D1.4

Innovation Agenda - Value case scenarios and validation KPIs

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Acronyms

Acronyms	Explanation
AI	Artificial Intelligence
AQI	Air Quality Index
B2B	Business to business
B2C	Business to consumers
BKK	Budapesti Közlekedési Központ
C2C	Consumers to consumers
CARA	European Cluster for Mobility Solutions
CBD	Central Business District
CEO	Chief Executive Officer
CI	Consequence Indicator
CID	Central Innovation District
CNG	Compressed Natural Gas
CoP	Community of Practice
DLW	Dedicated Logistics Warehousing
DNA	Digital Network Architecture
EDV	Electric Delivery Vehicles
EU	European Union
EV	Electric Vehicle
FUA	Functional Urban Area
GDPR	General Data Protection Regulation
GDP	Gross Domestic Products
GHG	Greenhouse Gases
GPS	Global Positioning System
H2020	Horizon 2020
HGV	Heavy Good Vehicles
INDIMO	Inclusive Digital Mobility
IoT	Internet of Things

Acronyms	Explanation
KPI	Key Performance Indicator
LAET	Transport, Urban Planning and Economics Laboratory
LEAD	Low-Emission Adaptive last mile logistics supporting 'on Demand economy' through digital twins
LEZ	Low Emission Zone
LGV	Light Good Vehicles
LL	Living Lab
LNG	Liquified Natural Gas
MaaS	Mobility as a Service
MC	Modelo Continente
Mobility4EU	Mobility for the European Union
MVM Zrt.	http://mvm.hu/bemutatkozas/mvm-csoport/mvm-bszk-zrt/
MVP	Minimum Viable Product
NGO	Non-Governmental Organisation
NO2	Nitrogen Dioxide
O3	Ozone
PI	Physical Internet
PM	Particulate matter
PPP	Public Private Partnership
PT	Public Transport
SME	Small Medium Enterprise
Si	Scenario i, i=1,2,3,4
SO2	Sulphur Dioxide
SP	Stated Preferences
SPROUT	Sustainable Policy RespOnse to Urban mobility Transition
STOR	Smarter Transport in the Oslo Region
SULP	Sustainable Urban Logistics Planning
SUMP	Sustainability Urban Mobility Planning
T&L	Transport and Logistics

Acronyms	Explanation
TEN-T	Trans European Transport Network
TÖI	Institute of Transport Economics
UCC	Urban Consolidation Centre
UFT	Urban Freight Transport
ULaaDs	Urban Logistics as an on-Demand Service
USA	United States of America
UVAR	Urban Vehicle Access Regulation
WP	Work Package
ZE	Zero Emissions

Executive Summary

City logistics is one of the essential elements of urban mobility planning. Also, the growth of e-commerce activities is a trend that has been reinforced by the COVID-19 pandemic. The consequence is that last mile flows are increasing with a high impact on cities. However, little has been done so far for investigating and addressing the implications of city logistics on social welfare. In recent years, this topic is gaining attention due to the economic, environmental and social consequences.

The perceived impact of this activity depends upon the perspective of the stakeholders involved. On one hand, cities are trying to tackle the negative consequences by introducing different policies to reduce the externalities. On the other hand, shippers and operators are challenged to find efficient ways to meet the end consumers' demand. Moreover, they have to continuously reinvent their business to fulfil the expected services while facing environmental regulations. Citizens are expected to keep using e-commerce activities while valuing high living conditions in their neighbourhoods. These requirements and challenges require decision-makers use robust decision support systems that take into considerations the needs of all stakeholders involved.

The LEAD project aims to create digital twins to support policymakers and private decision-makers in facing these challenges and better planning their activities. The LEAD project utilizes the Living Labs (LLs) methodology and is organized in three phases. The first phase is focused on the community set up, problem definition, and establishment of appropriate Key Performance Indicators (KPIs). The second phase aims to define the LLs implementation plan and prepare the use cases based on innovative models from the LEAD reference model library. The final step is the actual implementation, verification and validation of the LL value case scenarios which are defined as a set of measures and innovation being applied in one of the living labs.

This D1.4 details the work developed by the LLs for the first phase with a fourfold objective. First, to build and engage diverse types of last-mile stakeholders to set up the communities of practice (CoP). Their contribution to the LEAD project is essential to establish a co-creation and holistic space for sharing knowledge. Second, to define future scenarios and understand the sustainability consequences of different logistic measures using online surveys. Third, it aims to identify the opportunities and drawbacks of different logistics measures (described in Deliverable 1.1) and understand the business value and feasibility of the four future value case scenarios from a multi-stakeholder approach through local workshops.

Although the COVID pandemic did not allow to perform face to face meetings to fulfil the objectives above, LLs performed online workshops and bilateral meetings yielding meaningful results. LL1 Madrid analysed different locations for installing an urban consolidation centre and concluded the best location was an existing infrastructure close to the delivery area. LL2 Hague aims to advance towards hyperconnected logistics for the on-demand economy, the pilot intends for a step-change in the connectivity between different platforms. This LL2 suggests that while crowd-shipping may increase delivery time, having an open hyperconnected platform may help reduce the delivery time to competitive levels. In the case of LL3 Lyon, it considers the same location for the UCC but increases the complexity of the scenario with additional types of vehicles (bikes, electric, autonomous) and expanding the delivery area to the north. The results conclude that the territorial extension may justify the use of different types of vehicles. LL4 Budapest compares mobile and a permanent hub combined

with different time windows. The results lean towards wider windows and fixed installations. LL5 plans to explore the microhub concept furtherly and the potential for more crowd-shipping. It increments the complexity gradually considering various types of e-vehicles and commuters using the public transport for small items and concludes that "the lower feasibility, the more value". A relevant result is a need for these logistics measures of addressing data privacy and cybersecurity issues. For LL6 Porto, more business-oriented, the T1.4 exercises helped to confirm the electric deliveries as the most valuable and feasible scenario.

Finally, the preliminary KPIs for the project had been identified while ensuring all the LLs and their members have a common understanding. The identified set of KPIs includes a diverse number of generic KPIs for the three dimensions of sustainability (GHG emissions, noise level, delivery costs, jobs created) that will be extended and detailed during the second phase of the project. Indeed, the work will focus on identifying more stakeholder-specific KPIs.

The result of this period is six LLs with rich CoPs, a good understanding of the value case scenarios, and consensus on the objectives and common KPIs. All the objectives are considered essential inputs to the successful completion of the upcoming phases.

1 Introduction

1.1 Scope and objectives

This deliverable aims to report the four broad goals of task 1.4. The first one is to set up the Living Labs Communities of Practice (CoP). The second, to define the Living Labs value case scenarios. Third. conduct a preliminary impact analysis of the value case scenarios and a preliminary assessment of opportunities, threats, business value and feasibility of each LLs value case scenarios. Fourth, to identify the relevant KPIs for this project.

For the CoP, LLs require a diverse group of stakeholders per city to participate during the LLs development. During this task, a prospection on the ongoing initiatives and previous projects allowed identifying the interested parties may participate in the Living Lab activities. To engage relevant stakeholders for real-life experiments, some LLs set workshops or bilateral meetings inviting the local industry, government, associations and organizations. The goal is to enrich and keep these CoPs with additional stakeholders and events during the course of the project.

About the value case scenarios, each Living Lab described the current context and the baseline scenario. Then they defined four plausible value scenarios within each value case[1] may be implemented during the next phases of the LEAD project. They were the result of combining innovative logistics measures. After the definition of these scenarios, LLs experts responded to a survey that helped to understand the possible consequences of implementing these scenarios on the sustainability dimensions. In addition, local workshops and bilateral meetings with the CoP members helped to engage external stakeholders, validate and discuss the logistic measures' opportunities and threats, and assess the scenarios considering the different stakeholders added value and feasibility.

Finally, this task provides the initial identification of KPIs for this project, ensuring all the partners and stakeholders have the same understanding. This list will be enhanced and further detailed during the upcoming phases of the project.

The following table maps the DoW definition with the document Chapters along with an outline of the major respective activities performed to accomplish the envisioned goals.

Table 1: Deliverable's adherence to LEAD objectives and Work Plan.

LEAD GA requirements	Section(s) of present deliverable addressing LEAD GA	Description
ST1.1.4 LLs Local Communities setup	An in deep search in the intervention areas of the LLs to find at least 20 suitable stakeholders per city to involve during their development will be performed.	Every LL includes a specific section "CoP members and establishment process" with the external and internal stakeholders that are part of the local communities of practice and the establishment process. As indicated in the section, the reported community is just the seed to engage more participants during the project.

[1] A value case scenario is defined as a set of measures and innovation being applied in one of the living labs. We refer to these as the value cases. There are six value cases (for Example LL1 Madrid value case).

LEAD GA requirements	Section(s) of present deliverable addressing LEAD GA	Description
	A prospection on the ongoing initiatives and previous projects will be carried out to identify the interested parties.	Chapter 2.1 and Annexe 1 explore ongoing projects and initiatives to identify interested parties and engagement strategies.
	Workshops in the different locations will be organized inviting the local industry, governments and associations to engage relevant stakeholders for real-life experiments.	Section 2.4 describes the workshop objectives and methodology. As explained and reasoned in this Chapter, some LLs performed bilateral meetings to obtain the results. The COVID pandemic did not allow to celebrate face to face meetings. Every LL includes a specific section "Opportunities and threat - evaluation" describing the methodology and the results.
ST1.4.2 Problem Definition – LLs Value Case Scenarios	LLs vision, ambitions, objectives, main users and stakeholders are identified and conceptual designs of implementation cases to be tested in the LL are made. The output of Tasks 1.1-1.3 will allow the identification of at least 30 LEAD strategies and prominent value case scenarios to be simulated during the LLs implementation.	Every LL includes a section describing the status quo and the context description and vision statement (x.1, x in [3,8]) and a section describing the strategies they will follow (x.3.1, x in [3,8]). Every LLs describes 4 future scenarios based on a combination of logistics' measures. Together with the "as is" scenario lead to a result of 30 strategies.
	For each LL, the expected impacts of the simulation-based environment will be assessed, based on a consequence analysis in the context of each scenario including social acceptance and cybersecurity for drones' considerations. Opportunities and threats to each component of the city logistics in each LL will be analysed.	Chapter 2.3 and Annexe 3 describe the consequence analysis framework. Chapter 2.4 explains the methodology used to identify the opportunities and threats and evaluate every scenario. Every LL includes a section describing the results of the expected sustainability impacts and the opportunities and threats identified further detailed in Annexe 5.
	The expected results of the Digital Twins and impacts in the city logistics will be validated and revised by the local stakeholders during workshops to be undertaken in each LL by the local partners based on a methodology provided by the task leader.	See ST1.4.1
ST1.4.3 Target KPIs per LL	In this task, the relevant KPIs for this project are first identified and are specified in more detail in the second instance.	Section 9 describes the methodology and the preliminary set of KPIs. Annexe 6 details the process followed and additional KPIs will be reconsidered during the second instance.

1.2 How does this deliverable relate to other deliverables?

This deliverable with the rest of WP1 deliverables is an essential input for the Deliverable 1.5 and WP3. It synthesizes all the WP1 insights to arrive at the LEAD strategies that will be a candidate to be applied in first in the six LLs.

More specifically, this D1.4 replies to phase A of the Living Labs implementation plan (see Figure 1) and creates the main inputs for phase B that starts with T3.1 “LLs planning and management”. Specifically, Task 1.4 provides T3.1 with specific value case scenarios. The LL and LEAD members will also use T1.4 information and T1.2 reference models to further elaborate the conceptual diagrams to detailed design specifications for the LEAD innovative last-mile solutions following the Minimum Viable Product approach (MVP) in *ST3.x[2].1 Preparation: MVP Specification and modelling*. Finally, this task provides the project with the initial definition of the KPIs. They constitute an essential preliminary input for the WP3 evaluation in the project (ST3.8.2).

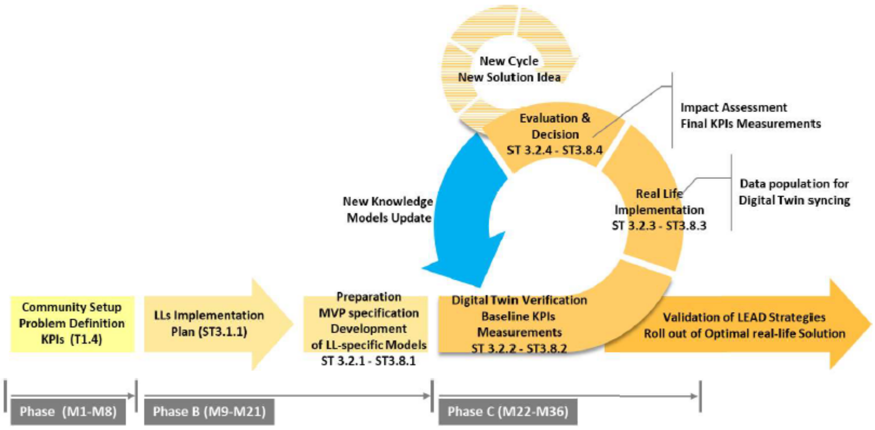

Figure 1. LEAD Implementation Approach through the LLs (LEAD, 2020a)***.***

1.3 Structure of the document

The deliverable is structured in four main sections:

1) The methodological phase, which sets the steps conducted to select the CoPs, defines the value case scenarios, the main context of the sustainability impact assessment and the workshops' objective. The specific information about the implementation and analysis phases of each LL further detailed in the Annexes (chapter 2).

2) LLs value cases descriptions which present the results of the activities implemented to set up the CoPs, define the LLs value cases scenarios and the results of the identification of the expected impact assessment (chapter 3 to chapter 8).

3) The initial list of relevant KPIs and the definition process followed that ensures all the partners and stakeholders use the same specification and understanding (chapter 9).

4) The conclusions and lessons learned (chapter 10).

[2] *ST3.x.1: The X refers to the LLs specific WP3 task number (T3.2: LL1 Madrid; T3.3: LL2 The Hague; T3.4: LL3 Lyon; T3.5: LL4 Budapest; T3.6: LL5 Oslo; T3.7L LL6 Porto)*

2 Methodological approach

2.1 Setting up the Communities of Practice

Communities of Practice (CoP) are groups of people working together towards achieving specific goals through the creation, sharing, harvesting and leveraging of knowledge or experience. CoPs enable practitioners to exchange knowledge and skills with external stakeholders and users. This open membership offers access to a wide range of expertise to help with technical challenges, fuel continuous improvement and allows more meaningful contributions to the goals of the Living Labs. The result is a better understanding of the expected impacts of introducing changes in specific scenarios from cooperation across multiple domains (AGILE, 2019).

The process for setting up the LEAD Communities of Practice (CoP) started with a prospection of the ongoing initiatives and previous projects that allowed the identification of the interested parties to involve [ZLC has built upon the experience developed in previous projects] such as Mobility4EU, SPROUT and INDIMO (see Table 16 in Annexe 1). Finally, the template included in (SPROUT, 2020b) and the stakeholder engagement strategies described in (INDIMO, 2020) were the basis for: 1) Supporting LEAD Living Labs in mapping the suitable stakeholders (either project associated partners or external organizations/ entities); 2) Defining the contact and engagement strategy (see template in Annexe 1). About the latter, the proposed methods for contacting people were "*snowball referrals*[3]" and LLs local partners' social media channels[4], as they are the most common and effective communication forms. It is important to outline that to support LEAD LLs in the recruitment process, T1.4 leaders also created a letter of support that describes the activities they engage to participate and why their contributions are so valuable for the society (see Annexe 1). To increase the level of willingness to be a member of the CoP, LLs were recommended giving some incentive such as premium accounts for free shipping or free parking tickets.

2.2 Value case scenarios definition

LLs value case scenarios comprise the "*do-nothing*" scenario and four future scenarios. The former is used as the baseline scenario to compare the impacts on the externalities of implementing some actions. The latter refers to the actions will be implemented which are the result of combining a set of logistics measures defined from the strategies and trends identified by WP1. LLs defined the value case scenarios in a three-step process.

Firstly, this activity started mapping the last-mile city logistics measures (see Table 19 to Table 23 in Annexe 2).The list of logistic measures was generated through a process of analysing the strategies in outstanding scientific reports (Verlinde et al., 2014), (Gatta et al, 2019), (Parcel and Postal

[3] *Snowball referrals* (Patrick et al., 1998). *Snowballing involves nomination of other potentially eligible people by study participants. Snowball recruitment is a recruitment source before field work began; therefore, names of potentially eligible persons are collected beginning with the first meeting. Snowball referrals can continue throughout the study.*

[4] *Social media channels: LinkedIn, Twitter and others more specific.*

technology international, 2017) and projects (STRAIGHTSOL[5], BESTUFS[6], C-LIEGE[7], CITYLOG[8], NOVELOG[9]). These measures are further detailed in the LEAD deliverable D1.1 (LEAD, 2020b).

Secondly, this information was presented to LLs using a template (see Annexe 2) along with further details about how fulfilling it to describe the future scenarios. The LLs used this template as a reference to iteratively build their scenarios. During T1.4, the LLs partners met several times for agreeing with the preliminary set of scenarios they wanted to present before starting with the consequence analysis and the validation workshops.

Finally, once the Living Labs agreed with the preliminary set of scenarios, the future scenarios were described with narrative text and used to assess the sustainability impacts (Section 2.3) and identify the opportunities and threats (Section 2.4). The outcomes of these two activities help to validate the scenarios.

2.3 Sustainability impact analysis of value case scenarios

Each future scenario was analysed from the sustainability impact point of view. To do so, the approach consists of three methodological steps (Figure 2). The first step is the development of the consequence analysis framework. The second step is the data collection from the LEAD LLs CoP through the distribution of LL specific surveys. The third and final step analyses the data collected and identifies the impacts of each scenario on the three sustainability dimensions: Economy, Environment and Society.

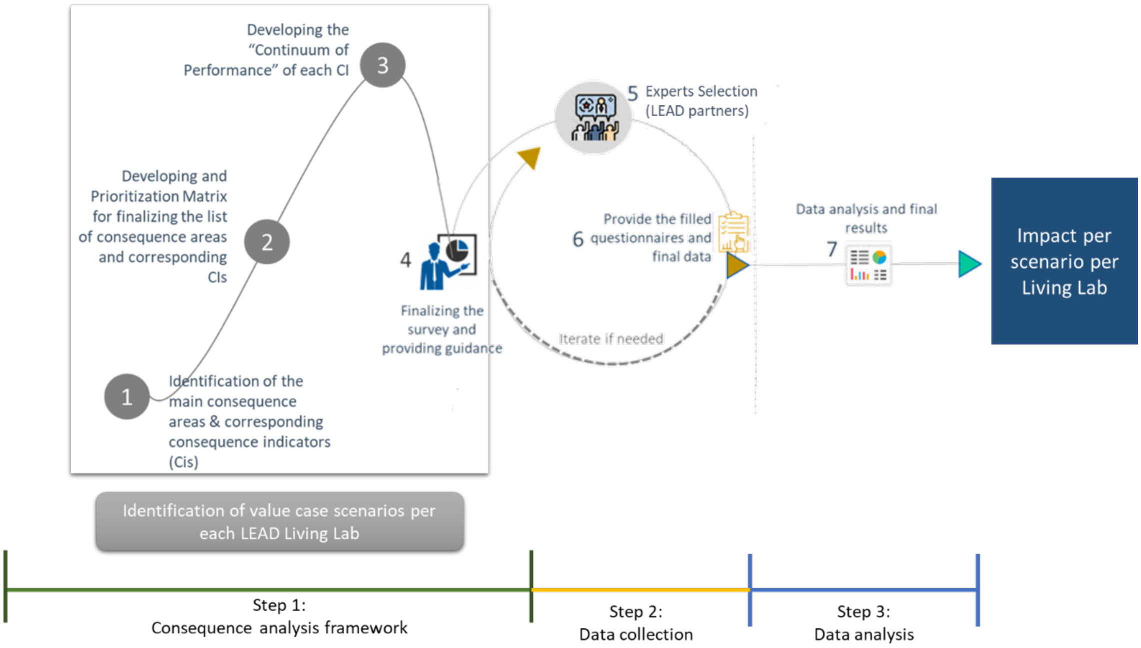

Figure 2. Methodological approach (Source: adapted from (SPROUT, 2020a)).

[5] http://www.straightsol.eu/
[6] http://www.bestufs.net/
[7] http://www.c-liege.eu/home/
[8] https://cordis.europa.eu/project/id/233756
[9] http://novelog.eu/

2.3.1 Step 1: Consequence analysis framework

The first methodological step concerns the developing of the consequence analysis framework that will set the ground basis of the consequence analysis and will guide and support the impact assessment process by the LLs. It includes three activities: identification of the main consequence areas; identification of consequence indicators and the development of the "continuum performance[10]" for each consequence indicator.

Activity 1: Identification of the main consequence areas and the draft consequence indicators

This activity concerns the identification of the main components of the consequence analysis (Figure 3) which are: 1) the identification of the main consequence areas within each of the three sustainability dimensions and 2) the definition of the measurable consequence indicators for assessing the different aspects within each consequence area.

