electric bike comes with a lower purchase and maintenance costs, combined with reduced fuel expenses, which makes them an economically attractive solution.

4.3.3 Governance Model

Stakeholder involved in the Use-Case

Stakeholder	Role	Responsibility
IMM Istanbul Metropolitan Municipality is the representative for Istanbul Municipality	Infrastructure and regulations	Providing: • Parking area of 5,213 m² • Charging infrastructure for e-delivery vehicles • Smart lockers
MIGROS Migros Ticaret A.Ş. is one of the biggest chains of supermarkets in Turkey.	Logistic vehicle and transportation service	Construction of UCC on the parking lot Delivering goods to the UCC and operating the last mile delivery with cargo bikes (through Paket taxi) Providing: • Logistic vehicles (Electric Cargo bikes) • Delivery personal • Structure of the UCC
ILETMEN ILETMEN is a logistics company specializing in efficient and	Logistic vehicles, operation and distribution service	Delivering goods to the UCC and operating the last mile delivery with cargo bikes

Stakeholder	Role	Responsibility
reliable transportation solutions tailored to meet diverse client needs.		Providing: • Logistic vehicles • Delivery personal
NGS (New generation Sensors)	Technical partner	Providing the sensors for the delivery vehicles
GGI (Genegis GI)	Technical partner	Analysing data providing the results

Table 19: Stakeholders involved in Istanbul UC3

Key partners for the implementation and operational phase of the Use-Case

Area of operation	Stakeholder	Responsibility
Logistic Operation	**ARAS KARGO**	Deliver goods to the UCC for ILETMEN
	HEPSIJET	Deliver goods to the UCC for ILETMEN
	PAKET TAXI	Operate the last mile deliveries from the UCC of MIGROS
Hardware tools	**KARGOPARK**	Providing the smart parcel lockers
	ISTANBUL ENERGY	Providing the charging stations
	-TBD-	Providing two prefabricated structures for the MCC
	-TBD-	Providing electric Cargo bikes

Table 20: Key partners Istanbul UC3

In contrast to Use Case 1, Use Case 3 required infrastructure to be installed outside existing areas. This is reflected in the high complexity of the RACI sheet in the implementation phase. In addition, several roles are used for the same responsibilities. This is due to the use of several partners for the implementation of the last mile.

Utilising the RACI sheet (Figure 35) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Carrier (Paket Taxi), for the delivery of goods on the last mile
- In Store Collector (Migros), for the compilation of the goods parcels on the last mile
- Store e-commerce supervisor (Migros), for maintaining the micro hub and controlling outgoing goods
- Last Mile Food delivery Company (Paket Taksi, Iletmen), for the provision and maintenance of the bicycles used on the last mile
- E-Commerce Operations Team (Migros), responsible for analysing the current processes
- e-commerce IT team (Migros), responsible for distributing all collected data to the correct partners
- Project Team, for the overall support of the use case
- Store Manager (Migros), responsible for the hub in collaboration with the e-commerce supervisor
- Legal Team (Migros), installation of the Hub
- ICT-Tool Partners (NGS), evaluation of the collected KPI's

- Public Authorities (IMM), must be informed about the installation and use of infrastructure
- Smartlocker Provider (Kargopark), responsible for providing the necessary HUBs
- Energy Provider (Istanbul Enerji), necessary for the power supply of the new infrastructure
- Construction Partner (TBC), involved in the installation of the HUBs

	Responsibility type	Responsibilit	Responsibility Description	Carrier	Dark store collector	Store e-commerce supervisor	Last mile food delivery company	E-commerce operations team	E-commerce IT team	MIGROS Project team	Store manager	Legal team	ICT tool partners	IMM Project team	Last mile cargo delivery company	Public Authority	Smartlocker Provider	Energy provider	Construction Partner
Implementation Phase	Core	UCC	Providing of logistic equipment / furniture (hub interior) - Migros				R	A		I				I					
	Core	UCC	Providing of logistic equipment / furniture (hub interior) - İletmen											A	R	C			
	Management	UCC	Installation and construction of UCC (infrastructure exterior)					C		A				C		I			R
	Support	UCC	Installation of Sensors				R			C			C						
	Support	UCC	Integration of ICT tools, softwares and applications					C	R	I			C	C	R				
	Management	UCC	Testing of logistic resources				R	I		I				I	R				
	Support	UCC	Ensuring regulatory requirements for the implementation are met					R		C				A	R	I			
	Support	UCC	Prepare the physical space for the UCC			R		A		I	R			C	R	I	R	R	R
	Support	UCC	Training delivery staff				R	I		I				C	R				
	Management	UCC	Setting up contracts							R		C		R		C			
	Core	UCC	Installation Smartlocker											I			R		
	Support	UCC	Develpment of ICT Tools?			I	I	I		A			R						
Operational Phase	Core	UCC	Managing ingoing and outgoing supplier deliveries in the UCC			R					A				R				
	Core	UCC	Collecting orders from store shelves		R	A		I			I				R				
	Support	UCC	Providing necessary utilities for the UCC			R		C		I	R			R		C			
	Support	UCC	Providing e-bikes, necessary equipment and staff for bike delivery - Migros				R	A		I									
	Support	UCC	Providing e-bikes, necessary equipment and staff for bike delivery - İletmen											C	R				
	Support	UCC	Providing charging station for e-bikes					C		C				A		I		R	
	Support	UCC	Maintenance of the logistic resources - Migros				R	A		I									
	Support	UCC	Maintenance of the logistic resources - İletmen												R				
	Management	UCC	Scheduling order collectors' shifts - Migros		I	R		A			C								
	Management	UCC	Scheduling order collectors' shifts - İletmen											C	R				
	Management	UCC	Decision about the forecasts of future orders for better inventory - Migros			I		R	C	I	I								
	Management	UCC	Decision about the forecasts of future orders for better inventory - İletmen											C	R				
	Core	Last Mile	Cyclelogistic operations (Delivering Orders with e-cargo bikes) - Migros	R		A	I	I	C		I								
	Core	Last Mile	Cyclelogistic operations (Delivering Orders with e-cargo bikes) - Kargopark+İletmen												R		R		
	Management	Last Mile	Decision about the Route for delivery run - Migros	R		A	I		C										
	Management	Last Mile	Decision about the Route for delivery run - İletmen												R				
	Management	Last Mile	Decision about the forecasts of future orders for better source planning - Migros			I	I	R	C	I	I								
	Management	Last Mile	Decision about the forecasts of future orders for better source planning - İletmen												R				
	Management	Last Mile	Measuring KPIs from sensors on the e-bikes - Migros							C			R						
	Management	Last Mile	Measuring KPIs from sensors on the e-bikes - İletmen											C	R				
	Support	Last Mile	Daily data sharing process between technical partners and Migros					A	R	I			R						
	Support	UCC	Maintenance of the smartlockers											C	I		R		

Figure 35: RACI sheet Istanbul UC3

4.4 Logroño Use-Case 1

The Use-Case (Figure 36) aims for the consolidation of logistic operators using a nano-hub and implementing Last Mile Delivery with Cargo bikes. The nano hub will be composed of two mini hubs from INT merged (no smart lockers) and completed by a container type for logistics purposes only (new equipment from INT from another project). **LGN** will provide ground space at Parkin Revellin to install the hub and Cargo bikes to operate the last mile logistics. DHL is willing to test to do the last mile with new cargo bikes (either with the **Regional Platform for Mobility (RPM)** cargo bike or 2 ones owned by the municipality).

Logroño Use-Case 1: Nano-Hub with cycle logistics

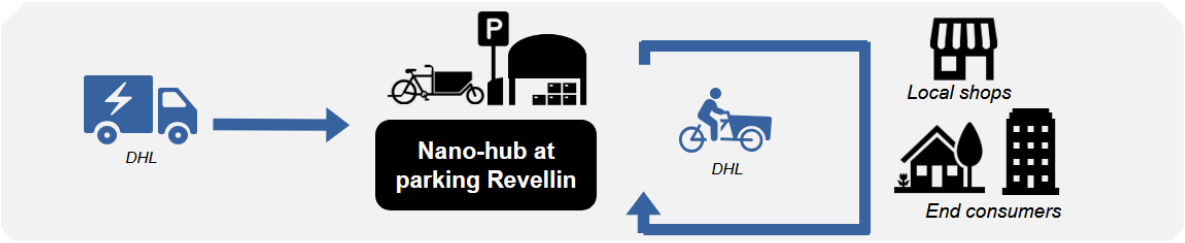

Figure 36: Logroño Use Case 1

Added value services

Some added-value services (Figure 37) were identified at the beginning of the use case definition and ranked by the local stakeholders depending on their level of interest for each, including decision support algorithms, parcel lockers on public space, and access control to the hub.

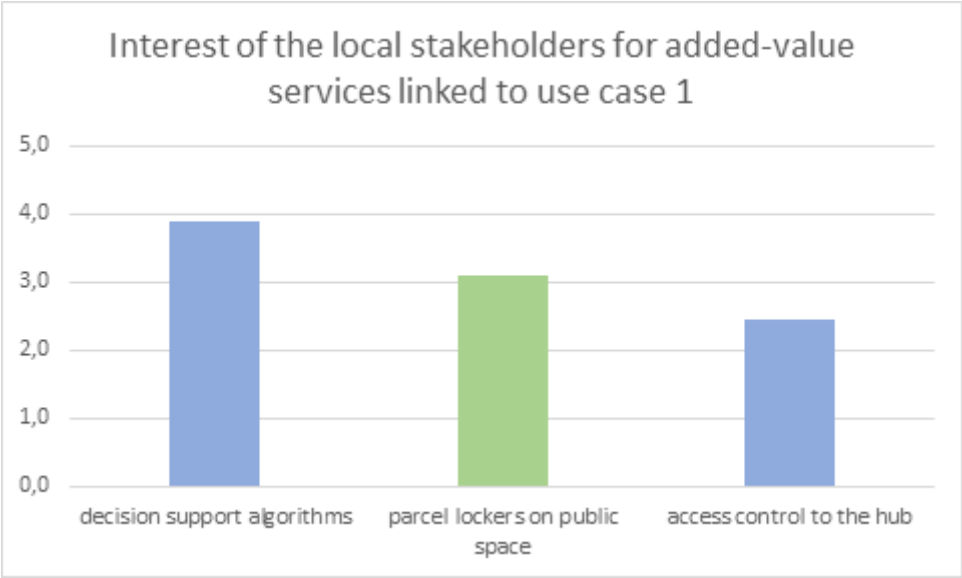

Figure 37: Local stakeholder interest for added-value services Logroño UC1

Based on these discussions, it is envisioned to implement the following services:

- Deported parcel storage (TBC based on the logistics lockers available)
- Renting of three public cargo bikes purchased by the municipality (with one owned by the mobility platform)
- Park and recharge cargo-bikes including private ones

The three cargo-bikes would be equipped with NGS trackers and made available to logistics operators or shops to book through the PVerde app, which will also provide access control to the hub.

To have decision support algorithm for the DHL operation is still under discussion.

The **Regional Platform for Mobility (RPM)** is interested in utilising the nano hub for parking one of their rental cargo bikes (either to DHL or to local commerce (B2C).

Value Proposition

DHL hopes that the implementation of the Nano Hub will give them the option to satisfy more direct and faster demands, improving movements between the base and the city centre. As in many cities, Logroño municipality is aiming to decrease traffic congestions especially in the narrow streets in the inner city. Additionally, replacing delivery by truck with electric cargo bikes aims to reduce the carbon footprint of logistic services leading to better air quality. The location at parking Revellin is a strategic location, close to the old town while providing a service to both sides of the city. Additionally, it will be creating a point for autonomous deliveries and will help the city to gaining data on deliveries to understand movements and volumes. Cargo bikes are not commonly known or used in Logroño. The city hopes that Use-cases like this will increase the visibility and encourage the future use of cargo bikes for logistic and personal uses.

4.4.1 Business Model

Time to market

Although there is no preexisting infrastructure specific to this use-case, significant groundwork has been laid. The hub structure has been successfully utilized on a smaller scale by INT in Logroño, providing a strong foundation for scaling up. Additionally, the PVerde app, already established for renting out cargo bikes, offers a seamless integration for managing the fleet. However, before operations can commence, it will be necessary to install the hub, purchase cargo bikes, and train logistics operators to ensure smooth functionality.

A key advantage is the municipality's active involvement, which facilitates the regulatory approval process. Given the straightforward and environmentally beneficial nature of the use-case, obtaining the necessary permits is expected to be relatively easy. However, securing the right stakeholders remains a challenge.

One of the most pressing concerns is securing a dedicated last-mile logistics (LML) and hub operator. Since logistic operators play a crucial role in the success of the project, their full commitment is essential. Ensuring clear communication and aligning goals external partners will be critical in minimizing potential delays.

Beyond securing partnerships, the implementation also requires the development of new operational processes for hub and cargo bike logistics, such as optimising bike loading and scheduling efficient bike routes. Furthermore, specialized training for personnel operating the cargo bikes is essential to ensure efficient use and minimal downtime.

Fortunately, resource availability is a strong point. INT is providing the necessary materials and infrastructure for the hub and cargo bikes, including the development and construction of the MCC. This reduces potential delays in acquiring equipment or setting up basic operations.

Financially, the initial costs for setting up the hub and purchasing two cargo bikes (including vinyl branding) are already covered, removing significant financial barriers.

Sustainable Business model Canvas

<table>
<tr><th colspan="4">Micro Hub with Cycle Logistic (Revellin)</th></tr>
<tr>
<td>Key Partnership
1. Hardware tools
- INT (MicroHub)
- FLEXIMODAL / CICLO XXI (cargo Bikes)
- INT (Charging stations for e-bikes)
- INT (Padlocks for bikes Security Equipment)
- NGS (Sensors to unlock and track Cargo bikes)

2. Software tools
- GGI (Data analysis)
-</td>
<td>Key Activities
1. Preparation and construction of Micro Hub
2. Delivering Parcels and Goods to the Hub
3. Last mile delivery of goods with cargo bikes

Key resources
1. Ground space with Micro Hub
2. Cargo bikes
3. Logistic service
4. Cycle logistic service</td>
<td rowspan="2">Value Proposition
1. Providing logistic/ storage space in the city centre
2. Increased efficiency due to consolidation of logistic operators
3. Integration of cargo-bikes into last mile delivery

Beneficiaries
Logistic operators through more sustainable delivery option, increased cost-efficiency and a consolidation hub in the city centre

Local authorities through reduced environmental and social costs

City residents through decreased congestion and air/noise pollution and option for sustainable delivery</td>
<td>Relationships
1. Personal assistance and Co-Creation during the rental of the ground space for Hub
2. Self Service operating the Hu and the cargo bikes

Governance model
Logistic Infrastructure:
- LGN
Logistic service:
- DHL</td>
</tr>
<tr>
<td colspan="2">Cost Structure
1. Development & Construction of UCC
2. Purchase of Cargo bikes
3. Operational costs of delivery vehicles and logistic infrastructure
4. Maintenance of ressources
5. Human Resources (Delivery staff etc.)
6. Training of delivery staff
7. Permits
8. Maintenance of logistic ressources</td>
<td>Revenue model
1. Cost reduction in last mile delivery due to increased efficiency
2. End receiver willing to pay more for sustainable delivery
3. Usage fee / rental of resources</td>
</tr>
<tr>
<td colspan="4">ICT-Tool integration:
In cooperation with DHL preliminary data collection could be initiated allowing for preliminary conceptualization and testing of real-time transportation monitoring and dynamic routing solutions. Tracking sensors will be installed at the cargobikes for T&T&M and there is potential for utilising dynamic routing solutions to optimize delivery paths, load optimization techniques to enhance freight efficiency.</td>
</tr>
</table>

Table 21: BMC Logroño UC1

Success Factors

For **DHL**, success hinges on maintaining operational performance comparable to the current delivery system. A **sufficient volume of shipments** is crucial to ensure the nano-hub is utilized optimally, enabling the delivery of the same number of shipments per day as their existing processes. Establishing efficient workflows and leveraging cargo bikes effectively will be key to achieving this goal. From the perspective of **Logroño's municipality (LGN)**, promoting the nano-hub and its benefits through targeted **communication campaigns** is vital. These efforts aim to enhance visibility and foster community support for the initiative. The project's success also relies on the **engagement of at least two logistics operators** to ensure multi-operator collaboration and sustainable hub utilization. Positive **public perception** is another critical factor. The hub must be seen as a beneficial addition to urban logistics, improving sustainability and reducing traffic congestion. Ensuring the long-term viability of the hub, ideally through continued operation by DHL and other operators, is a primary objective for the municipality. To prevent potential risks of failure, such as **vandalism of the nano-hub** or the **non-utilization of cargo bikes**, robust security measures and operational planning will be necessary. Encouraging consistent use of cargo bikes through proper training, reliable equipment, and operational efficiency will help mitigate these concerns.

Ultimately, the success of this use-case will be measured by its ability to maintain efficient delivery operations, foster collaboration among multiple logistics operators, and achieve a positive, sustainable impact on urban logistics in Logroño.

Operational Risks

One significant risk is the **lack of expertise in maintaining the cargo bikes**, as the municipality, while responsible for the bikes, does not have the technical knowledge required for upkeep. This could lead to mechanical failures or poor maintenance. To address this, training and technical support could be considered for the municipal staff or contracting a professional maintenance service for regular inspections and repairs could ensure the bikes remain in optimal condition.

Access issues at the hub, potentially caused by software malfunctions, could disrupt operations. To mitigate this, a robust support protocol will be established, including a hotline for immediate troubleshooting and contingency plans to handle temporary access challenges.

Physical damage or vandalism to the hub and cargo bikes represents another risk. Security cameras will be installed to monitor the hub and deter malicious activity. Proper training and signage will be provided to ensure bikes and equipment are handled carefully. To minimize financial losses from damages, insurance coverage for the bikes and hub infrastructure will be considered.

Ensuring cargo bikes have sufficient **battery power** for each delivery cycle is critical. If bikes are not plugged in after use or charging cables are missing or damaged, operations could face significant delays. To address this, operational protocols will require that bikes are plugged in after every use, supported by visual cues or a tracking app to monitor battery levels in real-time. An inventory system for charging cables, with regular checks and a rapid reporting mechanism for damages or losses, will ensure availability and functionality.

Finally, inefficiencies in the **hub layout or parcel sorting system** could lead to congestion or delays in deliveries. Careful planning of the hub's design and workflows, along with regular feedback and adjustments, will ensure efficient sorting and loading processes.

By addressing these risks through strategic training, protocols, and infrastructure enhancements, the nano-hub and cargo bike delivery system can operate reliably and efficiently, ensuring successful last-mile delivery in Logroño.

Long term perspective and scalability potential

For logistics operators like DHL, the hub's relevance will increase in scenarios where pedestrianized areas or stricter access restrictions make traditional delivery methods less viable. The development of complementary policies such as **low emission zones** will create a regulatory framework that further incentivises sustainable last-mile delivery solutions. DHL states that adapting to the new distribution structure will remain a challenge, but this use-case could serve as a valuable pilot for refining processes and aligning them with future urban logistics needs, thus they are open for a potential long-term implementation of the use case.

Finally, a positive perception of the hub among stakeholders, including logistics operators and the municipality, will be critical for long-term sustainability. If the hub demonstrates clear benefits, such as reduced emissions and efficient delivery services, the municipality is open to commit to continued operation and expansion.

The scalability of the nano-hub model lies in its adaptability and potential for expansion. Successful operations could pave the way for increasing the number of hubs across the city or expanding their size to handle larger delivery volumes. This approach aligns with a broader strategy to enhance urban logistics while minimizing environmental impact.

A key factor in scaling up is increasing the level of **delivery consolidation**. In the future, other logistics operators like GLS, MRW, or DASHER could be integrated into the hub's ecosystem, leveraging its

infrastructure to implement their own cargo bike delivery solutions. LGN is also exploring options to rent cargo bikes during the project timeframe, offering greater flexibility and supporting a wider range of operators.

Ultimately, the scalability of this model depends on its ability to demonstrate profitability and efficiency, fostering a shift in mindset toward sustainable logistics. With the right combination of stakeholder buy-in, policy support, and operational optimization, the nano-hub concept could become a cornerstone of Logroño's urban logistics framework.

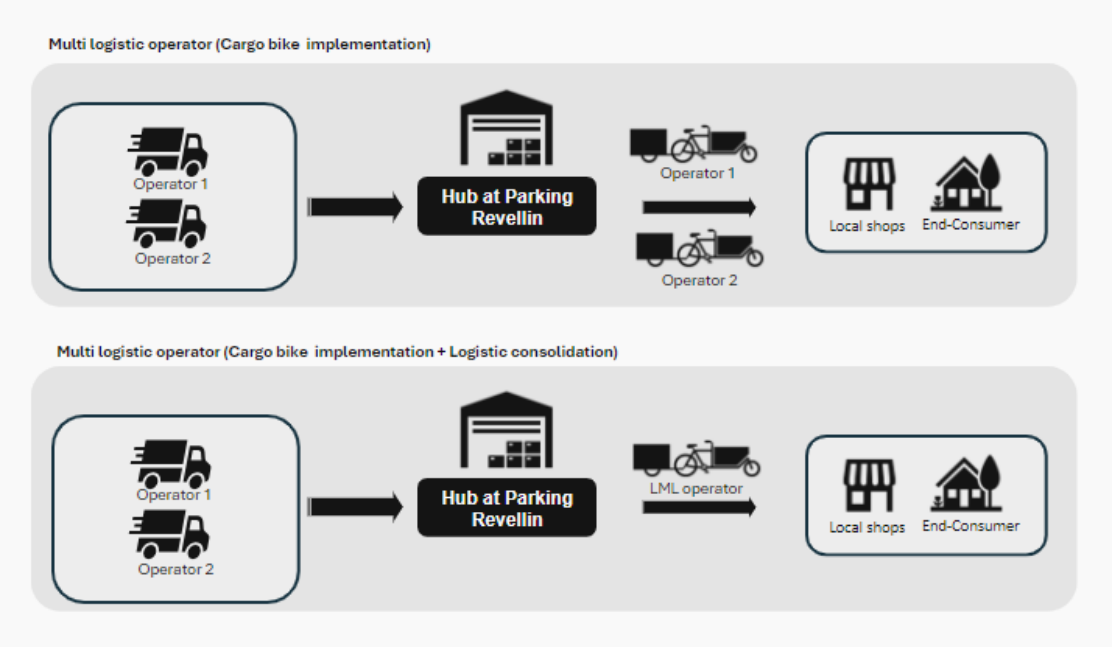

Figure 38: Example of the integration of an additional logistic operator in Logroño UC1

4.4.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the sensitivity of financial figures, **Erreur ! Source du renvoi introuvable.** the costs supported by each of the partners involved in this use case.

Partner	Costs Covered
LGN	- Purchase of cargo-bikes - Communication material costs - Infrastructure cost for hub implementation
DHL	- Carrier for the last-mile deliveries and training - Operational cost for the hub management
INT	- Hub development and installation - Hub maintenance
NGS/ GGI	- Purchase of the trackers - Management of the data

Table 22: Costs and partners responsible Logroño UC1

Currently, most of the resources and costs are covered by the project funds and the partners, which has enabled the initial implementation of the hub and cargo bikes. However, the continuation of these services beyond the project timeline remains uncertain, as it depends on the economic viability of such operations once the European funding is no longer available. A critical concern is whether DHL, as a

key logistics operator, will sustain its collaboration with either the municipality or another operator after the project's completion.

Hardware and operational costs are notable challenges. DHL has expressed concerns about the incompatibility of hardware systems, as logistics companies typically require the use of their proprietary systems. This creates potential inefficiencies and increases costs for multi-operator collaboration. Additionally, eco-friendly logistics solutions, such as cargo bike-based deliveries, are currently more expensive than traditional methods. DHL notes that **the higher costs associated with clean transportation must be offset by identifying and leveraging efficiencies in other areas of the operation**.

For the nano-hub to achieve long-term economic sustainability, cost recovery mechanisms need to be developed. These could include optimising delivery consolidation to reduce operational redundancies, exploring shared funding models with additional stakeholders, and securing municipal support for green logistics incentives. Parking models for cargo bikes, akin to city bike rental systems, may also offer an additional revenue stream and a scalable infrastructure solution.

4.4.3 Governance Model

Stakeholders involved in the Use-Case

Stakeholder	Role	Responsibility
LGN representative for Logroño Municipality	Infrastructure and regulations	Providing: • Legal framework • Ground space for the nano hub • 2 Cargo bikes
DHL DHL is a logistics company providing courier, package delivery and express mail service	Logistic Operator	Delivering goods to the MCC and operating the last mile delivery with cargo bikes • Providing: • Logistic vehicles • Delivery personal

Table 23: Stakeholders involved Logroño UC1

Key partner for the implementation and operational phase of the Use-Case

Area of operation	Stakeholder	Responsibility
Hardware tools	**FLEXIMODAL**	Cargo bike provider
	Regional Platform for Mobility (RPM)	Potential provider of 1 Cargo bike / Customer for renting the hub as parking space
	INTELLIGENT PARKING (INT)	Development and Construction of the MCC
	CICLO XXI	Maintenance of Cargo bikes
Technical partner	**NGS (**New generation Sensors)	Providing the sensors for the delivery vehicles
	GGI (Genegis GI)	Analysing data providing the results

Table 24: Key partners Logroño UC1

Due to the construction on public land and the provision of infrastructure also for the public sector, there is a high level of complexity, which is shown in the implementation.

In the operational phase, the local maintenance of the infrastructure as well as the management of the hub must also be mapped. The RACI sheet will be expanded for this purpose once it is clear which roles need to be informed.

Utilising the RACI sheet (Figure 39) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- User of municipal Cargo Bike, as a user of the public infrastructure
- Owner of private Cargo Bike, as user of public infrastructure
- Mobility Public Manager, as the person responsible for maintaining the installed infrastructure and for day-to-day management
- Nano Hub Installer (INT), as the installer of the infrastructure
- Projecto Coordinator, Data Recipient and Data Collector as roles still to be developed
- Digital Analyst, responsible for analysing the collected data

	Responsibility type	Responsibility Cluster	Responsibility Description	User of municipal cargo bike	Owner of private cargo bike	Mobility public manager	Nano hub installer	Projecto Coordinator	data recipient	data captured	data analyst
Implementation Phase	Core	Nano Hub	Providing of logistic infrastructure			R	R	A			
	Management	Nano Hub	Date of the Installation of Micro-Hub			R	A				
	Support	Last Mile	Installation of Sensors and Integration of Software applications			A	R				
	Support	Nano Hub	Testing of logistic ressources			A					
	Core	Nano Hub	Ensuring regulatory requirements for the implementation are meet			R		A			
	Support	Nano Hub	Preparation of the physical space			A					
	Core	Nano Hub	Setting up contracts			R	R				
	Core	Last Mile method 1	Purchase of municpal cargobikes			R		A			
	Core	Last Mile method 2	Agreement with users of parking for private cargobikes			R					
Operational Phase	Core	Nano Hub	Managing ingoing and outgoing deliveries in the mini hub	R	R						
	Core	Nano Hub	Installation of the nano hub			A	R				
	Management	Last Mile	Decision about the Route for delivery run	R	R						
	Core	Nano Hub	Promoting uses of nano hub			R					
	Management	Nano Hub	Agreement of goods and parcels that can be stored or not			R					
	Core	Nano Hub	Learning about platform use for operators and customers				R				
	Management	Last Mile method 1	Protocol for users of municipal cargo bikes			A	R				
	Management	Last Mile method 2	Protocol for users of parking of private cargo bikes			A	R				
	Support	Nano Hub	Reception of items/goods for delivery or storing	R	R						
	Support	Nano Hub	Classification of items/goods per route	R	R						
	Support	Last Mile 1	cargobikes storing	R	R	A					
	Core	Last Mile	data collection			A	R				
	Support	Last Mile	control of digital data captured			A	R				
	Support	Last Mile	analysis of digital data captured			A	R				R
	Support	Last Mile	Maintenance of digital tools			A					
	Support	Hub	Maintenance of the nano hub			A	R				

Figure 39: RACI sheet Logroño UC1

4.5 Logroño Use-Case 2

This use case (Figure 40) will focus on consolidating flows from the local market San Blas, with the creation of a consolidation centre in the basement, serving for storage purposes mainly for San Blas shops and other places (shops located nearby) if necessary. Vehicles of the operators would then continue their tour after they left the parcels at the hub, while the last mile delivery will be done by a cycle-logistic operator with electric cargo bikes. The ground floor of the UCC is 25m² and can serve for un/loading operations from different suppliers (DHL, Riofarco, merchants...) for the last miler Ciclo to sort and operate.