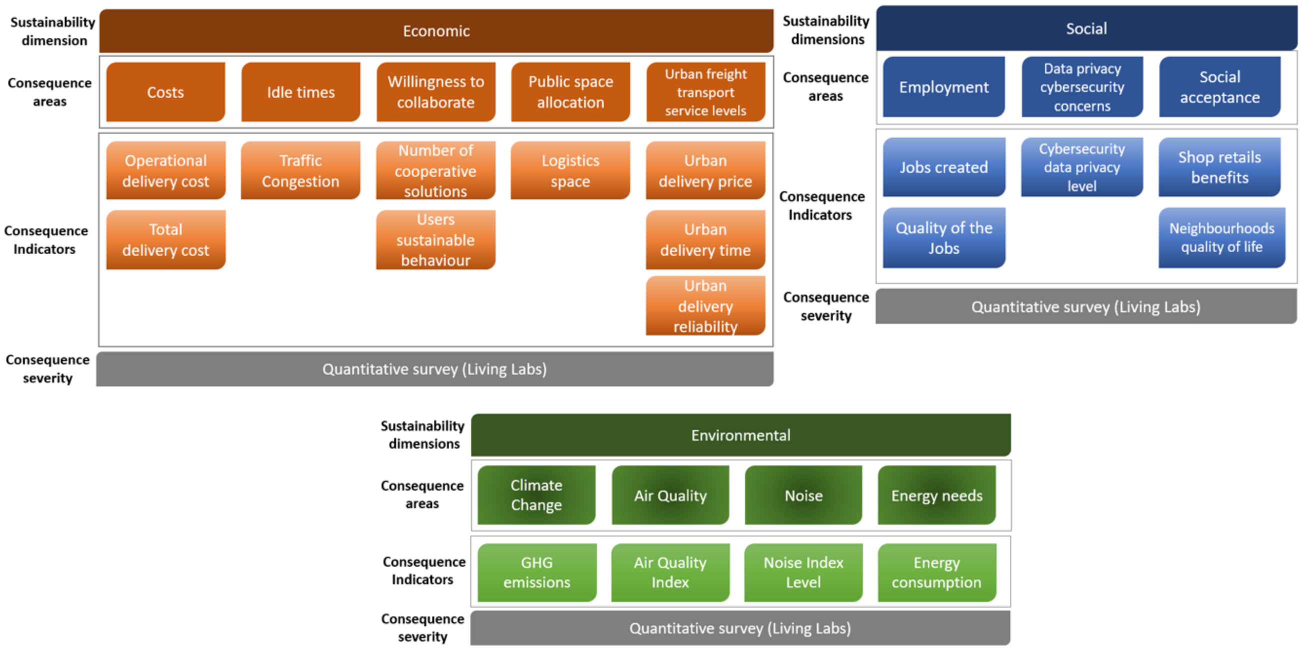

Figure 3. Main components of the consequence analysis.(Source: adapted from (SPROUT, 2020a)*)*

The identification of these areas together with all the potential consequence indicators assigned to each area, was a result of a thorough desktop research and a close cooperation with the technical partners involved in WP1 (ZLC, UPM, ARGUSI, MOLDE, TU-DELF).

The consequence areas and the correspondent list of CIs per area are detailed in Annexe 3 (description, units of measurement).

10 Continuum performance is defined and the classification of the indicators based on its continuum, considering continuum a range or sliding scale between two extreme points. The extreme points are based on (LEAD, 2020 a)

Activity 2: Development of the "Continuum performance" for each consequence indicator

For assessing the consequence indicators, identified in the previous activities, it is first necessary to select the appropriate impact rating scale for each CI and develop its continuum of performance. An impact scale can be expressed either verbally under terms such as: Minor impact, Moderate impact, Major impact e.tc. or numerically such as from - -4 to +4, or -3 + 3 where, each number represents a level of impact. Figure 4 contains the correspondence between the impact scale and the continuum performance (completed list in Annexe 3).

Expected impact on	Source	Increase			Not impact	Decrease		
		High	Medium	Low		Low	Medium	High
Environmental dimension: Climate change consequence area								
GHG emissions	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%

Figure 4. GHG emissions continuum performance and impact scale.

In this case, the impact on the scenarios on the CIs can take two directions (increase/ decrease), and within each direction they can take different levels of impact (Slightly/Moderately/Highly) and not applicable or no impact. Thus, for the needs of this survey, a 7 points Likert's scale was chosen.

Regarding the selection of the interval values in the continuum of performance, we considered the target values proposed in Table 10 on page 10 in the LEAD document of agreement Part B. This table contains a set of LLs KPIs, metrics and corresponding target values. Where the CI considered was not mentioned in this table, we analysed other previous research surveys and employ the experience of the LEAD partners involved.

2.3.2 Step 2: Data collection

For assessing each LEAD Living Lab scenario, a survey was designed per LL with a specific section for each LL scenario. The surveys were made available online using Microsoft Forms[11]. The target defined to respond the survey were 6 LEAD LL partners.

2.3.3 Step 3: Data analysis

Following the LLs responses' collection, a statistical analysis of the results was implemented following the methodology in (SPROUT, 2020a). More specifically, in this case when 60% of the stakeholders agreed in a specific survey question, then we considered that consensus has been reached. The value for considering the agreement is the result of adding all the responses in the same direction (positive, negative).

For selecting the level of impact (Low, Medium, High, Neutral) we applied the following rule: if consensus reached (60% on the same direction), then we selected the majority choice; if there was a tie or agreement was not reached, the median was calculated. For the cases where the median was not applicable, we referred to it as inconclusive.

[11] *https://support.microsoft.com/en-us/office/introduction-to-microsoft-forms-bb1dd261-260f-49aa-9af0-d3dddcea6d69*

To graph the results and compare the scenarios, LLs used the forms shown in Figure 5. If positive consequences, we used the green colour while the red colour for negative ones. The radius of the circle represents the level of impact. In the cases, where the stakeholder's opinion was neutral, we used a horizontal strip. When the mean was inconclusive, a cross was used. All the LLs different responses and LLs analysis are included in Annexe *5.*

Finally, it should be mentioned that the correspondence between the level of impact (Low, Medium, High) and the performance continuum is included in Annexe 3.

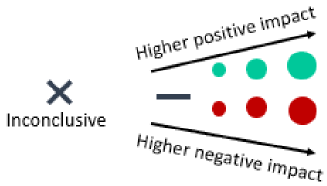

Figure 5. Sustainability impact assessment code.

2.4 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

An essential activity during T1.4 was the organisation of local LEAD LL workshops with a twofold objective: (i) to engage relevant stakeholders for real-life experiments from the local industry, governments and associations (CoP setup); (ii) to ask these local stakeholders to validate and revise the expected results of the Digital Twins and impacts in the city logistics of the proposed value case scenarios.

About the former objective, all the LLs identified, contacted and engaged stakeholders from different local organizations. About the second, LLs assessed the different value case scenarios (a combination of logistics measures) or expected results of the digital twins considering a multi-stakeholder approach. The evaluation consisted of the following steps:

1) Identify the key stakeholders' groups (roles) and their interests/ goals in transforming the current status of last-mile deliveries. The goals were defined as a combination of different criteria. Every LL followed the method that best fit their characteristics (desktop research, asking relevant participants of the CoP, own proposal). Due to time constraints for performing all the activities in T1.4, all the criteria received the same weight.

2) Opportunities and threats analysis: CoP members defined the opportunities and threats according to the interests identified in step 1.

3) Business value assessment: CoP were asked to rate the business value (interests obtained from step 1) using a five-point scale (0 lowest value, 4 highest value).

4) Feasibility assessment: CoP were asked to rate the feasibility (from step 1) using a five-point scale (0 lowest feasibility, 4 highest feasibility). For the feasibility, we mainly considered whether it is realistic or not, the level of acceptance and economic viability for each specific stakeholder.

Due to COVID constraints and distance measures that prevented face meetings, LLs adapted the workshop proposal for performing the steps and collecting the information above. The workshops designed by the task leader consisted of using ideaClouds[12,] a collaborative brainstorming and decision-making online tool that facilitates the participation and interaction of all the workshop attendees with a limit of 20 participants. Some LLs (LL1, LL4, LL6) followed this proposal to compile the information explained by the points above, while others needed to redesign this approach to tackle additional circumstances (see LLs sections for further details).

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[12] https://www.ideaclouds.net/

3 LL1 Madrid value case

3.1 Context description and vision statement

3.1.1 Introduction

Madrid is the biggest and most populated city in Spain with 3.3 million inhabitants, and together with its metropolitan area is the third biggest Functional Urban Area (FUA) in Europe, with 6,779,888 inhabitants. Located in the centre of the country between the Atlantic and the Mediterranean TEN-T[13] corridors, is one of the main crossroads and it functions as an important logistic and commercial hub, accounting a nominal GDP of 133,129 million € –12% of the national GDP–being the first Spanish metropolitan area in economic activity —19% of GDP-, and the tenth of Europe.

Consequently, like many other big cities, it suffers occasional air quality and congestion challenges that require integrated approaches, ambitious regulations and innovative urban mobility solutions, including city logistics as a strategic element of sustainable urban development. In this regard, the LEAD project will help to develop innovative solutions and tools for better planning based on advance technology and new methodologies.

The target location for the Madrid LL activities is within the central district of the municipality. It is the most touristic area of the city and accounting 141,527 registered inhabitants. The LL will consist of an urban consolidation centre (UCC) placed at the Plaza Mayor parking facility, strategically located in the old centre of the city and the Low Emission Zone/UVAR of “Madrid Central”. (Figure 6).

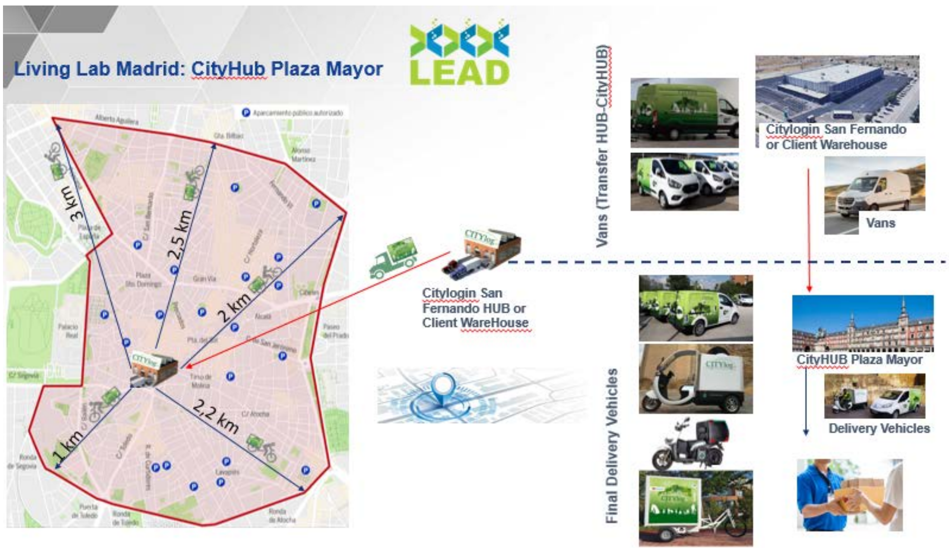

Figure 6. LL1 Madrid: Location of the UCC

3.1.2 A brief on current transport

The commercial sector of Madrid region is currently made up of more than 65,000 retail establishments and more than 39,000 wholesalers, as well as 55 markets, mostly municipally owned, about 300 Commercial Galleries and more than 2,000 establishments in regime of self-service

[13] https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

(between 40 and 2,500 m^2), with an average surface of 750 square meters[14]. Additionally, according to the municipal census[15] there is a total of 178,992 commercial premises (not necessary shops, but locations with business activity). And finally, each one of the households, potentially becoming a "shop" due to e-commerce.

Obviously, managing the entire supply chain of such vast commercial network requires a huge fleet that includes, according to Madrid City Council censuses, a total of 86,729 light commercial vehicles (maximum authorized mass less than or equal to 3,500 kg), and 4,348 heavy commercial vehicles. (maximum authorized mass greater than 3,500 kg) are registered in the city of Madrid, figures which do not include those vehicles registered out of the city.

From the analysis of the data gathered from the accesses to the Madrid UVAR[16] scheme, this central area of the city (so called "Madrid Central") got around 56,300 daily deliveries (incoming flows between January to June 2019), which gives an idea on the size of the challenge.

On top of that, most of the logistic operators are located within an area up to 30 km from Madrid, especially in the South and East of the city, and quite often this means huge flows from these peripheral platforms that could potentially be improved by innovative solutions and better planning, especially considering the existing access regulations to the city centre.

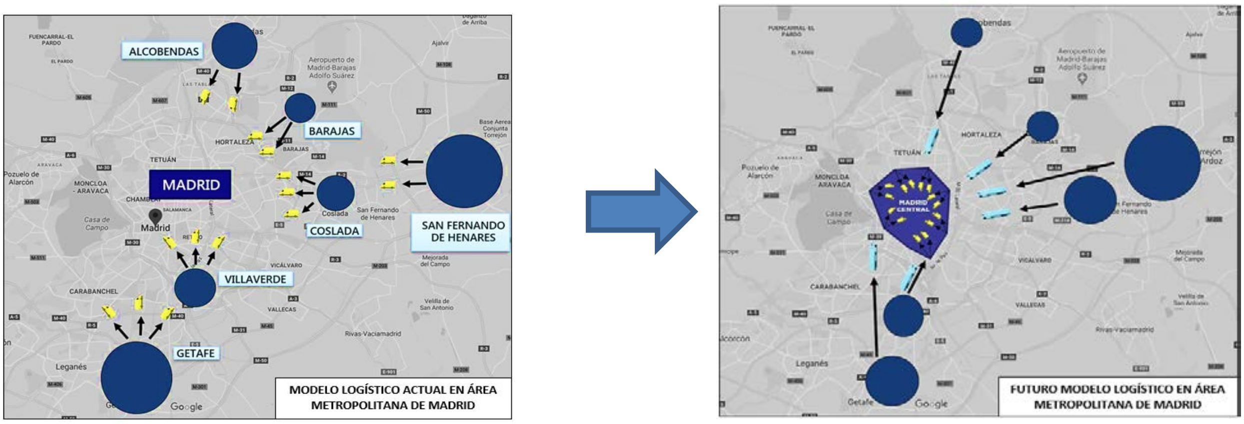

Figure 7. LL1 Madrid: Current (left) and expected (right) logistic approach by using UCC[17]

3.1.3 The need for change

As it happens in many cities around the world, the following general shortcomings could be pointed out regarding urban logistics, as also reflected by the European Environment Agency[18]:

- Urban freight and urban logistics quite often suffer of a lack of focus and strategy, and only a few cities count with someone in authority responsible for urban logistics.

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[14] Report "El Comercio de la Comunidad de Madrid en cifras". Dirección General de Comercio y Consumo. Comunidad de Madrid. January 2021
[15] Censo de Locales y Actividades a 1-7-2020. Ayuntamiento de Madrid
[16] Urban Vehicle Access Regulation
[17] Urban Consolidation Centre
[18] Source: "The first and last mile — The key to sustainable urban transport". Transport and environment report 2019 European Environment Agency, EEA Report 18/2019

- In addition to that, it is also quite common the lack of coordination among actors involved in urban logistics, and in many cases insufficient dialogue between city authorities and the private actors who operate there.
- Finally, there is an additional drawback, which is the lack of data and information, which makes it difficult to improve operational efficiency and long-term planning.

More in particular, as the Madrid City Council "Madrid360" Sustainability Strategy indicates, there is a number of specific and local challenges regarding the urban distribution of goods in the city:

Urban infrastructure:

- Lack of planning at the urban level of distribution points, which generates impact problems especially in residential neighbourhoods.
- Parking bay challenges:
  - More than 100,000 establishments use the reserved loading and unloading bays across the city
  - The ratio of establishments for each bay is 13.5
  - Only 23% of businesses are located within 50 meters of a reserved bay
  - Only 8% of the establishments have a private bay
  - There is a significant growth of home delivery derived from e-commerce

Management

- There is no distribution logistics management model that adequately identifies and organizes the numerous agents and operations for each urban distribution channel.
- There is no system to identify the vehicles that carry out the loading and unloading.
- Growth in e-commerce activity and trend towards new delivery models, as well as the need to adapt operations to the new e-commerce requirements.
- Negative effects of the misuse of loading and unloading activity.

Impact

- Increase in emissions: Commercial vehicles account 10% of the vehicles that circulate in the city, and 95% use diesel as fuel.

Precisely, the above reasons, is what makes a change necessary and the implementation of innovative solutions, including tools so all the agents involved can advance in the optimization of both planning and regulations (mainly from the public sector perspective), as well as operations and management (from the operators' side), setting common and integrated approaches.

3.1.4 Living lab goals, values, mission and vision statement

The overall mission and vision of Madrid Living Lab is to help improving urban logistics in the city for the sake of all citizens and stakeholders, as the benefits are clear. The particular objectives include the followings:

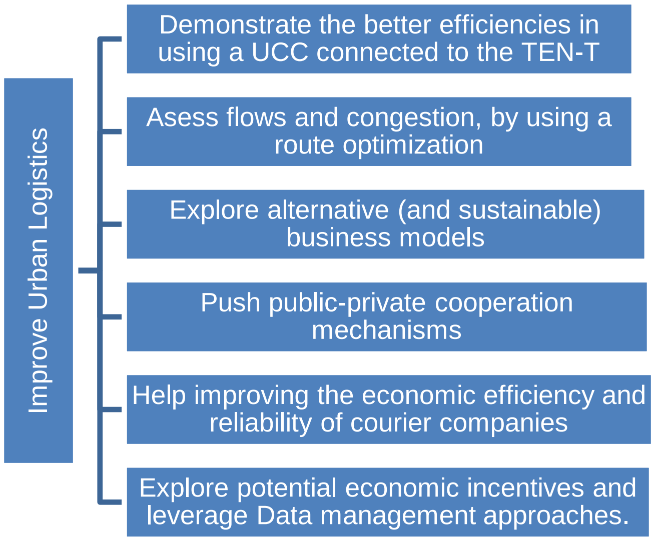


Figure 8. LL1 Madrid: LEAD objectives

3.2 CoP members and establishment process

In order to set up the Community of Practice of Madrid LL, EMT, with the advice of Madrid City Council, defined the different profiles of stakeholders which have a role to play in the urban freight scenario (Logistic associations, neighbourhood associations, commerce/merchant associations, user associations, etc.). After checking internally with the rest of Madrid LL partners, on November 6th, 2020, the invitations were sent and the agenda of the first CoP workshop (November 17th) was released.

The participants of the Madrid Community of Practice include different organizations, associations, companies and institutions. The idea is to keep it open for further incorporations if needed/willing to do so. Additionally, via CIVINET Spain and Portugal network there is a number of municipalities involved. Madrid LEAD partners are also involved as internal members.

Table 2. LL1 Madrid: CoP members.

Organization Name	Role / Description
Madrid City Council	Governmental bodies
City of León (ES), City of Alcobendas (ES	Governmental bodies
UNO, CITET, Capillar, AEDISMA, ATA-MADRID (Asociación de transportistas autónomos de Madrid), ATRADICE (Asociación de Empresas de Transporte de la Región Centro), AECOC (Asociación de Fabricantes y Distribuidores), CMTC (Comité Madrileño de Transporte por Carretera), FENASDISMER (Federación Nacional	Shippers/Transport associations
FRAVM (Federación Regional de Asociaciones Vecinales de Madrid), AAVV MADRID CENTRO (Coordinadora Vecinal Madrid Centro)	Neighbour associations
Asociación de Comerciantes Barrio de las Letras, Asociación de comerciantes, amigos y vecinos de la plaza mayor de Madrid y su entorno	Commerce/Merchant associations
PEDALIBRE/CONBICI (cyclists)	Users (riders)

3.3 Madrid Future Scenarios

3.3.1 Future value case scenarios description

To ameliorate the sustainability impacts of the increasing level of urban freight transport demand aggravated by COVID pandemic, the LL1 Madrid designed four scenarios to analyse the impact of introducing a microplatform in different locations and with different combinations of logistic measures (Figure 9). More detailed information in Figure 60 in Annexe 5.

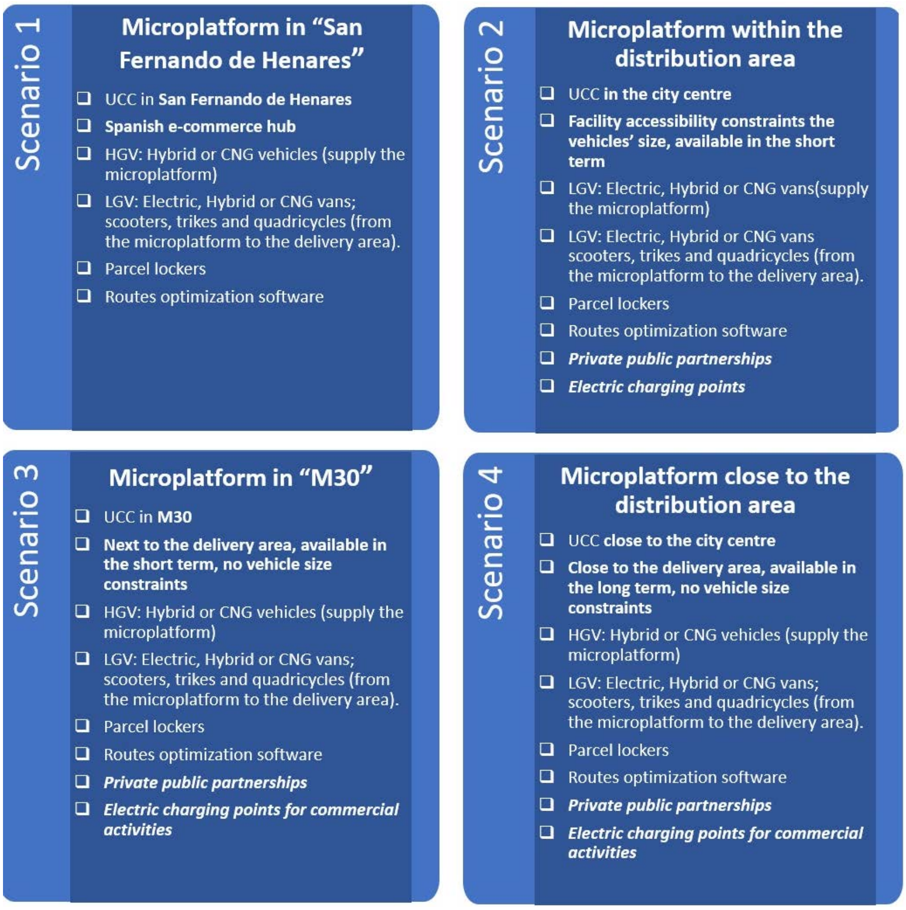


Figure 9. LL1 Madrid: future value case scenarios.

The S1 location "El Corredor del Henares" embraces more than 30.000 companies and around 150.000 jobs in 6,5 million built square metres. It is closed to the Adolfo Suarez airport. E-commerce has increased the commercial activities and is at the same level than other logistics HUBs like the famous one in New Jersey in the USA that provides Manhattan. "San Fernando de Henares" is coined as the "zero area" of e-commerce in Spain. The S2 location would be within Madrid LEZ, near "Puerta del Sol". The vehicles supplying this facility would be constraint by height but very close to the end consumers. The S3 location allows the entry of trucks with high loads and the distribution into the Madrid LEZ. Finally, the S4 location properties (enhance operability in terms of forging resistance, widths and turning radius) allow access to larger capacity vehicles and work as a microplatform to deliver to the entire Madrid.

3.3.2 Preliminary impact analysis of Madrid Future Value Case Scenarios

The sustainability impact analysis was conducted as explained in section 2.3.4. Taking advantage of the first workshop that this LL celebrated on November the 17th with the CoP members, the LL1 Madrid distributed the survey among LEAD local partners and external members. Figure 10 shows that the distribution of profiles from the CoP members who responded to the online questionnaire (eleven members) was quite balanced.

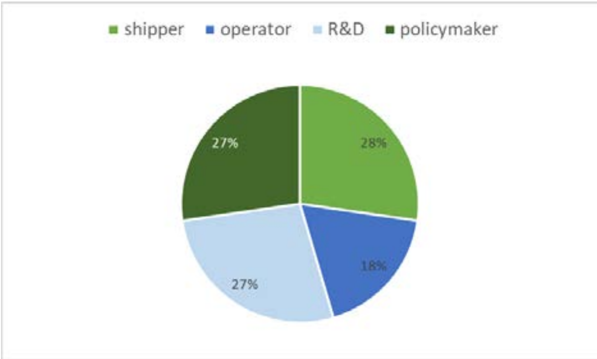


Figure 10. LL1 Madrid: sustainability impact assessment survey respondents' profiles.

Figure 11 shows a summary of the results comparing the four scenarios defined for the LL1 Madrid and according to the methodology explained in section 2.3.4. Further detail about the results and the specific analysis can be found in annex 5.

For the environmental dimension, stakeholders think that S2 will be the one with the most positive consequences for the four indicators. S1 and S3 got less favourable impact on noise and energy consumption than S2. The distance of the micro platform to Madrid Central will influence the energy needs for delivering to the end-consumers. S1 is the one with the worst scores for energy consumption and noise while the GHG emissions and air quality remain the same than the previously mentioned scenarios. The *distance* to Madrid Central is the greatest, reaffirming this factor is *essential for minimizing energy needs*. About the *electric charging points*, S1 is the only one without this facility. However, all the scenarios may impact on the GHG and air quality in a similar way. Therefore, this factor is not so crucial when it comes the *environmental dimension.*

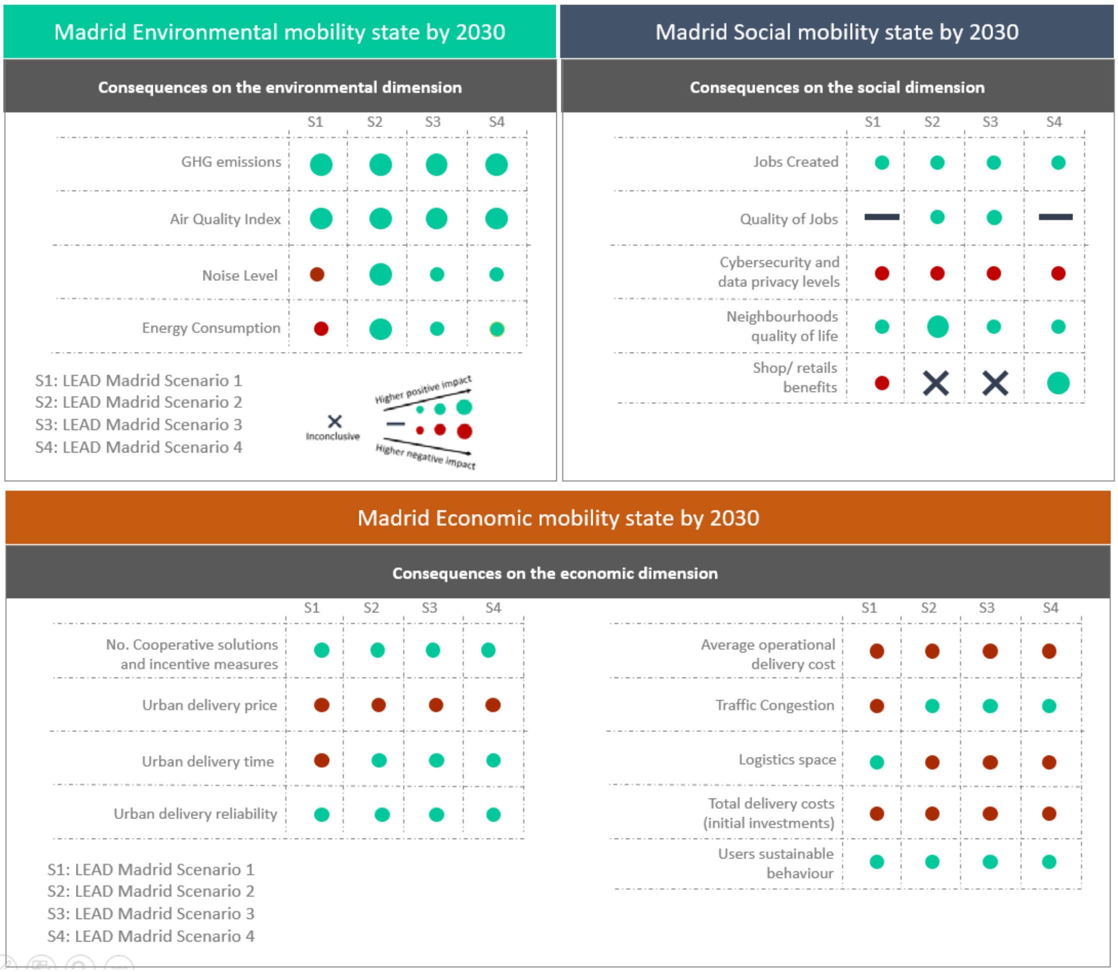


Figure 11. LL1 Madrid: Consequence analysis- Scenarios comparison.

For the social dimension, the participants agree on the four scenarios having a slight positive impact on the number of jobs created. About the quality of jobs, only S2 and S3 get a light positive score, while for S1 and S4 the results are not clear. Cybersecurity and data privacy concerns will slightly deteriorate in the four scenarios similarly. Regarding the neighbourhood quality of life, participants think all the scenarios will positively impact on that indicator, where S2 got the highest score. Finally, S4 is the only scenario with a moderately positive effect on the shop/ retail benefits. *The location close to the delivery area but not inside the area* may *positively* impact on the *local shops' acceptance.*

As for the economic dimension, on the one hand, the four scenarios got similar positive results for cooperative solutions, users' sustainable behaviour and reliability. It seems the location, the consumer incentives and the public-private partnerships may not impact on these indicators. On the other hand, regardless of the combination of measures, prices and costs (both operational and total) are expected to increase slightly.

About the rest of indicators, only S1 reports a different value for the delivery time. This scenario presents the *longest distance to the city centre* so it may *negatively impact on the time* needed for delivering. About *logistics' space,* the surveyors think the *location far away* from the city centre, where more space is free, *will positively impact on the installation of a microplatform*, whereas locations close to the delivery area with less space available will negatively impact.

3.3.3 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

3.3.3.1 Description

The identification of the opportunities & threats of the scenarios along with the evaluation phases was carried out with the celebration of an online workshop following the methodology proposed by the task leader (section 2.4)

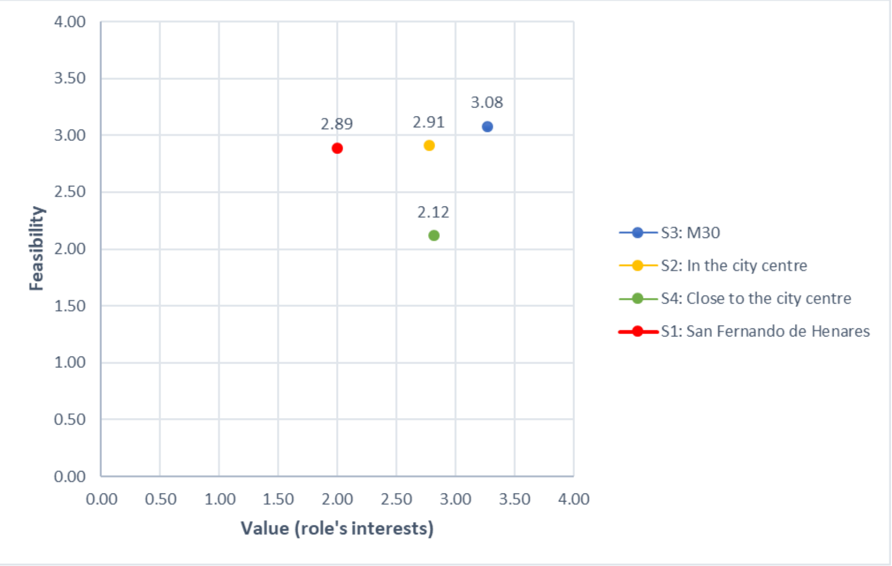
The web-workshop took place on December the 17th (see Annexe 5 for further detailed information). There were 17 attendees from different organizations who provided feedback according to the role allocated and the role's interests previously identified by the LL LEAD partners.

Table 3. LL1 Madrid: Stakeholders interests/ objective – business value.

Role/ Stakeholder	Objectives/ interests – Business value
Policymakers	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	Reduce traffic congestion.
	Improve the distribution and use of public space.
Riders	Increase job opportunities.
	Improve working conditions.
	Contribute to social sustainability.
Logistic service providers, operators, carriers	Gain efficiency.
	Improve customer satisfaction and quality of service.
	Promote social and environmental sustainability.
Local stores, retail, shippers	Increase local distribution channels.
	Increase public space for commercial and leisure activities.
	Reduce last mile distribution costs.
Users, consumers	Increase options to receive packages.
	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	Incentives: convenience delivery/ pick-up points (reverse logistics); fast deliveries; flexible time deliveries;

3.3.3.2 Results

Figure 12 shows the final results of the workshop evaluation phase. The stakeholders voted the business value and feasibility defined above and in section 2.4 using a 5-point Likert scale. As observed, S3 ended up being the most preferable scenario followed by S2. For better understanding the results of this graph, we also analysed the information compiled during the brainstorming phase and additional comments during the evaluation phase. They are presented and detailed in Annexe 5.



Business value: Table 2 (Feasibility: realistic, level of acceptance, economic viability from the stakeholders' viewpoint).

Figure 12. LL1 Madrid: scenarios evaluation (feasibility vs value)

Location is the key factor when evaluating each future scenario. Proximity to end consumers is positively valued by the 5 groups considered (electric vehicles' autonomy according to logistics operators and public administration; shorter distances for riders, shorter delivery time windows for local businesses; proximity to the end customer for users). According to the results of the analysis, the location of the M30 would be the ideal one to distribute to end consumers with electric vehicles and supply the consolidation centre with larger vehicles.

Another essential factor is the accessibility to the consolidation centre by the vehicles that supply it in terms of gauge, size and capacity of the facility, traffic congestion, etc. At this point, the location close to the M30 would have more strengths than other options (less congestion to access and fewer regulations or access limitations).

The parcel lockers, present in all scenarios, have a more positive assessment in locations with less accessibility and greater congestion such as scenarios 2 and 4. The possibility of having recharging points on the M30 is considered a critical factor by the municipality and other agents.

The definition of public-private agreements is identified as a barrier by logistics operators, as well as the need to make an initial investment for the renewal of the fleet.

3.4 Conclusion

The work during these first months of the project has served as a take-off for the LL. First, the LLs has built a varied and enriching CoP with high interested and participatory members who shared valuable arguments and knowledge at the two interactive sessions organized, so far. This feedback provided the whole community with a better understanding of the urban distribution sector and stakeholders' interests and challenges. The result is a shared space for learning and creating fruitful discussions on a topic with growing interest.

The LL scenarios design required partners to think about how the logistics' measures (either individually or combined) may impact the urban freight transport externalities. Indeed, it helped identify some logistics' measures' essential factors when deciding (e.g. UCC location) that may depend on the city and the distribution area characteristics (e.g. orography, distance, economic activity).

The interactive sessions exercises proved evidence on the suitability and potentiality of the initially proposed scenario and the LEAD project impact on enhancing last-mile logistics comprehension. The knowledge and tools developed will improve decision-making towards more sustainable and resilient cities.

4 LL2 Hague value case

4.1 Context description and vision statement

4.1.1 Introduction

The population of The Hague is currently around 0.5 M and expected to grow by 20% until 2040. The Hague is a hot spot for international institutions (193 organizations currently, with an expat community of over 60,000 people). The city is undergoing a densification process in already dense areas. The main areas undergoing redevelopment and growth are the Central Innovation District (CID) and Binckhorst area. The CID is the mixed CBD and residential area between the three main railway stations: Centraal, Holland Spoor and Laan van NOI. The CID currently is the home of 80,000 habitants with 23,000 housing units, offers 63,000 jobs and attracts 200,000 commuters and 30 M visitors per year. Attached to the CID is the Binckhorst area, a former industrial district of The Hague that is being revitalized in order to accommodate for new housing and commercial areas, with easy underground access to the motorway network. Both areas are being rethought with new public areas and new mobility solutions, with a strong focus on the liveability of the area. The population density is 68 inhabitants/ha for The Hague and 88 for the CID area. Figure 13 shows the positioning of these areas in the city where the CID is the blue triangle and Binckhorst the blue rectangle.

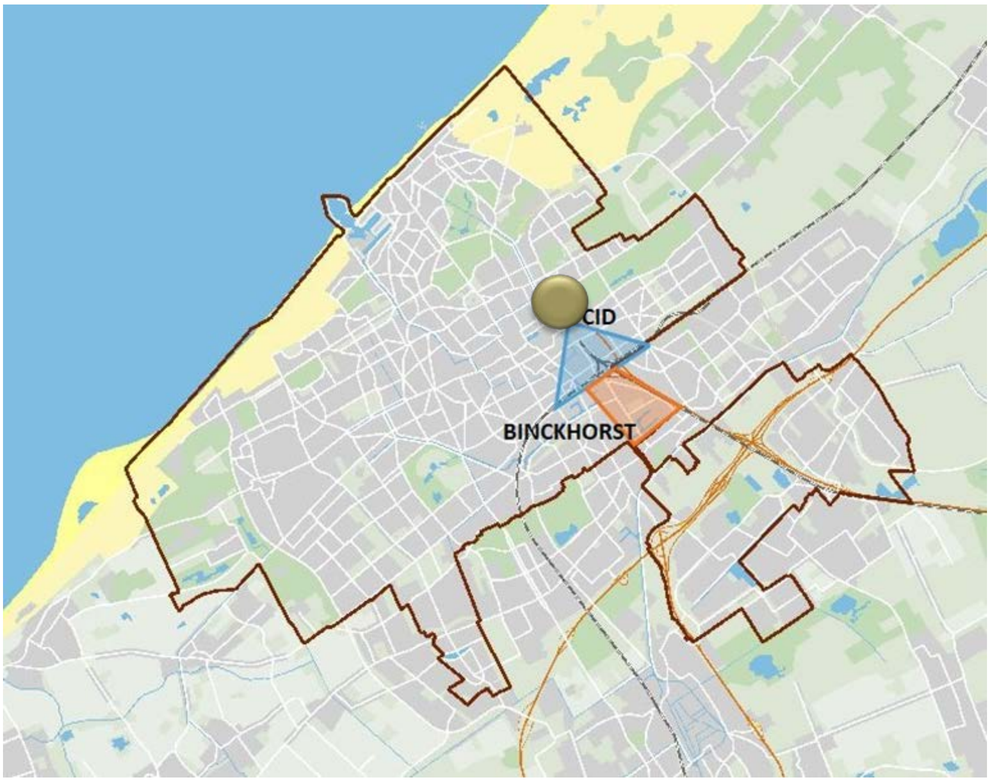


Figure 13. LL2 Hague - Location of the CID and Binckhorst areas

4.1.2 A brief on current transport and the need for change

The densification of the CID and development of Binckhorst comes with the building of larger and higher department buildings. Besides the mobility of thousands of people, it brings a logistical challenge: "*how to deal with the supply of goods to these buildings, such as groceries, parcels and furniture."* Currently, over 3 million of vehicle-km of delivery vans per working day are done in the Netherlands, in order to satisfy the demand for parcels and this will inevitably grow with the development of the city. Also, it raises the question of "*how to make the roads drivable and how to make the city liveable?"*. There is no more space for more roads and the space that is available in the city, will be divided in favour of pedestrians and bicycles. So, this requires for more efficient use of cars, vans, trucks and roads in general. The volume of traffic not only affects the congestion and the cleanness of the air, but it also produces noise pollution. Figure 14 shows the sound disturbance in the whole city of The Hague, showing especially how the CID is affected by the noise pollution and affects its liveability.

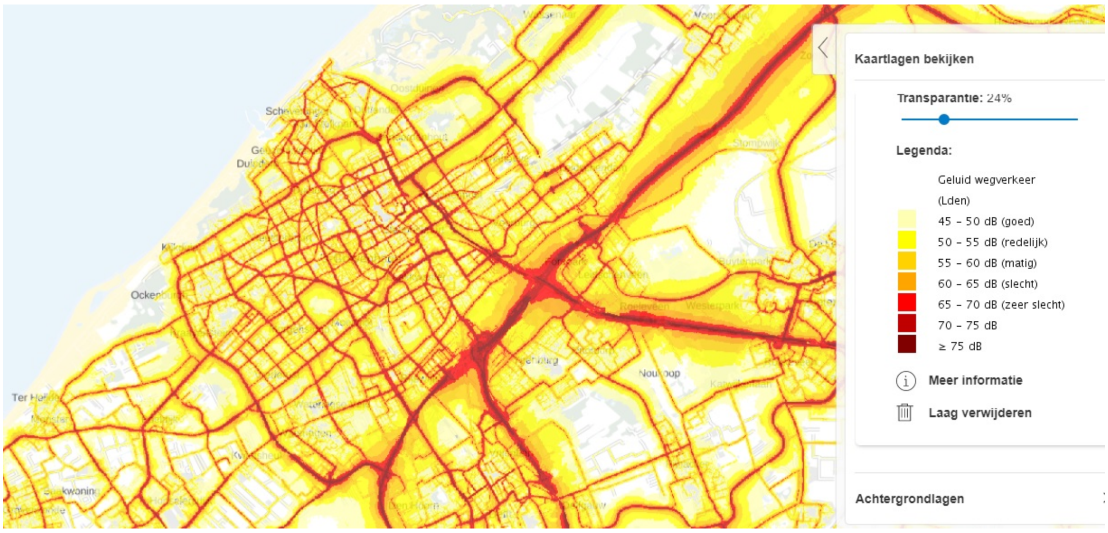


Figure 14. LL2 Hague: sound disturbance heat map

Finally, the increase of e-deliveries and the development of delivery platforms bring more pressure to the supply chains and the infrastructure of the city. Strategies to mitigate these problems include deploying other modes of transport (cycling), combining freight trips and also combining freight trips and passenger trips. The living lab for The Hague focuses on the integrative use of ICT platforms for on-demand logistics to support all these 3 strategies.

4.1.3 Living lab goals, values, mission and vision statement

Taking as an opportunity the ongoing development of the CID and Binkhorst area, the city can test and prepare solutions in advance. The LEAD project will allow testing innovative solutions to generate a sustainable inner-city logistic service for parcels. Important approaches for sustainable parcel logistics include crowdshipping solutions, platform-based approaches and public consolidation places like mobility hubs. Many times, these are stand-alone solutions however, with no or limited integration with other companies. This LL aims to innovate by creating improved connectivity between different services and across platforms as a new proposition, to create an overall more efficient and sustainable urban parcel delivery system. It is a necessary first step towards creating hyperconnected city logistics as included in the Physical Internet (PI) vision, the guiding vision for the future of logistics (ALICE, 2020).