A range of additional services is planned to enhance the hub's functionality. One key initiative is the implementation of reverse logistics, utilising the San Blas market hub to consolidate and recycle waste (oil and glass) from local HORECA (Hotels, Restaurants, and Catering) businesses. Additionally, a community delivery service is being considered, aiming to leverage the hub for consolidating essential goods – such as pharmaceutical products, meal trays, and other necessities- to dependent individuals.

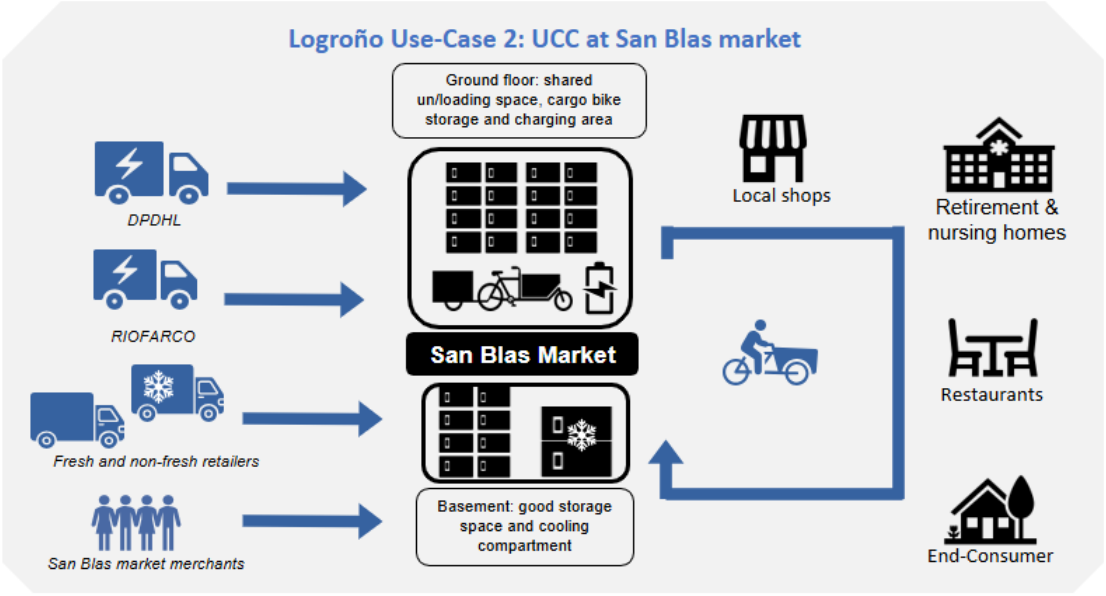

Figure 40: Logroño Use-Case 2

Use Case 2.1 Reverse logistics

Reverse logistics for local HORECA commerce' waste (oil and glass), with multimodal transport (cargo-bikes and light vehicles), will be integrated in the use case as an added-value service. On the way back from fresh good delivery, the logistic operator will pick up waste from restaurants to store them in a separate area of the San Blas basement. Waste collectors (including relevant services from the municipality such as the environmental department) will then come and pick up the waste at the hub to go back for treatment.

Actors involved would be:

- Jimeno Tagus and its clients (used oil recycling company)

Figure 41: Logroño Use-Case 2.1

Use Case 2.2 Community services

Riofarco is currently consolidating products for pharmacies mostly (some B2C as well), leading to quite express / urgent deliveries with up to 20-30% empty space in the vans. They do not have electric vehicle in their fleet. Their current location is quite central (7 km to city centre), from where they operate 3

vans. They have internalised all their deliveries. Their average route is 16 km, and average delivery weight per pharmacy is around 10 kg.

When it comes to social deliveries, regulations foresee the employment of a specialised carrier, either because the goods treated are sensitive (Riofarco) or because of the assistant profile of the work (TSYS).

This additional service to the San Blas hub could aim to consolidate deliveries to elderly homes including, pharmacies, orthopaedics and/or food delivery utilising the newly created consolidation area and implementing last mile delivery with cargo bikes. The idea is that instead of several operators and shops delivering goods individually, goods are delivered, consolidated and stored at San Blas according to their destination, from where goods are delivered by one operator using cargo bikes.

Optionally, the flows of goods to the San Blas market hub will be already consolidated by one operator, collecting goods from different shops based on available space.

Actors involved would be:

- Riofarco
- TSYS

Figure 42: Logroño Use-Case 2.2

Other services identified:

A survey was sent to local stakeholders, to narrow-down other services that might be interesting to add. According to the survey decision support algorithms and parcels lockers on public space are interesting. Figure 43 presents the results of the survey.

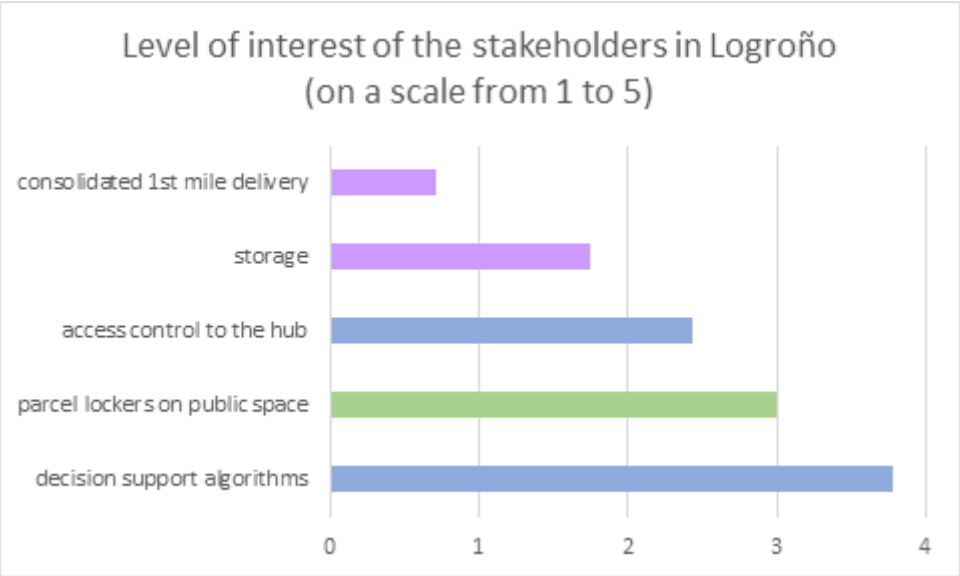

Figure 43: Level of interest of stakeholders in Logroño UC2

Thus, parcel lockers will be placed near San Blas market and is discussed the use of digital solution to optimise consolidation operations from the San Blas market.

Value proposition

The San Blas Market Urban Consolidation Centre (UCC) presents a multi-faceted value proposition, offering a range of benefits for the participating stakeholders, including merchants, logistics operators, but also for the local community.

For merchants, the UCC enhances delivery services by providing a centralized hub for consolidating goods, enabling small shops and local businesses to participate in efficient last-mile delivery services. This not only promotes the modernization of local commerce but also increases the market's attractiveness by creating new shop rental opportunities for both existing and prospective merchants.

For logistics operators like DHL, the UCC ensures greater proximity and speed for deliveries within the city centre, allowing operators to drop off parcels at the hub and optimize their routes. This consolidation model also supports the use of sustainable cycle-logistics, with electric cargo bikes ensuring non-autonomous, eco-friendly last-mile deliveries.

Beyond standard logistics, the UCC introduces innovative services like reverse logistics for consolidating and recycling HORECA waste, as well as community-focused deliveries of pharmaceutical products, meal trays, and essential goods for dependent individuals, such as the elderly or those in nursing homes.

The use-case aligns with urban sustainability goals by promoting cycle-logistics businesses, aiming for reducing traffic congestion in the inner city, and gathering valuable data to improve urban delivery systems. Additionally, the integration of restaurant delivery services extends the UCC's reach to areas outside the city centre, enhancing service scope while supporting local eateries.

Ultimately, the San Blas Market UCC represents a modernized logistics solution that not only improves operational efficiency for merchants and operators but also reinforces the municipality's commitment to sustainable urban development, community service, and the promotion of local commerce.

4.5.1 Business Model

Time to market

The time to market for the San Blas market consolidation hub is dependent on several key factors, primarily involving infrastructure adaptation, new equipment integration and stakeholder engagement and coordination. Although the San Blas market building was identified quickly and provides a ground infrastructure to be utilised as UCC, several modifications, including the installation of an additional **elevator entry** and setting up the **basement warehouse** with shelves and fridges need to be executed. While the **market space** is available, the infrastructure for **cycle-logistics** does not yet exist and will need to be developed. This was identified as one of the most time-consuming factors for the implementation since LGN LL must establish a new service from scratch. Finding a suitable **cycle-logistics operator** for last-mile deliveries is a critical step. A **tender** will need to be initiated to identify and secure the right operator, which could delay the project timeline.

Navigating the **regulatory landscape** required a close collaboration with the **municipality**, which is an active partner and thus could secure the necessary approvals. Coordination with **external stakeholders** (e.g., DHL, Riofarco, local shops) also poses challenges, as the integration of different systems and processes remains undefined and the commitment of stakeholders during the planning phase was pending. During the initial trial phase, only a **small number of shops** will be included to establish basic processes before scaling up.

From an **equipment integration** standpoint, cargo bikes will need to be thoroughly tested, as this new equipment will require adaptation and process development. No predefined **consolidation processes** exist, and decisions around the appropriate tools, software, and data protection regulations will need to be made. In addition, a designated **training** period will be necessary as no prior experience in cycle-logistics, or the consolidation process exists.

The project and the project partners are covering the key costs for the use-Case, thus the construction and preparation of the space, the personnel costs and the two cargo bikes. Nevertheless, while **personnel resources** for logistics are covered by the municipality, they are not financing the **training of delivery personnel,** which is due to the difficulty to justify the hiring of a delivery service that needs training in a public procurement**.**

In summary, the key influential factors for a longer time to market for the San Blas Use-Case are the stakeholder engagement and consolidation and the lack in established cycle logistics and consolidation processes to build on.

Business model canvas

Urban Consolidation Centre with cycle logistic at San Blas market

Key Partnership

1. Hardware tools
   - INT (storage lockers)
   - LGN (Refrigerated lockers)
   - Fleximodal (Cargo Bikes with Padlocks and charging stations)
2. ICT Tools
   - NGS (Sensors to unlock and track Cargo bikes)
   - GGI (Data analysis)
3. Services
   - CYCLO XXI (Bike maintenance)

Key Activities

1. Selection & Preparation of rental space
2. Construction of Micro Hub in San Blas market with charging station for electric vehicles
3. Delivery and storage of goods in the UCC
4. *Delivering goods to UCC
5. Distribution of goods from the UCC with Cargo bikes
6. *Collection of Waste from restaurants and local shops and storage in UCC
7. *Collection and disposal of waste

Key resources

1. Logistic operation (delivery vehicles and personal)
2. Ground space with UCC
3. Electric Cargo bikes and charging infrastructure
4. *Logistic operation (delivery vehicles and personal)
5. *Logistic operation (delivery vehicles and personal)

Value Proposition

1. Providing logistic/storage space in the city centre
2. Providing access to last mile delivery with cargo bikes
3. Integration of cargo-bikes & electric vans into last mile delivery

Beneficiaries

Logistic operators & Local shops through more sustainable delivery option, strategic hub location, and increased cost-efficiency

Local authorities through reduced environmental and social costs

City residents through decreased congestion and air/noise pollution and option for sustainable delivery

Added Value Service

*Reverse Logistics (Recycling)

* Community service delivery

Relationships

1. Personal assistance and Co-Creation during the rental of the Micro Hub
2. Self Service operating the Micro-Hub lockers

Governance Model

Logistic operator:

- DHL
- RIOFARCO

Logistic infrastructure: LGN

Last mile delivery: TBD through a tender

Waste collection: Jimeno Tagús

Cost Structure

Implementation Costs

- Preparation of rental space
- Construction of Micro Hub, Smart lockers & charging stations at San Blas market
- Software purchase / development
- Training of delivery personal

Running Costs

- Maintenance of logistic resources
- Human Resources (delivery and customer support)
- Operational costs for logistic vehicles
- Electricity for Hub
- Sever for Data storage
- IT-Support

Revenue model

- Rental of storage space
- Service fee / Subscription for last mile delivery with Cargo bikes
- Pay per use + Margin on electricity provided
- Cost reduction in last mile delivery due to increased efficiency
- End receiver willing to pay more for sustainable delivery

ICT-Tool integration:

Sensors at cargo bikes can enable real-time transportation monitoring and reporting. Additionally, there is the potential for the utilization of load optimization, network design, and forecasting and optimization algorithms.

Figure 44: Sustainable Business Model Canvas Logroño UC2

Success Factors

DHL emphasized the importance of partnering with a reliable cycle logistics operator who has a deep understanding of the transport market. Daily route organization and strict adherence to schedules are critical to building client trust and ensuring smooth delivery operations. Similarly, the municipality identified several success factors, with one of the most significant being the identification and contracting of a dependable cycle logistics operator. This operator will be responsible not only for

managing last-mile deliveries but also for coordinating and consolidating goods from multiple suppliers. Efficient management and coordination of the various customers and users of the service will also be crucial. Establishing a practical and effective consolidation process is essential to ensure the success of logistics operations. Additionally, providing clear and proper contracts and tenders to all stakeholders is a key priority. Lastly, the successful integration of cargo bikes as a sustainable mode of transport must be carefully managed. This includes ensuring the bikes meet the diverse requirements of transported goods, particularly for recycling items like oil and larger pallets, to address the specific needs of this use case.

Operational Risks

Several operational risks have been identified by the stakeholders.

The **25m² ground floor**, designated for storing bikes and facilitating un/loading operations, may prove insufficient during peak times, potentially causing congestion and delays. To mitigate this, operations should start with a **minimum viable number of parcels and logistics stakeholders**, scaling up gradually as processes stabilize. Additionally, **demand forecasting** and **scalable storage solutions**, such as modular shelving or off-site storage, will ensure adequate space during peak periods.

Poor scheduling or communication between suppliers and the hub/last-mile operator could lead to **bottlenecks**, especially when synchronizing deliveries with cycle-logistics operators, given the diverse systems and software used by each operator. To address this, **clear communication protocols**, **process guidelines**, and **contingency plans** for delays will be established. The **lack of integration** between software systems used by suppliers, the hub, and cycle-logistics operators may further hinder seamless operations. As highlighted by DHL, companies often restrict the use of their proprietary systems. To overcome this, the UCC will evaluate the extent to which existing systems can be leveraged and develop **cross-platform coordination mechanisms**.

Other factors that could compromise the delivery process include **supplier delays** and **delivery volume overload**. Delays caused by traffic, strikes, or unforeseen disruptions could disrupt the timely flow of goods into the hub. **Contingency plans** and **protocols for late arrivals** will help manage this risk. Additionally, an excessive volume of deliveries could overwhelm the hub's capacity to coordinate and distribute goods effectively. To mitigate this, clear **thresholds for parcel volume** and a **defined delivery radius** will ensure operations remain manageable, especially during the initial implementation phase.

During site visits, it was identified that **Fleximodal trailers** used in the logistics process may not fit through the basement corridor, complicating the movement of goods between levels. This issue will be addressed by identifying **alternative trailers or equipment** to facilitate smooth transitions.

Finally, the use of **electric cargo bikes** could face performance issues during severe weather conditions such as rain, extreme heat, or snow. To mitigate this, regular **maintenance schedules** and **backup vehicles** will ensure continuity of service. Additionally, delivery personnel will be provided with **protective gear**, including rain jackets, gloves, and helmets, to enhance safety and operational resilience in adverse weather.

Long term perspective and scalability potential

The long-term viability and scalability of the San Blas market consolidation hub remain to be fully determined. However, several factors will influence its future success. One hindering factor is the **lack of a dedicated cycle-logistics operator** to drive the project forward. For long-term perspective, it will be essential to establish a **functioning logistics process**, secure a reliable **last-mile logistics operator**, and reach an agreement on the **rental of San Blas market space**.

In terms of scalability, the potential exists to expand the service by **including more local shops**, increasing **delivery volume**, and adding **more vehicles**. As the system matures, these expansions could significantly enhance the operational capacity and reach of the service, positioning it as a sustainable, city-wide solution for local deliveries.

4.5.1.1 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Taking into account the sensitivity of financial figures, **Erreur ! Source du renvoi introuvable.** presents the costs supported by each of the partners involved in this use case.

Partner	Costs Covered
LGN	- Hub implementation (including adaptation works) and management costs - Last-mile deliveries operator
DHL and other	- Courier to consolidate goods to the hub
INT	- Lockers' development, installation and maintenance
Jimeno Tagus	- Courier to pick-up waste consolidated into the hub

Table 25: Costs and partners responsible Logroño UC2

Thanks to the public procurement established and launched by the municipality, last-mile deliveries by cargo bukes will be free of charge for the entire duration of the use case. This applies to logisitics operators using the San Blas hub for consolidation and to San Blas merchants, who will have the opportunity to test shared deliveries for their goods.

This experimentation period will allow the municipality and local partners to evaluate the model and explore its long-term viability. After the project ends, they aim to develop a sustainable approach based on stakeholder interest and willingness to pay for this newly tested service.

4.5.2 GOVERNANCE MODEL

Stakeholder involved in the Use-Case

Stakeholder	Role	Responsibility
LGN representative for Logroño Municipality	Logistic infrastructure and regulations	Construction of UCC in San Blas Providing: - Ground space in the Basement of San Blas market with smartlockers - Charging infrastructure for e-delivery vehicles - 2 Electric Cargo bikes
CICLO XXI Is a bicycle repair shop in LGN LL carrying out all kinds of bike inspection and repair work	Bike maintenance *Potential Last mile operator (The last mile operator will be defined through a tender)	Maintaining and repairing the Cargo bikes. * Consolidating of goods and last mile cargo bike delivery Providing: - Trained personal + equipment - Cargo bike maintenance service
DHL DHL is a logistics company providing courier, package delivery and express mail service	Logistic Operator	Delivering goods to the UCC
RIOFARCO	Logistic Operator	Delivering goods to the UCC
JIMENO TAGÚS	Recycling and recovery of waste company	Picking up waste from San Blas market for treatment

Table 26: Stakeholders involved in Logroño UC2

Key partner for the implementation and operational phase of the Use-Case

Area of operation	Stakeholder	Responsibility
Hardware tools	**FLEXIMODAL**	Cargo bike provider (2 electric cargo bikes) Locks for the bikes Charging stations
	INTELLIGENT PARKING (INT)	Providing the Smartlockers
	LGN	Refridrigated Lockers
Technical partner	**NGS (**New generation Sensors)	Providing the sensors for the delivery vehicles
	GGI (Genegis GI)	Analysing data providing the results
User of the UCC	**San Blas merchants**	Storing goods in San Blas Basement

Table 27: Key partners involved in Logroño UC2

Instead of creating new infrastructure, this use case focuses on redesigning existing areas and implementing new processes in already established procedures. A correspondingly small amount of responsibility lies in the implementation, as new operational processes have to be set up. Reverse logistics was outsourced to a separate RACI sheet for clarity and due to the significantly different processes; the roles involved also differ.

Utilising the RACI sheet (Figure 45) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Delivery person, responsible for last mile delivery
- Hub controller, for the acceptance of goods for the transshipment centre
- Retailers, as delivering customers
- Hub maintenance staff, for the maintenance of the local infrastructure
- Project coordinator, mainly responsible for the implementation of processes
- Market manager, responsible for the entire San Blas complex
- Data recipient, as data collector
- Data analyst, as data analyst
- Restaurant user, as customer of the waste process
- Waste company (Jimeno Tagus), as the executing waste specialist

	Responsibility type	Responsibility Cluster	Responsibility Description	Delivery person	Hub controller	Retailers	Hub maintenance staff	Project coordinator	Market manager	data recipient	data analist
Implementation Phase	Core	Hub	Providing of logistic infrastructure					C	R		
	Core	Last Mile	Hiring the delivery service					C	R		
	Support	Last Mile	Installation of Sensors and Integration of Software applications					R	A		R
	Support	Hub	Testing of logistic ressources	R				I	A		
	Management	last Mile/hub	Ensuring regulatory requirements for the implementation are meet					A	R		
	Support	Hub	Preparation of the physical space				R	A	R		
	Support	Last Mile	Training delivery staff	R				C	A		
	Support	Last Mile	Setting up contracts					A	R		
Operational Phase	Core	Hub	Commercial tasks to catch potential customers					C	R		
	Management	Hub	Agreement of goods and parcels that can be stored or not	C	C		I	C	R		
	Management	Hub	Protocol for beneficiaries of the delivery service	C	C		I		R		
	Support	Hub	Reception of items/goods for delivery or storing		R				I		
	Support	Hub	Classification of items/goods per route	R					I		
	Support	Hub	Storing of items/goods		R				I		
	Management	Last Mile	Decision about the Route for delivery run	R					I		
	Support	Hub	Providing necessary utilities for the hub						R		
	Core	Last Mile	Cyclelogistc operations (Delivering Parcels with cargo bikes)	R					A		
	Support	Last Mile	cargobikes storing	R							
	Core	Last Mile	data collection			I				R	
	Support	Last Mile	control of digital data captured						R	A	
	Support	Last Mile	analysis of digital data captured	C					A		R
	Support	Last Mile	Maintenance of digital tools	C						R	
	Support	Hub	Maintenance of the logistic ressources	C			R				

Figure 45: RACI sheet Logroño UC2

	Responsibility type	Responsibility Cluster	Responsibility Description	Delivery person	Hub controller	Restaurant user	Waste company	Hub maintenance staff	Project manager	market public manager	data recipient	data captured	data analyst
Implementation Phase	Core	Hub	Providing of logistic infrastructure focused on reverse logistics	I				C	A	R			
	Support	Reverse logistics	Installation of Sensors and Integration of Software applications	I			I		A			R	
	Support	Hub	Testing of logistic ressources	R					A				
	Core	Hub	Ensuring regulatory requirements for the implementation are meet						A	R			
	Support	Hub	Preparation of the physical space					R		A			
	Core	Hub	Setting up contracts							R			
	Support	Reverse logistics	Training delivery staff	R						A			
Operational Phase	Core	Reverse logistics	Demand method of waste collection	R		C	R						
	Support	Reverse logistics	Commercial tasks to catch potential customers							R			
	Support	Hub	Drafting Protocol to store waste in the hub	I		C	C			R			
	Core	Reverse logistics	Drafting Protocol for restaurants users of the service	I		C	C			R			
	Support	Reverse logistics	Requirements for reception of waste collection	I			C			R			
	Support	Reverse logistics	cargobikes storing	R				I					
	Core	Data	data collection									R	
	Support	Data	control of data captured							R	A		I
	Support	Data	analysis of data captured							R	A		R
	Support	data	Maintenance of digital tools							R	A		
	Support	Hub	Maintenance of the hub					R					
	Support	Hub	Cleaning tasks		A			R					
	Core	Reverse logistics	Delivery of waste to final manager	I	R								

Figure 46: RACI sheet Logroño UC2

4.6 Logroño Use-Case 3

To encourage citizens to explore the city centre and shop in the local shops, Logroño will install parcel lockers near commercial areas of the city centre and old town, in 3 different locations. The lockers will serve two main functions.

First, they will provide storage for citizens to store their bags or shopped goods, for up to 24h, while visiting the city or going to a restaurant. This will be a way to promote the combined entertainment of local shopping and restauration in a single trip to the centre.

Second, they will allow local shops to sell goods outside opening hours by utilising smart lockers as self-service pick up stations. Shops can store the goods purchased online to be picked up by citizens.

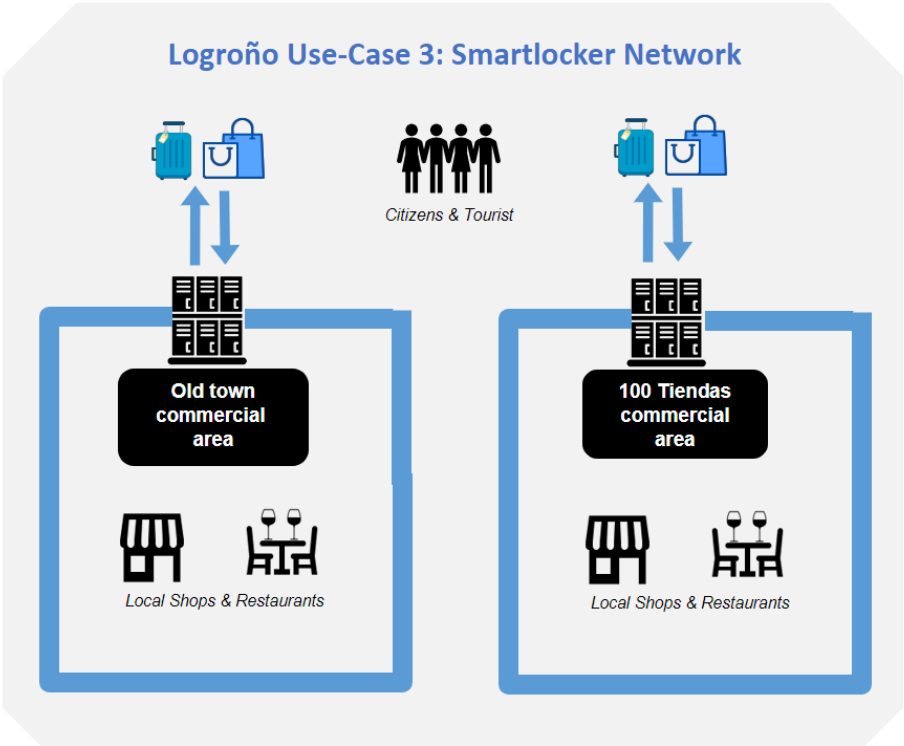

Figure 47: Logroño Use-Case 3

Value Proposition

Logroño, the capital city of La Rioja, Spain, is renowned for its vibrant cultural heritage, bustling shopping districts, and rich culinary experiences. Despite its charm, the city is facing a significant decline in the number of citizens and tourists engaging in local shopping activities within the city centre. One issue identified is the lack of convenient storage options, as there are no lockers available for visitors to store their purchased goods or luggage. This discourages extended visits, as people must carry their belongings, limiting their ability to explore the city and dine at local restaurants freely. The installation of parcel lockers in Logroño's city centre and old town aims to enhance the urban experience for residents and visitors while supporting local businesses. By providing convenient storage solutions, the lockers enable citizens and visitors to store their shopping bags or goods for up to 24 hours, encouraging them to combine retail and recreational activities, such as dining or exploring the area, in a single visit. Additionally, the lockers serve as smart pick-up stations for local shops, allowing businesses to extend their reach beyond traditional opening hours. This feature also benefits restaurants, enabling off-business hours pick-up services. Overall, the lockers reduce the need for extensive travel within the city for shopping and entertainment, promoting more sustainable and accessible urban mobility while fostering the growth of local commerce.

4.6.1 Business Model

Time to Market

Overall, the time to market for this use-case is expected to be relatively short, thanks to the proximity of key stakeholders, streamlined resource availability, and the municipality's active support in navigating regulatory and logistical challenges. However, identifying appropriate locations and establishing robust operational processes remain critical milestones for timely implementation.

The most challenging aspect of the implementation has been identifying suitable and secure locations for the lockers. While several potential locations were identified, not all met the necessary criteria, such as easy access to electricity. An ideal location must balance user accessibility with a safe environment to mitigate risks of vandalism or theft.

Infrastructure availability and equipment integration are also key factors. Since the lockers need to be newly constructed and installed, with no pre-existing infrastructure being repurposed, the process requires careful planning and execution. Fortunately, INT's proximity to Logroño ensures efficient management of the installation phase.

Regulatory approvals play a crucial role, as the lockers will be placed on public ground. The municipality's involvement is essential for navigating local regulations, securing necessary permits, and ensuring compliance with data protection laws for customer information and potential camera surveillance.