The mission of the LL in The Hague is to connect different stakeholders involved in the urban freight system in the CID to provide a more efficient parcel service with less environmental impact that improves the liveability of the CID area. It will do this by creating platform linkages, using a smart connector that can act between platforms, allowing exchange of data to make door-to-door chains from different services. Platforms and hubs will thus make the system hyperconnected, in PI terms, allowing a shared use of resources and improving the offer for consumers, while reducing the negative externalities. Despite model-based predictions showing a positive impact, cities are not yet experimenting with ways how to create this hyperconnectivity. Our objective is to create a series of experiments to allow businesses who fulfil different functions in city logistics (mainly SME like crowdshipping platforms, cycle couriers, locker providers, mobility hub providers) to connect vertically and horizontally, to increase asset sharing horizontally and create new service chains vertically.

4.2 CoP members and establishment process

The CoP was established through contacting the stakeholders that had a significant (potential or real) interest and influence on the pilot. A first workshop was held on 4 December 2020. The objective of the workshop was to record their interests, engage them to expand the LL by promoting their engagement, to generate jointly the scenarios of LL and to obtain their recommendations for the LL. After the workshop, many bilateral meetings were held in order to validate the scenarios and their objectives. Table 4 shows LL2 core representative group ("coalition of the willing") of internal and external stakeholders integrating the The Hague CoP.

Table 4. LL2 Lyon: CoP members (internal and external stakeholders).

Organization name	Role / Description
TUDelft	LEAD Partner, scientific coordination of the pilot
Municipality of The Hague	LEAD Partner, client city for the pilot, involvement from several departments: mobility, city planning, area development, finance
Nimber	LEAD Partner, crowdshipping platform provider
Next2Company	LEAD Partner, ICT solution provider
Bereikbaar Haaglanden	The Hague region; Mobility program with independent advisors
Cargaroo	Cargo cycle courier
Hely	Mobility hub provider
Mobian	Mobility Hub provider
Mypup	Parcel locker & hub service provider
DB Schenker	Global logistics service provider
Prime Vision	Logistic automation
TUDelft	LEAD Partner, scientific coordination of the pilot

From this point onwards, the group is working on a detailed experimentation plan to create concrete steps for the pilot investing in a modern approach towards hyperconnected city logistics. Besides mapping ongoing initiatives, we are mapping opportunities with the current approach to connect these initiatives. Our aim is to extend the above coalition with every scenario.

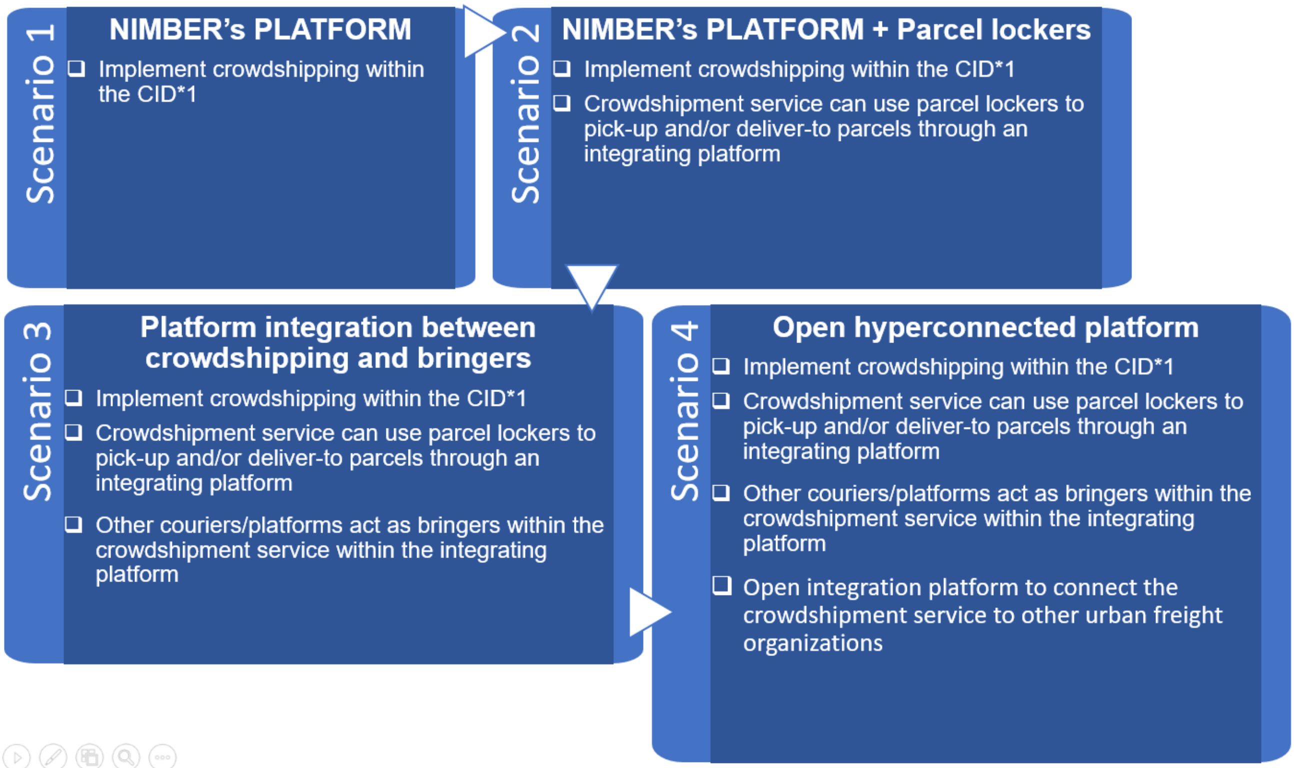
4.3 Hague Future Scenarios

4.3.1 Future value case scenarios description

As the LL aims to advance towards hyperconnected logistics for the on-demand economy, the pilot aims for a step change in the connectivity between different platforms. Each scenario will address a new layer of services of different providers to be linked through a platform connector. This will allow to connect transport services in new service chains for sharing and exchange of freight, or for vertical connections to provide a door-to-door service. In addition, hubs as new connecting nodes can be integrated, to complement the current service stations of service providers. Even though there is an increase in complexity and functionalities between the scenarios, it is worth mentioning that the numbering of the scenarios do not necessarily represent an order of implementation

Figure 15 summarises the current layout of scenarios.

- The first scenario is implementing the Nimber's crowdshipping platform that would allow a more sustainable urban freight by allowing regular commuters to deliver packages, acting as *bringers*.
- The second scenario includes the possibility that the bringers to pick-up/deliver-to parcel lockers. For this, a connector is built to allow the automatic connection between Nimber and the locker company.
- The third scenario consist of allowing an existing courier to be linked by a digital connector with Nimber's platform and allowing the use of parcel lockers. This would allow the courier to bid as a bringer in the platform improving the reliability and level of service of the combined service.
- The last scenario consists on the use of an open platform that allows multiple services to interact. This is a more ambitious vision that would better allow hyperconnectivity between platforms and the implementation of different and innovative business models. The first organizations to use this open platform would be Nimber, a locker company and a courier service, but it is not limited to them.



**1. Central Innovation District.*

Figure 15. LL2 Hague: future scenarios.

4.3.2 Preliminary impact analysis of The Hague Future Value Case Scenarios

This section presents the sustainability impact analysis of the four Hague LL scenarios presented above. The process was developed as explained in section 2.4. More specifically, the questionnaire was shared with LL2 Hague Lead partners who have already developed thinking about possible system-wide impacts. Table 5 shows the 6 questionnaire participants as requested by the methodology (section 2.3.3).

Table 5. LL2 The Hague: consequence analysis participants.

Organization Name	Role in the LL2
Jeroen Hutten/ Municipality of The Hague	City representative
Sven Mittertreiner / Municipality of The Hague	City representative
Jackson/ Nimber	Crowdshipping platform
Rodrigo Tapia/TU Delft	LL manager
Lori Tavasszy/TU Delft	LL member
Ioanna Kourounioti/TU Delft	LL member

Figure 16 contains the results of the expected sustainability impact analysis further examined in Annexe 5. For the environmental dimension, the difference is between the S1 and the rest of the scenarios. The former may affect slightly lower than the rest of the cases for all the environmental CIs, except for the air quality index in S4 for which the impact is not clear.

For the social dimension, we observe that S3 impact is not clear while the rest of the scenarios may slightly increase the number of positions. About the quality of the jobs, S1 may negatively impact on this CI while S2 may not have any effect, and S3 and S4 could slightly improve the quality of the jobs. About cybersecurity and data privacy level of concern, the S1 may not have any impact while the rest of the scenario may slightly increase people's awareness. About the rest of the social indicators, the future hypothetical value cases may positively impact on them.

For the economic dimension, S4 is the most complex and may have a positive impact on most of the CIs in comparison with all the previous scenarios. There are just four indicators that may not be affected by the S4 complexity, the urban delivery time, traffic congestion and logistics space obtain the same result that S3 and the initial investments the same that S1.

Figure 16. LL2 The Hague: Consequence analysis- Scenarios comparison.

Focusing on every specific scenario, we observe the following consequences:

Scenario 1 implements crowdshipping within the CID. This scenario is the least complex and the only one with a negative impact on the urban delivery time and the jobs' quality. This lowest complexity has a low positive consequence on the rest of the CIs, except in the operation and total costs. This scenario and the most complex one (S4) may decrease these costs moderately. Regardless of the need for crowshippers to share private data to access to the platform, it may not impact on the cybersecurity and data privacy CI.

Scenario 2 ads parcel lockers to S1. Most impacts on the CIs remain the same, except for the following ones. The delivery time passes from a low negative effect to a low positive impact but decreases the operational and total costs' positive S1 impact level from moderate to low. The neighbourhoods' quality of life may slightly improve. Finally, in this case, the quality of jobs may improve and increase cybersecurity and data privacy concerns.

Scenario 3 adds other couriers and platforms to S2. They act as bringers within the crowdshipping services included in the integration platform. It may have a positive impact on the logistics space and the quality of jobs while the rest of the CIs would not be affected.

Scenario 4 is the most complex one. It includes an open integration platform to connect the many different urban freight organization. This additional measure may further reduce the operational and total costs and support the use of parcel lockers included in S2. The creation of an open logistics connection facility may increase the number of cooperative solutions and users' sustainable behaviour. It may impact positively on the price and reliability.

4.3.3 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

From the scenarios presented, opportunities and threats have been identified and are presented in Table 6. This list was made after the workshop and circulated between the partners. The general item refers to the overall context of the LL: to improve the liveability in the CID; to aim for a more sustainable city and; the COVID-19 pandemic that affects freight and passenger transport.

Table 6. LL2 Hague: Scenarios' opportunities& threats

Scenario	Opportunity	Threats and challenges
General	Liveability impact COVID Sustainability	
Scenario 1	No other crowdshipping service in the city Sustainability focused business model Use of existing passenger flows	Senders and bringers recruitment
Scenario 2	Flexibility for senders and bringers More use of lockers New business model for lockers	Public space use Complexity of delivery steps Locker locations/coverage
Scenario 3	Less rejection rate Higher volumes for courier	Competition between Nimber and the courier
Scenario 4	More participants can join the platform Better asset use for participants More efficient service More value added to customer Less externalities to the city	Connector not available for multiple platforms Data sharing protocols Privacy regulation GDPR Complementarity of business models

4.4 Conclusion

The set-up process of the LL allowed the identification of the relevant stakeholders for the urban logistic system in the city and permitted the inclusion of some of them towards the LL as active organizations. This enlargement helps with the expansion of the awareness between the stakeholders of each other's needs and objectives.

The first workshop was a key instrument for this process, since it allowed further defining and consolidating the vision of the LL, which is to move towards a hyperconnected and sustainable city by connecting different platforms and combining business models in an innovative manner. After the workshop, further meetings were done in order to generate different scenarios that could accommodate the interests of the partners and contemplate the need for a more liveable city.

The four scenarios differ in complexity, ambition and impact, but all of them move towards the connection of different platforms by integrating horizontally and/or vertically the business models. With more platforms being connected, the complexity and potential threats of the pilot increases, as also do the opportunities and value for the city and consumers.

5 LL3 Lyon Value case

5.1.1 Introduction

Stretching over 1,5 km², Confluence is a distinctive district as it naturally encompasses the peninsula tip of Lyon's historical centre, while fostering massive urban construction with over a million m² built in between year 2000 and 2030. Urban policies are looking forward to settling a peaceful and low-motorized environment, hence confronting the still-roaring automotive mobility. Another goal is also to ensure a better share of public spaces. Hosting and being surrounded by some iconic landmarks of the city Lyon Confluence combines commercial, economic and cultural activities with housing.

Existing LL sites (Figure 17) include: (1) Unibail Shopping Centre (70.000 m²), (2) Parking operated by LPA, (3) Logistics centre operated by La Poste. Potential development sites are: (4) logistics hotel operated by LPA, multimodal hub dedicated to freight operations (road, train and river) and candidate to support local experimentations, (5) area that can include some small logistics installations, (6) Perrache multimodal hub connected to the major TEN-T transport networks that can house a logistics space, and a limited number of physical gates (entries and exits).

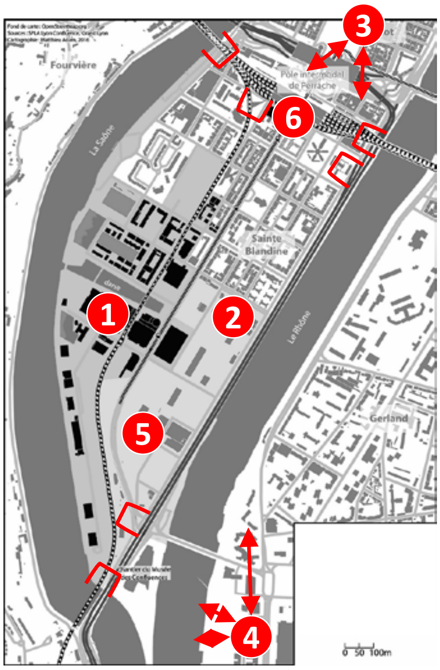


Figure 17. LL3 Lyon sites: Confluence District.

Key figures:

- 1 million m²
- 17.000 inhabitants by 2030
- 10 million visitors per year
- 25.000 workers
- 1.650 companies
- 340 shops and craftsmen
- 120 bars and restaurants
- 6 schools, 7 universities
- 8.400 students
- 21 operations (public space, public equipment, infrastructure)
- 5.000 new housings
- 30.000 m² of office eco-renovated
- 600 housings eco-renovated
- 16 sports and leisure equipment
- 11 collaborative housings
- 10 km cycle tracks
- 200.000 travellers day at the train station
- 16 bus lines, 6 metro and tramway lines
- 40 EV charging stations
- 4.000 parking lots
- 35 ha of green space, 4.500 trees

5.1.2 A brief on current transport in Lyon

Most of the freight operators are located in a 20 km radius from Confluence, in the south-east of Lyon. They usually operate several other districts on top of Confluence (Figure 18). When serving Confluence one operator would stop in average 7 times within the district. Direct deliveries are rare and limited to large commercial stores. Access is complex due to limited accesses (3) and traffic congestions occurring from 7:00 am.

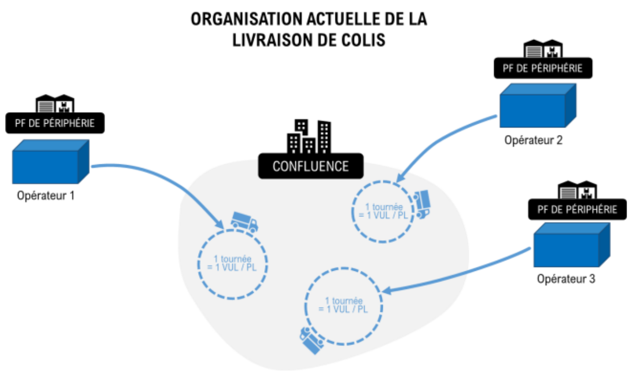


Figure 18. LL3 Lyon: Current organization of parcel delivery.

The logistics chain is based on massive disintegration of flows coming from peripheral platforms located 10, 15 km away.

Key figures:

- 2.400 freight deliveries per day
- 270 home deliveries per day
- 900 commercial vehicles
- 80% of deliveries proceeded by light commercial vehicles
- 0.5% of deliveries proceeded by cargo bikes
- 15% of deliveries achieved on delivery bays
- 40% of delivery bays are less than 12m long

5.1.3 The need for change

The current situation calls for new spots within the district to host freight operations, close to core areas. In the meantime, flows should be concentrated to cope with this organisation and to ensure the integration of new modes and the reduction of externalities.

Lyon LL will focus on parcels deliveries. It will include the use of an underground parking (Parc Marché Gare) as a hub towards final customers through cargo bikes, autonomous droids and electric assisted handling tools (Figure 19). The goal is to reduce the number of trucks entering and parking in the district, namely on public space.

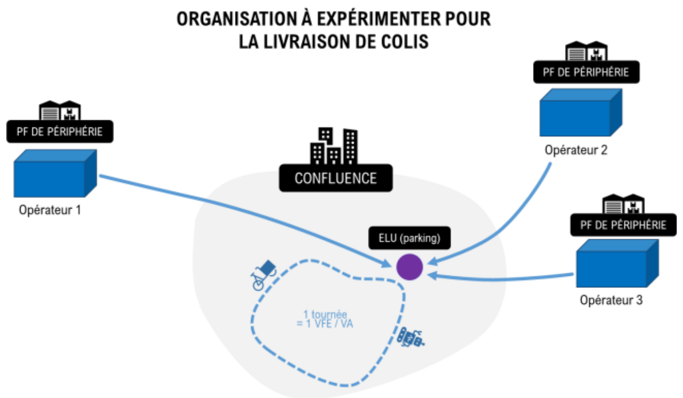


Figure 19. LL3 Lyon: Envisioned organization of parcel delivery.

In the meantime, Lyon LL will also develop and experiment a freight access monitoring tool to count, measure and qualify the freight traffic going in and through the district. This will support the lively update of the digital twin approach.

All activities will support the implementation of Lyon Metropole Oxygen plan focusing on the reduction of pollutants emissions. They will also build on the low emission zone commissioned in 2020.

5.1.4 Living lab goals, values, mission and vision statement

Lyon Living Lab is meant to focus on last mile delivery within a dense urban area. It is set up on a twofold approach:

- Validation of a last mile distribution model based on soft modes and/or autonomous vehicles
- Definition of framework conditions to deploy an urban logistic platform in an underground parking

Having in mind those objectives, partners have set up a living lab supported by modelling facilities to explore and qualify the feasibility of such approach. It will focus on small parcels volume distribution, B2B and B2C, including a limited number of units per recipient, with the final goal to combine the reduction of environmental footprint and the preservation of service quality and ease of distribution.

Among the stakes of this reformed model, Lyon LL will explore whether this framework is viable without the enforcement of any regulation, the impacts of a local low emission zone, the capacity of new vectors (cargo bikes, light vehicles, autonomous vehicles) to cope with the current and future demand. Business indicators such as the size of the fleets and the operational costs will be also scrutinised.

Exploratory results will be discussed with local authority and freight stakeholders to ensure their consistency with politics and industrial models. In that manner modelling results and exploratory scenarios will support a decision process towards local experimentations.

5.2 CoP members and establishment process

Lyon LL gathers local freight stakeholders concerned by the approach. External partners are consulted through a series of bilateral interviews to assess the framework process and generate support in these innovative perspectives. Table 7 shows Lyon LL stakeholders.

Table 7. LL3 Lyon: internal and external stakeholders.

Organization Name	Role / Description
Governmental bodies	SPL Confluence, Grand Lyon Métropole
Academics Networks	LAET, CARA, Eureka Confluence
Infrastructure service providers	Lyon Parc Auto
Shippers	Urby, last mile delivery companies (enrolment ongoing)
Research	IRT SystemX

5.3 LL3 Lyon Value case

5.3.1 Future value case scenarios description

Future scenarios are based on a sequential 4 steps process (Figure 20). A new Urban Consolidation Centre (UCC) to be based in an existing underground parking represents the pivot infrastructure. On this basis, four delivery scenarios will combine low emission distribution means (cargo bikes, light electric vehicles, light autonomous vehicles) and the extension of the catchment area towards northern urban districts.

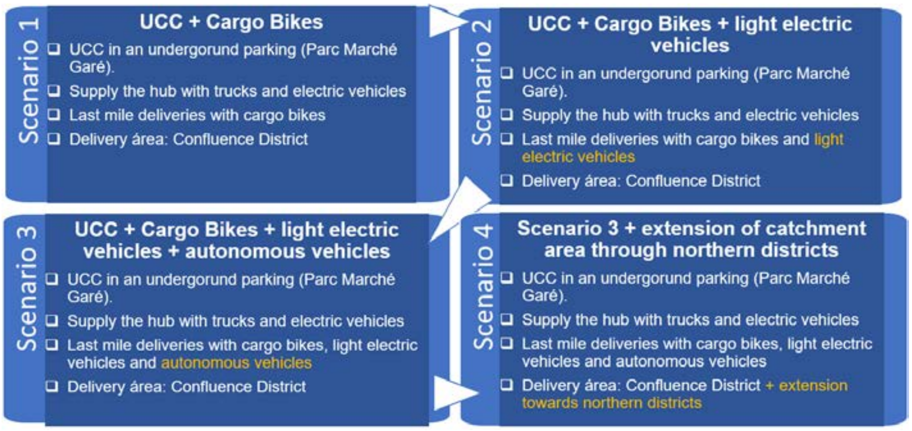


Figure 20. LL3 Lyon - Future value case scenarios

5.3.2 Preliminary impact analysis of Lyon Future Value Case Scenarios

This section presents the sustainability impact analysis of the four Lyon LL scenarios presented above. The process was developed as explained in section 2.4. More specifically, the questionnaire was shared with LL3 Lyon Lead partners. Table 8 shows the questionnaire participants (6 participants as suggested by the methodology).