Key partnerships are well-aligned, with INT and the municipality (LGN) actively engaged in the consortium. However, successful operations will also depend on close collaboration with local stakeholders, particularly local shops. Since this will be the first time smart lockers are used for food and goods delivery by local merchants, a straightforward user experience and clear training processes will be essential to ensure adoption and smooth functionality.

Business model canvas

<table>
<tr><th colspan="4">Smartlocker network in the city centre</th></tr>
<tr>
<td rowspan="2">Key Partnership
Hardware tools:
- INT (Smart lockers)

Local shops:
- 100 tiendas merchants' association</td>
<td>Key Activities
1. Selection & Preparation of rental space
2. Construction of Smartlockers
3. Maintenance of Smartlockers
4. Customer service</td>
<td rowspan="2">Value Proposition
1. Providing storage space in the city centre for pedestrians
2. 24/7 sales and distribution point for local shops

Beneficiaries
Local shops through more sustainable delivery option and sales outside opening hours

Local authorities through reduced environmental and social costs

City residents through easier access to city by foot and delivery services outside of shop opening hours</td>
<td>Relationships
1. Self Service operating the Smart lockers
2. Customer support and Co-creation with local shops</td>
</tr>
<tr>
<td>Key resources
Ground space
Smartlockers</td>
<td>Private Public Partnership
Service offered by the Municipality in close cooperation with local shops.</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation Costs
- Preparation of rental space
- Construction costs of smartlockers

Running Costs
- Maintenance od smartlockers
- Human Resources for customer support
- Electricity</td>
<td>Revenue model
- Rental of Lockers to local retailers
- Pay per use / fee per usage of lockers</td>
</tr>
</table>

Table 28: Sustainable business model canvas Logroño UC3

Success Factors

The municipality defined several success factors for the implementation of the smartlockers. Since the use of the lockers is highly dependent on great stakeholder engagement and adaptation, effective communication strategies will be essential to inform local citizens, tourists, and shops about the lockers' benefits and usage. This includes targeted campaigns to raise awareness and encourage adoption and a direct communication with the local merchants. Additionally, a great user-experiencing will be key to establish the use of the lockers in the community. This will be linked to a straightforward and easy to navigate user interface

Operational Risks

The installation and operation of parcel lockers in Logroño introduce several potential risks, but these can be effectively mitigated with proactive measures.

One significant risk involves theft, either through physical break-ins or unauthorized access to lockers. Insurance coverage of around 100€ per locker is planned to cover in such a case. To mitigate the risk of vandalism and theft the lockers will be constructed with vandal-resistant materials and located in well-lit, high-visibility areas with frequent monitoring to deter criminal activity. Additionally, one criteria for the locker's location was to have a wall or other type of construction that it can be placed against to limit the possibility of it being pushed over. Finally, routine maintenance and rapid repair protocols will be established to minimize downtime and ensure uninterrupted service in case of the lockers being damaged or malfunctioning.

Another risk mapped was the remaining of goods in lockers beyond the designated 24-hour period. This would not only reduce availability for other users and create operational inefficiencies but also introduce the question of responsibility to clear out and handle unclaimed items. An automated notification system will be implemented to remind customers to collect their goods within the allowed time limit. For unclaimed items, clear procedures will be established, such as moving items to a secure holding area or charging additional fees for extended storage. Additionally, local shops using the lockers will be responsible for clearing unclaimed items to ensure availability.

Technical malfunctions, such as faulty access codes, may prevent users from retrieving or depositing items. To mitigate this, a remote or virtual support system will be available 24/7 through a hotline or mobile app, offering prompt assistance for any issues.

Human error in the placement or retrieval process could lead to misplaced goods or tracking issues. Training and clear instructions for both users and shop operators will minimize this risk, alongside regular system audits to ensure accuracy.

During peak usage times, full lockers may prevent customers from accessing the service. Monitoring usage patterns and deploying additional lockers during high-demand periods will help maintain availability. Another potential risk is the **misuse of lockers**, such as individuals sharing access codes or repeatedly accessing lockers for unintended purposes, which could reduce their availability for other users. To address this, a system limiting the number of times a code can be used to access a locker will be implemented, ensuring proper usage and maintaining operational efficiency.

Lastly, conflicts arising from claims of lost, damaged, or stolen goods could harm the reputation of the service. Clear terms of use, robust tracking systems, and customer support channels will be essential in managing and resolving disputes fairly.

Long term implementation

Both the municipality and INT are open for a long-term partnership if the smart lockers are successfully integrated. However, a key hindering factor could be a resistance from last mile logistic operators as they would prefer local shops to utilize their delivery services rather than independently operate through the lockers. To enable a long-term implementation some conditions, need to be ensured. First considers the ownership of the lockers. The municipality has shown willingness to purchase or rent the lockers post-project, ensuring their continued availability. Nevertheless, a formal tender process will likely need to be conducted to determine the operator of the lockers, with INT expressing interest in continuing as the locker manager. Additionally, a tender will be required to select shops and restaurants that will utilize the lockers, ensuring demand aligns with the service capacity. Finally, compliance with legal requirements, particularly around data security, is essential for the sustained operation of the lockers.

4.6.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the sensitivity of financial figures, Figure 48 presents the costs supported by each of the partners involved in this use case.

Partner	Costs Covered
LGN	- Communication costs - Infrastructure costs for the lockers' installation
INT	- Lockers' development and installation - Management of the lockers and maintenance

Figure 48: Costs and partners responsible Logroño UC3

The use case does not involve a lot of operational costs, and with the investment costs covered by the project's funding, the operations should be economically viable if local shops and citizens accept this new equipment and include it in their habits.

4.6.3 Governance Model

Stakeholder involved in the Use-Case

Stakeholder	Role	Responsibility
LGN representative for Logroño Municipality	Infrastructure and regulations	Planning and preparation of the construction of the smart lockers in the City of Logroño Providing: - Ground space
INT INTELLIGENT PARKING	Smartlocker operator	Construction and maintenance of the smartlockers in the city: Providing - Hardware (Smartlockers) - Software (User-Interface)

Table 29: Stakeholders involved Logroño UC3

Key partner for the implementation and operational phase of the Use-Case

Area of operation	Stakeholder	Responsibility
Marketing	**Old Town commercial association**	Promote use of lockers among their associates
Development	**Paseo de las 100 Tiendas commercial associations**	Support for the location of the lockers
Usage	**San Blas shops**	Potential users of the smart lockers network

Table 30: Key partners Logroño UC3

Due to the simple design of the use case, the corresponding governance model is also less complex. The focus is on installing and publicising the lockers as well as the final contractual arrangements between the provider and the retailers.

Utilising the RACI sheet (Figure 49) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Minorists user, as using retailers in the city centre
- Client user, as the final user of the lockers
- Locker installer (INT), as the installer responsible for the lockers
- Project coordinator, as the accompanying instance
- Local commerce public manager, as the executing and management role
- Local commerce associations, as support for better customisation

	Responsibility type	Responsibility Cluster	Responsibility Description	Minorists user	Client user	Locker installer	Project Coordinator	local commerce public manager	local commerce associations
Implementation Phase	Management	locker	Decision on where to install smart lockers			A	C	R	C
	Core	locker	Ensuring regulatory requirements for the implementation are meet				A	R	
	Support	locker	Preparation of the physical space				A	R	C
	Support	locker	Setting up contracts (Installer)			R	C	R	
	Support	locker	Setting up contracts (Local Commerce Association)					R	R
Operational Phase	Support	use	promoting smart locker use	I	I		C	R	C
	Core	use	Managing minorists using smart lockers					R	C
	Core	use	protocol for users				C	R	
	Core	locker	Installation of smart lockers			R		A	I

Figure 49: RACI Sheet Logroño UC3

4.7 Nantes Use-Case 1

The Use-Case (Figure 50) targets two different ways to amplify the delivery with cargo bikes.

1. Use-Case 1.1: **Tout en vélo** will consolidate flows of **Heppner** and other suppliers
2. Use-Case 1.2: Will use the existing **Triporteurs (TRI)** hub at Rue des Olivettes to test trackers and sensors (GPS, temperature, humidity, etc.) attached to dedicated new cargo-bikes (TricyLift from FLEX).

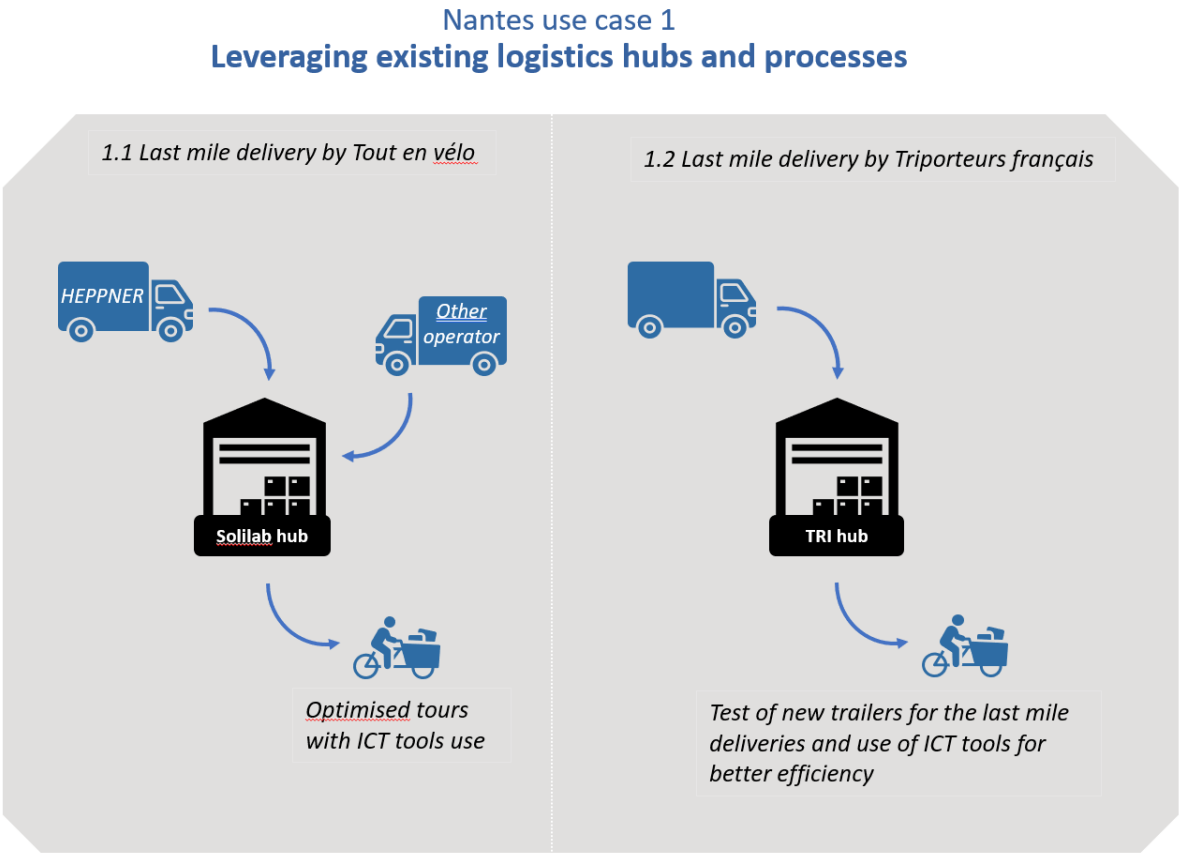

Figure 50: Nantes Use-Case 1

Value proposition

By consolidating freight and leveraging innovative tools like NGS sensors and the FLEX TricyLift cargo bikes, the solution enhances productivity while significantly contributing to decarbonizing logistics activities. This approach not only streamlines delivery operations but also aligns with broader sustainability goals, reducing the environmental footprint of last-mile deliveries and promoting efficient, pooled freight solutions tailored to urban needs.

4.7.1 Business Model

Time to market

The time to market for this use case benefits from leveraging existing infrastructure and resources provided by TRI and Tout en vélo (TEV), including hubs, employees, and vehicles. TRI is well-positioned to integrate software tools into its existing systems with minimal challenges, facilitating rapid deployment of sensors and data collection processes. However, TEV presents a slower adoption curve due to its lack of prior technology use, requiring careful handling of the implementation process and negotiation of suitable data privacy agreements to ensure compliance and access to data.

The hardware installation process is straightforward, with trackers being easy to install on vehicles, requiring no prior technical experience. Following deployment, collecting, and processing data will be essential to train forecasting algorithms and validate tracking functionalities, ensuring optimized performance. While TRI's readiness accelerates the timeline, additional time may be required to address TEV's concerns and align on technological integration strategies.

Sustainable Business model Canvas: Use Case 1.1

Use Case 1.1 – Consolidating good flows

Key Partnership

1. Hardware tools
   - NGS (sensors)
2. Software tools
   - GGI, IMT (optimisation algorithms)
   - GGI, IMT, TXMTT (forecasting tools)

Key Activities

1. Preparation of logistic infrastructure & installation of sensors
2. Delivering goods to the Hub
3. Consolidation of goods and last mile delivery with Cargo bike

Key resources

1. Logistic operator and logistic vehicles
2. Cyclelogistic operator and e-cargo bikes
3. Software & hardware tools to operate the hub and bikes
4. Logistic Data

Value Proposition

1. Consolidation of logistic flows
2. Integration of cycle logistic for last mile delivery
3. Optimised deliveries thanks to ICT tools

Beneficiaries

Logistic operators through more sustainable and efficient delivery option

Local authorities through reduced environmental and social costs

Relationships

Self Service operating the Micro-Hub

Application / Network to consolidate the flow of goods

Governance Model

Cyclelogistic & infrastructure provider:

- Tout en velo

Logistic service provider

- Heppner

Cost Structure

Implementation Costs

- Adaptation of hubs / Lockers for logistic operators
- Development of Software tools & applications
- installing sensors, calibrating tracking system and algorithms

Operational Costs

- Operational costs of logistic service (Human resources, logistic vehicles, energy / fuel)
- Maintenance of resources
- IT-Costs

Revenue model

- Rental of the logistics space to logistic operators / Pay per use / fee per usage of the hub
- Pay per delivery / subscription for cyclelogistic service
- Cost reduction in last mile delivery due to increased efficiency
- End receiver willing to pay more for sustainable delivery

ICT-Tool Implementation

The existing Micro Hub from TRI at Rue des Olivettes will be utilised to test trackers and sensors attached to new cargo bikes. The gathered data will feed into ICT tools to increase delivery efficiency through T&T&M and real-time transportation monitoring as well as forecasting and optimization solutions.

Figure 51: BMC Nantes UC1.1

Sustainable Business model Canvas: Use Case 1.2

<table>
<tr><th colspan="4">Use Case 1.2 – Implementation of ICT tools for cycle logistic</th></tr>
<tr>
<td rowspan="2">Key Partnership
1. Hardware tools:
- FLEXIMODAL (cargo bikes)
- NGS (sensors)
2. Software tools
- GGI, IMT (optimisation algorithms & forecasting tools</td>
<td>Key Activities
1. Coupling ICT tools / cargo bikes
2. Delivering goods to the Hub
3. Last mile delivery with Cargo bike</td>
<td rowspan="2">Value Proposition
1. Consolidation of logistic flows
2. Integration of cycle logistic for last mile delivery
3. Optimised deliveries thanks to ICT tools

Beneficiaries
Logistic operators through more sustainable and efficient delivery option

Local authorities through reduced environmental and social costs</td>
<td>Relationships
Self Service operating the Micro-Hub

Application / Network to consolidate the flow of goods</td>
</tr>
<tr>
<td>Key resources
1. Micro-Hub at rue des Olivettes
2. Cyclelogistic operator and cargo bikes
3. Software & Hardware tools to operate the hub and bikes
4. Logistic Data</td>
<td>Governance Model
Cycle logistic & infrastructure provider:
- TRI
Logistic operator:
- DB SCHENKER</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation Costs:
- Adaptation of vehicles
- Development of Software tools & applications
- Purchase of Cargo bikes

Operational Costs:
- Operational costs of logistic service (Human ressources, logistic vehicles, energy / fuel)
- IT-Costs
- Maintenance of resources</td>
<td>Revenue model
- Pay per delivery / subscription for cyclelogistic service
- Cost reduction in last mile delivery due to increased efficiency
- End receiver willing to pay more for sustainable delivery</td>
</tr>
<tr>
<td colspan="4">ICT-Tool integration
Possible utilisation of trackers at the Cargo bikes to enable real-time transportation monitoring as well as forecasting and optimization solutions</td>
</tr>
</table>

Figure 52: BMC Nantes UC1.2

Success Factors

Adaptability of FLEX TricyLift Cargo Bikes: For the FLEX TricyLift model to succeed, it must attract new clients with goods suited for delivery using this system. Its compact storage advantage, compared to traditional cargo bikes, provides a unique value proposition that can drive efficiency in space-constrained environments. However, its operational efficiency must meet or exceed existing alternatives to avoid being deemed a failure.

Optimized Tour Organization through NGS Sensors: The integration of NGS sensors (GPS, temperature, humidity, etc.) offers significant potential to improve delivery operations. By optimizing tour organization in real time and ensuring delivery personnel adhere to planned routes, these sensors can enhance performance and reliability, adding measurable value to the service.

Added Value Without Risk of Failure: The NGS sensors inherently enhance service quality by providing data-driven insights, such as monitoring environmental conditions during deliveries. Their integration is a critical success factor as they supplement the existing logistics framework without introducing significant operational risks.

Operational Risks

For Use-Case 1 there are limited operational risks since its building upon an existing use-case. Nevertheless, the following risks have been identified:

Technology Integration Challenges: The implementation of new ICT tools and sensors (GPS, temperature, humidity, etc.) on cargo bikes may encounter technical issues, such as compatibility problems or inaccurate data collection, which could disrupt operations.

Equipment Reliability: The TricyLift cargo bikes, being new and relatively untested in this context, may face mechanical or operational issues that could delay deliveries or impact service quality.

Coordination Between Hubs: Consolidating flows between Heppner and other suppliers at the ancient MIN hub require seamless coordination. Poor communication or scheduling issues could lead to bottlenecks or delays in the supply chain.

Environmental Factors: Weather conditions or unexpected environmental challenges might impact the functionality of the bikes or sensors, particularly those tracking temperature and humidity.

Training Gaps: Inadequate training for personnel on the use of new ICT tools or cargo bikes may reduce operational efficiency and increase the likelihood of errors.

Mitigation strategies should focus on robust testing of new equipment, establishing clear communication protocols between hubs, conducting regular maintenance of cargo bikes and sensors, and providing comprehensive training for all involved personnel.

Long term perspective and scalability potential

TRI states that a critical factor for long-term success is implementing an action plan that reduces dependency on external funding. This includes exploring alternative revenue streams, optimizing operations, and investing in scalable technologies. Additionally, improving maintenance efficiency is a priority. One way to achieve this could be through standardizing bike types to simplify the repair processes. Additionally, training employees for in-house maintenance or establishing partnerships with specialized maintenance providers can reduce costs and improve service reliability. Finally, developing a connected diagnostic tool for bikes could proactively identify repair needs and consequently improve the maintenance schedules.

Scalability opportunities lie in leveraging technology and expanding the operational model:

1. Utilising ICT tools to develop an application that helps to track real-time data on congestion, construction, and optimal routes for cargo-bikes could improve tour efficiency, reducing delivery times and resource use.
2. Expanding the use of these sensors and integrating their data into decision-making processes will enable better routing and planning.
3. Centralizing and standardizing maintenance processes, investing in after-sales service, and enhancing training programs will prepare the organization to scale operations effectively.
4. explore expanding its operational model to other regions or urban areas, potentially creating a network of hubs and contributing to a broader shift towards sustainable logistics.

4.7.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the sensitivity of financial figures, Figure 53 presents the costs supported by each of the partners involved in this use case.

Partner	Costs Covered
TRI/ TEV	- Human resources for hub management and carriers
FLEX	- Cargo-bike development
NGS/ GGI	- Purchase of the trackers - Management of the data

Figure 53: Costs and responsible partners Nantes UC1

This use case allows the cycle logistics operators to include new equipment and tools to their current operations without additional costs, during the project timeframe. Especially, the track and trace and monitoring tool developed by NGS and GGI is proposed for free and should only be bringing operational efficiency and thus cost savings to the operators testing it. They will then be able to take informed decisions as to whether they want to keep using the device and at what costs to be economically viable after the project ends.

4.7.3 Governance Model

Stakeholders involved in the Use-Case 1.1

Stakeholder	Role	Responsibility
HEPPNER	Logistic operator	Consolidate goods in ancient MIN hub Provide: - delivery vehicles and personnel
TOUT EN VÉLO	Logistic operator	Last mile delivery of goods from the Hub Provide: Delivery vehicles and personnel

Table 31: Stakeholders involved in Nantes UC 1.1

Stakeholders involved in the Use-Case 1.2

Stakeholder	Role	Responsibility
TRIPOTEURS FRANCAIS	Logistic operator	Consolidate flows from DB SCHENKER and operate the last mile delivery with Cargo bikes Provide: - "Rue des Olivettes" Hub - Last mile delivery vehicles and Personel
DB SCHENKER	Logistic operator	Delivery of goods to the Hub Provide: Delivery vehicles and Personel - Delivery vehicles and Personel

Table 32: Stakeholders involved in Nantes UC1.2

Key partner for the implementation and operational phase of the Use-Cases

Area of operation	Stakeholder	Responsibility
Technical partner	**NGS (**New generation Sensors)	Providing the sensors for the delivery vehicles
	GGI (Genegis GI)	Analysing data providing the results
Hardware tools	**FLEXIMODAL**	Providing 2 Cargo bikes

Table 33: Key partners Nantes UC1.1

The focus of this use case is on the two mini hubs to be installed and their integration into existing processes. Accordingly, a large part of the responsibilities falls on the role of the hub manager. This concentration on a single role poses a risk of overburdening the role from the perspective of the governance model, but no practical alternatives have been found. Due to the integration into existing processes, the scope of responsibilities remains manageable.

Utilizing the RACI sheet (Figure 54) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- **Loader Manager**: Responsible for carrying out loading and unloading tasks at the mini hub.
- **Loader Deliveryman**: Responsible for loading and unloading vehicles.
- **Mini Hub Manager (TRI)**: Responsible for managing the mini-hubs and implementing the processes.
- **Cargo Bike Deliveryman (TRI)**: Responsible for last-mile deliveries.
- **NTS Project Manager (NTS)**: Responsible for project support.
- **Final Client**: The recipient of consolidated deliveries.
- **Hardware Provider 1 (NGS)**: Manufacturer of the hardware used.
- **Hardware Provider 2 (FLEX)**: Manufacturer of the hardware used.

	Responsibility type	Responsibility Cluster	Responsibility Description	Loader Manager	Loader Deliveryman	Mini Hub Manager	Cargo bike deliveryman	NTEs project manager	Final Client	Hardware Provider 1
Implementation Phase	Core		Providing of logistic infrastructure			R				A
	Core		Intstallation of Micro-Hub			R				A
	Core		Installation of Sensors and Integration of Software applications			R				A
	Support		Testing of logistic ressources	R	R	A	R			C
	Management		Ensuring regulatory requirements for the implementation are meet			R		I		
	Support		Preparation of the physical space	A		C				
	Support		Training delivery staff	R	I	A	I			
	Support		Prepare the physical space for the UCC /Hub			R				A
	Support		Setting up contracts			A		I	R	
Operational Phase	Management	mini hub	Managing ingoing and outgoing deliveries in the mini hub	C		R		I		
	Support	mini hub	Providing necessary utilities for the mini hub	R		A	C			
	Support	mini hub	Maintenance of the logistic ressources			R	C			
	Core	ingoing	ingoing deliveries in the mini hub	A	R	I				
	Management	mini hub	Last mile round planification	C		R				
	Support	mini hub	Monitoring / optimization of last mile deliveries			R	C			
	Core	mini hub	Cargo bike load			A				
	Core	Last mile	Last mile delivery	I		A			I	
	Core	Last mile	Return to the hub and storage or new round			A	R			
	Support	mini hub	Handling Customer Complains and Advice	C	R	A	R	I		
	Support	mini hub	Cleaning tasks	I		A	C			

Figure 54: RACI sheet Nantes UC1

4.8 Nantes Use-Case 2

In this Use Case (Figure 55), a logistics station will serve as a temporary micro hub for urban logistics. The station will be open during the day and last-mile deliveries will be conducted using cargo bikes from there. More specifically for each group of stakeholders, they will be the following scenarios:

1. **For citizens:** Residents within proximity to the logistics stations will be able to rent bikes and trailers for personal use. (For instance, they will be able to rent a bike and a trailer for a trip to a store or to dispose of construction debris at waste disposal).
2. **For craftsmen:** Craftsmen who work in the city but live outside Nantes will be able to park their vehicles at the logistics station. They will transfer materials to trailers and utilise cargo bikes

for transportation within the city. The station will also offer secure lockers for picking up pre-ordered tools or materials, ensuring operational efficiency.

3. **For logistics operators:** Logistics companies will be able to drop off goods at secure lockers in the morning hours. Once available, internal notifications will prompt delivery personnel to collect the goods using cargo bikes for last-mile delivery in the city.

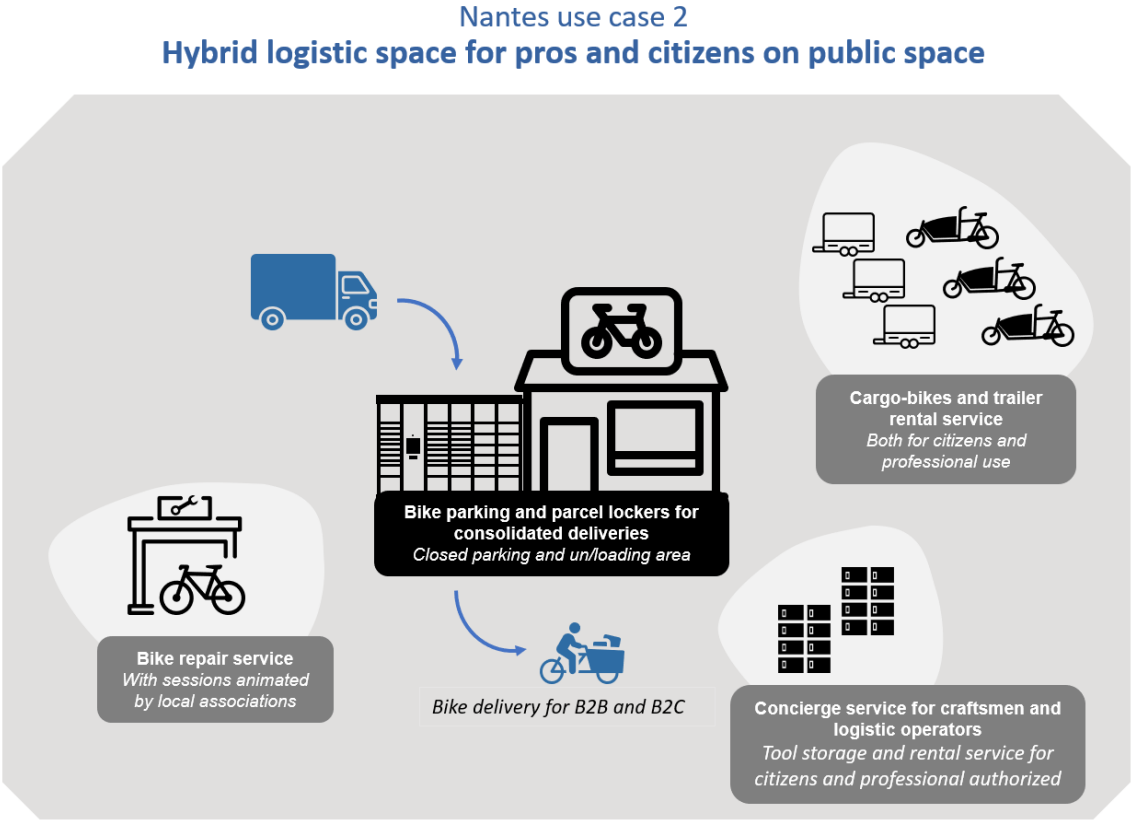

Figure 55: Nantes UC2

Added Value service

At the time of sending the added-value service survey, this use case was not planned.

Value proposition

Use Case 2 can bring a significant value proposition by integrating sustainable and efficient logistics operations into the city's urban core. From an ecological perspective, the use of cargo bikes for last-mile deliveries reduces carbon emissions and traffic congestion, contributing to greener urban logistics and offering a practical approach to environmentally responsible operations.

For logistics operators, the hub will provide dedicated parking spaces for logistics vehicles. Craftsmen will benefit from parking spaces for their vehicles while at work in the city and secure lockers for tool storage, citizens will gain improved access to bike facilities, fostering sustainable mobility options for personal use, which will encourage greener transportation habits.

4.8.1 Business Model

Time to market

The time to market for use-case 2 faces significant challenges due to lack of an identified operator to manage its implementation and operation. The concept involves substantial investment costs without immediate financial returns, making it difficult to attract private operators. Additionally, the labour-

intensive nature of the case – requiring security for access control of the area as well as the lockers and maintenance personnel- can further complicate the operational feasibility.

With no financial resources available from either the municipality or the project to fund the operation, the burden of financing falls entirely on the potential operator. This includes both the initial setup and operational costs, presenting a considerable barrier to implementation. While the municipality can offer the business concept, a space for operation, and support in stakeholder communication, these contributions might be insufficient to address the financial and operational difficulties. Consequently, these factors can collectively delay the time to market.

Sustainable Business model Canvas

<table>
<tr><th colspan="4">Hybrid Logistics Space (Logistics Station)</th></tr>
<tr>
<td rowspan="2">Key Partnership

1. Hardware tools
- Box n' service (Smart lockers)
- En cargo Simone Cycload (Cargo bikes & repair tools)

2. Software tools
- NGS (Sensors)
- GGI (Data analysis)</td>
<td>Key Activities
1. Development and setting up of the parking space
2. Marketing / Recruit Businesses
3. Customer service and manage access to the space</td>
<td rowspan="2">Value Proposition
Logistic storage space in the city (smart lockers) with access to cargo bikes including an area for parking / charging and repairing the bikes

Beneficiaries
Logistic operators through more sustainable and efficient delivery option + repair area + storage area

Local authorities through reduced environmental and social costs

Added Value Service:
Citizens through easy access to cargo bikes, bike repair and storage space for bags</td>
<td>Relationships
Self Service operating the smartlockers & renting the cargo bikes

Customer service for establishing access to the area</td>
</tr>
<tr>
<td>Key resources
1. Ground space
2. Parking (& Charging) Area for bikes
3. Cargo bikes
4. Smart lockers in varied sizes
5. Cycle Repair tools
6. Software tools
7. Security equipment to regulate access</td>
<td>Public Private Partnership
Nantes municipality and the Chamber of commerce will partner for this project to provide the logistic space.</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation Costs
- Adaptation and construction of parking space
- Purchase of resources like Cargo bikes, charging stations, repair tools & smart lockers
- Implement software tools to control access to the space

Operational Costs
- Maintenance of resources
- Security & Energy costs
- Personal costs for regulating the access and customer service</td>
<td>Revenue model
- Subscription for accessing the area to utilise the space (B2B)
- Rental of Lockers to logistic operators
- Rental / subscription for cargo bike usage
- Pay per use / fee per usage of lockers</td>
</tr>
</table>

Table 34: BMC Nantes UC2

Success Factors

Engagement with Local Stakeholders: Detailed discussions and confirmations with the local stakeholders are essential to ensure active participation and alignment with the use-case's objective for the station. A measurable indicator of success could be avoiding the use of one heavy truck per day.

Utilization by Target Users: The station's success hinges on its usage. Logistics operators should prefer using the station for load breaks rather than relying solely on their hubs. Similarly, craftsmen will need to actively use the station's facilities.

Identifying a Lead Partner: A key actor should be identified to carry the project forward, taking responsibility for coordination and operational tasks.

Securing Funding from Nantes Métropole: Financial support from the municipality of Nantes is critical, both for the pilot phase and the long-term sustainability of the project.

Recruiting Testers for Logistics Services: The recruitment of participants to test and validate the logistics services should be necessary to assess the station's practicality.

Operational Risks

Despite its promising benefits, several risks could arise during this use case's operational phase, as seen below.

Low Utilization of the Hub: If the logistics operators, craftsmen, or citizens do not adopt the facility as intended, the hub could fail to achieve its objectives, resulting in underperformance and reduced impact on urban logistics and sustainability goals.

Limitations of Cargo Bikes: Certain deliveries may exceed the weight or volume capacities of the cargo bikes, leading to delays or incomplete deliveries. Additionally, craftsmen might find the cargo bikes do not meet their operational needs, especially for transporting construction materials or tools that are large or heavy.

Weather-Dependent Operations: Inclement weather, such as heavy rain, could make cargo bike deliveries challenging, potentially disrupting operations.

Infrastructure and Accessibility Challenges: The hub's location and layout may not fully meet the needs of all user groups. For instance, poorly designed access routes or inadequate parking for craftsmen's vehicles could limit the hub's usability.

Public Perception and Adoption: If residents or businesses perceive the hub as an inconvenience or fail to see its value, they may be less likely to participate. Negative public sentiment could also lead to reduced political or financial support for the project.

Mitigating these risks requires proactive engagement with stakeholders, thorough user feedback collection, and a flexible operational model for addressing the needs of all stakeholder groups.

Long term perspective and Scalability Potential

At this stage, certain aspects of the use case remain uncertain and will require further clarification through upcoming conversations with stakeholders and actual implementation of the station.

Minor adjustments, such as parking space dimension optimization, reservation tool refinement, or enhancement of the locker locking/unlocking system, can be introduced progressively. These factors are not expected to hinder the experimentation phase if they are fully established at the beginning.

4.8.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the sensitivity of financial figures, **Erreur ! Source du renvoi introuvable.** presents the costs supported by each of the partners involved in this use case.

Partner	Costs Covered
NANTES	- Purchase and installation of the load break space (lockers and bike parking)
TRANSECO	- Human resource for logistics operations - Load break costs
TBD	- Management and maintenance of the different equipment
TBD	- Installation of the repair area and bike rental

Table 35: Costs and responsible partners Nantes UC2

This use case is about creating a whole new service for different type of users. With the minimum viable product of proposing parking space for unloading operations and load break space to use zero-emission vehicle, this use case seems not economically viable for the logistic operator involved in the testing, Transeco. For them, the load break cost (corresponding to time, human resource's training and operations of two different vehicles instead of one) has to be less than 2€ per delivery or will not be viable. The environmental gain may not be sufficient to balance the load break costs.

On the other hand, for the logistic operators and craftsmen, the use case may represent an interesting opportunity to not support the investment costs for cargo-bike and rent them at a lower price instead. Additionally, if the city's restricting regulations are reinforced (e.g., low-emission zones), it may create new incentives and shape better economic outcomes.

Either way, long-term viability is unlikely without metropolitan funding and/ or support. Additional solution is to make the public contribute to this service for professionals, by making them pay for service provider fees.

What is envisioned is to make the test proposing the services to craftsmen and logistics operators for free at the beginning and make it a paid service if demand grows (by including access to the public).

4.8.3 Governance Model

Stakeholders involved in the Use-Case 2

Stakeholder	Role	Responsibility
Nantes Métropole	Infrastructure provider	Providing: authorization, regulation, parking adaptation (TBC) and will review legal frameworks concerning parking lot use
Chamber of Commerce and Industry	Ground space provider	Owner of the parking lot + provider of ground space the infrastructure
TBD	Logistic hub manager	Implementation of the lockers + provide part of the infrastructure Providing: Cargo bikes maintenance service
TBD	Infrastructure provider	Potential smart lockers provider
TBD	Infrastructure provider	Potential cargo-bike provider

Table 36: Involved stakeholders Nantes UC2

While the HUB manager is clearly involved in the implementation, the day-to-day management in this use case is handled by third parties; the implementation of the processes is the responsibility of the companies that provide the bicycle logistics. Accordingly, there is a transfer of responsibility in this use case that needs to be considered. As the areas in this use case are used by a second party, precise coordination with the other users is also necessary. This is ensured via the existing security.

Utilizing the RACI sheet (Figure 56) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Loader Manager, for carrying out the activities at the mini hub
- Loader Deliveryman, for loading and unloading vehicles
- Cyclogistic Company Manager, for managing the hub and implementing the processes
- Hub Manager, for carrying out the implementation
- Cargo bike deliveryman, for the execution of the last mile

- NTES project manager, project support
- Final client, recipient of the consolidated deliveries
- Craftsmen, provide necessary repairs
- Maintenance manager, manages the maintenance requirements
- Security and access manager, , must be informed about processes
- Hardware provider, manufacturer of the hardware used

	Responsibility type	Responsibility Cluster	Responsibility Description	Loader Manager	Loader Deliveryman	cyclologistic company Manager	Cargo bike deliveryman	NTES project manager	Final Client	Craftmen	Maintenance Manager	Security and access officer	Hub Manager	Hardware Provider (multiple)
Implementation Phase	Core		Providing of logistic infrastructure			R		C					A	C
	Core		Intstallation of Micro-Hub			I		C					R	A
	Support		Installation of Sensors and Integration of Software applications			R	I	C					R	A
	Support		Testing of logistic ressources	R	R	R	R			C	C		R	A
	Core		Ensuring regulatory requirements for the implementation are meet			R		A					R	
	Support		Preparation of the physical space					C					R	
	Support		Training delivery staff	R	I	R	I						A	
	Core		Prepare the physical space for the UCC /Hub					C					R	
	Support		Setting up contracts			R		R	R				A	
Operational Phase	Management	micro hub	Managing ingoing and outgoing deliveries in the micro hub	R		I		I				I	I	
	Support	micro hub	Providing necessary utilities for the micro hub	R		R	C						A	
	Support	micro hub	Maintenance of the logistic ressources			R	C				R		A	
	Core	ingoing	ingoing deliveries in the mini hub	A	R	I						I	I	
	Management	micro hub	Last mile round planification	C		R	C					I		
	Support	micro hub	Monitoring / optimization of last mile deliveries			R	C	I						C
	Core	micro hub	Cargo bike and lockers load	C	R	A						I	I	
	Core	Last mile	Last mile delivery	I	R	A	R		I		I			
	Core	Last mile	Return to the hub and storage or new round			A	R				I			
	Core	micro hub	Cargo bike and trailers rent			A	R		R	R		I		
	Support	micro hub	Access authorization to parking slot			C				I		R	C	
	Support	micro hub	Handling Customer Complains and Advice	R	R	R	I	I	C				A	
	Support	micro hub	Cleaning tasks	R	R	R				I	C	I	A	

Figure 56 : RACI sheet Nantes UC3

4.9 Nantes Use-Case 3

The consolidation hub (Figure 57) will utilize two repurposed shipping containers. The containers will be purchased and modified to operate autonomously using solar panels installed on their roofs.

Two big container measuring 40 feet (12*2.5m) will be used for storage, while a smaller one measuring 20 feet (6*2.5m) will serve as a social space. This hub will be operated exclusively by Triporteurs Français but will remain open for the consolidation of goods from multiple logistics operators.

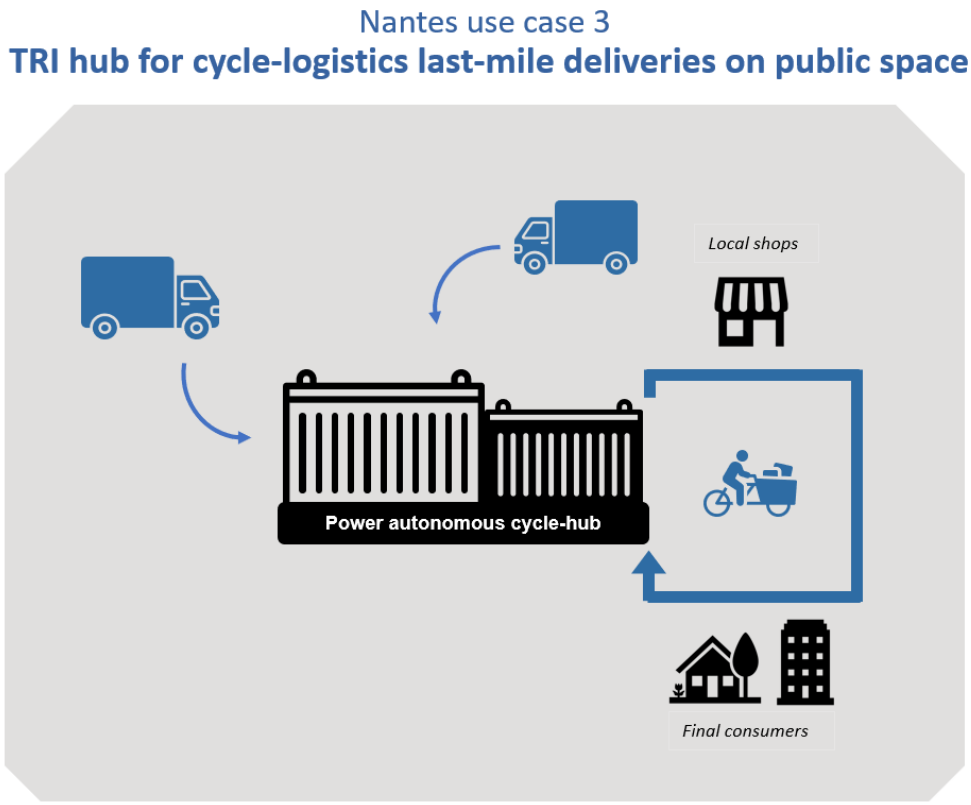

Figure 57: Nantes UC3

Added Value Service

This use case presents three (3) key points for the municipality. Firstly, it will offer an opportunity to increase the clean and sustainable delivery operations in the city centre. Secondly, it will allow the municipality to try a new logistics service on Ile de Nantes without requiring significant investment in property – a crucial factor given the excessive cost and limited availability of urban spaces. Lastly, it will provide an opportunity to assess whether the container-based logistics system can be scaled and replicated in other areas of the metropolis. Successful approach could offer a cost-effective and sustainable solution for urban logistics across the region.

Value proposition

The use case provides distinct value to its key stakeholders. For TRI, it addresses challenges such as finding appropriate land for operations and expanding their client base. The use case offers a high-quality, sustainable service that positions TRI to attract new clients and enhance its competitive edge.

4.9.1 Business Model

Time to market

Obtaining the necessary regulatory authorizations is a critical step for this use case. Permits for installing the containers, including sidewalk encroachment, and the existing construction authorization from 2017 will need to be validated for this project. The timeline also includes determining the duration required for REV to construct the containers (3 months, aiming at being ready by April 2025) and finalizing the administrative process with TRI to allocate investment costs for the hub.

The parking area should include designated spaces for the TRI employees and ensure accessibility for container placement, including navigating sidewalks. While ground preparation might be necessary, container integration is expected to be straightforward, requiring no electrical supply or intensive

testing. Additionally, a small container will be installed to being used as a break space by the four (4) TRI employees.

Finally, TRI as a consortium member, is the key partner with additional collaboration anticipated with other local cycle logistics actors. Ensuring the hub's long-term viability beyond the experimentation phase will be a priority.

Sustainable Business model Canvas

<table>
<tr><th colspan="4">Temporary Logistic Hub (TRI)</th></tr>
<tr>
<td>Key Partnership
1. Hardware tools:
- Station REV (Container Hub)

2. Infrastructure
- SAMOA (Ground space owner)</td>
<td>Key Activities
1. Development and setting up of the parking space
2. Installing the HUB
3. Operating the Last mile delivery

Key resources
1. Ground space
2. Parking (& Charging) Area for bikes
3. Cargo bikes
4. 2*Containers (MCC)</td>
<td rowspan="2">Value Proposition
Logistic storage space in the city centre

Access for logistic operators to the Integration of cycle logistic for last mile delivery

Beneficiaries
Logistic operators through more sustainable and efficient delivery option

Local authorities through reduced environmental and social costs</td>
<td>Relationships
Self Service operating the Smartlockers & renting the cargo bikes

Governance Model
Hub owner and last mile operator:TRI

Ground space provider: Nantes Municipality</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation Costs
- Adaptation of parking space
- Investment in the containers

Operational Costs
- Operational costs of logistic service (Human resources, logistic vehicles, energy / fuel)
- Maintenance of resources</td>
<td>Revenue model
- Rental of ground space
- Cost reduction in last mile delivery due to increased efficiency
- End receiver willing to pay more for sustainable delivery</td>
</tr>
</table>

Table 37: BMC Nantes UC3

Success Factors

The municipality's role includes engaging with the local stakeholders to confirm the station's operation and outcomes. A potential success indicator could be avoiding the need for at least one heavy truck per day, while failure would be considered the low usage of the hub by the logistics operators or craftsmen.

For TRI, success would involve an increase in client outreach due to expanded service area enabled by the new hub. Failure is deemed unlikely but would occur if operations cannot be sustained.

Some critical success factors can include the following:

Localization and Space: Securing a well-located parking area with a minimum of 200-300 sqm to ensure sufficient space for operations and scalability.

Duration of Experimentation: Longer trials will better amortize costs and provide meaningful data for evaluation.

Scalability: Adequate space for adding containers or other logistics solutions in the future will enhance the hub's long-term potential.

Operational Risks

Operational risks for this use case may arise from several key factors. Some relevant ones can be as follows.

Low Utilization of the Hub: Low utilization of the hub can pose a significant risk, particularly if its location proves suboptimal for the logistics operator. If the hub is too far from clients, the added time and effort required for deliveries may outweigh its benefits. Since this will serve as a second hub for TRI in the city and only one logistics operator is currently committed to using it, there is no fallback option if the location does not meet operational needs, making the success of this hub highly dependent on its efficiency and strategic positioning.

Stakeholder Disengagement: Sustained collaboration among stakeholders, such as customers, local authorities, TRI, and space owners is critical for the hub's success. A loss of stakeholder interest or engagement could weaken the hub's ability to adapt to evolving needs or expand its services.

Weather-related Disruptions: As an outdoor facility relying on solar-panel-powered containers, extreme weather conditions could pose risks. For instance, prolonged periods of low sunlight might affect power autonomy, while storms or flooding could damage infrastructure or disrupt operations.

Long term perspective and scalability potential

The long-term perspective envisions replicating this type of implementation across other sites in the metropolitan area. For Nantes, the priority is to first demonstrate the hub's success and then establish a rental model to strengthen and monetise the service. For TRI, scalability could involve adding more containers to expand operations if space permits prove successful. Additionally, improving vehicles and equipment would enhance the range of transportable goods and increase delivery time availability and flexibility.

4.9.2 Cost-Benefit Analysis

Building on the cost structure proposed by the Business model, the cost sheet for this use case details the different expenses and the partners responsible for the financial support. Considering the sensitivity of financial figures, **Erreur ! Source du renvoi introuvable.** presents the costs supported by the partner involved in this use case.

Partner	Costs Covered
TRI	- Purchase and installation of a new hub - Operations and hub management costs

Table 38: Costs and responsible partners Nantes UC3

For this use case, the investment is quite significant as we are launching a new service with a new infrastructure. For this, TRI will use some of the funding to cover for the renting of the infrastructure. All other costs linked to the operations will be supported by them. This hub will allow their catchment area to grow, propose a wider range of service to potential clients and thus generate more revenues. Additionally, this use case will help local stakeholders (such as the municipality) better understand how the local delivery ecosystem is working and bring ecological and social gains to the city.

4.9.3 Governance Model

Stakeholders involved in the Use-Case 3

Stakeholder	Role	Responsibility
Station REV	Infrastructure provider	Provider of the containers / logistic HUB
TRI	Logistic operator	Last mile delivery of goods from the Hub Provide: Delivery vehicles and Personnel
SAMOA	Ground space provider	Providing: authorisation, reglementation, parking adaptation (TBC) and will review legal frameworks concerning parking lot use, contract

Table 39: Involved stakeholders Nantes UC3

A sole provider was found for this hub, which makes the number of roles manageable. The responsibilities are also less complex, as the Last Mile Operator will be responsible for most of the responsibilities.

Utilizing the RACI sheet (Figure 58) to specify the governance model of the Use-Case and create an actionable tool for the implementation, the following roles were defined:

- Containers provider (Station REV), for the provision of infrastructure
- Last-mile operator (Triporteurs français), as the sole provider of last-mile delivery
- NTES project manager, as project support
- Final client, as recipient of the goods on the last mile
- Hub manager, primarily for implementation
- Cargo bike deliverymen (Triporteurs français), as executing force on the last mile

	Responsibility type	Responsibility Cluster	Responsibility Description	Containers provider	Last-mile operator	Space operator	NTES project manager	Final client	Hub Manager	Cargo bike deliverymen
Implementation Phase	Core		Providing of logistic infrastructure		R		C		A	C
	Core		Installation of the micro hub		A	C	I		R	
	Core		preparation of the containers	A						
	Core		Ensuring regulatory requirements for the implementation are meet		R	R	A		R	
	Support		Preparation of the physical space	C	C	A	I		R	
	Support		Training delivery staff		A	I			I	C
	Support		Setting up contracts	R	R	R	I		A	
	Support		Testing of logistic resources		R	I	I		A	R
Operational Phase	Management		Managing ingoing and outgoing deliveries in the micro hub		I	I			C	R
	Support		Providing necessary utilities for the micro hub		R	R			A	C
	Support		Maintenance of the logistic ressources						A	
	Management		Last mile round planification		R				I	C
	Core		Cargo bikes load		I				I	A
	Core		Last mile delivery		R			I		A
	Core		Return to the hub and storage or new round		I	I				A
	Support		Acces authorization to space		C	R			C	I
	Support	micro hub	Handling Customer Complains and Advice		A	R	I	C	R	C
	Support	micro hub	Cleaning tasks		R	A			R	

Figure 58: RACI sheet Nantes UC3

5 SATELLITE CITIES

In addition to collaborating with the Living Labs, the Satellite Cities have been integrated into the process of defining their Use-Cases and related Business Models as effectively as possible. All Satellite Cities participated in a Kick-off Meeting, where CBS introduced the Business Model creation process. Follow-up meetings were held with Getafe to explore Business Model options. Unlike the Living Labs, the development of Business Models in the Satellite Cities faced limitations due to restricted Use-Case development and information flow. Despite these challenges, a couple of insights into the status of Getafe and Sarajevo are outlined below.

5.1 GETAFE

Getafe is a rapidly growing industrial city south of Madrid. Its Use-Case focuses on establishing a micro-hub at the central train station. The hub features smart parcel lockers of various sizes, bike racks, cargo bikes, electric chargers, and advanced technology for secure access and surveillance. It serves as a central node for last-mile delivery logistics, facilitating deliveries during off-business hours and enabling returns to improve efficiency. The project involves collaboration with local retailers to enhance their online sales channel integration.

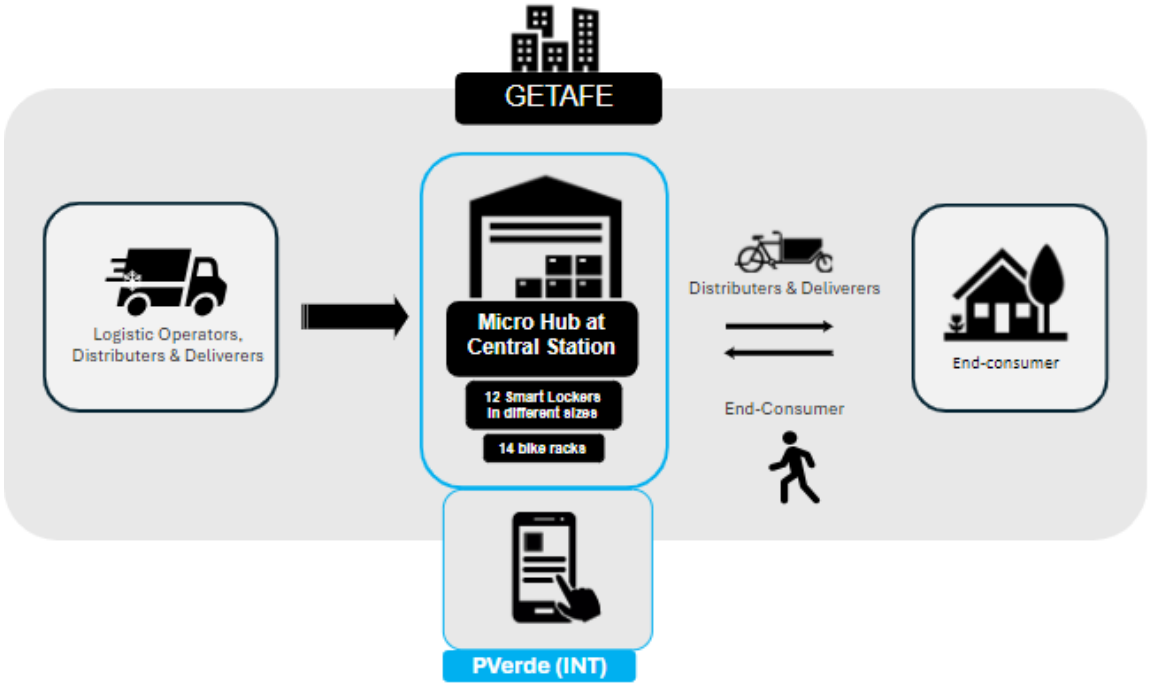

Figure 59: Getafe Use-Case

Value Proposition & BM-Canvas:

- Encourages sustainable urban logistics using bicycles and e-scooters.
- Reduces congestion and emissions, aligning with Low Emission Zone regulations.
- Improves delivery convenience for end-users while supporting local businesses.
- Offers a scalable model for urban cycle logistics with potential replication in other cities.

<table>
<tr><th colspan="4">Micro Hub in the City centre (Municipality of Getafe)</th></tr>
<tr>
<td>Key Partnership
- Local retailers and business associations
- Sustainable logistics operators (e.g., Koiki)
- Intelligent Parking (platform technology provider)</td>
<td>Key Activities
1. Smart locker delivery management and operations
2. Involvement of local retailers for e-commerce integration
3. Maintenance and security of the micro-hub
4. Educational events (e.g., safe urban cycling)
Key resources
12 smart lockers
14 bike racks
1 micro hub
PVerde App</td>
<td rowspan="2">Value Proposition
Providing of logistic infrastructure and last mile logistic vehicle in the inner city

Beneficiaries
Logistic operators through more sustainable delivery option / available infrastructure and expention of logistic operation hours

Local authority's trough reduced environmental and social costs

City residents through more flexible decreased congestion and air/noise pollution and option for sustainable delivery outside of business hours</td>
<td>Customer Relationships
- Regular communication with retailers for feedback and optimization
- Engaging events for community awareness
- User-friendly app and website for parcel management

Private Public Partnership
Getafe City Council provides public space and supports policy alignment (e.g., Low Emission Zone regulations).</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation Costs
- Purchasing costs of lockers, HUB and bike racks
- Set up of the MicroHub and Smartlocker
- Software adaptations in PVerde App

Operational Costs
- Maintenance and Security of Hub and Cargo bikes</td>
<td>Revenue model
- Locker Usage Fees: Charges for parcel storage and retrieval.
- Subscription Plans: Regular users or businesses can opt for monthly or annual packages</td>
</tr>
</table>

Table 40: BMC Getafe

5.2 SARAJEVO

The project involves the establishment of a micro-hub located outside the pedestrian zone on a public parking lot managed by the Municipality of Stari Grad. The hub serves as a centralized logistics facility combining multiple functionalities:

- **Core Features:** A designated area with several parking spots allocated for a logistics centre, including spaces for charging, maintenance, and storage of cargo bikes.
- **Delivery Operations:** Cargo bikes are used for last-mile deliveries within defined urban areas, minimizing environmental impact and improving logistics efficiency.
- **Parcel Locker Installations:** Lockers installed at 2-3 strategic locations enable convenient shipment pick-up for end-users, even outside standard working hours.

Objective and Added Value: This use-case aims to foster sustainable urban logistics by reducing pollution, noise, and traffic congestion, while improving pedestrian safety and urban aesthetics. The solution enhances delivery efficiency, provides secure and flexible parcel handling, and supports the operational needs of cargo bike-based logistics.