Table 8. LL3 Lyon: consequence analysis participants.

Organization Name	Role in the LL3
Yann Briand / IRT SystemX	LL coordinator
Jakob Puchinger / IRT SystemX	Scientific leader
Maxime Valentin / SPL Confluence	Innovation manager
Jérémy Harnie-Coussau / SPL Confluence	Project manager
Elsa Roussellet / LPA	Project manager
Philippe Bossin / LPA	Innovation director

After analysing Figure 21, we observe that regardless of the incremental complexity of adding more types of vehicles for the delivery scenarios, the impact on some CIs is the same.

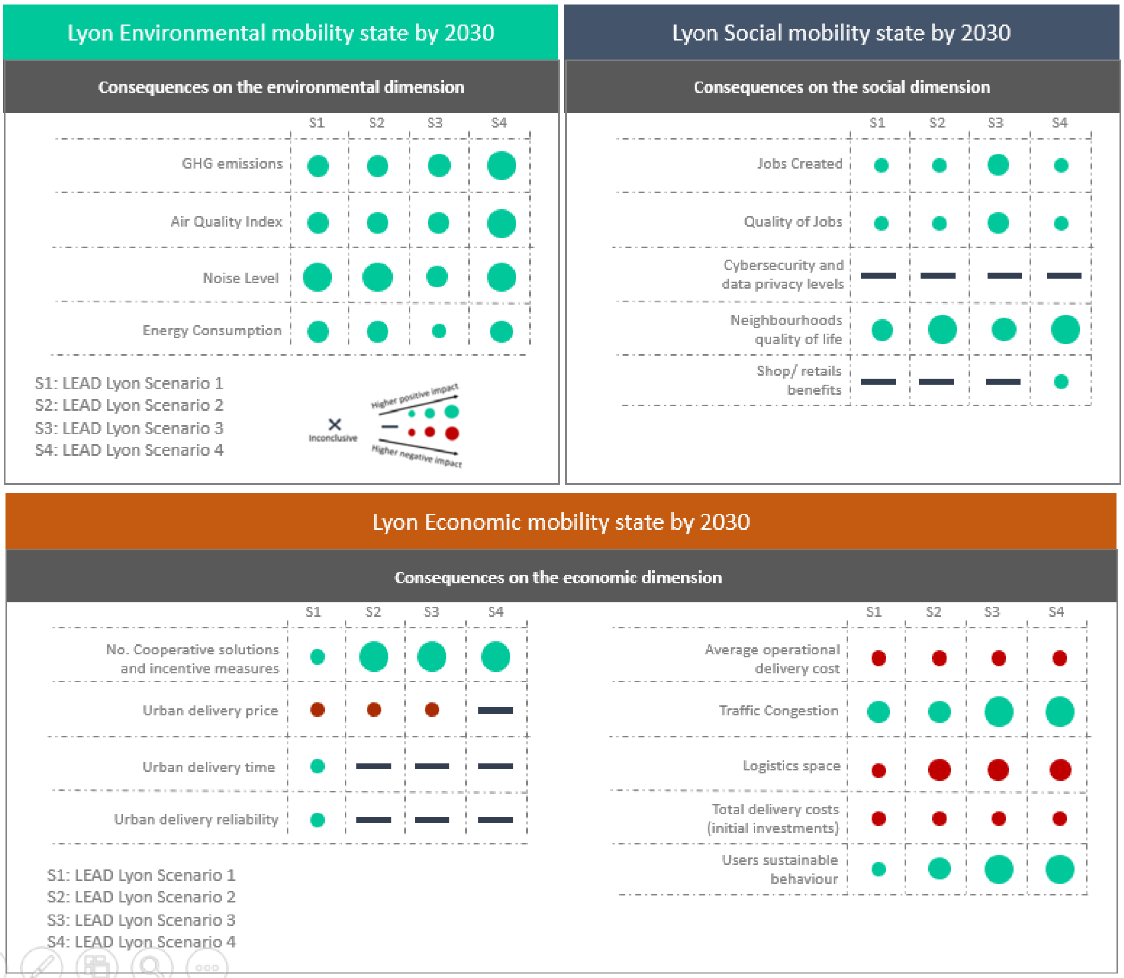


Figure 21. LL3 Lyon: Consequence analysis- Scenarios comparison.

After analysing Figure 21, we observe that regardless of the incremental complexity of adding more types of vehicles for the delivery scenarios, the impact on some CIs is the same. The operational and total costs increase slightly, and the cybersecurity remains as now, even with the presence of autonomous vehicles (S3, S4). However, some differences arise depending on the complexity of the scenarios. S1 may improve the urban delivery time and reliability, and slightly increase the need for more public space. The number of cooperative solutions and users' sustainable behaviour may slightly increase. S2 and S3 include more vehicles types to S1, increasing the complexity and the need for collaboration. On the one hand, the time, logistics' space and reliability are negatively affected. Even the energy consumption needs and the noise may get worse with the added types of vehicles. On the other hand, traffic congestion and users' sustainable behaviour may be optimistically affected. S4 represents the most complex combination of vehicles (S3), but scale out to other areas only raises the S3 positive CIs impact while keeping the negative effects. Even the shops/ retail benefits that are not affected in the previous scenarios may slightly increase when spreading the new delivery business models to other areas.

5.3.3 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

Based on the identified scenarios, opportunities and threats have been identified and are presented in Table 6. This list has been consolidated following a series of bilateral interviews conducted with local stakeholders.

Table 9. LL3 Lyon: Scenarios' opportunities& threats

Scenario	*Opportunity*	*Threats and challenges*
General	Impact on the environment Economic sustainability	
Scenario 1	District urban design (road and parking accesses) Support of local policies	Logistic hub sizing to host trucks Cost of shipping Business model
Scenario 2	Higher volume of parcels Increased efficiency	Logistic hub sizing to host trucks Cost of shipping Business model Parking priority, access control
Scenario 3	Emerging business cases not yet identified	Logistic hub sizing to host trucks Cost of shipping Business model Parking priority, access control Regulation, policy support
Scenario 4	Extended scope could help to sustain business models Greater impacts on the environment More coherent for citizens and operators	One single hub would not be enough

5.4 Conclusion

Launching the LL process helped to gather a range of relevant stakeholders around a prospective vision. Sharing approaches supports the LL owner into challenging the current scenarios. Sound feedbacks on the economic and technical feasibility of such proposals contributes to elaborate on the details and explore potential mitigations to cope with industrial constraints.

The series of interviews was an appropriate medium to collect feedbacks and confidentially discuss the economic challenges which are aimed to be faced. A thorough debriefing is planned with local authorities to assess the weight of potential local policies to incentivise future processes. In this perspective a balance between innovation and local sustainability is to be identified.

The four scenarios represent a progressive approach which supports technical implementations and business models. The first 3 scenarios represent an incremental vision but geographically limited, whether the fourth on proposes a territorial extension which could help to balance the threats identified above.

6 LL4 Budapest Value case

6.1 Context description and vision statement

6.1.1 Introduction

The city of Budapest, as an urban node, affected by the Orient East Med and Mediterranean TEN-T corridors[19], is an important logistics area with 20% of the country's population.

The target location for the pilot activities for Budapest LL will be defined within the inner-city area, enclosed by the Grand Boulevard where the density of retailers/ shops and loading areas are the highest (Figure 22).

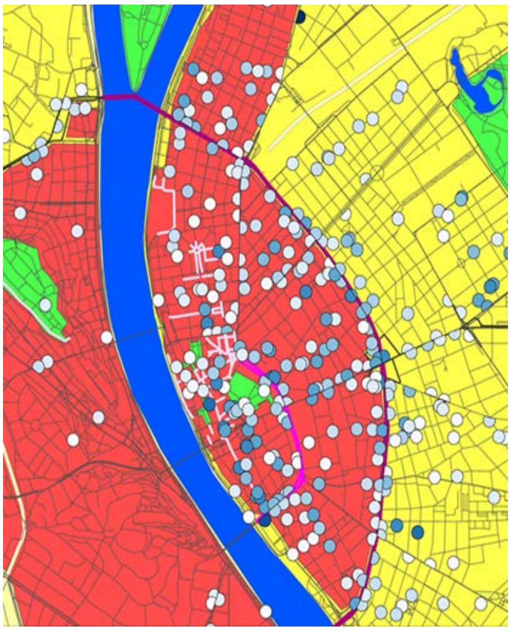


Figure 22. LL4 Budapest location: enclosed by the Grand Boulevard..

Budapest LL (with the coordination of the participating partners: BKK, Waberer's-Szemerey Logisztika, Széchenyi István University and Panasonic) will explore in the LEAD framework:

1) Advantages of using UCCs for serving a certain area. Different locations for centres (along TEN-T corridor, suburbs, city centre), also to explore the optimal distance of UCCs from the endpoint of delivery,

2) Use of Digital Twin as an advanced tool with already existing macroscopic transport model (model development, data collection, matrix development) for the improved assessment of UFT (freight transport, package delivery, consolidation centres),

3) Impacts of consolidation centres on air quality,

4) Assessment of inner-city UFT demand and practice, to be able to make suggestions for policy refinement in certain cases (e.g. for off-peak hour deliveries, development and assessment of loading area policy and regulation and also for establishment and usage, based on citizens user demands and needs),

5) Impact of freight vehicles from UCCs on the environment and on the traffic, depending on vehicle attributions (size).

6.1.2 A brief on current transport in Budapest

The Freight Transport Strategy for Budapest has been a system since 2009 operable for Budapest's roads on the whole territory of the city to mitigate traffic and regulate road transport. It was made by taking primarily environmental protection and city logistics aspects into account. The Freight Transport Strategy for Budapest is based on two decrees made by the General Assembly of Budapest. There are 15 weight restricted and 11 highly protected zones in Budapest to mitigate environmental burden, improve life quality of the residents and protect areas with outstanding values. The freight access

[19] https://ec.europa.eu/transport/themes/infrastructure/mediterranean_en

system fosters harmonised goods delivery; thus, road traffic can be mitigated and air- and noise burden can be reduced.

The bottom-line of the strategy is to set up freight restrictions on the whole territory of Budapest, forcing transit freight traffic to use the M0 motor ring, instead of city roads. In addition, the light-green and blue routes have been designated to provide free access (no need of access permit) to major industrial and logistics areas.

The development of the Freight Transport Strategy for Budapest is well depicted by the map drawn about the total weight restricted zones, the highly protected zones and the routes accessible in destination traffic (Figure 23).

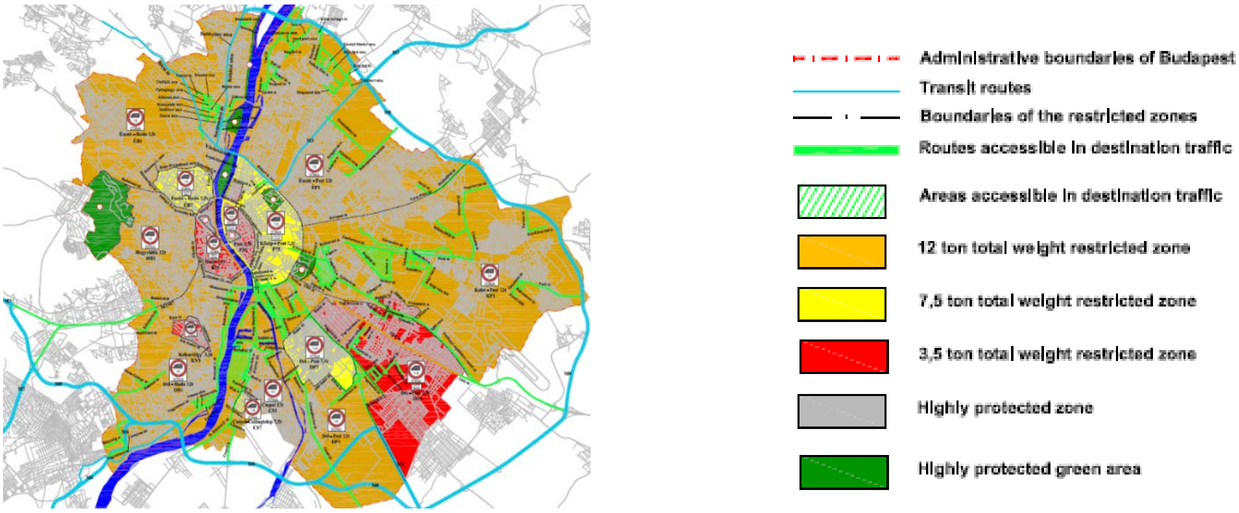


Figure 23. LL4 Budapest: Freight Transport Strategy map with restricted and protected zones and type of routes.

6.1.3 The need for change

Air pollution at street level has already became a critical area of focus, and post-covid car boom currently seems to worsen the situation. There were also government decisions on free parking for the COVID pandemic curfew period, although temporary (to help and encourage people to maintain their mobility when public transport became suddenly abandoned). These measures imposed an even higher pressure on delivery vehicles trying to manage their park and load tasks. The typical demand and therefore the timing of freight deliveries (of dairy products) is scheduled in the morning peak hours. To ameliorate the negative impacts of urban mobility, BKK Centre for Budapest Transport is in charge of the development and the implementation of the first Sustainability Urban Mobility Planning (SUMP)-based transport development strategy, the Budapest Mobility Plan. LEAD objectives are well connected to the following Budapest Mobility Plan's strategic objectives and measures:

- Development of the logistics centres, consolidation centres and their connections
- More stringent regulations for the zoning system based on the total weight and traffic restrictions based on environmental characteristics
- Operation and development of the freight transport access regulation system
- Implementation and development of a city logistics system with territorial and time regulation

- Environmentally friendly technologies in freight forwarding.

6.1.4 Living lab goals, values, mission and vision statement

The LL4 Budapest aims to improve urban freight transport efficiency and sustainability with clear benefits for all actors on the Budapest inner city. It will follow a multi-objective multi-stakeholder approach by considering the needs of the whole community (Figure 24).

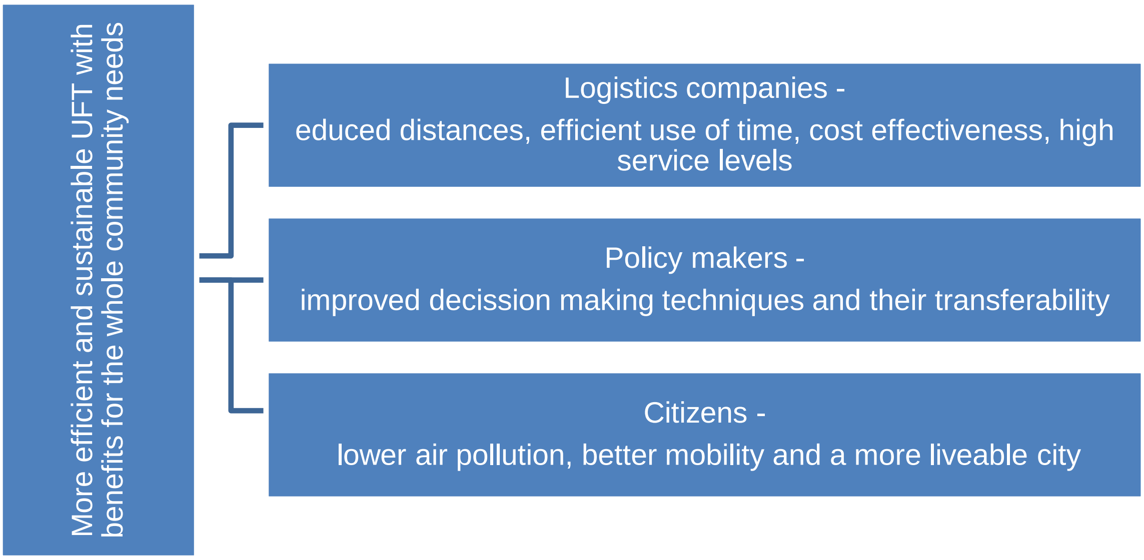


Figure 24. LL4 Budapest: actors' benefits.

As transport modelling is a vital tool for a mobility manager in strategic decision making and decision preparation, the participation of BKK in this LL facilitates the development of more efficient mobility management and better policy planning. A key ambition is also knowledge/technology transfer to other administrations, municipalities and public transport operators. BKK aims to broaden its expertise in freight transport modelling and simulation technologies. The LL Digital Twin will provide insight about the use of UCCs and their optimal location for efficient last mile operations in Budapest. The knowledge gained will be integrated in the city's transport model.

The LEAD framework will also help to quantify the different effects of the e-mobility and regulations to freight transportation scenarios. In Budapest LL KPIs are strategic since they are meant to support decision making processes. As a result of the LL, quantifiable evidence can prove the necessity of UCCs in the city. With relevance to the SUMP, this sequence will also support local decision makers with contextual investigations of scenarios and solutions. KPIs will support the quantitative assessment of local objectives, such as: softening logistic impacts, managing traffic flows, better sharing of public space, mitigating externalities notably CO2/NOx emissions, exploring the balance between public and private responsibilities against logistic, assess innovative technical solutions, support the specification of future infrastructures and services. Once evaluated and selected a set of solutions will be tested in operating environments, based on prototype solutions, innovative regulations and governance schemes.

6.2 CoP members and establishment process (LL owner)

Figure 38. LL6 Porto: CoP members. Table 10. Internal members will actively participate in the development of the LEAD digital twins and external stakeholders with periodic involvement will provide

essential and valuable contribution; they will give support during the Living Lab development (e.g. data, experience, opinion) and validate the intermediate and final results.

In order to set up the Community of Practice for Budapest LL, BKK took as a starting point the previous co-operations and involvement of similar target groups and entities playing roles of interest in urban freight related projects that BKK was also involved in. BKK already has a close co-operation and partnership with policy makers, logistic service providers, urban public road operator, and also will expand this to the energy providers and shop owners and with the help of the Hungarian Association of Logistics, Purchasing and Inventory Management the LL will be able to pull in further expertise related to the actual objectives.

First contacts were made via e-mail and phone calls from the LLs' LEAD partners BKK, SZE and WSZLK, describing the setup of the Budapest Living Lab and forwarding them invitations to webinars featured by LEAD partners introducing the project objectives. Familiarization with the future scenarios was helped by circulating the consequence questionnaire translated into Hungarian and shared (as a second step) with external CoP members. Until the first stakeholder workshop organized on 12th January 2021, the contacting of CoP members was mainly bilateral. As the participants of the Budapest CoP include different organizations, associations, companies and institutions, the idea is to keep it open for further incorporation of new participants with the advancing of the project.

Table 10. LL4 Budapest CoP members.

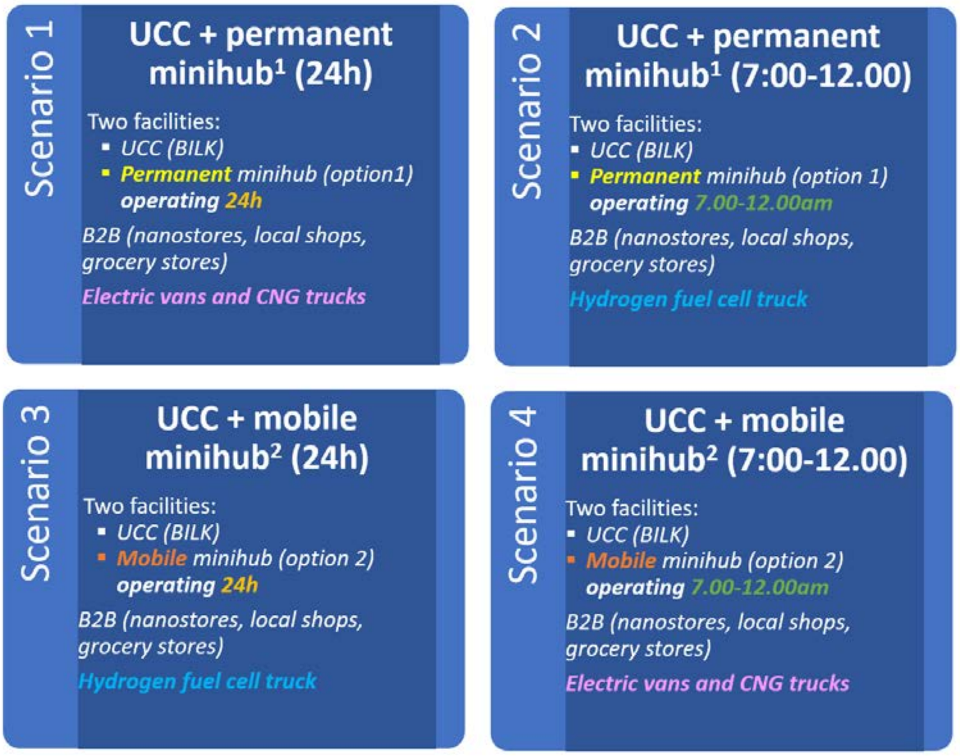
Organization	Description
BKK Centre for Budapest Transport, project partner	Budapest LL coordinator, local mobility manager, decision support for the municipality, responsible for SUMP
Széchenyi István University (SZE), project partner	academics in disciplines of urban mobility, logistics, data science, computer science
Waberer's-Szemerey Logisztika Kft. (WSZLK), project partner	service provider (warehousing, consolidation centres)
Municipality of Budapest	regulator and general decision maker, providing input and support
Budapest Roads	public road operator
MVM Zrt.	energy provider
Hungarian Association of Logistics, Purchasing and Inventory Management (MLBKT)	association for logistics, inventory management
NiT Hungary	federation of national private transporters
BME / Technical University of Budapest, Department of Material Handling and Logistics Systems	academics in disciplines of urban mobility, logistics, data science, computer science
SAP Hungary Kft.,	systems, applications, and products in data processing
BI-KA Ltd. Logistics	complex logistics service provider

EX ANTE Consulting Ltd.	extensive international experience supporting successful development and efficient public services
Hajtás Pajtás	courier service

6.3 The LL4 Budapest future scenarios

6.3.1 Future value case scenarios description

To ameliorate the sustainability impacts of the increasing level of urban freight transport demand aggravated by COVID pandemic, the LL4 Budapest designed four scenarios to analyse the impact of introducing a 2-echelon distribution network with different combinations of logistic measures (Figure 25).



**1. Option 1: minihub is a permanent regional warehouse facility*
**2.Option 2: minihub is a mobile crossdocking facility*

Figure 25. LL4 Budapest: future scenarios.

6.3.2 Preliminary impact analysis of Budapest Future Value Case Scenarios

The sustainability impact analysis was conducted as explained in section- 2.3.4. Table 11 shows the questionnaire participants (twelve respondents).

Table 11. LL4 Budapest: consequence analysis participants.

Organization	Description
BKK Centre for Budapest Transport, project partner	Budapest LL coordinator, local mobility manager, decision support for the municipality, responsible for SUMP
Széchenyi István University (SZE), project partner	academics in disciplines of urban mobility, logistics, data science, computer science
BME / Technical University of Budapest, Department of Material Handling and Logistics Systems	academics in disciplines of urban mobility, logistics, data science, computer science
BME / Technical University of Budapest, Faculty of Transportation Engineering and Vehicle Engineering	academics in disciplines of urban mobility, logistics, data science, computer science
SAP Hungary Kft., Széchenyi István University, PhD. student	academic expert in disciplines of urban mobility, logistics, data science, computer science
BI-KA Ltd. Logistics	complex logistics service provider
EX ANTE Consulting Ltd.	extensive international experience supporting successful development and efficient public services
Waberer's-Szemerey Logisztika Kft. (WSZLK), project partner	service provider (warehousing, consolidation centres)
Hungarian Association of Logistics, Purchasing and Inventory Management (MLBKT)	association for logistics, inventory management

Figure 26. LL4 Budapest: sustainability impact assessment survey respondents' profiles.

Figure 27 shows the results of comparing the LL4 Budapest scenarios impact analysis further detailed in Annexe 5.

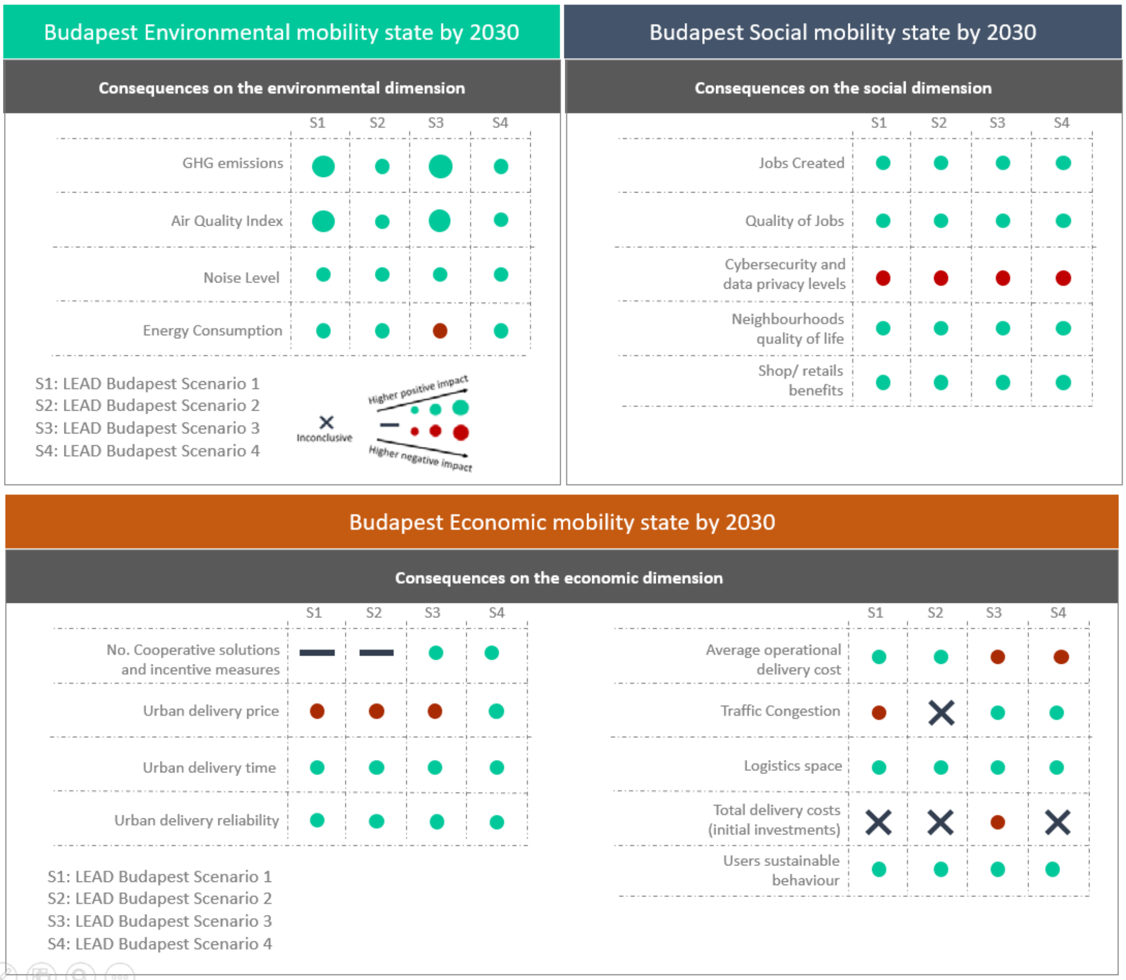


Figure 27. LL6 Budapest: Consequence analysis- Scenarios comparison.

For the environmental dimension, the time the *microplatform* is available will impact on the *GHG emissions and air quality*. *The more time available the more positive impact*. About considering a mobile or permanent facility may impact negatively on energy needs. *The use of a mobile depot 24 hours will slightly increase consumption (S1, S3).*

For the social dimension, regardless of the combination of measures, all the scenarios will slightly improve the number and quality of jobs, the neighbourhoods' life and local stores benefits, however, they may increase the cybersecurity and data privacy concerns.

For the economic dimension, the four scenarios will positively impact on the users' sustainable behaviour, delivery time and reliability and logistics' space. However, on the one hand, the use of a *mobile depot will negatively impact on the operator's costs*, especially on the operational costs while a *permanent facility will have a positive effect (S1, S2)*. On the other hand, *the mobile depot will impact positively on traffic congestion* (S3,S4) while the *permanent micro hub will have a negative effect (S1, S2)*. Finally, the price may get better only when the scenario presents a mobile depot 7/12h (S2, S4).

6.3.3 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

The identification of the scenarios' opportunities & threats and the evaluation phases were performed with an online workshop following the methodology proposed by the task leader (section 2.4).

The workshop took place on the 12th January 2021 (see Annexe 5 for further detailed information). There were 20 attendees from 12 different organizations who provided feedback according to their field of expertise and to their roles and interests previously identified.

Table 12. LL4 Budapest: Stakeholders interests/ objectives.

Role/ Stakeholder	Objectives/ interests
Policymaker	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	Reduce traffic congestion.
	Improve the distribution and use of public space.
R&D+i	Exchange of knowledge.
	New related initiatives and approaches.
	New projects and synergies with current ones.
Logistic service providers, operators, carriers	Greater efficiency.
	Improve customer satisfaction and quality of service.
	Contribution to social and environmental sustainability.
Local stores, retail, shippers,	Increase in local distribution channels.
	Increase in public space for commercial and leisure activities.
	Reduction of distribution costs associated with the last mile.
Users, consumers	Increased options to receive packages.
	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	Incentives.
Energy	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	New engineering solutions.
	New strategy focused through the logistics.
Business models	Support some go-to market solutions.
	Improve economy efficiency, customer satisfaction and services quality
	Contribution to social and environmental sustainability.

6.3.3.1 Results

Figure 28 shows the final results of the workshop evaluation phase. The stakeholders voted the business value and feasibility defined above and in section 2.4 using a 5-point Likert scale. As observed, S1 is the most preferable scenario followed by S3. For understanding the results on this graph, we need to further analyse the information compiled during the brainstorming phase and additional comments during the evaluation phase, which are presented and detailed in Annexe 5.

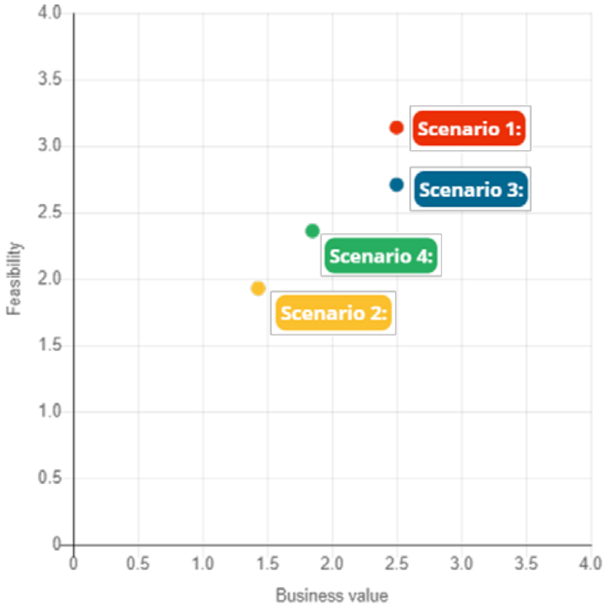


Figure 28. LL4 Budapest: scenarios evaluation (feasibility vs value).

Time window is a key factor when evaluating each future scenario. The considered groups valued positively the longer delivery time window. The 0-24-time window would be the ideal for the deliveries to local shops with electric and CNG vehicles.

Another essential factor is the accessibility of the minihub by the vehicles that supply the minihub. At this point, the longer time window should be strengthened.

Scenarios 1 and 3 provide an opportunity to organize the deliveries more scheduled to avoid traffic congestions. The attendees considered risky the use of hydrogen cell vehicles due the cost and lack of charging infrastructure.

The use of “rust zones” (special development zones) is a key opportunity based on the opinions of the attendees.

6.4 Conclusions

The work during the first months of the project was essential to identify and engage external stakeholders. It helped to define the value case scenarios and align all the stakeholders’ groups interests.

The dynamic and participated workshop made clear that the scenarios suggested by the LEAD partners involved in Budapest LL have value and potential to provide useful evidences for the community. In addition to the base combination of scenario elements, the participants of the CoP and the workshop suggested further fine-tuning criteria that should be considered, with respect as well of the ranking of the scenarios by their business value and feasibility:

- defining a longer time window would be preferable,
- the hydrogen fuel cell trucks should be rather used for supplying the minihub,
- scenarios with lower ranking would also give a measurable difference compared to the present, therefore these scenarios should be kept.

7 LL5 Oslo Value case

7.1 Context description and vision statement

7.1.1 Introduction

The LL5 is located in Oslo, the capital of Norway with a total surface area of 454 km2. Two thirds of the area consist of protected forest. Oslo has around 690.000 inhabitants whereas around 1.5 million people reside in the Greater Oslo area.

The annual population growth rate has been around 1.8% from 2004-2020 (see Figure 29), with the strongest growth (up to more than 3% per year) taking place in districts close to the Central Business District (CBD). Currently, 21% of the population is younger than 20 years whereas 58% is younger than 39 years. The youngest age groups (below 40 years) have a slightly higher growth rate than those above 40 years). The annual growth forecasts for Oslo up to 2050 are expected to be between 0.0 and 0.9% up to *2050* with the *main population growth scenario of around 0.5%.*

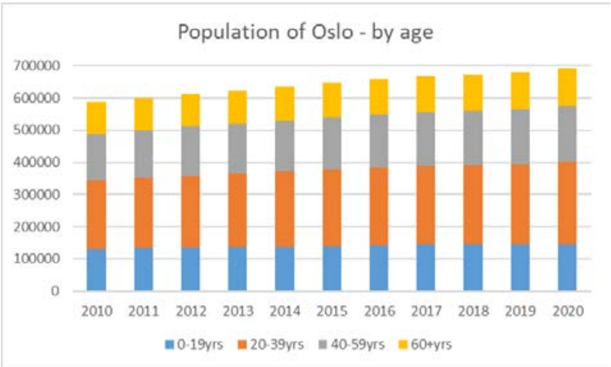


Figure 29. LL5 Oslo: Oslo population by age groups[20] (2010-2020).

Oslo has traditionally been an industrial town with mills, mechanical industries and shipyards. During the last 40 years, the traditional industries have been widely replaced by the knowledge intensive business services sector. As the population of Oslo increases rapidly, the former industrial plants are redeveloped for housing and commercial activities. The former city planning was zone-based, depending on mass-transportation between zones for housing and zones for industry and commercial activities. Present city planning creates a more mixed urban structure that allows for new thinking of transportation with more attention towards softer modes and micro-mobility.

The downtown area is compact and walkable, and the city council has introduced a car-free-city programme to devote streets former filled with congestions and parked cars to people and recreational activities.

The Figure 30 below shows Oslo city centre with the e-mobility hub at ***Skøyen*** that will be the logistics hub for the LEAD scenario (see Annexe 5 for further detailed information).

[20] Statistics Norway, general population stats.

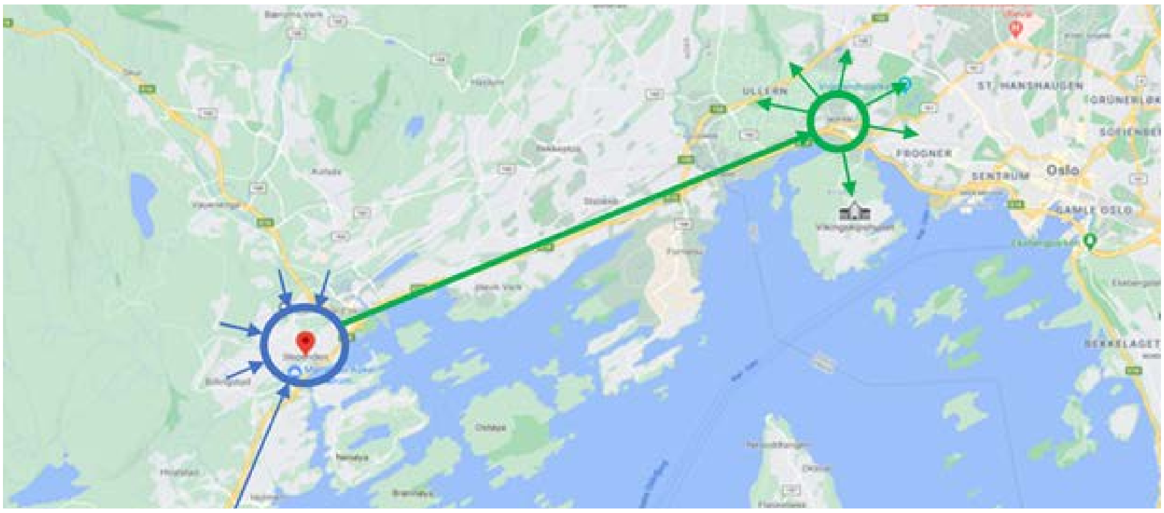


Figure 30. LL5 Oslo: IKEA store with micro-hub (blue) and Skøyen mobility hub for the LEAD scenarios (green).

7.1.2 A brief on current transport in Oslo

Smarter Transport in the Oslo Region (STOR) is a collaborative project between the Norwegian Public Roads Administration, Oslo Agency for Urban Environment and Ruter, the public transport provider. Together they are piloting new mobility services such as autonomous busses, traffic light assistance, mobility as a service etc. The project is primarily focusing on services that may increase the use of sustainable mobility solutions. However, they are also optimizing existing services such as smart parking for disabled, cyclist detection, and park and ride services. The aims are:

- to improve mobility
- to reduce carbon emissions and other negative impacts on the environment
- to reduce the number of traffic accidents

The parties are sharing valuable insight in smart use of technology and future mobility needs. Residents are engaged along the way to validate hypotheses, concepts and prototypes. The innovation methodology is inspired by Design Thinking and Lean focusing on early insights and testing in collaboration with users, in order to find the right solutions to carry forward.

About the urban freight logistics in Oslo, the city has detailed information about the freight transport activity and emissions (see Annexe 5). Furthermore, Oslo is in the process of making a pre-project for a Sustainable Urban Logistics Planning, as a start-up for the process of developing a SULP. The LEAD project will feed into this plan with the Oslo LL and NIMBER's business model (see section 7.1.4).

7.1.3 The need for change

There is an understanding worldwide that there is a need for change to fulfil the need for sustainable development. As mentioned above, Oslo City has goals and ambitions to reduce GHG emissions and reduce the use of cars through better conditions for the softer modes, public transport and shared mobility. Oslo is affected by many underlying trends, like increases in urbanization, digitalization, environmental consciousness among the population and use of shared services. In addition, the need for flexibility and led use of private cars creates markets for innovate home deliveries.

This means that there is a need for a more efficient urban freight logistics and hence new and innovative urban freight logistics concepts. Smart city logistics in general are expected to provide more efficient transport and logistics solutions and make urban freight logistics more sustainable. One example that will be addressed in the Oslo LL is to used spare transport capacity for urban freight through shared mobility by means of e.g. crowdshipping (see Table 23). Even though the market for home deliveries and urban freight is increasing, one could then achieve a reduced need for freight transport kms.

7.1.4 Living lab goals, values, mission and vision statement

The Living Lab goals are in alignment with the Oslo transport overall strategy. It aims to contribute in the decarbonization of the transport and reducing the externalities while improving mobility options, with the focus on freight transport.

NIMBER is the key partner who will take care of the practical design of the scenarios and carry out the operations and register the necessary flow data. NIMBER's business strategy is to be a platform for linking various needs in the urban freight supply chain, with particular focus on the B2C relationship. One main objective is to provide environmental-friendly solutions to the market by providing relevant incentives. Figure 31 shows NIMBER's priorities.

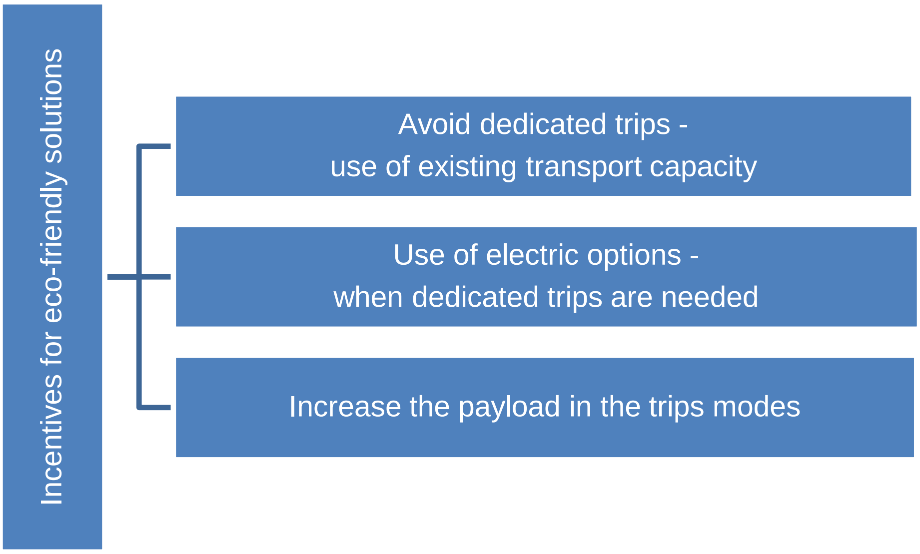


Figure 31. LL5 Oslo: NIMBER's priorities.

As per today the demand is the strongest from customers that cannot send their cargo through e.g. the postal services. Some of the reasons are:

- *The items are too big*
- *The items are fragile and hence there is a need to avoid reloading in a terminal*
- *The items are sent without packaging*
- *Additional services like return, installation etc. is needed*
- *Same day delivery is needed.*

7.2 CoP members and establishment process

The list below shows the already LL5 stakeholders integrating the LL5 CoP. The composition of the community will be enriched with additional stakeholders linked to the location and the operations once the location for the micro hub is confirmed.

- Ruter[21], the urban public transit company
- Property owners of the location for the micro-hub
- Businesses taking part in the shipment (IKEA +)
- Residents
- Norwegian Public Roads administration (NPRA)
- Regional project coordinator for urban freight projects
- Participants in selected ongoing urban freight logistics projects, like cycle freight companies
- The national industry and commerce association, transport and logistics department
- Researchers participating in projects dealing with related issues

The LL5 Oslo team has good and frequent contacts with most of the potential CoP members. Ruter is 60 % owned by Oslo City and will be engaged through them. Nimber has a number of businesses as customers and their flows can be fed into the IKEA+ shipments. There are regular contacts with NPRA and they are prepared to participate. The regional urban freight project coordinator is contacted, with clear interest in contributing to LL5 Oslo. Participants in ongoing urban freight logistics projects and researchers dealing with related issues have already contributed in the validation of the scenarios.