Value Proposition & BM Canvas

- **Environmental Benefits:** Significant reduction in pollution and noise levels, contributing to a cleaner and quieter urban environment.
- **Traffic and Safety Improvements:** Less congestion and enhanced pedestrian safety through optimized logistics operations.
- **Urban Aesthetics:** Reduced street damage and a better overall impression for visitors and tourists.
- **Efficiency Gains:** Streamlined delivery processes with reduced time spent searching for parking and more time allocated to actual deliveries.
- **Convenience for Users:** Parcel lockers enable flexible pick-up options, including after work, and offer secure storage for various obligations.
- **Comprehensive Support for Cargo Bikes:** Centralized facilities for charging, maintenance, and storage of cargo bikes enhance operational reliability.

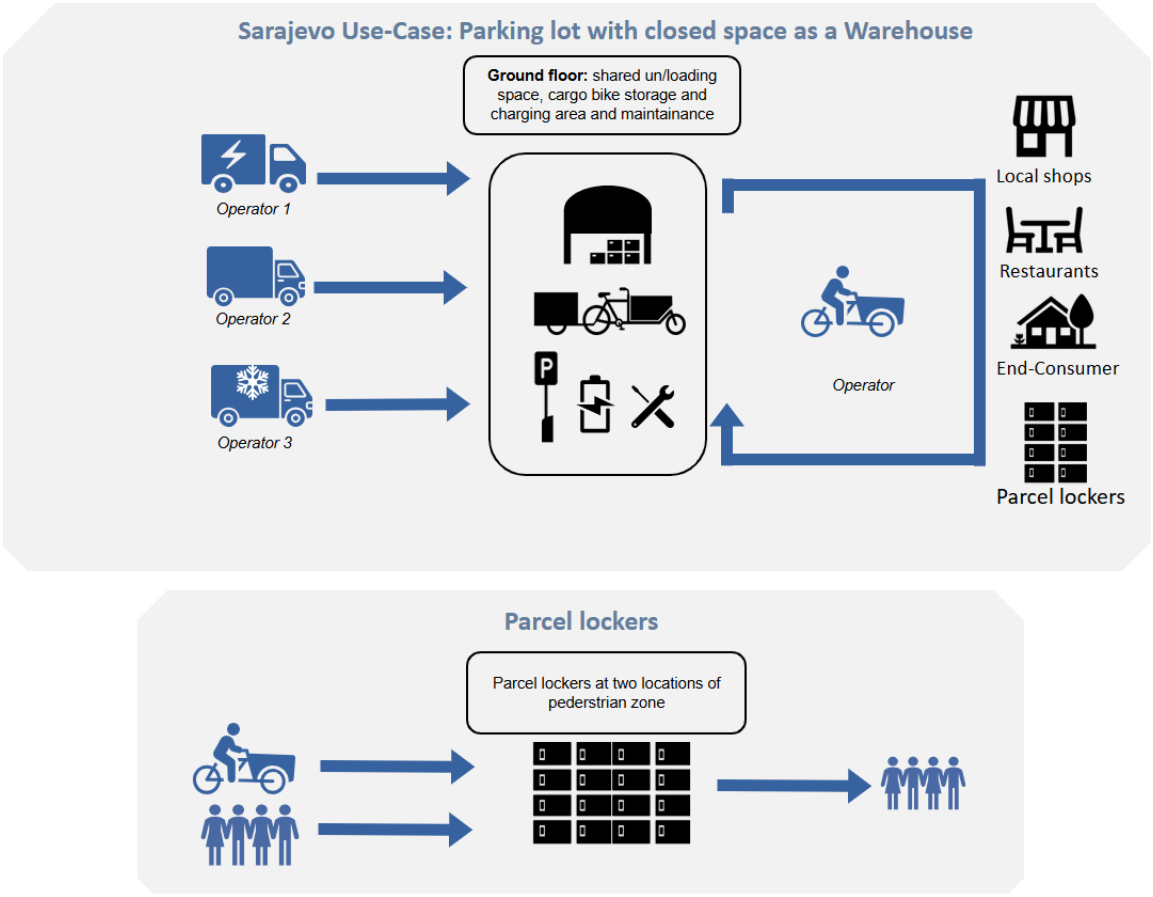

Figure 60: Sarajevo Use-Case

<table>
<tr><th colspan="4">Unloading zones in the Old town</th></tr>
<tr>
<td>Key Partnership
- Municipality Stari Grad Sarajevo
- Logistic companies which delivery to micro-hub
- Logistic companies which will provide LML service with cargo bikes</td>
<td>Key Activities
1. Building of parcel lockers and micro hub
2. Transport of goods from a logistic hub to the HUB
3. Distribute goods to end consumers

Key resources
1 Micro-hub
2-3 parcel lockers
10 cargo bikes
Logistic service provider
Software</td>
<td rowspan="2">Value Proposition
Access to logistic infrastructure and ground space
Logistic infrastructure availability in the city centre

Beneficiaries
Pedestrian zone residents
Pedestrians, tourists
City authorities in a reduction of damage to streets and squares
Logistic companies in efficiency, no need for searching of parking space
End consumers-More time for the delivery

Added Value Service
Low emission zone, noise reduction, less traffic jam</td>
<td>Relationships
Regular communication with retailers for feedback and optimization

User-friendly app and website for locker usage and bike rental

Governance model
Logistic operators
Municipality of Sarajevo</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Implementation costs:
- Construction of a logistics centre including working space, following equipment, hardware and software
- Mobile app development
- Installation of chargers
- Costs of purchase of materials
Operational Costs:
- Marketing
- Customers support
- Human Resources: Staff salary
- Operational costs (Electricity, Maintenance, Cleaning..)
- Insurance</td>
<td>Revenue model
Locker Usage Fees: Charges for parcel storage and retrieval.
Subscription Plans: Regular users or businesses can opt for monthly or annual package</td>
</tr>
</table>

Table 41: BMC - Sarajevo

CONCLUSIONS

Value Public-Private Partnership

Summarizing the business model developments in the Living Labs, Public-Private Partnerships (PPPs) have been a critical mechanism for addressing the complexities of urban logistics. By combining public governance with private sector efficiency, PPPs enable innovative approaches to urban challenges. The public sector provides strategic oversight, regulatory frameworks, and essential infrastructure, while private entities contribute capital investments, operational expertise, and technological innovation (Bergqvist & Pruth, 2006). This dynamic collaboration was evident across the Living Labs, where the public sector played a key role in regulatory oversight, land provision, and infrastructure investments, while the private sector—comprising delivery operators, technology providers, and logistics service providers—focused on vehicle investments, IT tools, and specialized equipment.

The goal is that through PPP, logistics ecosystems become more resilient and adaptable, paving the way for long-term urban sustainability and economic growth. Literature points out that the value of PPPS lies in their ability to create a "win-win" framework where both sectors leverage their comparative strengths. For urban logistics, PPPs facilitates co-design and governance of initiatives such as Urban Consolidation Centres, cooperative delivery networks, and smart city platforms. Additionally, PPPs allow smaller businesses to access resources and expertise typically out of their reach, fostering inclusivity and collaboration. Examples of this can also be found in the DECARBOMILE use-cases. The LL of Istanbul demonstrated how IMM can support private operators, particularly through the establishment of a consolidation centre. The Hamburg UC serves as a great example on fostering exchanges between public and private sectors to address logistical system needs. Logroño highlighted how PPP can help to enable small businesses through digitalization and market expansion. And finally, Nantes LL showcased the municipality's role as a navigator and legislative support for logistics innovations.

Overall Value Proposition from municipalities:

For the municipalities of the Living Labs the following general Value Proposition could be identified:

- Ground space for logistic storage solutions in the city
- Charging Infrastructure for LML vehicles
- Access to logistic vehicles for LML
- Knowledge and Connections (Data, Permits, Legal Permissions)
- Information Technology - Software tools for efficient LML solutions (Route planning etc.)

Social and Environmental Costs of the BM

The implementation of the BMs across the Living Labs involves both social and environmental costs, as well as long-term benefits. During the construction phase, setting up new logistics hubs, micro hubs, or consolidation centres can lead to temporary emissions and noise pollution due to infrastructure development, transportation of materials, and installation processes. Additionally, the adaptation of public spaces for logistics purposes may require regulatory adjustments and urban planning considerations, potentially impacting local communities.

Operationally, urban logistics solutions such as cargo bike hubs, micro hubs, and consolidation centres can contribute to emissions and noise pollution, particularly in cases where existing logistics fleets still rely on conventional vehicles. The use of public spaces for logistics purposes also might raise concerns about accessibility, pedestrian safety, and urban congestion. However, these costs are offset by the long-term sustainability benefits of these models.

By promoting green last-mile logistics solutions, the business models contribute to significant emission reductions over time, leading to improved air quality in urban areas. The replacement of heavy-duty vehicles with cargo bikes and smaller electric vehicles decreases noise pollution and traffic congestion,

enhancing the quality of life for residents. Additionally, more efficient logistics processes help reduce delivery delays, benefiting businesses and consumers alike. The transition towards sustainable urban logistics also creates new job opportunities, particularly in bike-based delivery services and logistics management. Furthermore, increased safety measures, such as shifting deliveries away from large trucks, contribute to a safer working environment for delivery drivers (e.g., reduced traffic risk, optimized routes, lighter cargo loads, etc.).

Overall, while the transition towards sustainable logistics involves short-term costs and adjustments, the long-term environmental and social benefits outweigh these challenges, reinforcing the importance of integrating green logistics solutions in urban planning.

General Results Governance Model

During the creation of the governance models for the planned use cases, it became clear that the final processes for the individual test phases had not yet been developed in several living labs. This was a significant problem for some use cases, as it was not possible to establish responsibilities without an already established process landscape. However, this problem was relativised during the course of the work phase, especially as the RACI matrix was chosen as the governance model. Due to its adaptability and basic design for later changes, it was easily possible to make subsequent adjustments to the use cases. However, the final linking of responsibilities and roles was not an obstacle. This is due to a clear organisational structure in all use cases, an advantage for the final execution of the tests.

At the beginning of the work on the governance models, only a single matrix was planned for each use case. In the course of the work, however, it became clear that the implementation and actual realisation of the use cases had to be separated from each other in the presentation. However, this was done in a single matrix for each use case for easier visualisation and clarity.

It is noticeable that the implementation phase was given a higher proportion of responsibilities in most use cases. This was to be expected, as the tests set up in the use cases do not have established processes but are set up from scratch. However, this means that even after the RACI matrices have been created, further changes must be made to the responsibilities and roles in order to ensure correct mapping. The responsibility for this lies with the respective Living Labs.

In fact, in some cases, the creation of an overview of responsibilities helped to clarify processes in the use cases. Even if this was not actually intended, it can be seen as a positive aspect of the work on the RACI sheets. The joint workshops for working on the RACI sheets also ensured that the Living Labs had a greater understanding of the other use cases and that the responsibilities of other groups were checked for application in their own area.

Further consideration of the governance models within the Living Labs is absolutely essential to ensure that they are kept up to date and that the defined responsibilities are properly assigned to the relevant roles. It is advisable to do this in detail in each living lab shortly before the start of the practical tests.

General Results CBA

Looking at the different cost-benefit analysis, some main conclusions can be drawn out for each of the Living Labs. For example, the **Hamburg** Living Lab stands out with the highest investment costs, linked to the construction of the barge. This investment is, in this case, only possible thanks to the project's funding and would not be realistic in a different context. Additionally, no scaling-up possibilities have been found by the local partners which makes this use case not viable outside of a project funding scheme. It will be interesting to analyse at the end of the experimentation specific elements of the logistics process and the different challenges that have been faced in the implementation phase.

In **Istanbul**, and **Logroño**, the social benefits linked to the implementation of the different use cases will bring valuable insights. Because cycle-logistics is not very well known in those two cities, having the pilots showcasing the use of this new last-mile delivery method should raise awareness amongst the citizens and make them reflect on the environmental costs linked to e-commerce deliveries for

example. Additionally in the two cities, the strong private-public partnerships implemented are the key to the economic viability of the pilots. In the 3rd use case in Istanbul, the municipality is providing the space where the hub will be implemented for free. In Logroño, the municipality is putting in place a public procurement procedure to provide without any additional fee last-mile deliveries for the merchants located in the San Blas market, as well as logistic infrastructure. This demonstrates the importance of public (financial) support in the launching and testing of such innovative experimentations.

Finally, in **Nantes,** the cost-benefit balance is secured thanks to the strong engagement of the Triporteurs Français (cycle-logistic operator), which can test the different innovations developed in the frame of the project without supporting additional costs (use case 1). Moreover, thanks to the 3rd use case, TRI will increase their catchment area and thus find new clients, but as well social and environmental benefits should be observed at the city level. The use case 2 should also bring economic, social and environmental benefits but since it will propose brand-new services to a wide range of users, the cost-benefit analysis will be more relevant after the use case implementation to assess if the benefits overcome the costs of the implementation.

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ANNEXES

A. Added Value Survey general results
B. Summary of projects benchmarked for Added-Value Service study
C. Interview guidelines BM-SOTA
D. General results BM-SOTA
E. Value Proposition Canvas Results from each LL
F. Results BM Workshop 1 from each LL
G. Workshop Material T2.5 (including Example of Agenda and WS templates)

A)

USE CASES BY LIVING LAB	HAMBURG		ISTANBUL					
	Use case 1: mutualization of the mean of transportation and green deliveries (boat+cargo bikes)		Use case 1: improve existing e-commerce operations from a MIGROS hub		Use case 2: new MCC in the proximity of the existing one from use case 1		Use case 3: new UCC for multi stakeholders parcels consolidation	
SERVICES	main use case	added value service	main use case	added value service	main use case	added value service	main use case	added value service
TYPES OF HUB								
micro consolidation centre (>100m²)					x			
urban consolidation centre (>500m²)							x	
temporary hub on public space	x							
permanent light urban consolidation centre on public space								
break of load in exterior, on public space (no hub)		x						
construction materials consolidation hub								
REVERSE LOGISITCS		x						
waste collection of cardboard								
waste collection of household waste								
vending machines waste collection								
FLUVIAL								
fluvial last mile deliveries	x							
floating hub and last mile delivery		x						
multimodal delivery associating boat and cargo-bikes	x							
CARGO BIKES								
mutualised last mile deliveries with e-cargo-bikes (1 tour = several suppliers)						x		x
not mutualised last mile deliveries with e-cargo-bikes (1 tour = 1 supplier)	x							
AUTONOMOUS VEHICLES								
"follow-me" vehicles to help delivery men								
last mile deliveries with autonomous vehicles								
SMART LOKERS								
smart lockers placed in residential housing								
smart lockers placed on public space	x							
smart lockers placed in shopping centre						x		x
smart lockers for fresh food						x		x
mobile smart-lockers		x						
DIGITAL TOOLS								
controlled access to the hub			x		x			
digital twin model								
decision support algorithms		x	x					
load pooling algrorithms			x					
sensors (temperature monitoring,…)		x	x				x	
track&trace&monitor systems		x	x				x	
HUB ASSOCIATED SERVICES								
electric charging stations		x				x		x
first mile deliveries for businesses								
autonomous vehicles to help carry heavy loads								
cargo bikes sales and repairs		x						
temporary storage for on-demand deliveries		x				x		
expertise and training for cycle-logistic projects		x						
TRANSPORT OF PEOPLE								
yayacletas								

USE CASES BY LIVING LAB	LOGRONO								NANTES					
	Use case 1 : consolidation of parcels distribution and pharmaceutiacl products w/ cyclo-logistics		Use case 2: consolidation of "social" deliveries - Service to Community		Use case 3: improve supplies and/or pickup/deliveries of fresh food + drinks flows		Use case 4: optimisation of logistics flows and circular economy		Use case 1: shared hub in pedestrian area (Parc des Chantiers)		Use case 2: temporary hub in a bus depot		Use case 3: mobile, temporary hub on a parking space	
SERVICES	main use case	added value service	main use case	added value service	main use case	added value service	main use case	added value service	main use case	added value service	main use case	added value service	main use case	added value service
TYPES OF HUB														
micro consolidation centre (>100m²)	x		x		x		x		x					
urban consolidation centre (>500m²)	x		x		x		x							
temporary hub on public space									x			x		x
permanent light urban consolidation centre on public space														
break of load in exterior, on public space (no hub)												x		x
construction materials consolidation hub														
REVERSE LOGISITCS														
waste collection of cardboard								x		x		x		
waste collection of household waste								x						
vending machines waste collection														
FLUVIAL														
fluvial last mile deliveries														x
floating hub and last mile delivery														x
multimodal delivery associating boat and cargo-bikes														x
CARGO BIKES														
mutualised last mile deliveries with e-cargo-bikes (1 tour = several suppliers)	x		x		x		x			x	x		x	
not mutualised last mile deliveries with e-cargo-bikes (1 tour = 1 supplier)										x	x		x	
AUTONOMOUS VEHICLES														
"follow-me" vehicles to help delivery men														
last mile deliveries with autonomous vehicles														
SMART LOKERS														
smart lockers placed in residential housing														
smart lockers placed on public space		x		x		x				x		x		
smart lockers placed in shopping centre														
smart lockers for fresh food						x				x		x		
mobile smart-lockers												x		
DIGITAL TOOLS														
controlled access to the hub		x		x		x		x	x					x
digital twin model										x		x		x
decision support algorithms		x		x		x		x		x		x		x
load pooling algrorithms														
sensors (temperature monitoring,…)		x		x		x				x		x		x
track&trace&monitor systems		x		x		x		x		x		x		x
HUB ASSOCIATED SERVICES														
electric charging stations	x		x		x		x			x		x		
first mile deliveries for businesses		x		x		x		x		x		x		
autonomous vehicles to help carry heavy loads														
cargo bikes sales and repairs		x		x		x		x		x				
temporary storage for on-demand deliveries		x		x		x		x		?		?		?
expertise and training for cycle-logistic projects		x		x		x		x		x		x		x
TRANSPORT OF PEOPLE														
yayacletas				x										

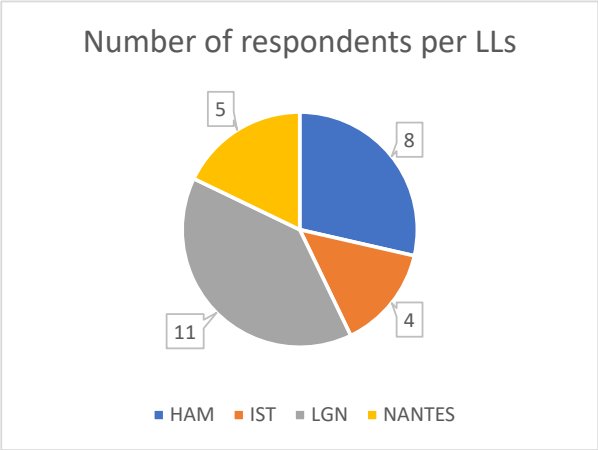
B)

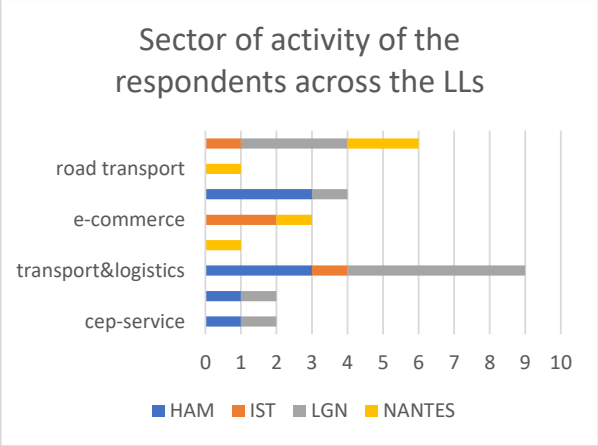
General Results Added Value Service Survey

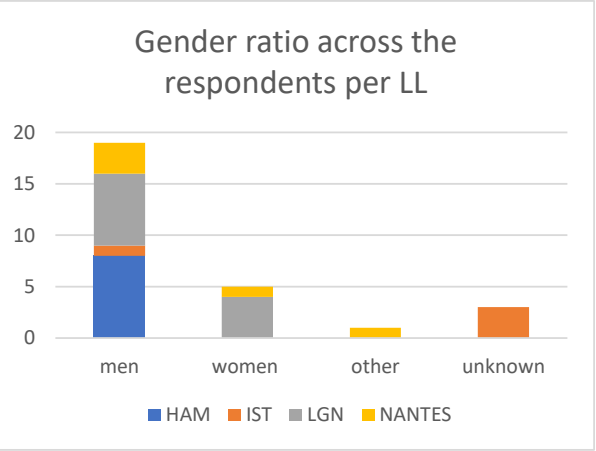
Number of respondents	
HAM	8
IST	4
LGN	11
NANTES	5
total	28

Type of activity	HAM	IST	LGN	NANTES
cep-service	1	0	1	0
public administration	1	0	1	0
transport&logistics	3	1	5	0
cycle-logistics	0	0	0	1
e-commerce	0	2	0	1
other	3	0	1	0
road transport	0	0	0	1
food transport	0	1	3	2

Gender ratio	HAM	IST	LGN	NANTES
men	8	1	7	3
women	0	0	4	1
other	0	0	0	1
unknown	0	3	0	0







C)

Introduction: Brief introduction of the DECARBOMILE project and its aim to develop sustainable and carbon-neutral business models for last-mile logistics.

This interview aims at getting insight on innovative business models (BM). We define an innovative BM as a BM that includes specific actions to (i) **reduce LML impact on the environment,** (ii) improve **social sustainability**, (iii) use optimization **digital tools** and/or (iv) include an element of **collaboration**.

Ask the interviewers if the signing of an NDA is necessary before conducting the survey.

Business model structure:

1. What is the value proposition of your BM?
2. What are the side services associated with your value proposition?
3. Would you define your BM as an innovative one (based on the definition stated above)?
4. Is your BM responding to a specific constraining public regulation? If so, please give details. *For example, following an incentive or copping/anticipating a regulation?*
5. What is your governance model? *Private-public partnership, association, horizontal or vertical model, …*
6. What are the main benefits and challenges associated with the innovative character of your BM?

Benefits could be: faster and more flexible delivery, more convenient and personalized service, real-time traceability, and better pricing...

Challenges could be: ensuring the quality and reliability of service, ensuring compliance with regulations, risk of under-utilization of resources and capacity....

Economic structure:

1. Did you receive subsidy to help you settle? If so, what type of subsidy was it and how did you use it? *Subsidy for investment, for operations, for space acquisition, in the frame of a financed project, with fund rising, …*
2. Would you describe your BM as currently sustainable?
    a. If yes, what was the delay necessary to get your BM up and running and economically viable?
    b. If not, what are the reasons? What challenges need to be tackled to achieve sustainability?
    c. What type of KPI do you use to assess if your BM is viable or not?
3. How many employees does it take to efficiently run your activity?
4. In what equipment did you invest to launch your activity (focus only on hardware – dedicated section for software further down this document)?
5. What categories of costs are most impacted by the innovative aspect of your BM?
6. In what ways does the innovative aspect of your BM benefits to your activity?

If your BM is based on a collaborative model:

1. How is collaboration fostered / implemented in your model?
    a. Is there collaboration between public and private partners?
2. How did you agree on the mechanism to share the savings and costs?
3. How do you make sure that these mechanisms are equitable and transparent?
4. What type of process/tool do you use to assure effective communication between the different stakeholders?

If your BM focuses on sustainability, social durability, and environmental impact:

1. How do you define sustainability in your BM, and how is it integrated? (social / environmental …) *Reduced carbon emissions, noise pollution, air pollution, congestion*
2. What type of KPIs do you use to measure the social and environmental impact of your activities?
    a. What are your targets and means of measurement?
3. What type of suppliers did you hire in link with your innovative BM?
    a. Where do they come from (is your BM valorising the local employment)?
4. What specific measures do you put in place to assure to your employee gender equity, safety, and comfort in the workplace?
    a. What occupational risks (= risks associated to the activity of the company) do you have identified?
    b. Do you feel that the innovative aspect of your BM has exacerbated the occupational risks or minimized them?
    c. How do you manage occupational risks?

Technology and digitalization:

1. To what extend are ICT tools used in your activity? / What is the level of digitalisation in your model (data value stream)? Please specify the types of ICT tools used. *End-to-end tracking of goods, algorithms for decision support and network design, algorithms for trip planning and dynamic routing, real-time transportation monitoring and fleet management, demand forecasting and optimization platform, load pooling tool, urban digital twin, …*
2. Did you buy the IT solutions used or did you develop it?

Commercial risks and time to market:

1. What where the risks foreseen?
2. How have they been tackled?
3. How did you manage the risk to have a bad “time to market”?
    a. Did you use KPIs or study to help you in the definition of the best time to launch your activity (=time to market)?
4. Where there risks you had not anticipated?
5. How did your clients respond to your innovative BM? And the final users? Do you think that there is any aspect who may block the implementation of such BM?

Conclusion:

1. What do you think about the scalability potential of your activity?
2. What recommendations or lessons learned from your success stories can you provide to inspire and guide the DECARBOMILE Living Labs in developing their business model?

D)

CONSOLIDATION – UCC/MCC

BENCHMARK

Urby (France) ; Urban Logistic Hotel (Lyon, France) ; Locowest (Nantes, France)

CHALLENGES

- **Initial investment:** significant investments needed for land costs, construction, or leasing.
- **Regulatory barriers:** can be an obstacle to the implementation.

LEARNINGS

- **Transparent collaboration**: if there is collaboration between different LSPs, equitable sharing between stakeholders needs to be implemented but difficulties for data sharing can be faced.

BENEFITS

- **Cost optimization**: pooling, mutualization of resources costs (energy, space, management).
- **Improved efficiency**: when mutualising the deliveries.
- **Opportunities to innovate**: the infrastructures can be used to showcase demonstration and experiment news services.
- **Private engagements**: can go beyond governmental obligations with for example building label (B Corp, RSE, BREEAM, etc.) and green branding for the company.
- **Creation of new jobs** with innovative organization practices.

CONSOLIDATION – PARCEL LOCKERS

BENCHMARK

Surflogh (Drenthe, Netherlands) ;
Pick-up Box (La Doua, France)

CHALLENGES

- **Localisation :** important to place the lockers where there is a need but complicated to place on public spaces (depending on the local regulations).
- **Multi-operators** : complicated to have different LSPs sharing the same lockers.

LEARNINGS

- **Good communication**: needed with the local actors that could see competition in the parcel lockers (pick-up point in local shops).
- **Multi-purpose of the lockers**: when having multi-operator lockers with different uses for citizen, local shops, craftsmen, it allows to create added-value services and ensure revenues.

BENEFITS

- **Acceptability**: if the service is well accepted by the citizens, it will be more frequented and therefore more profitable. Acceptability is also link to respect for the equipment, which means lower maintenance and repair costs.
- **Practicality for citizens :** time range, accessibility, with fewer constraints for users, this solution is preferred and used.

INNOVATIVE TRANSPORTATION MODES

BENCHMARK

Triporteurs Français (France) ; Ulaads (Groningen, Netherlands) ; CityLog (Germany) ; AVATAR ; River'TRI (Lyon, France) LDK (Toulouse & Montpellier, France).

CHALLENGES

- **Competition and multiplication of companies:** challenge to find customers and in the worst-case can cause bankruptcy.
- **Initial cost**: important investment at the beginning for some modal options (especially for river logistics) which requires having sufficient funds.
- **Recruitment and fidelity challenge:** retain employees and avoid turnover to have less training costs.
- **Location :** difficulty to find the right location for logistic hub without municipality support.

LEARNINGS

- **Quantity transported:** economic viability depends on the tonnage. Need to reach a critical mass, especially for river logistics to cover for the initial investment.
- **Long term support:** needed from big companies (human and economic resources) to expand the activities.
- **Coordination between the stakeholders & interoperability:** reduce the time of load break, the waiting time and improve the quality of service and satisfaction of the end-customers.

BENEFITS

- **Quality of life:** less air pollutions (GHG emissions and fines particulates), less noise pollution and less road congestion.
- **Economic validity and demand:** real need of this type of services from companies and municipalities. They are ready to pay for it, which strengthens activities.
- **Operational efficiency / flexibility** (especially for cycle-logistics).
- **Innovative vehicles**: new uses and commercialization (rent or sale).
- **Sense of community**: within the local shops when sharing vehicles and behaviors.
- **New jobs, with ethical value:** contribute to the job's attractivity and increase the working conditions.