Nimber is now dealing with property owners to agree upon the location for the mobility hub. Once this is decided, the property owner(s) will be included. Representatives for the residents will be included once the location is finally decided upon, because we believe that the contribution from those living in the vicinity of the mobility hub will be of a particular value. The Oslo City/Ullern district administration will be contacted to find suitable CoP members. The LL5 Oslo team has contacts with directors of the national industry and commerce association that will be activated once the location is decided upon. From experience it is easier to get busy CoP members on board when the experiments are set up in an initial version.

Apart from the residents all CoP contacts are made through either institutional or personal contacts that exist on a regular basis. Hence, the risk of recruiting members of the CoP is considered as being minor. We are now collecting experiences from a selection of successful LLs to avoid unnecessary pitfalls. Once the CoP is finally established, based on experiences from elsewhere we will work with the members to find a feasible way for the CoP to follow the development of LL5 Oslo and to provide their inputs.

7.3 LL5 Oslo future scenarios

7.3.1 Future value case scenarios description

The LL5 Oslo plans to explore the microhub concept furtherly with the scenarios presented below. Oslo city already performs some types of consolidation centre. Elskedeby[22] is handling the freight of

[21] https://ruter.no/en/
[22] https://elskedeby.no/about_elskede_by/

one of the larger operators (Bring[23]) to the customers' homes and are the same time picking up returns such as electrical waste. From the operators' side, it is a challenge agreed with the supplier to deliver the item to the buyer. They cannot do it another way unless the buyer has approved in advance. So, in many cases, the operators are contractually obliged to handle also last-mile delivery. The end-customer must accept other delivery methods than the pre-accepted deal between the businesses and the freight forwarders. However, in Oslo LLs scenarios, the customer has already approved by having visited IKEA physically and then ordered the goods shipped to home.

A pre-test of a variant of the IKEA home delivery concept took place during one week in November 2020, with a micro-hub located at the IKEA facilities at Slependen[24] in Asker west Oslo for dedicated and consolidated trips. This experiment turned out to be highly successful. It will be repeated in the first quarter of 2021, tailored at serving the needs of LEAD. The location is in line with the current main markets for NIMBER.

A micro-hub for the LEAD experiments, the location is closed to a station for city buses and e-vehicles (please see Figure 30). One of the objectives with the Skøyen hub is to explore the potential for more crowd-shipping. The hub will be manned, with cooling facilities and charging facilities for e-vehicles. The location should allow for using various types of e-vehicles but also being served by other vehicles in non-dedicated trips and public transport (PT) commuters for smaller items.

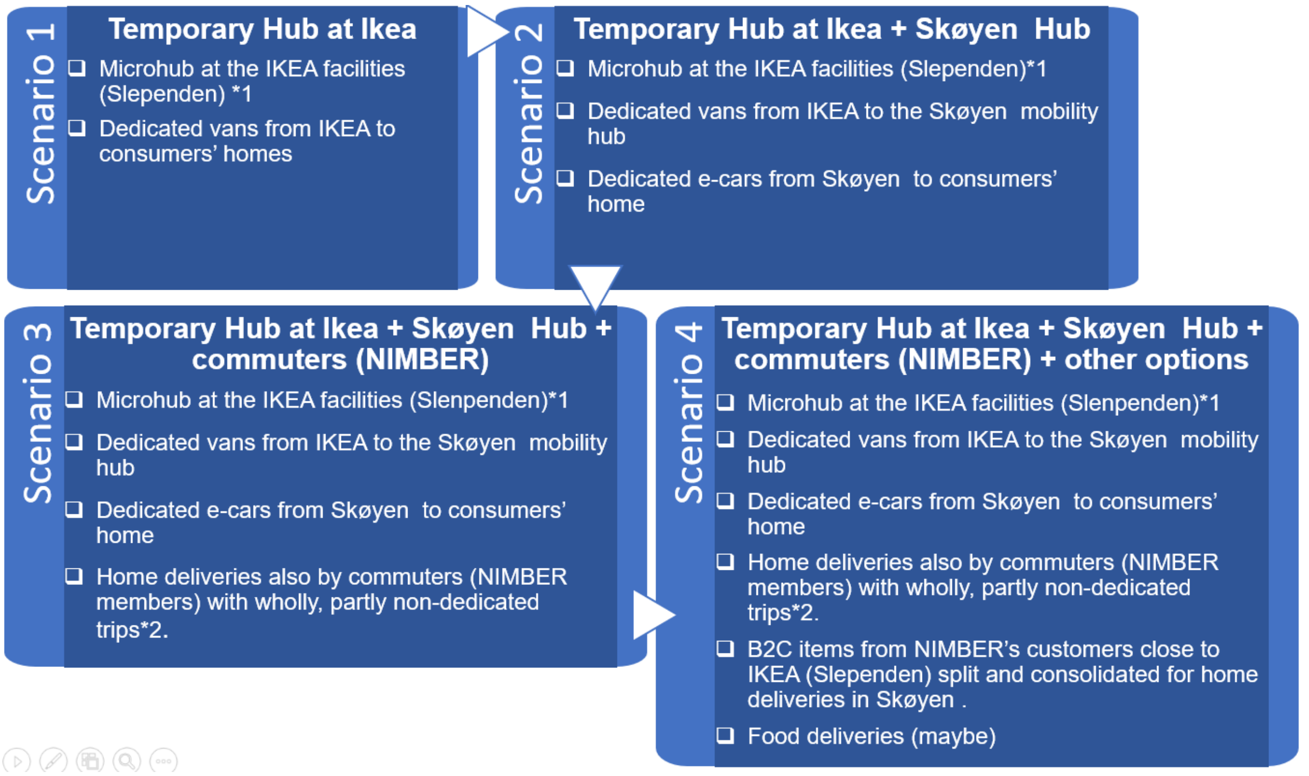
IKEA facilities will be the departure point the set of alternative scenarios will challenge the current B2C transport pattern. The current model will be the baseline scenario.

Figure 32 shows the future value case scenarios LL5 Oslo had been exploring. About S3 and S4, various modes had been foreseen for the commuters' deliveries, including the use of the PT system.

Finally, because of the strong competition in the market for ordinary packages, LL Oslo will focus on shipment of larger items, and bring smaller items when needed, e.g. as part of larger shipments from the stores and to the homes.

[23] *https://www.bring.com/*

[24] *https://www.ikea.com/no/no/stores/slependen/?utm_campaign=IKEA_NO_NO_P_FY19RTCSokAO&utm_medium=MFA&utm_source=NO+Google&utm_content=FY19Sok_V1_HFBMUL_LP_C2_1x1&utm_term=SRC_multi_C_CPC_K1_none_N_c3_Sok&gclid=CjwKCAiApNSABhAlEiwANuR9YKAPL2NJ9BsSEfjTGDAtW4eY9-ij7Vr8LE_zZiYjHqFblBIbYOvBFRoCdkUQAvD_BwE&gclsrc=aw.ds*



**1. A micro-hub located at the IKEA facilities at Slependen in Asker west of Oslo for dedicated and consolidated trips.*
**2. Various modes will be explored, including the use of the public transport system.*

Figure 32. LL4 Oslo: future scenarios.

LL5 Oslo will use these scenarios as basis for carrying out the consumer preferences studies by means of Stated Preferences (SP) studies. Both measurements of what will take place in the scenarios (by using relevant KPIs) and the SP experiments will support the digital twin part of LEAD.

7.3.2 Preliminary impact analysis of Oslo Future Value Case Scenarios

This section presents the sustainability impact analysis of the four Oslo LL scenarios presented above. The process was developed as explained in section 2.4. More specifically, the questionnaire was shared with LL4 Oslo Lead partners. Table 13 shows the questionnaire participants.

Table 13. LL5 Oslo: consequence analysis participants.

Organization Name	Role in the LL5
Paal Mork/ Oslo Kommune	City of Oslo
Svein Brathen/ Molde University College	Task leader
Valerio Gatta/ Molde University College	LL manager
Jon Martin/ Nimber	Project member
Jackson/ Nimber	Project manager

Martin Bergheim / Municipality of Oslo	Co-partner
Edoardo Marucci/ Molde University College	Project member
Lisa Hansson/ Molde University College	LL member

Figure 33 contains the results of the expected sustainability impact analysis further examined in Annexe 5. As observed, the combination of measures may impact on the shop retails benefits and urban delivery reliability similarly. For the jobs created and neighbourhood's quality life, the positive impact is slightly higher, not when the combination of measures gets added complexity (S1, S2, S3), but S4 includes other delivery services to S3. On the other hand, the operational costs remain with a low negative impact on the three first combination of measures, while it is not clear the effect of expanding the services with S4.

It is noteworthy that as the comments in Annexe 5 show, there were some uncertainty as to what the base case looks like, i.e. *how are the shipments carried out as per today.* Hence, the *responses can only be considered as indicative.*

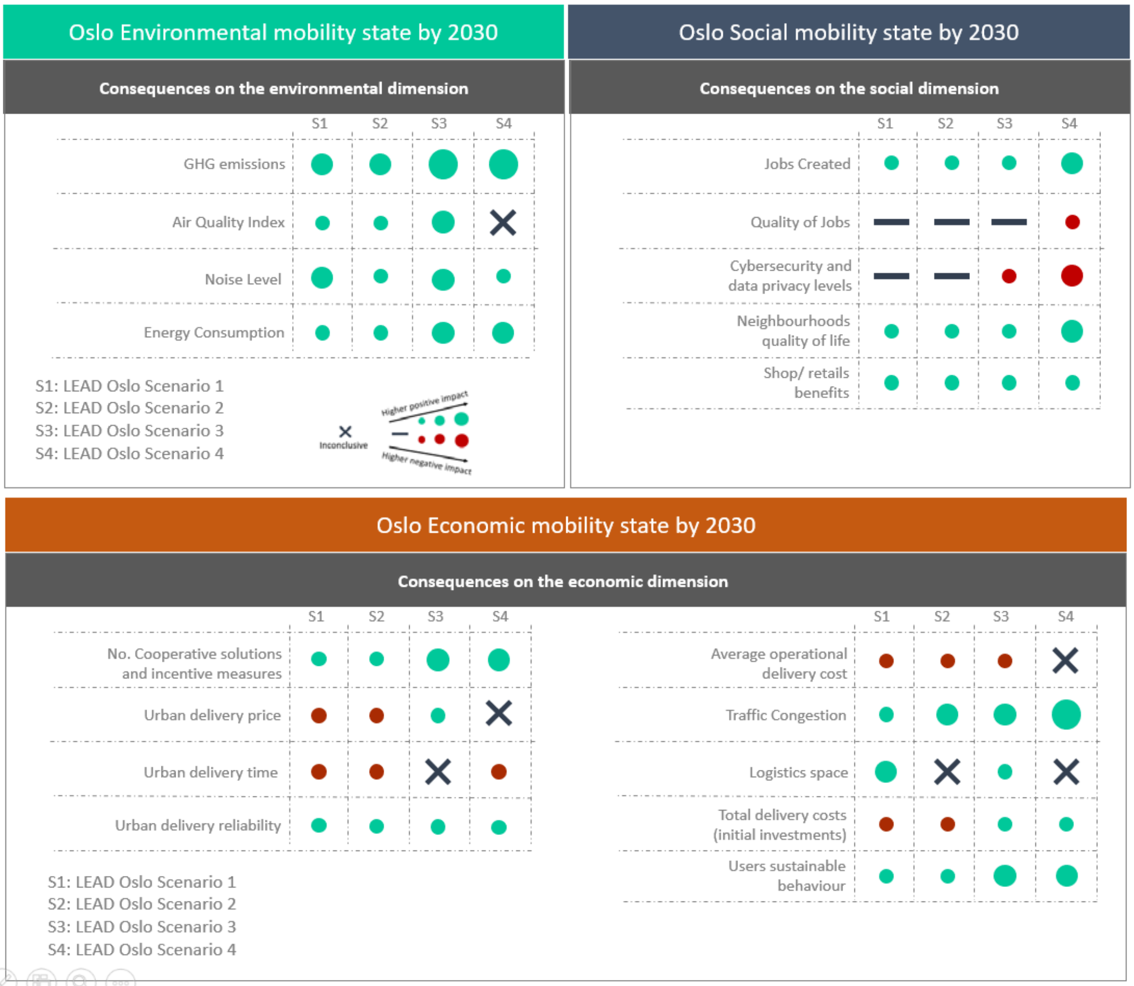


Figure 33. LL5 Oslo: Consequence analysis- Scenarios comparison.

Focusing on every specific scenario, we observe the following consequences:

Scenario 1 includes direct shipments from IKEA's store to the final consumers but replaces conventional vehicles with e-vans. This fleet renewal may have a positive impact on most of the indicators. Especially the GHG emissions, the noise level and logistics space. However, the transition towards electric vans may increase the price, the operational and initial investments costs.

Scenario 2 divides the first scenario into a two-echelon distribution network with the mobility hub in Skøyen. The previous direct shipments with e-vans will supply Skøyen's facilities and distribute goods into e-cars from this hub to the end consumers. If we compare S1 with S2, this additional step and the change of e-vans to e-cars for the last part of the distribution may harm the noise level. However, it will help to reduce traffic congestion. About the logistics space, it is not clear the effect of this additional measure to this CI.

Scenario 3 includes Nimber`s members for the distribution of goods. This scenario plans to consider these commuters, either using a private vehicle or public transport, with wholly or partly non-dedicated trips. The impact on the environmental dimension may be substantially notable. The need for registering commuters for the last mile deliveries may probably increase the cybersecurity and data privacy concerns. Additionally, the need for collaboration and the people involvement may increase the number of cooperative solutions and users' sustainable behaviour. Finally, the total costs and price may benefit from considering commuters for urban deliveries.

Scenario 4 is similar to the third one but includes other services (B2C items from NIMBER's customers, food deliveries). The consequences on the air quality index, the operational costs, the price and the logistics space of this expansion are not easy to foresee. It seems it may positively impact on the GHG emissions and traffic congestion. However, the quality of jobs and cybersecurity and data privacy concerns may negatively increase.

7.3.3 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

7.3.3.1 Description

The identification of the scenarios' opportunities & threats and the evaluation phases were performed through bilateral meetings with a limited number of informants and stakeholders, partly following the methodology proposed by the task leader (section 2.4). At the time of writing there is a combination of COVID-related lockdowns and a peak in demand for B2C deliveries that has made a conventional workshop difficult to arrange within the time frame. These meetings have been arranged with highly experienced professionals where opportunities and threats related to the 4 scenarios were thoroughly discussed, along with the proposed KPIs (see section 9).

The web-meetings took place on January 19th and 25th. There were 3 attendees from two different organizations who provided feedback according to their roles in the urban freight sector. These roles were 1) a director of a large, multi-national express delivery service (DHL Express) and 2) leading researchers from a research institute that has extensive experience with running LLs and projects within urban freight logistics in Oslo and who is currently running another Horizon-2020 project on urban freight deliveries (Institute of Transport Economics). To what extent the scenarios were feasible preliminarily defined as how they would work in practice with respect to sustainability/energy and emissions, economic viability and realism to perform and deploy.

The location of the mobility hub is causing a strong competition for relevant land areas in the vicinity of the LL, therefore LL5 partners decided to involve just DHL Express and the Institute of Transport

Economics (TÖI) (see Annexe 5 for details about the participants). Both are located within Oslo and well familiar with the professional domain. Nimber and Oslo City also contributed during the meetings. Their close contacts with both senders, bringers and the receivers helped to fairly represent essential stakeholders' view. More stakeholders will be involved as soon as the location is confirmed, as they will be directly affected by the final decision.

About the location, it is important to outline from what LL5 has observed, namely that there is a trade-off between different purposes. If smaller mobility hubs should prove to be an efficient way of doing flexible 'on demand' deliveries then there may be a regulatory issue that has to do with the balancing of both network and density externalities (user gets benefits from other user's utilization of the hub) against other forms of land use in densely populated urban areas.

7.3.3.2 Results from the discussions

In general, the scenarios were assessed realistic and feasible, with an increasing amount of opportunities as we move from S1 to S4. The main threat is to find a suitable location of the mobility hub near the residential areas in the urban Centre.

The operators underlined that the customer might order delivery at a desired time of day, but flexibility was essential. The mobility hub close to residential urban areas will enhance the flexibility by having access to many potential bringers (through the Nimber mobile app) and shorter distances from the mobility hub to homes. On the other hand, there are clear advantages to not having to reload goods along the way, especially oversized freight. Time spent can be significant when having to go to a hub for consolidation. For certain time-critical items, delivery time is oftener prioritized than the use of transhipment's points. On the other hand, the limited range of e-vehicles may raise the need for some sort of hub located near the city Centre. These concerns need to be balanced.

The idea of including several companies as senders in scenario 4 could be facilitated by a well-functioning mobility hub. Nimber's experiences indicate that local companies could be interested in delivering goods to the hub or even to act as crowd-shippers from the mobility- hub and to the homes.

One important concern is that last mile deliveries have already been tested in other European cities, but the initiatives seem to be struggling to survive after the test period. It may be hard to find the willingness to pay for these services after the pilots have ended. There are examples of initiatives that have continued. One important issue for making the services sustainable after the experiments is to consider the different areas of responsibility carefully. There are indications that using the micro hub or mobility hub as the address for the customers and then merge names with home addresses there, may make it easier to make this type of multi-party transport chain work. The company that is running the hub then takes responsibility for the last mile delivery. This is due to that logistics companies are in general reluctant to hand their goods over to other companies unless the responsibility is clearly assigned. There is still an issue that the logistics companies may lose their profiling by outsourcing the last mile freight operation to other parties.

It was clearly stated that delivery of larger items is an interesting segment where competition with e.g. parcel lockers and pick-up points are less pronounced.

A number of practical technical and operational issues were discussed too. The IKEA pilot mentioned above showed that the smallest vans were too small. Minimum dimension is an inside length of at least two meters. The pilot then managed to get 3-4 orders shipped per van. The operator (Nimber) indicated that at least two orders per van are needed to make a profit. Because several orders can be shipped simultaneously, profitability will increase given the option of intermediate deliveries through a hub. Corporate shipping (B2B) is also interesting to consider. The shipping is often invoiced to the end customer, and the prices are higher. It could be worth considering if there is an option to combine it with deliveries from IKEA. The hub increases flexibility also in this respect. It could also be considered to include return logistics and assembly services, e.g. of furniture. There are indications that value-added services may reduce price sensitivity. This may be an issue to address in the research part of LL Oslo dealing with consumer preferences. It was also underlined that customers may be offered to change the delivery time in a highly flexible manner given the existence of a mobility hub close to the homes.

7.4 Conclusions

The work during the first months of the project has been essential to define and refine the scenarios. Key stakeholders (operators, Oslo City, research professionals and businesses/suppliers of freight) have provided valuable insights and validation.

The lack of a suitable area for the mobility hub at Skøyen was a challenge that has slowed down the external stakeholders' involvement. Nevertheless, once the location is agreed, this list will incorporate additional members, including the residents in the mobility hub's area enriching the CoP.

Although the feasibility/value matrix is not available. The responses provided show a trade-off between these two criteria. Scenarios complexity is incremental and reflected in the expected value, "the lower feasibility, the more value".

Finally, from the successful results from the S1 partial test in November 2020 and Nimber's preparatory work to set up the operations, we may conclude this LL5 Oslo is prepared to take off and implement the scenarios once the location is ready.

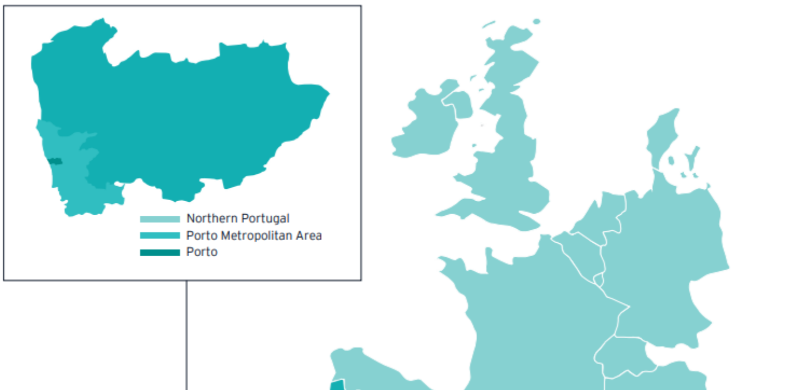
8 LL6 Porto Value case

8.1 Context description and vision statement

8.1.1 Introduction

The LL6 is located in Porto metropolitan area in the North of Portugal (Figure 34). Porto is the second-largest city in Portugal and one of the Iberian Peninsula's major urban areas. Porto city is small compared to its metropolitan area, with a population of 237,559 people. Porto's metropolitan area has an estimated 1.7 million people (2019) in an area of 2,395 km2 making it the second-largest urban area in Portugal[25].

[25] https://en.wikipedia.org/wiki/Porto



City	Population
V. N. de Gaia	299,820
Porto	214,587
Braga	181,382
Matosinhos	173,753
Gondomar	165,626
Guimarães	153,294
S. M. da Feira	138,613
Maia	136,769
Famalicão	131,909

Source: INE.

Figure 34. LL6 Porto: LL location (Lima & Franfo, 2019).