DIGITAL COLLABORATION

BENCHMARK

IDEA ; Barcelona data City Lab ; GISA plateform ; LEAD ; Logico ; Roots-on-Wheel ; CULT ; Cargomatic and Ontruck ; Colivri ; Cityline.

CHALLENGES

- **Sharing data and digital tools:** agreement between the stakeholders (sensitive data, ...).
- **Implementation and new practice :** significant change with mind shift needed from the partners to go beyond competition and collaborate.

LEARNINGS

- **Coordination effort** and trust between the partners involved.
- **Framing the collaboration:** useful to use contract like for example a Data Cooperation Canva to put into writing the collaboration between the different partners.

BENEFITS

- **Vertical, horizontal, and multilateral approach.**
- **Dates spaces** for fair data exchange.
- **Create new innovative services** for various actors. Interesting to patent each innovation and sell the solution.
- **Decision support and comparison** of different scenario and impact (digital twin).
- **Optimisation resources** (Laas) to help the logistics operation (visualising and analysing data), with economic margin that can be generated.
- **Help collaboration** and mutualisation to save costs with real time data.

PRIVATE - PUBLIC PARTNERSHIP

BENCHMARK

HLU ; Surflogh ; Pick-up Box ; Triporteurs Français ; Ulaads ; CityLog ; River'TRI ; LDK ; IDEA ; Barcelona data city Lab ; GISA plateform ; Lead ; CULT ; Cytiline.

CHALLENGES

- **Economic viability without funds**: project that start with grant but may not last without.
- **Data sharing** between the municipality and private actors respecting GDPR law can slow down the implementation of the project.

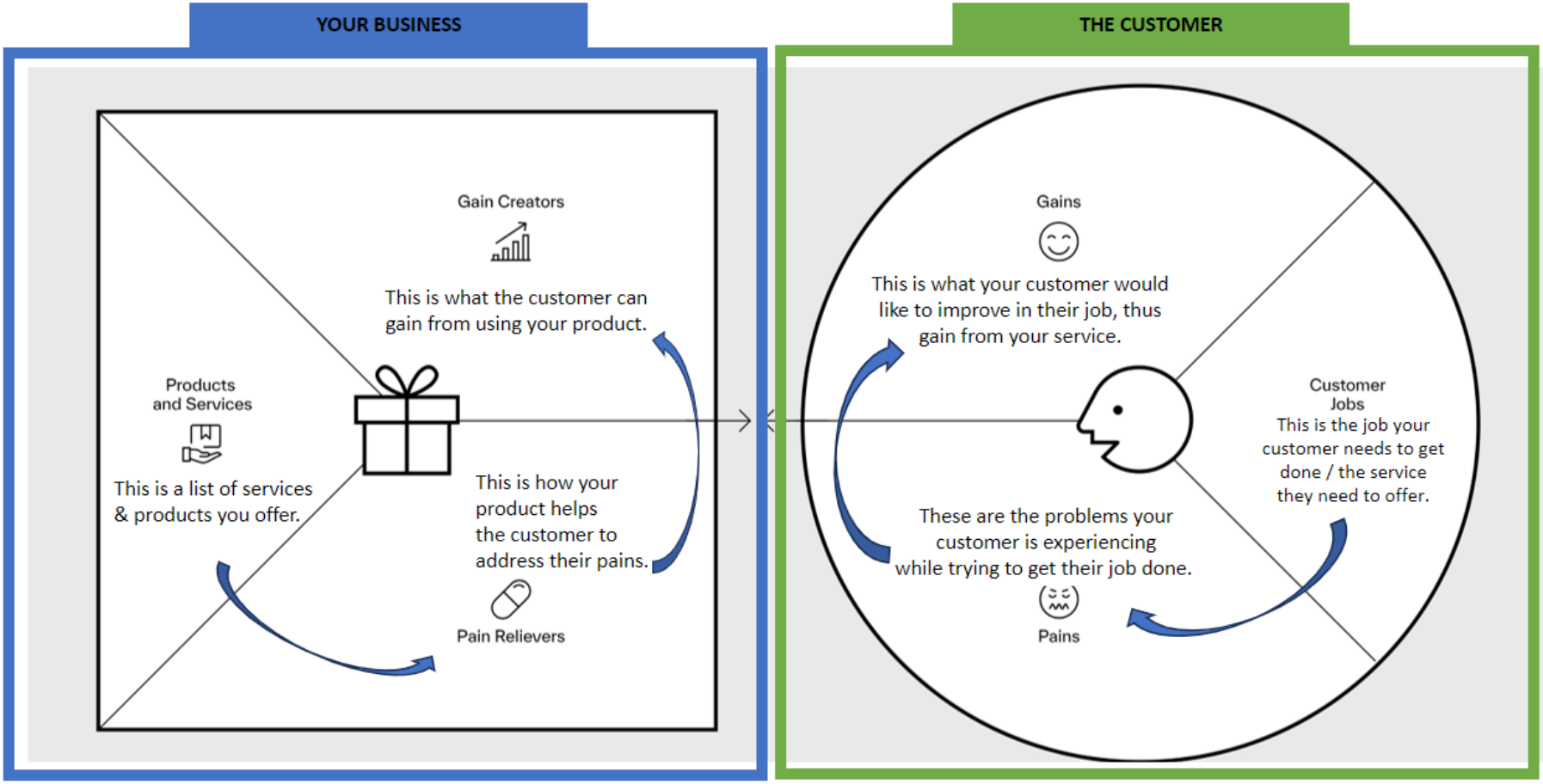
LEARNINGS

- Creation of **regulatory framework** and granting of authorization.
- **Governance**: integrate private and public in the governance at the start to unlock issues (authorization, permit, etc.) and define the role of each partners.

BENEFITS

- **Success of regulations' objectives**: regulation incentives foster the implementation of new logistics.
- **Help legitimizes the projects** and the acceptability of the citizens and customers.
- **Provision of land**: municipality can provision buildings or land (agreement for occupation of public spaces), sometimes with interesting prices.
- **Additional income for the municipalities** for example with the implementation of tolls at the entrance to the city.

E)


YOUR BUSINESS
THE CUSTOMER
Gain Creators
This is what the customer can gain from using your product.
Products and Services
This is a list of services & products you offer.
This is how your product helps the customer to address their pains.
Pain Relievers
Gains
This is what your customer would like to improve in their job, thus gain from your service.
Customer Jobs
This is the job your customer needs to get done / the service they need to offer.
These are the problems your customer is experiencing while trying to get their job done.
Pains

Nantes

Customer	Customer jobs	Pains	Gains
Logistic Service Provider / Carriers	• Delivery of goods to citizens within the city • Delivery of goods to shops & businesses within the city	**Logistic Providers** • Delivery delays due to traffic jams • Restricted access to the city centre due to urban traffic regulations • Inefficient delivery process leads to high costs and low margins • Issues coping with customers' expectations • Lack of knowledge about emission reporting **Citizens** • Noise and air pollution in the city • Delivery delays	**Logistic Providers** • More efficiency through improved delivery routes • Increased reliability of the delivery process to end consumer • Improved security through tracking systems for drivers and packages • Better working conditions for delivery staff **Citizens** • Safer usage of inner city • Reduced air and noise pollution
Business	**Products & Services**	**Pain reliever**	**Gain creator**
Nantes Municipality	• Ground space in the city for logistical infrastructure • Overnight storage with charging infrastructure for logistic vehicles (cargo bikes)	• Providing an easy access for zero-emission delivery vehicles to freely enter the city centre • Providing space for logistic infrastructure close to the city centre	• Increased reliability of delivery service through better city access • Increased efficiency in terms of the usage of space, time and resources • Marketing advantage due to sustainable delivery • Increased space for pedestrians in the inner city

Logroño

Customer	Customer jobs	Pains	Gains
Logistic operators and local businesses	**Local businesses and shops** • Receive product deliveries **Logistic Operator** • Deliver fresh products • Delivery of medicine • Waste recycling • Delivery goods	**Logistic Operator** • Time consuming delivery process • Missing logistical storage space in the inner city • High-cost logistic operations • Inefficient logistic process due to restricted areas, congestion, traffic jam (time and resource consuming) • Difficulty to track different supply channel • Limitations to expand / scale the business and reach new markets **Local businesses** • Low level of digitalization • Unreliable delivery	**Logistic Operators** • Reliable and efficient logistic system • tax savings due to smaller tax on green logistic solutions • Increased productivity leading to higher profits • Greener image through focus on sustainable delivery opportunities **Local Businesses:** • Increased reliability and flexibility in delivery • Cost savings
Business	**Products & Services**	**Pain reliever**	**Gain creator**

Municipality	• Providing the ground space for the Hubs and space in public buildings for lockers and storage
	• Charging infrastructure
	• New multipurpose cargo bikes
	• Trailer
		• Improve the availability and simplify the access to sustainable logistic infrastructure through the provision sustainable logistic resources like multipurpose Cargo bikes
		• Reducing the number of vehicles & deliveries in the city centre
		• Raising awareness about sustainable last mile logistics through increased visibility within the city
			• Increased efficiency in terms of the usage of space, time and resources
			• Cost reduction due to increase in delivery efficiency and decrease in tax
			• Marketing advantage due to sustainable delivery
			• Increased space for pedestrians in the inner city
			  • Safer usage of inner city
			  • Reduced air and noise pollution

Istanbul

Customer	Customer jobs	Pains	Gains
Citizens + logistic operator	**Citizens** • Easy and flexible access to ordered packages • Coordinated package flow • Being able to utilize the space of the city center for citizens **Logistic Operator** • Starting a new distribution operation in new neighbourhood • Make last-mile-logistic in the city more efficient and more nature friendly	**Citizens** • Unreliable delivery • Missing possibility to coordinate package and delivery flows • Crowded and old historic city (landscape and infrastructure) due to Lots of delivery traffic in the inner city • Bad air quality due to ineffective logistic with trucks (gasoline vehicles) • Noise pollution **Logistic Operator** • Missing opportunity for collaboration and aavailable SW solutions are not collaborating • Lack of knowledge how to change • Can't involving with full motivation • Citizens are still missing a sustainability mindset / awareness	**Citizens** • Improved living and working environment • More time efficient day-to day management **Logistic Operator** • Increased productivity and higher profits • More reliable collaborative logistic • Possibility of collaboration with other businesses • Having a new consolidation center as a firm • Greener image through focus on sustainable delivery opportunities • More visibility for green delivery options
Business	**Products & Services**	**Pain reliever**	**Gain creator**
Istanbul Municipality	• Ground space for logistic hubs in the city • Charging infrastructure for electrical bikes in the city • Expert advice for example from Istanbul Energij and other partners about for example the Consolidation center design	• Improve the availability and simplify the access to sustainable logistic infrastructure • Improving the access to logistic collaboration processes • Increasing the safety, reliability and efficiency of the logistic processes • Reducing the number of vehicles & deliveries in the city centre due to smart lockers and delivery with cargo bikes • Raising awareness about sustainable last mile logistics through increased visibility	• Increased space for pedestrians in the inner city • Safer usage of inner city • Reduced air and noise pollution • Flexible access and pick up of packages through smart lockers • Increased efficiency in terms of the usage of space, time and ressources • Collaborative logistic network • Increased visibility of green last mile solutions

Hamburg

Customer	Customer jobs	Pains	Gains
B2B Logistic Providers	• Reliable package delivery • Sustainable and economic delivery in time	• Decreased efficiency due to logistic traffic • Costs for sustainability and delayed deliveries • Damaged deliveries • Comply with digital delivery forms	• Increase in cost efficiency through fewer package material and bundling • Safe and flawless • More flexible delivery time window
Business	**Products & Services**	**Pain reliever**	**Gain creator**

Hamburg Municipality	• Ground space for Micro Hubs
	• One stop Shop for waterway access
	  • Access point to all relevant data
	  • One shop solution for all permits needed
	  • Tracking & customizable sailing schedule
	  • Legal framework guidance
		• Easy access to relevant data needed to use the waterways for logistic transport
		• Increasing logistic efficiency and security through software tools to track gods and customize sailing schedules
		• Leading the reactivation of the waterways as transport route
		• Supporting the development of electronic barge for water transport
		
		<u>Pain relivers of utilizing the waterways</u>
		• deliver goods in the evening and beyond opening hours
		• Secured deliveries outside operating hours (Schleusen lösung)
		• Traffic shift leading to less congestion on the road
			• Smoother logistic traffic due to an increased time flexibility
			• Increased sustainable delivery
			• Co2-reduktion instead of compensation

F)

DECARBOMILE

Decarbonise last mile logistics

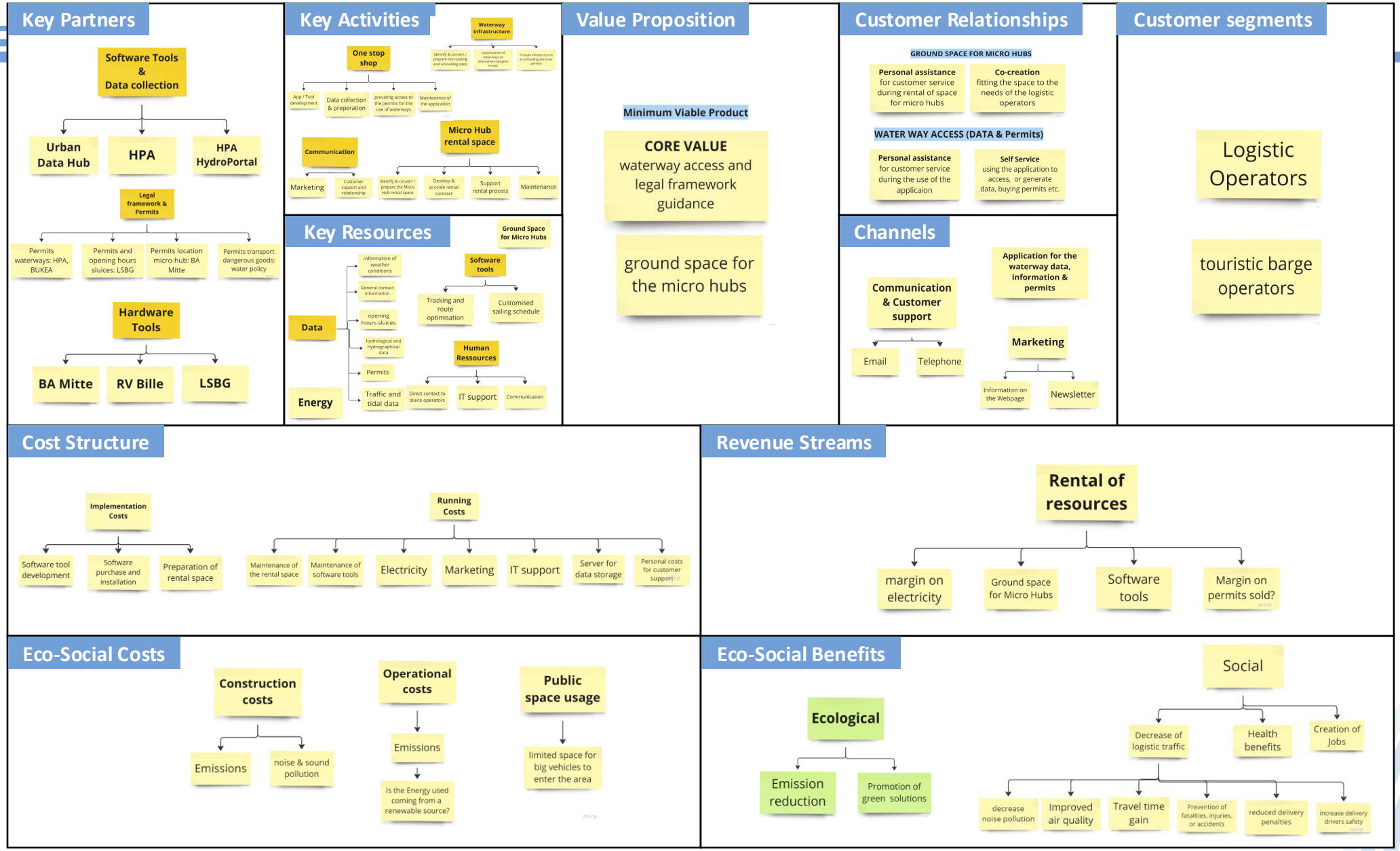
Business Model Results WS1

Hamburg Municipality

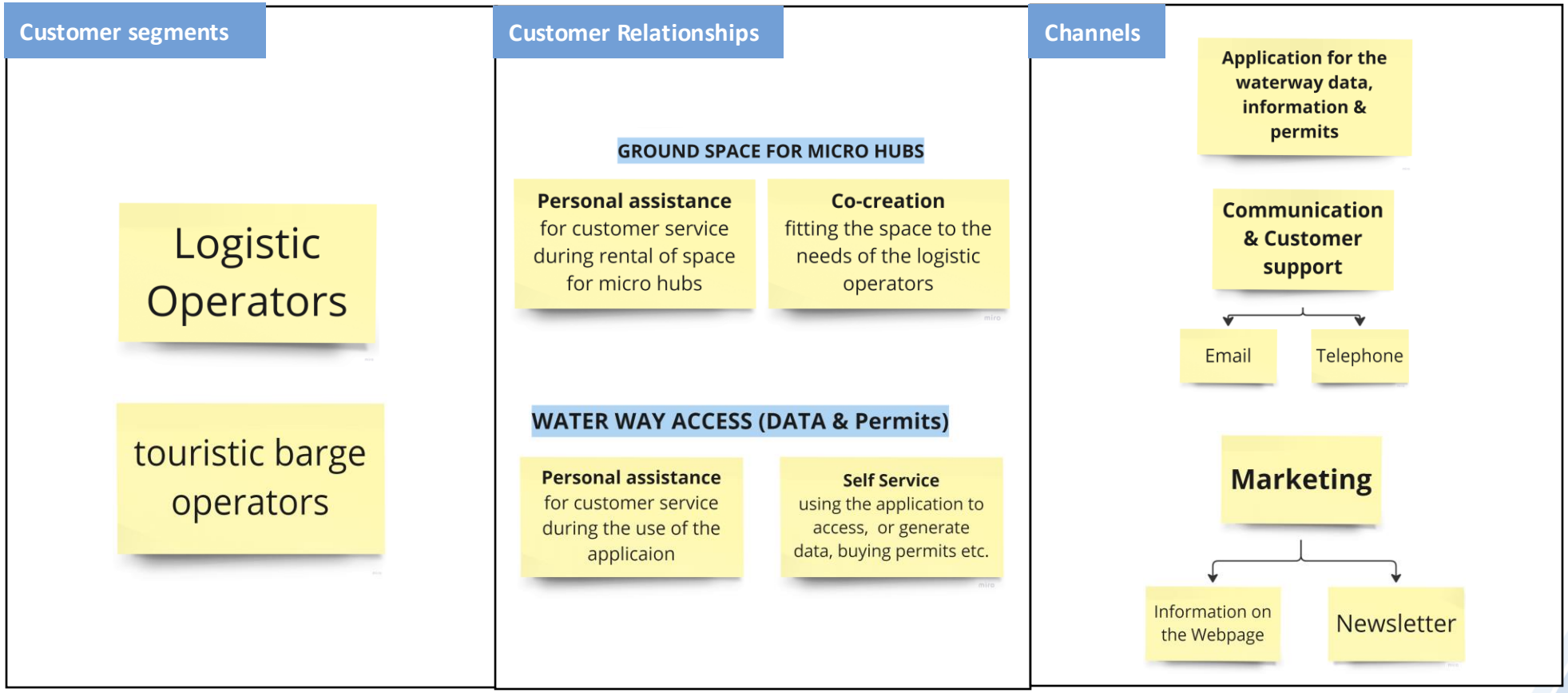
March 2024

This project has received funding from the European Union's **Horizon Europe Research and Innovation programme** under Grant Agreement No. **101069806**

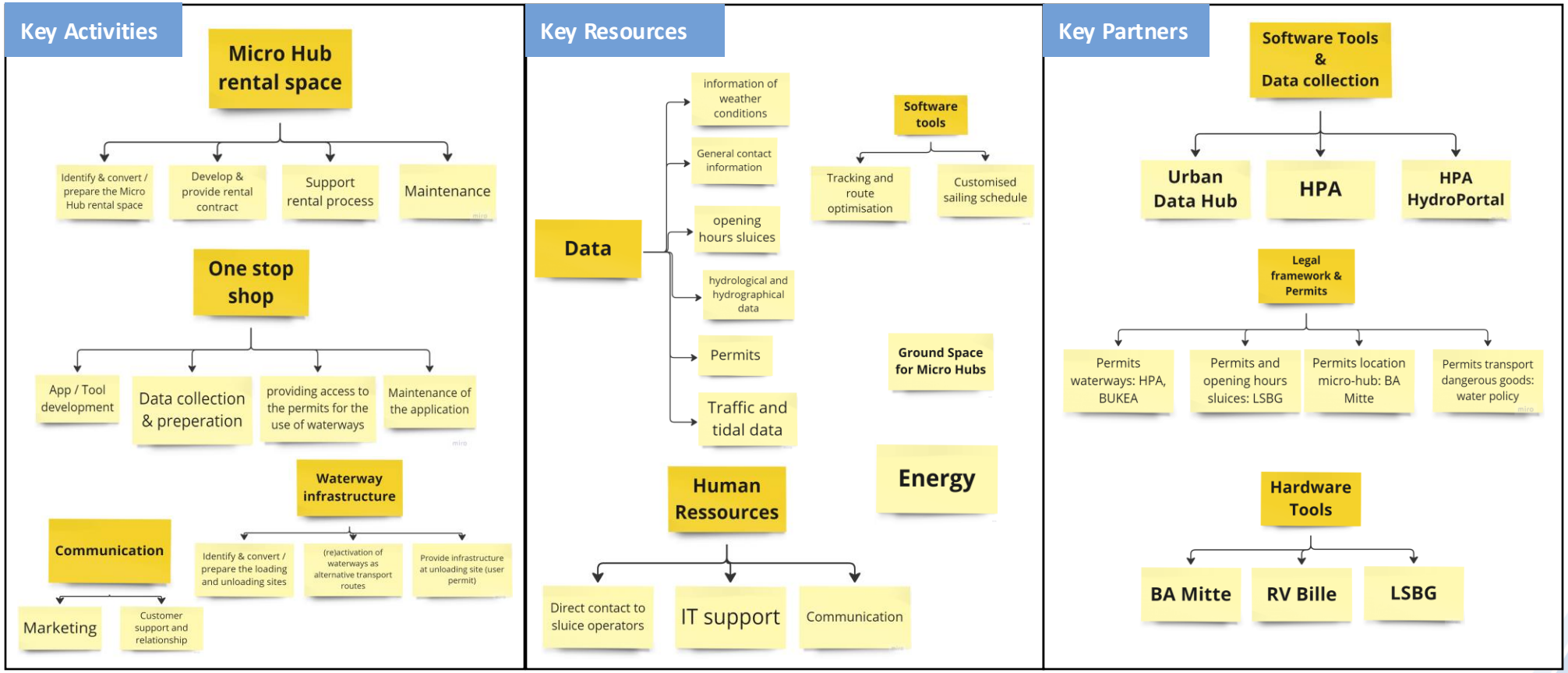
Hamburg Municipality



Customers


Customer segments
Logistic Operators
touristic barge operators
Customer Relationships
GROUND SPACE FOR MICRO HUBS
Personal assistance for customer service during rental of space for micro hubs
Co-creation fitting the space to the needs of the logistic operators
WATER WAY ACCESS (DATA & Permits)
Personal assistance for customer service during the use of the applicaion
Self Service using the application to access, or generate data, buying permits etc.
Channels
Application for the waterway data, information & permits
Communication & Customer support
Email
Telephone
Marketing
Information on the Webpage
Newsletter

Key Elements of the Business



Value Proposition

The core value provided by the municipality is the access to data and permits necessary to use the waterways and ground space in the city that can be used Micro-Hubs.

Waterway Access (Data, Permits etc.)

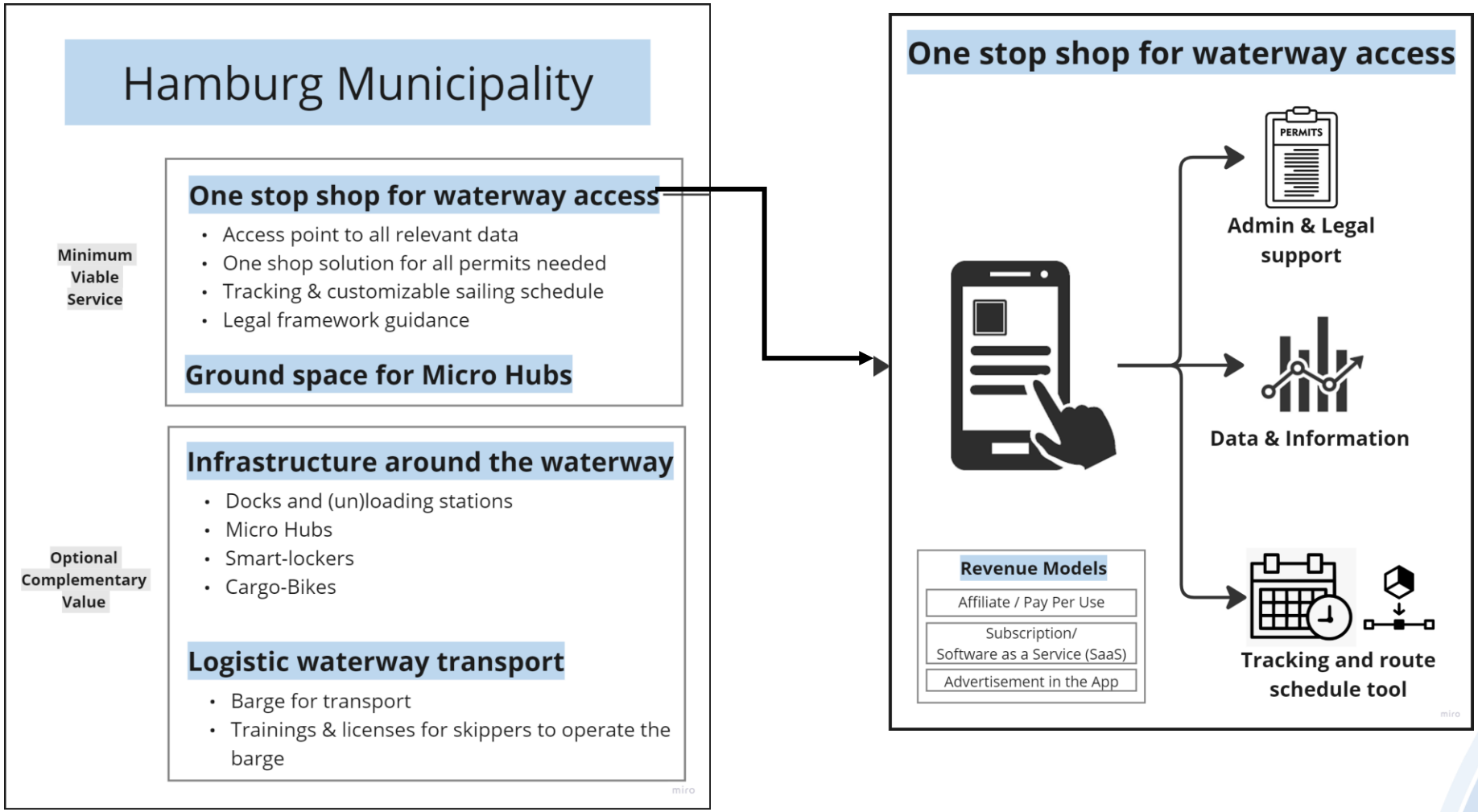
Ground space for Micro Hubs

After the Project is over, the Municipality could find an agreement with the project partners to buy out additional resources to add value to the business.

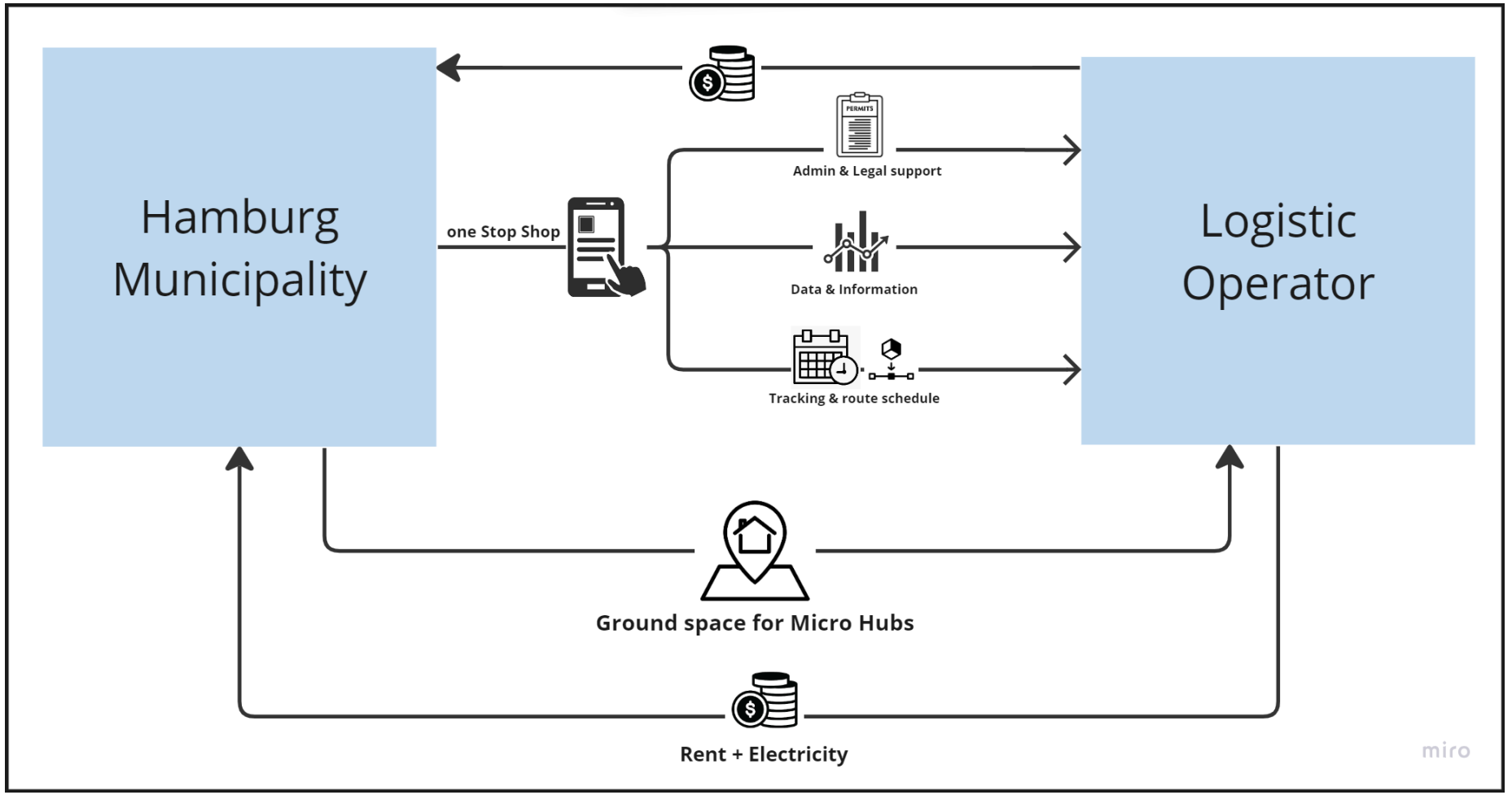
Barge

Micro-Hubs

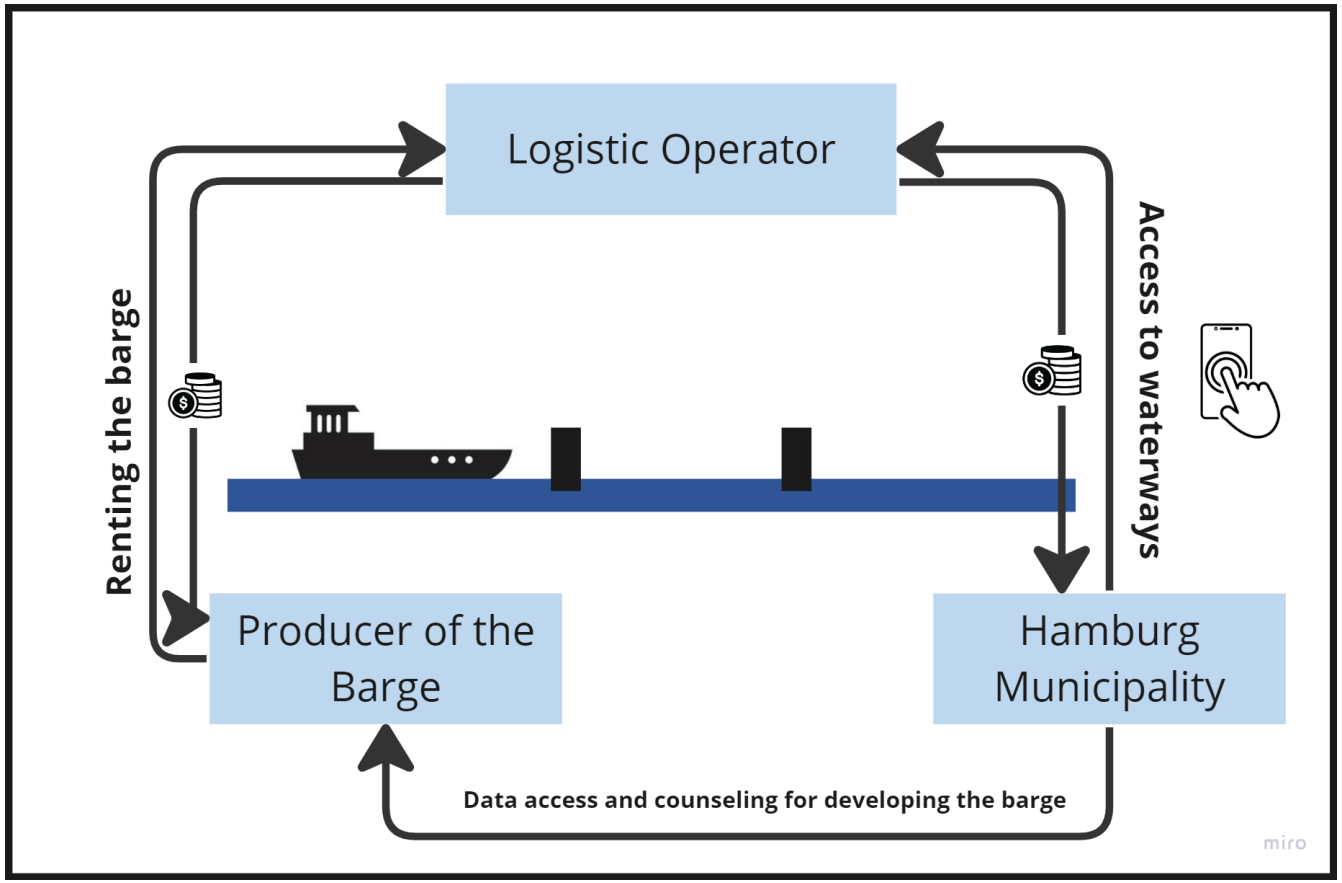
Value Proposition



Customers & Revenue model



Option for the barge



DECARBOMILE

Decarbonise last mile logistics

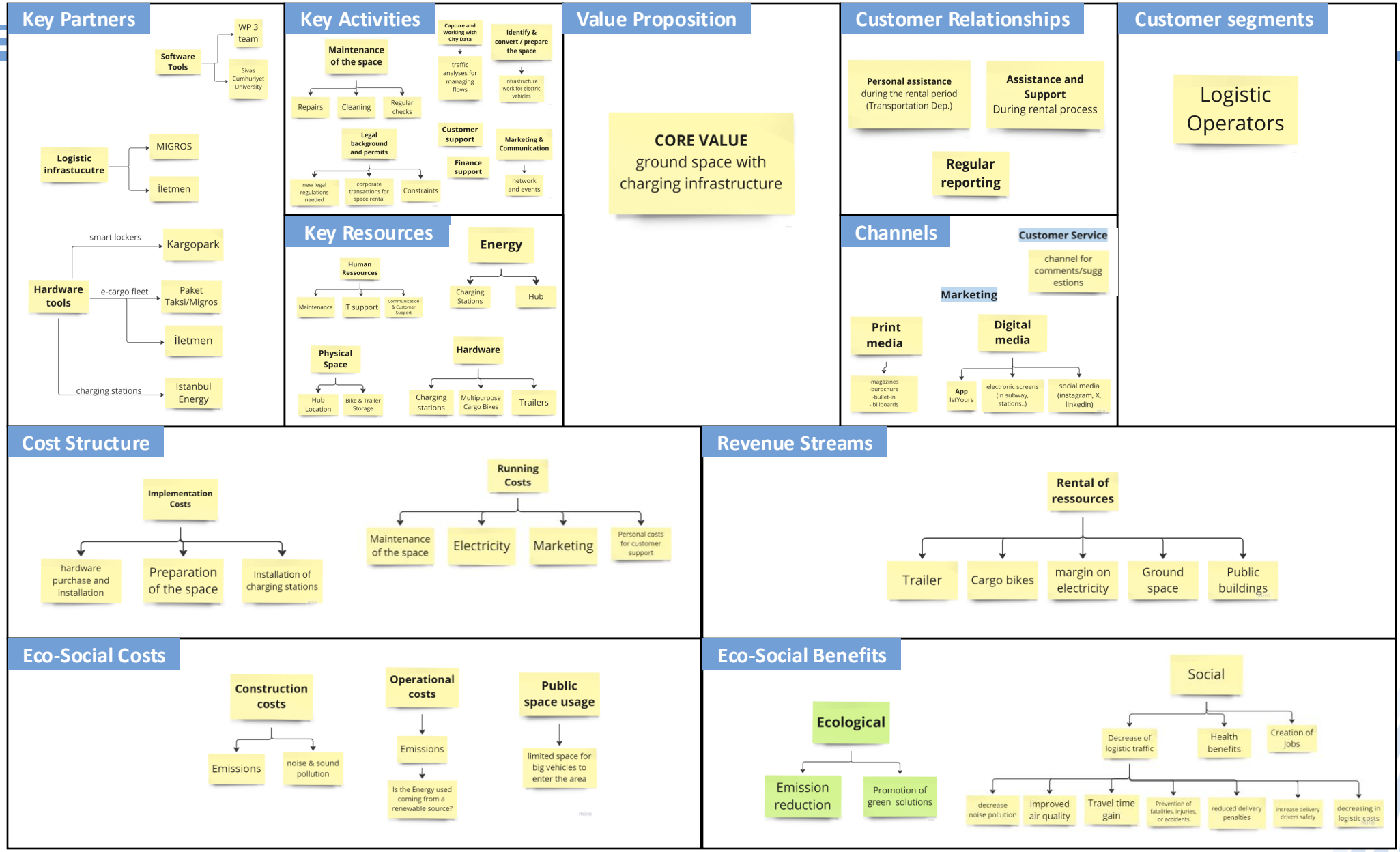
Business Model Results WS1

Istanbul Municipality

Status: March 2024

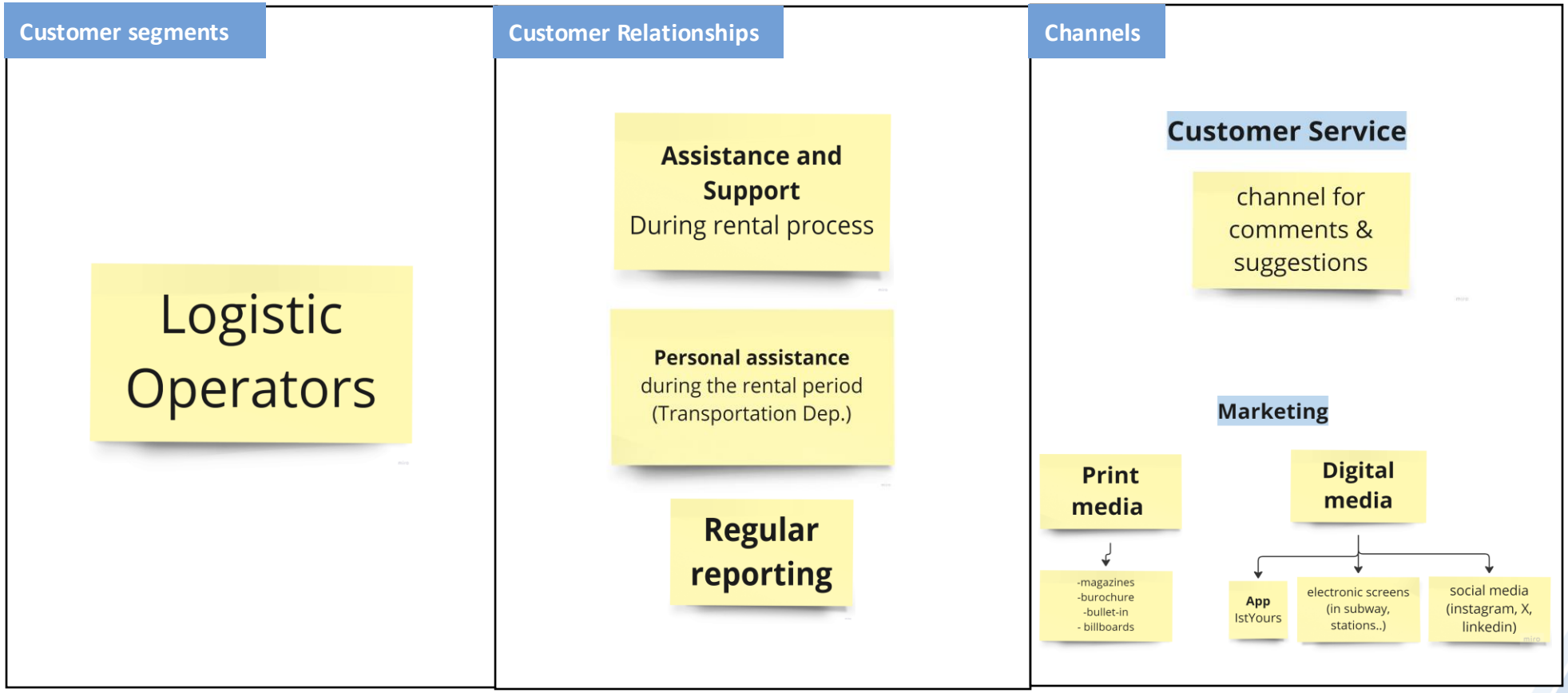
This project has received funding from the European Union's **Horizon Europe Research and Innovation programme** under Grant Agreement No. **101069806**

Istanbul Municipality



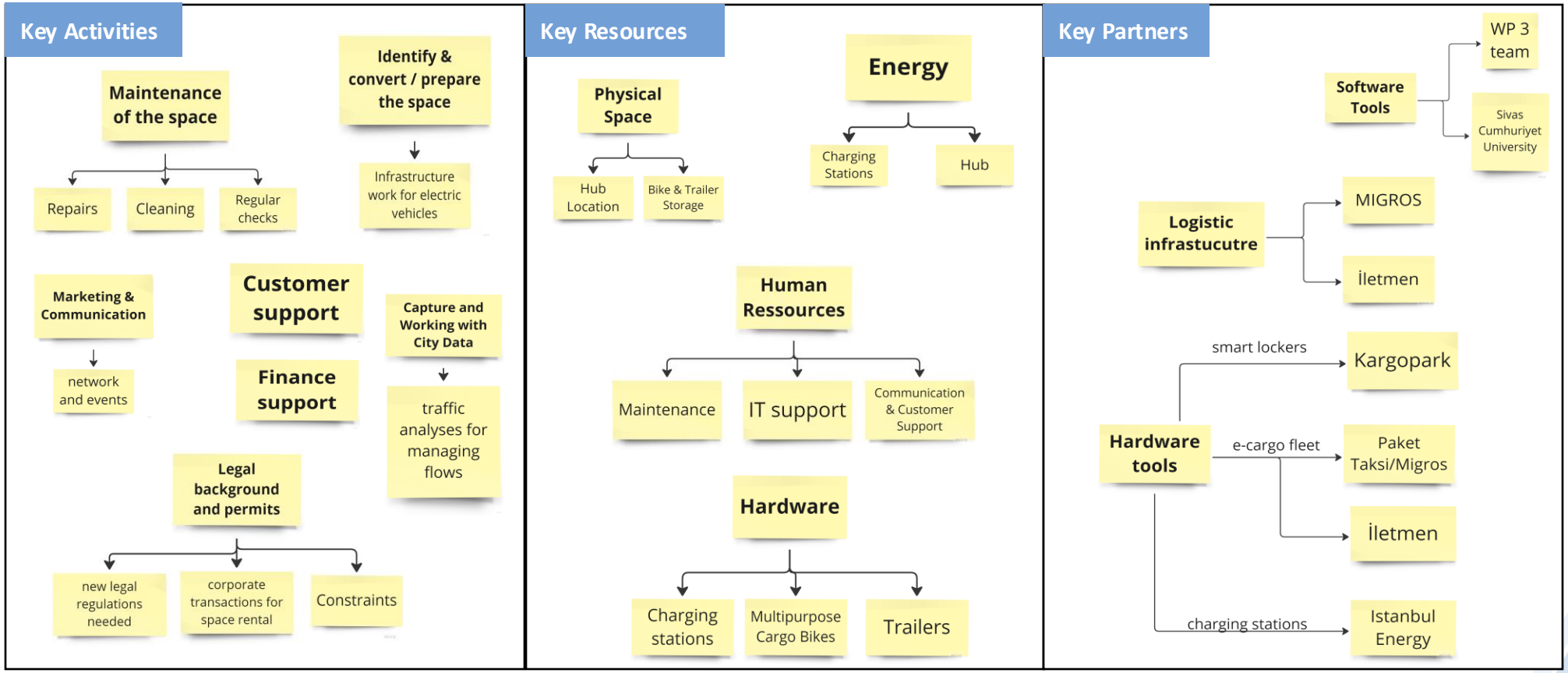
Customers

Comment



Key Elements of the Business

Comment



Value Proposition

The core value provided by the municipality is ground space in the city that can be used for logistical infrastructure.

ground space
in the city

After the Project is over, the Municipality could find an agreement with the project partners to buy out additional resources to add value to the business.

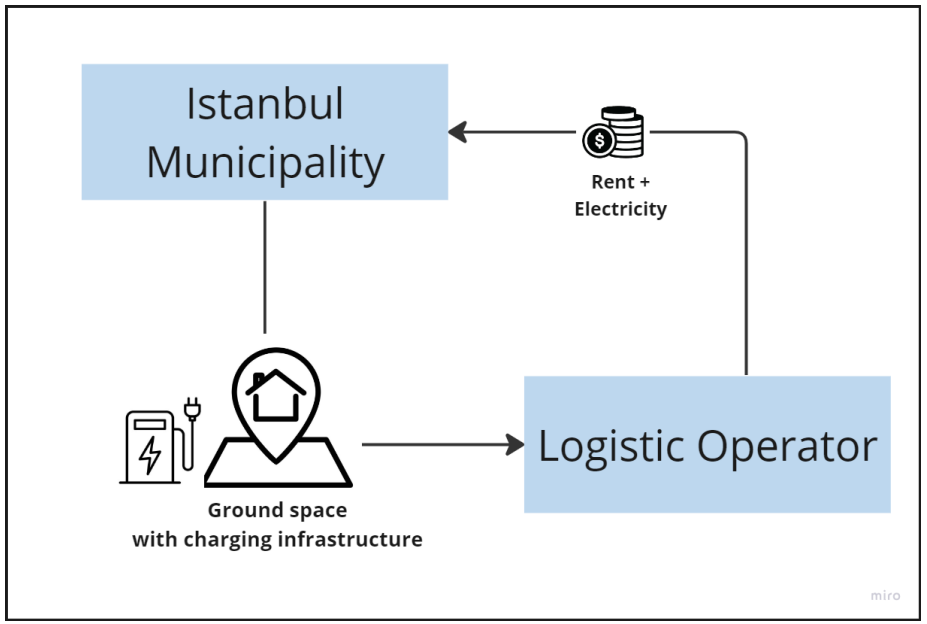
Cargo-bikes

Hubs

Micro-Hubs

Customers & Revenue model

The core customer group are logistic provider, which rent the spaces to install Hubs for logistic infrastructure in the city. The revenue Model will focus on the rental of space through a subscription and thus recurring payment and the Provision of electricity which is paid per use, with a markup on the price.



DECARBOMILE

Decarbonise last mile logistics

Business Model Results WS1

Logroño Municipality

Status: March 2024

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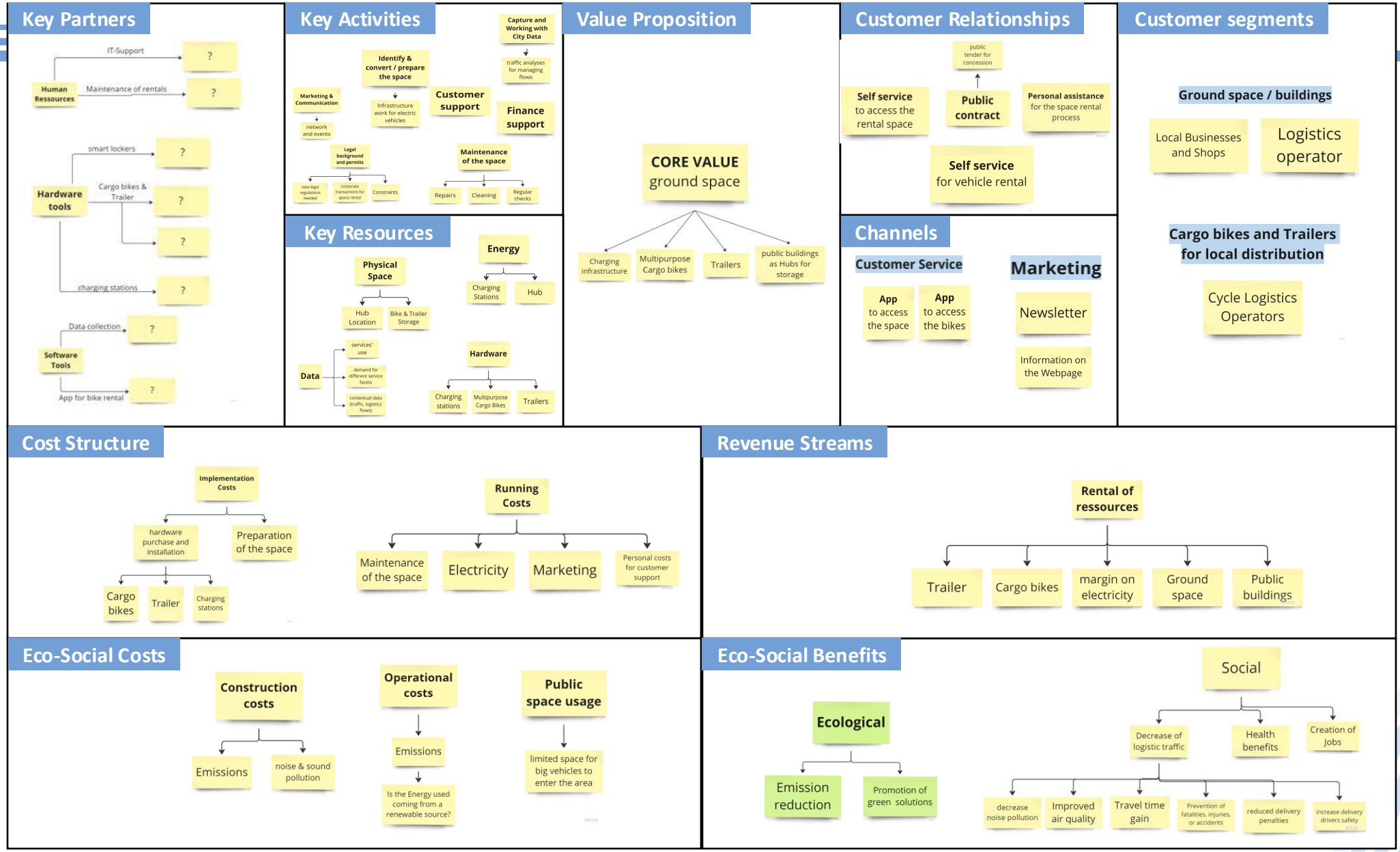
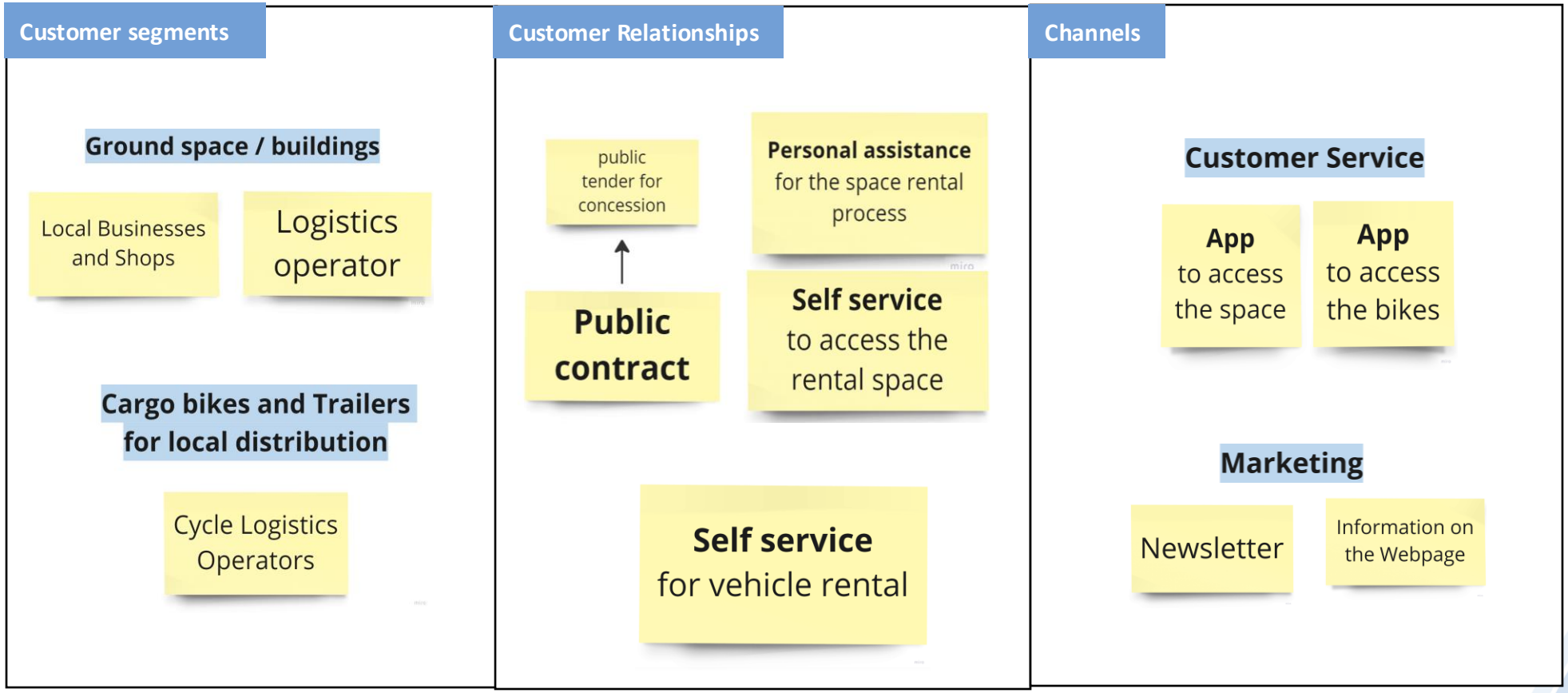
Logroño Municipality

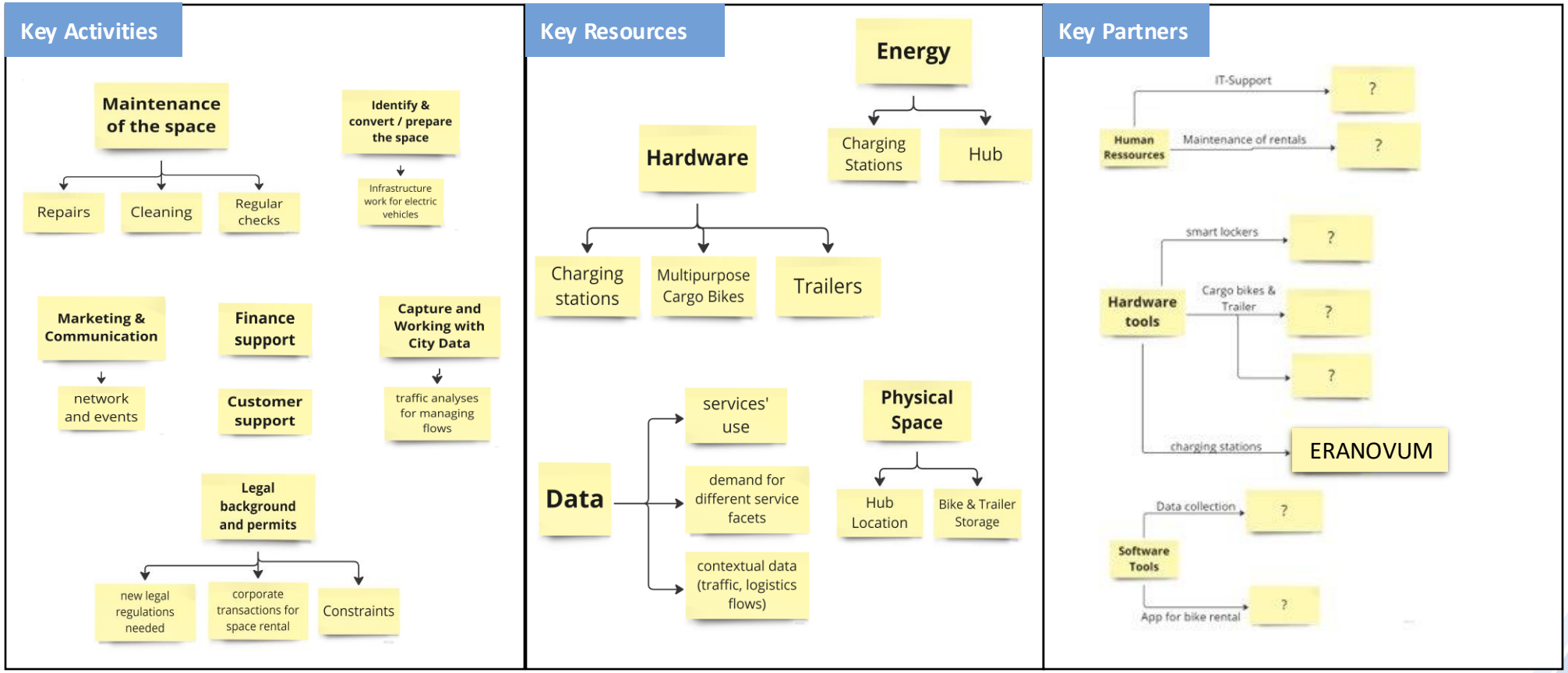


Customers

Comment



Key Elements of the Business



Value Proposition

The core value provided by the municipality is ground space in the city that can be used for logistical infrastructure.

ground space with charging infrastructure in the city

Logistic vehicles (Multipurpose Cargo Bikes & Trailers)

After the Project is over, the Municipality and/or the local stakeholders could find an agreement with the project partners to buy out additional resources to add value to the business.

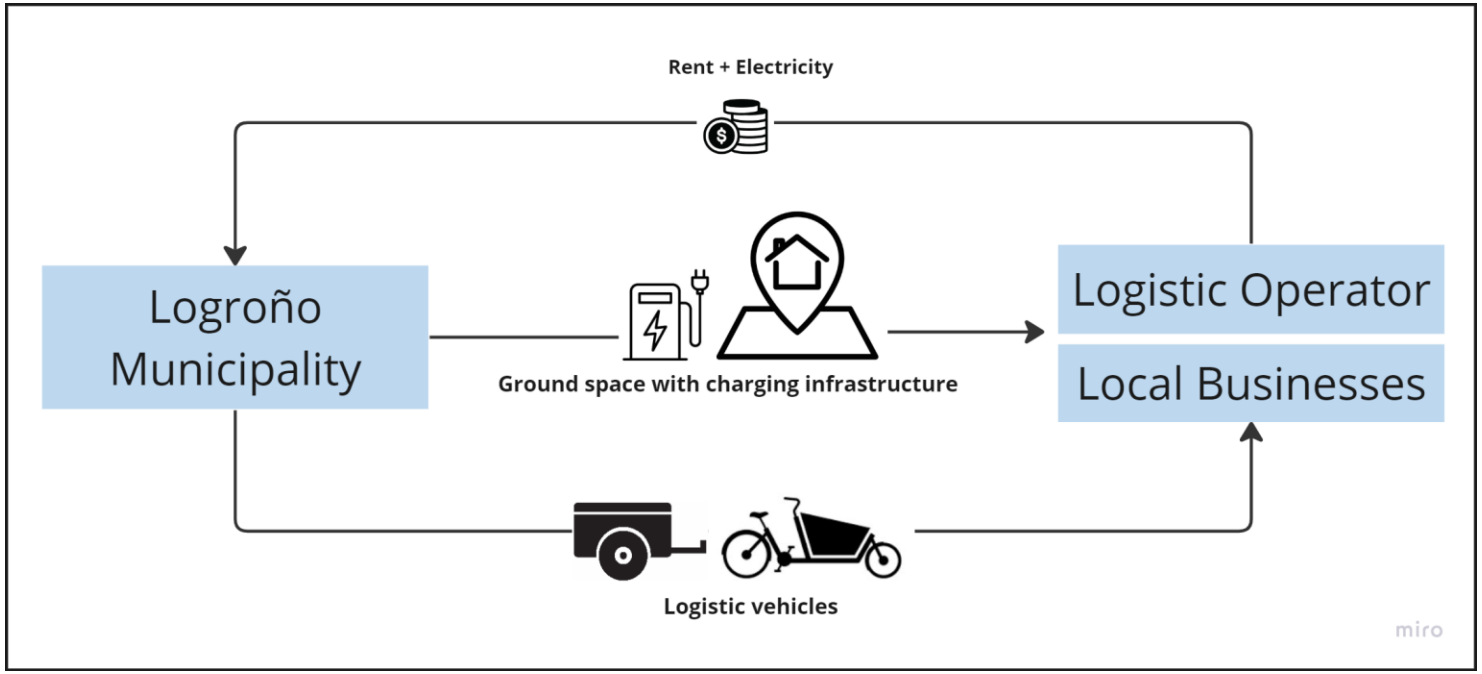
IT Tools

Hubs

Micro-Hubs

Customers & Revenue model

The core customer group is logistic provider, which rent the spaces to install Hubs for logistic infrastructure in the city and rent the logistic vehicles to distribute gods. The revenue model will focus on the rental of space and vehicles through a subscription and thus recurring payment and the provision of electricity which is paid per use, with a markup on the price.



DECARBOMILE

Decarbonise last mile logistics

Business Model Results WS1

Nantes Municipality
Status: March 2024

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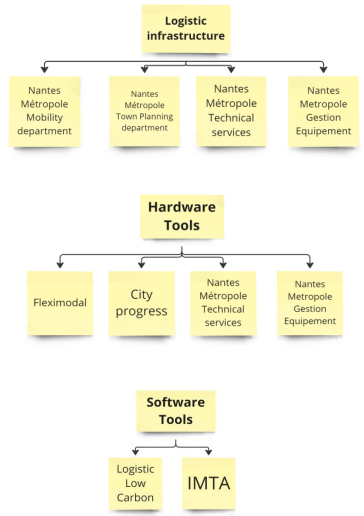
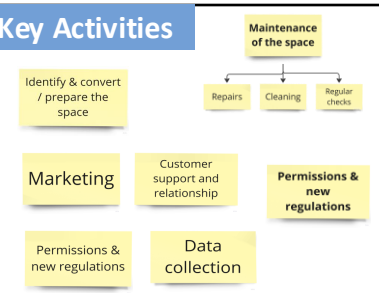
Nantes Municipality

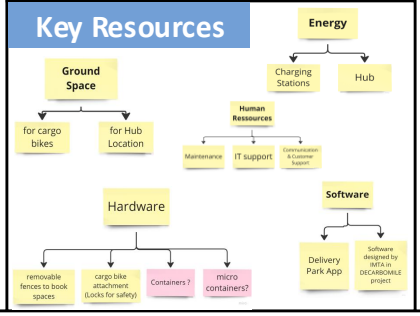
Key Partners



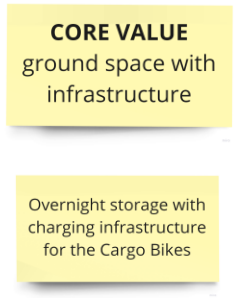
Key Activities



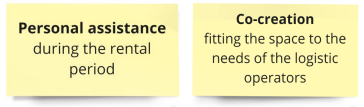
Key Resources



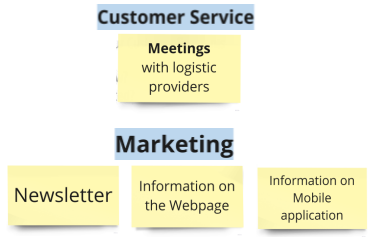
Value Proposition



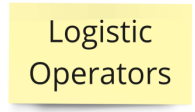
Customer Relationships



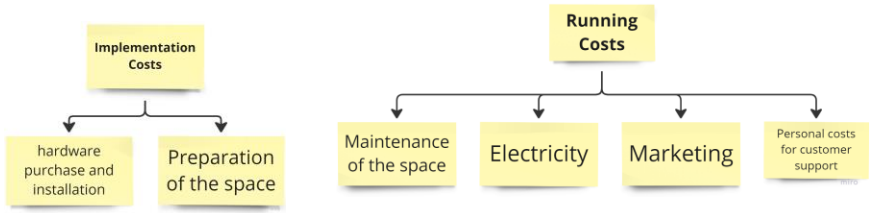
Channels



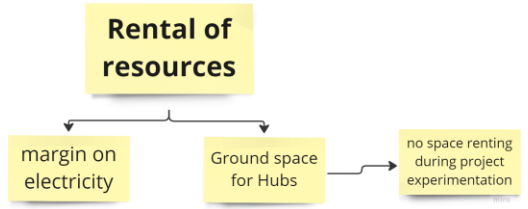
Customer segments



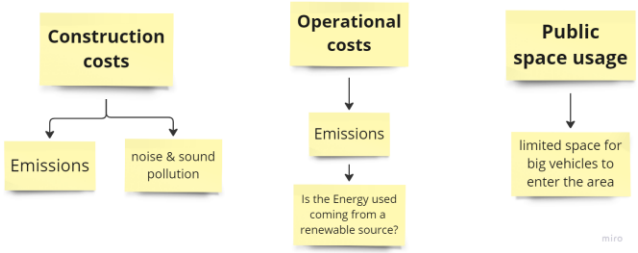
Cost Structure



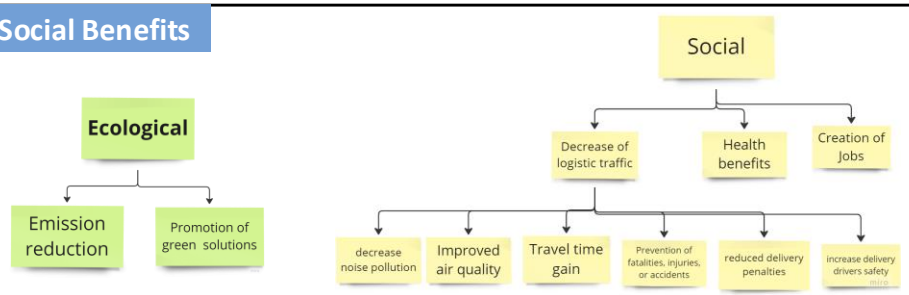
Revenue Streams



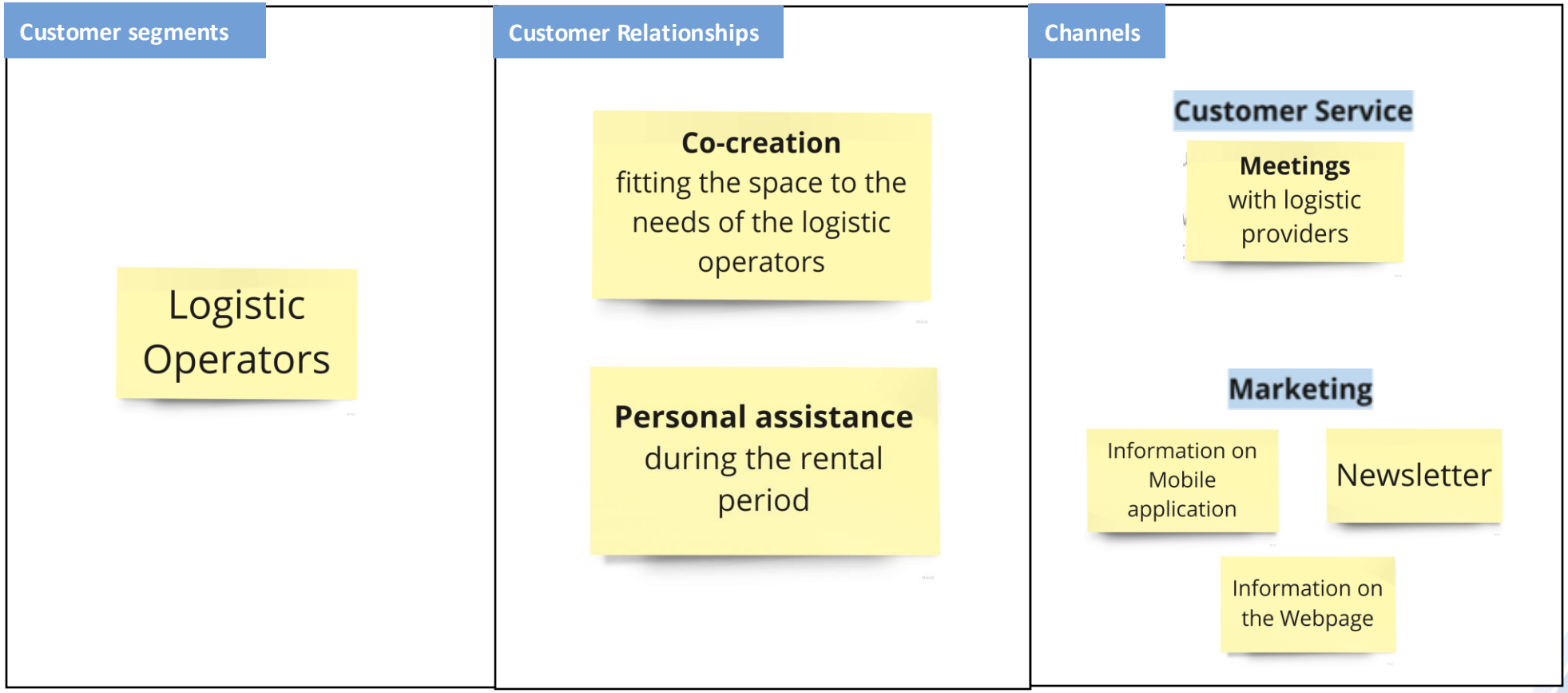
Eco-Social Costs



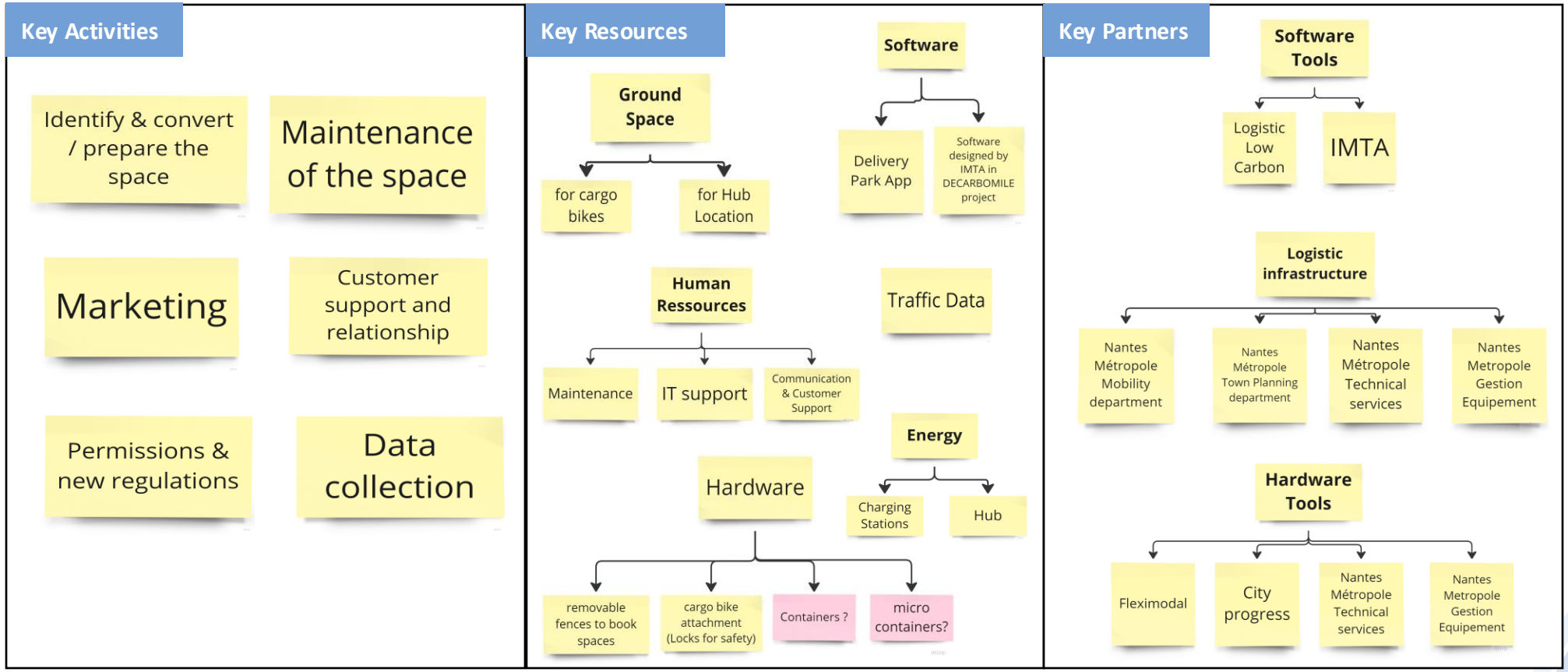
Eco-Social Benefits



Customers


Customer segments
Logistic Operators
Customer Relationships
Co-creation
fitting the space to the needs of the logistic operators
Personal assistance
during the rental period
Channels
Customer Service
Meetings
with logistic providers
Marketing
Information on Mobile application
Newsletter
Information on the Webpage

Key Elements of the Business



Value Proposition

The core value provided by the municipality is ground space in the city that can be used for logistical infrastructure.

ground space in the city

Overnight storage with charging infrastructure for Cargo-Bikes

After the Project is over, the Municipality could find an agreement with the project partners to buy out additional resources to add value to the business.

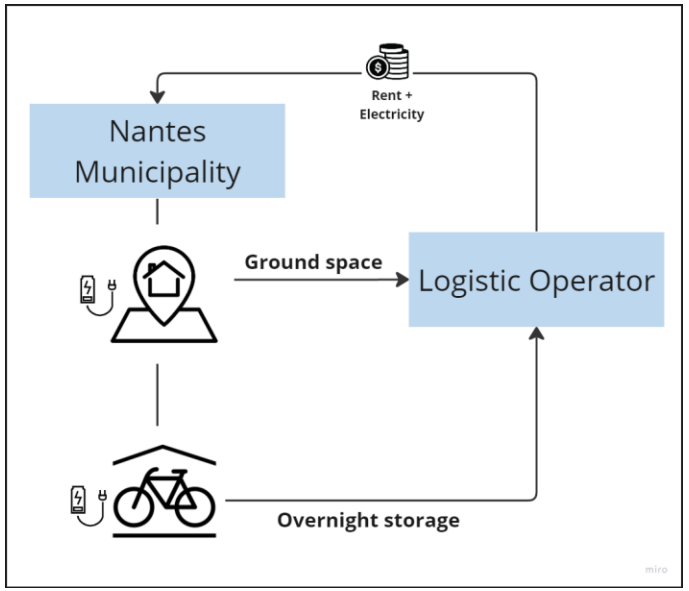
Cargo-bikes

Hubs

Micro-Hubs

Customers & Revenue model

The core customer group is logistic providers, which rent the spaces to install Hubs for logistic infrastructure in the city. The revenue model will focus on the rental of space through a subscription and thus recurring payment and the provision of electricity which is paid based on usage, with a markup on the price.



G)

Hamburg WS-Agenda

Monday 21st October 2024 **Location:** Senate Chancellery Hamburg, Hermannstraße 15, **Participants:** OHB, HAM, LIHH, CBS, DPDHL, BA, BWI, TUHH		
Objective	**Time**	**Activity**
Meetings	**9-12.00**	- 1. Specification vessel and status of constructions Scissor lift, Storage of Materials (09-10h) - 2. Skippers, recruitment and licences (10-11h) - 3. Clarification of operational licences (11-11.30h) - 4. Transporation of the vessel to Hamburg (11.30-12.00)
Lunch Break 12.00-13.00		
Transfer from Senate Chancellery to RV Bille 13.00-13.30		
Side visits	**13.30-17.00**	- 13.30: Visit at RV Bille - 15.30: Visit at Am Alsterfleet/Schaartorschleuse (cf. JF slides 15/08/2024)

Tuesday 22nd October 2024 Location of the WS: **Location:** Senate Chancellery Hamburg, Hermannstraße 15, WS participants: OHB, DPDHL, HAM, LIHH, TUHH, CBS		
Objective	**Time**	**Activity**
Arrival time	**9.00-9.10**	
Cost-Structure (30 min)	**9.10-9.40 min**	Reflect on key Use-Case costs and identify and address budget allocation issues (incl. Manon via Teams)
Introduction	**9.40-9.50**	Welcome words Introduction round of participants Workshop objectives goals and activities explained
10 min BREAK		
Time-to-Market assessment (30 min)	**10.00-10.05**	Introduction / Transition time
	10.05-10.35	Review the factors and brainstorm additional factors if needed that influence the implementation time of the Use-Case
Operational Risk Assessment (45 min)	**10.35-10.40**	Introduction / Transition time
	10.40-11.00	Group brainstorm to identify operational risks
	11.00-11.10	Prioritization of risks based on likelihood & impact
	11.10-11.30	Discuss risk management strategy for key risks identified
10 min BREAK		
Long-Term Implementation Planning (35 min)	**11.40-11.45**	Introduction / Transition time
	11.45-12.15	Group brainstorm to determine the necessary conditions to replicate the Use-Case and set it up for long-term success
Wrap up	**12.15-12.30**	*Space to discuss topics that were not touched yet / discuss next steps*
12.30 -14.00 Lunchbreak		
Bilateral Meeting with Martin & Sophronius	**14.00-15.30**	T2.5: HAM responsibility for BM suitability assessment—talk about strategy and next steps

Activity 3: Long Term Perspective

Discuss: Is a long-term implementation of the Use-Case realistic? And why?

TO-DO: Collect (1) hindering factors and (2) necessary conditions on Post-Its.

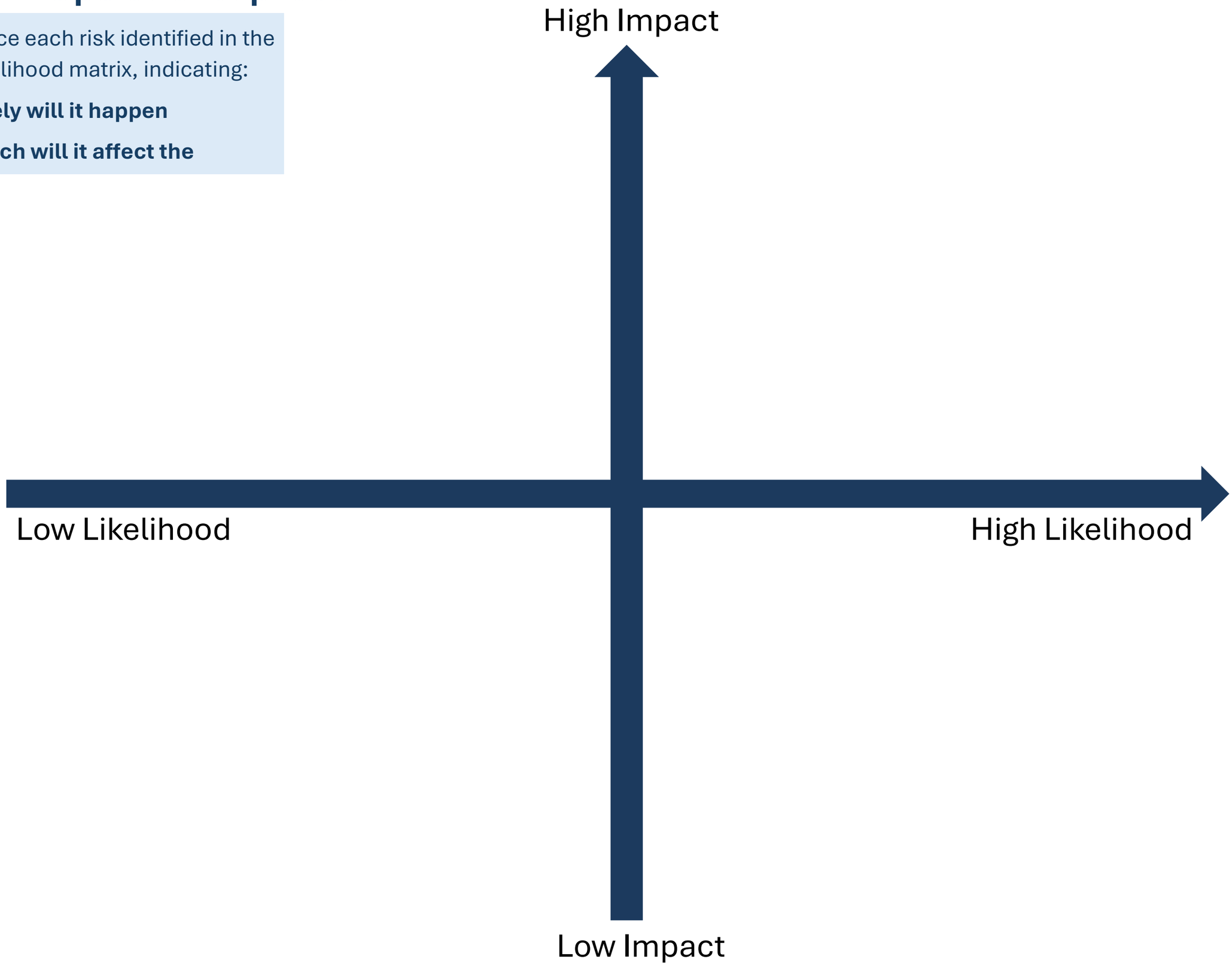
Hindering Factors	Necessary Conditions

Activity 2 – Operational phase

TO-DO: Place each risk identified in the Impact/Likelihood matrix, indicating:

(1) How likely will it happen

(2) How much will it affect the



Time to Market Factor	Explanation	Use-Case specific Time to Market Factor
Infrastructure availability	To what extent can your Use-Case utilize existing urban / logistic infrastructure?	
Regulatory approvals	Are there significant legal or regulatory approvals needed and how complex and time-consuming are these processes?	
Partnerships and Stakeholders	Do you have the necessary team and how well do stakeholders timelines aligned with your project needs?	
Equipment Integration	Does your solution involve integrating new or complex equipment that need time intense development & testing?	

Time to Market Factor	Explanation	Use-Case specific Time to Market Factor
Resource Availability	Are skilled personnel, equipment, or materials readily available to support the development and launch? Could shortages create delays?	
Costs and Finances	Do you have the financial resources necessary to keep your project on track?	
Environmental & Geographical Factors	Are factors like weather, geography, or location-specific issues impacting the Use-Case development or deployment timelines?	