Gross Domestic Product (GDP) has been growing at annual rates of approximately 4% to 5% for the past few years, averaging at around twice those for the country as a whole, which shows the North region's resilience (Figure 35).

	Northern Portugal				Porto Metropolitan Area			
	2015	2016	2017	2018	2015	2016	2017	2018
GDP (annual growth rate)	3.9	4.7	4.4	-	3.7	4.4	4.5	-
GDP (billion €)	52.7	55.0	57.2	-	28.2	29.4	30.7	-
GDP per capita (EU28=100)	64.5	65.5	64.8	-	72.0	73.0	72.5	-
Gross fixed capital formation (annual growth rate)	12.8	11.3	21.6	-	12.4	8.1	25.3	-
Goods Exports (annual growth rate)	6.1	6.0	7.9	2.6	4.9	6.4	7.5	1.0
Unemployment rate (in percentage)	13.7	12.0	9.8	7.3	-	-	-	-

Source: INE.

Figure 35. LL6 Porto: Economic indicators (Lima & Franfo, 2019).

This LL is led by Sonae Modelo Continente (MC)[26], the leading multi-format omnichannel Food Retailer in Portugal with almost the 25% of the total market share. Based on an 99% brand awareness in Portugal, Sonae MC operates over the brands[27] Continente (Urban Hypermarkets), Continente Modelo (Large Supermarkets), Continente Bom Dia (Proximity Supermarkets), Continente online (ecommerce) and Meu Super (Proximity Supermarkets – franchise), representing its food retail portfolio across a national network of more than 600 stores.

8.1.2 A brief on current delivery service of Sonae

In all Porto metropolitan area (Figure 36), Sonae MC operates its home delivery service under three main types of infrastructures considering its own ecommerce channel: (1) the Distribution Centre in

[26] *https://sonaemc.com/en/*
[27] *https://sonaemc.com/en/portfolio/*

Maia city, (2) a dedicated Darkstore in Gaia city and three Preparation Centres located in Gaia, Matosinhos and Valongo city.

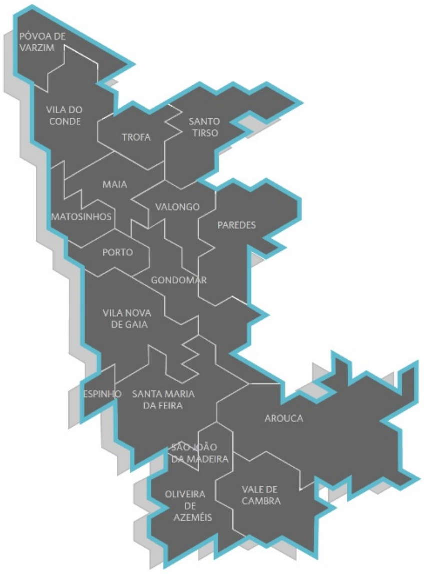


Figure 36. LL6: Porto Metropolitan Area.

It is also important to refer that Sonae MC doesn't own delivery vehicles fleet and so works collaboratively with a range of external logistics partners that – through a cohesive management - provide the home delivery services based on the brand "Continente".

8.1.3 The need for change

During the first lockdown in Portugal, the ecommerce through its own app and digital platform www.continente.pt had grown more than six times and stabilized more than twice when compared to 2019. So, it is an important moment to introduce new mindsets, new business models and new strategies regarding the home deliveries service to our customers.

8.1.4 Living lab goals, values, mission and vision statement

The vision for Porto Living Lab is clear: turn the Sonae MC home deliveries based on electric mobility through turning retail stores into electric mobility nodes and test some new business models based on this important transition on its last-mile home deliveries.

The main challenges to be tackled will be the positioning of the EDV charging stations, routing optimization and the cost factor. To study, test and prepare the TO BE scenarios some important factors will be considered (grid connection costs, renewable energy sources, etc.) as well as some parameters (Lead time, distance travelled, CO2 emissions, traffic, stops frequency, stops duration, types of batteries and its strategy, vans and motorbikes models, charging types, etc.). Through this framing and modelling, scenarios will be created and will support important decision to a near future, regarding the electric mobility through the operations of Sonae MC, being for sure an important example in Portugal to other players (not only in food retail sector) take the same mindset and deploy strategies in these domains through their operations.

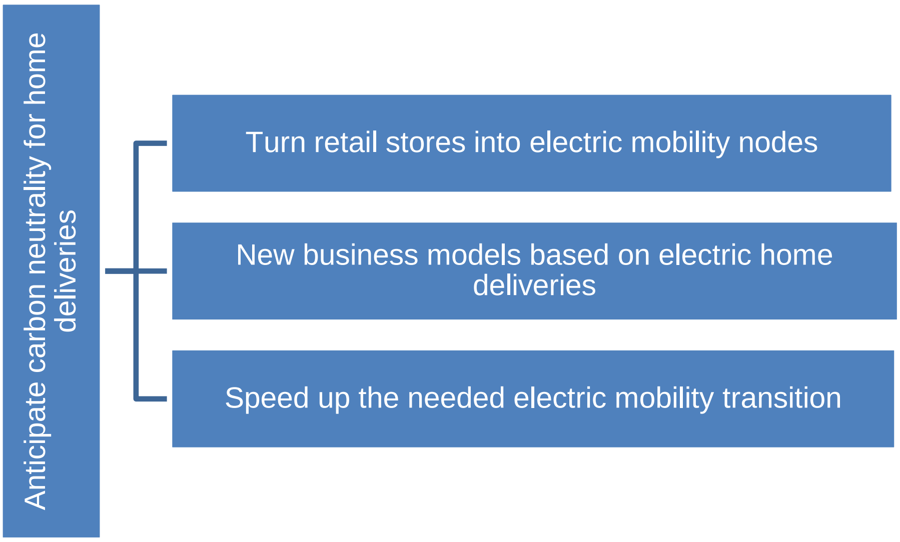


Figure 37. LL6 Porto: objectives.

During the LEAD project and within its Living Lab Sonae MC (and all the partners involved) will be focus on turning the retail stores to electric mobility nodes, to speed up the needed electric mobility transition that Sonae MC ambitioned. This decision is clearly aligned with one of the most relevant Institutional Sonae`s Group ambitions: "*We have made the commitment to anticipate the aim of carbon neutrality by ten years because, unfortunately, the planet can`t afford to wait any longe*r" stated Claudia Azevedo, CEO at Sonae, during 2020. LEAD project will contribute directly to Sonae anticipate the aim of carbon neutrality by ten years, through the organization to a needed electric mobility transition, testing also new business models to leverage our value proposition preparing.

8.2 CoP members and establishment process

Figure 38shows the members of the CoP of the LL6 Porto. On the left side, in green, it shows the internal stakeholders or LEAD partners. These members will actively participate in the development of the LEAD digital twins. On the right side, in blue, it shows the external stakeholders with a minor involvement but with an essential and valuable contribution; they will give support during the Living Lab development (e.g. data, experience, opinion) and validate the intermediate and final results.

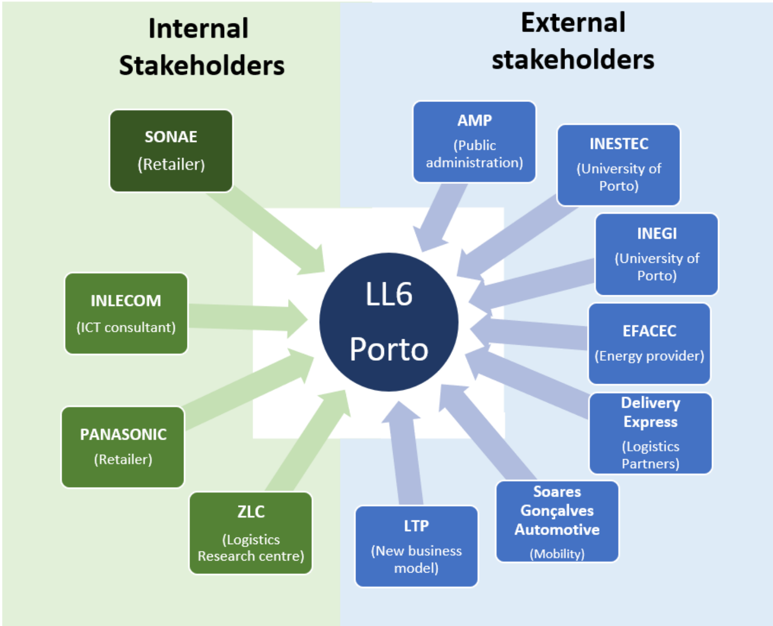


Figure 38. LL6 Porto: CoP members.

8.3 LL6 Porto future scenarios

All the scenarios are based on the “electricity” as the energy source to propel vehicles for the last mile deliveries. However, they are very singular from one each other (see Figure 39). S1 and S4 are about transforming or improving the current situation, while scenarios 2 and 3 concern new SONAE’s business models.

Figure 39. LL6 Porto: future scenarios.

8.3.1 Preliminary impact analysis of Porto Future Value Case Scenarios

This section presents the sustainability impact analysis of the four Porto LL scenarios presented above. Unlike, other LLs, Porto shared the survey with the workshop attendees, once the CoP was more engaged and familiar with the project and the scenarios to get different expert roles' perspective.

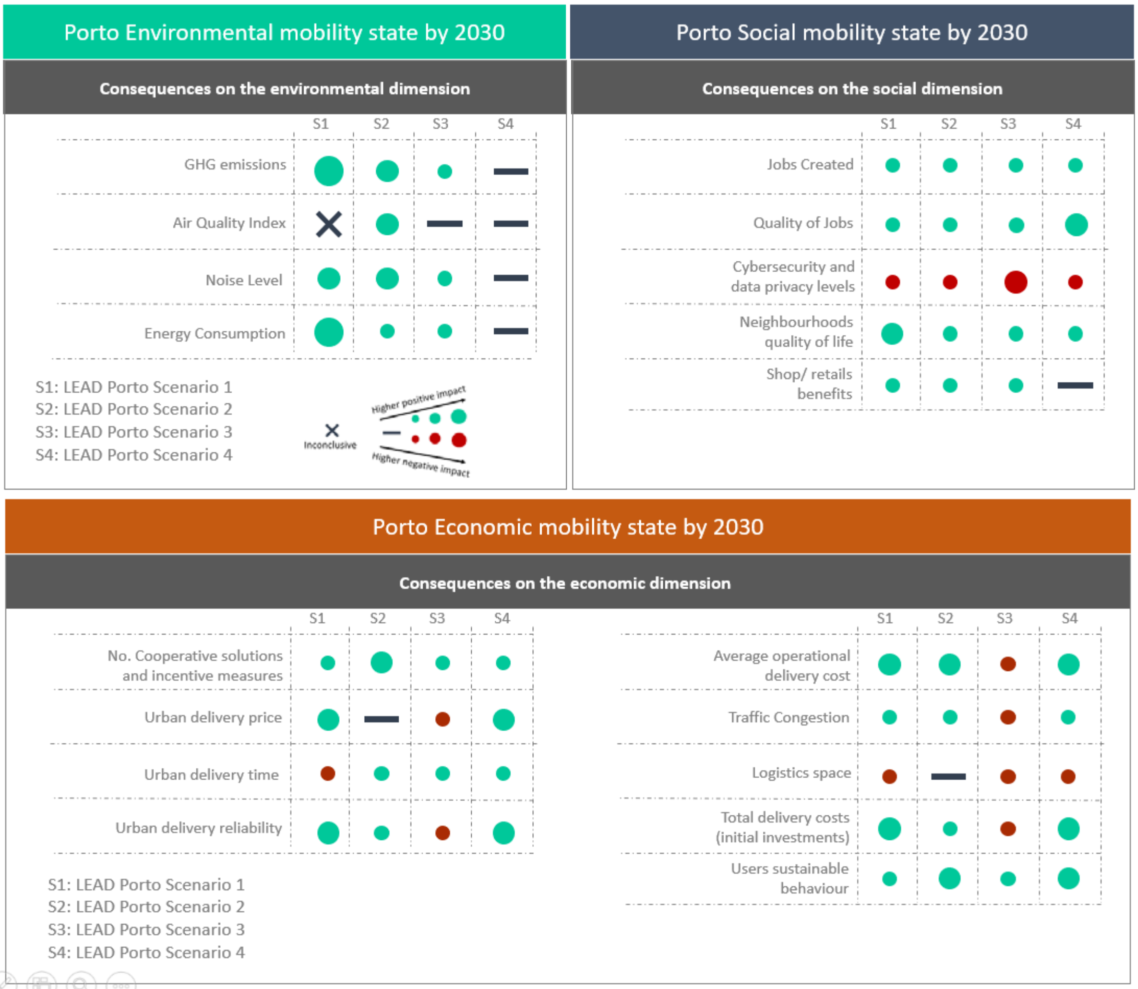


Figure 40. LL6 Porto: Consequence analysis- Scenarios comparison.

After analysing Figure 40, we observe the results for the four scenarios are very different. Indeed, they reflect and are aligned with the value cases definition divergence. S1 and S2 are the scenarios with a higher positive impact in all the CIs. Both aim to use electric vehicles for SONAE's deliveries. S1 is about transforming the existing services, and the positive consequences on the environmental dimension are higher than S2, which introduces a new service based on electricity, but the current deliveries remain the same. However, we have to point out that S1 services fleet renewal may harm the delivery time and the logistics space "*due to the added complexity".*

S3, as S2 are about proposing two new business model. S3 focuses on e-commerce while S2 on food deliveries. From the results, we observe that the e-commerce scenario consequences are not as good as S2 consequences. Indeed, S3 may negatively impact on the economic dimension.

Finally, S4 may create the highest profit for the business but with no impact on the environmental dimension.

8.3.2 Preliminary assessment of opportunities, threats, business value and feasibility of LLs scenarios

8.3.2.1 Description

The identification of the scenarios' opportunities & threats and the evaluation phases were performed with the celebration of an online workshop following the methodology proposed by the task leader (section 2.4).

The web-workshop took place on December the 16th (see Annexe 5 for further detailed information). There were 20 attendees from different organizations who provided feedback according to the role allocated and the role's interests previously identified by the LL LEAD partners (Table 14). The feasibility meaning was preliminarily defined as the level of acceptance, economic viability and realism to perform and deploy.

Table 14. LL6 Porto: Stakeholders interests/ objectives.

Role/ Stakeholder	Objectives/ interests
Public administration (AMP)	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	Reduce traffic congestion.
	Have relevant players to demonstrate the transition in the region.
R&D+i (INES TEC, INEGI)	Exchange of knowledge.
	New related initiatives and approaches.
	New projects and synergies with current ones.
Logistics (Delivery Express)	Economy efficiency.
	Improve customer satisfaction and quality of service.
	Contribution to social and environmental sustainability.
Energy (EFACEC)	Reduce the negative impacts on the environment of freight transport (Air quality, GHG, noise).
	New engineering solutions.
	New strategy focused through the logistics.
Mobility (MSG)	Exchange of knowledge
	Product development and customized solutions.
	New products & services.
Business models (LTP Labs)	Support some go-to market solutions.
	Improve economy efficiency, customer satisfaction and services quality
	Contribution to social and environmental sustainability.

8.3.2.2 Results

From the input compiled during the brainstorming phase (see Annexe 5) and the graph with scenarios feasibility and business value trade-off results[28] (Figure 12), this LLs built the analysis below:

28 The stakeholders voted the business value and feasibility defined in Table 13 and in section 2.4 using a 5-point Likert scale

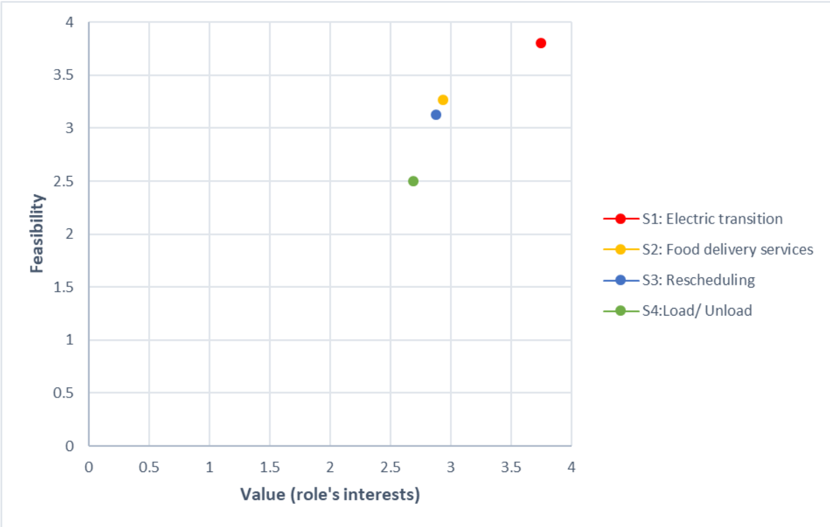


Figure 41. LL6 Porto: scenarios evaluation (feasibility vs value)

Scenario 1 is *highly aligned with the partners' perspective and public strategy*. There are some parameters that some partners think they are very important to consider from the beginning, since Sonae could *scale this approach for other areas in Portugal.* It was referred as well as the *potential to create added value* in the minds of Sonae`s customers

Scenario 2 is acknowledged with *great potential*. The lead time reduction, the capillarity of Sonae`s stores as well as the synergies with the renewable assets that Sonae had already deployed in some areas at Porto area could be strong advantages for this implementation and go-to-market approach. The *market competition* was appointed. There are many *ways to enter in this market* and Sonae is *studying* that accordingly, particularly *based on some external logistics partners*.

Scenario 3 was identified with *many advantages*. This service of course will be optimized and the DNA of this new service is *not about profitability but about level of service to SONAE's customers*. Combined with this mindset, Sonae intend to perform that based on EDVs.

Scenario 4 were appointed some threats and weaknesses related with some *operational difficulties* and manly about the discharge time could not be enough to complete charge of the batteries. Even though it is a scenario that presents *some opportunities that should be explored in the future.*

8.4 Conclusion

The work during the first months of the project was essential to identify and engage external stakeholders. It helped to define the value case scenarios and align all the stakeholders' groups interests.

The dynamic and participated workshop, made clear that the scenarios suggested by Sonae were very well evaluated by all partners making clear that all of them have great value and potential to improve the delivery services of Sonae. Moreover, all the scenarios were also well ranked on questions related to the feasibility. Furthermore, the sustainability impact analysis conducted after the workshop concurs with the workshop results.

Based on those evaluations is clear that the Porto Living Lab presents all the conditions to test, evaluate, optimize and deploy the selected scenarios that were discussed along this first phase of the LEAD project.

9 KPIs identification

The performance of the LLs will be measured through well-defined Key Performance Indicators (KPIs) to facilitate the evaluation of the LLs. One of the objectives of this Task 1.4 is to identify and outline the KPIs of the project. The specific KPIs for each LL will be defined in greater detail in WP3.

The approach for identifying KPIs consist of three steps (Figure 42).

1. The first step, "refinement", takes advantage of the list of consequence indicators (CIs) used for the sustainability impact analysis of the scenarios by providing a more detailed description of each indicators sorted according to the triple bottom line of sustainability: environmental, social and economic.
2. The second step, "local consensus & analysis", was initiated with the distribution of a questionnaire to all the LLs. They responded whether the local community of the LLs agreed with the definition of each KPI, the calculation was feasible, and they consider them relevant to the local LL community. Once all LLs have completed the questionnaire, we analysed and created the "2nd set of KPIs".
3. The third step is the "LLs global consensus & analysis". During this step, results from the previous analysis (see Annexe 6) were presented to the LLs during a proactive and efficient meeting with the LLs coordinators, along with INLECOM as LEAD technical coordinator, UPM as leader of the LLs impact and validation frameworks, and ZLC as the LEAD LLs coordinator. They discussed the definitions and relevance of the "2nd set of KPIs" during an on-line meeting. The rule for reaching the consensus was that all LLs agreed with considering a specific KPI as KPIs for the project. The result is the "final set of KPIs" detailed in Table 15. This list, which can be adapted in T3.1 to the specific characteristics of each LL, will be used to assess the effectiveness of the LLs. Additionally, from the discussion and the questionnaire analysis, a list of new suggested KPIs is included in Annexe 6.

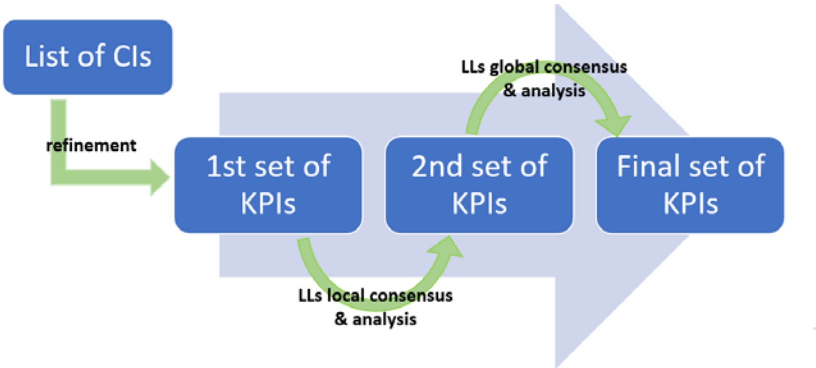


Figure 42. LEAD LL project KPIs: identification process.

Table 15. LEAD LLs project KPIs.

Sustainability dimension	KPI Name	Definition
Environmental	GHG emissions	CO_2e savings compared to the “do-nothing” scenario
	Air quality	Savings of [PM10; PM2.5; NO2; VoC] compared to the “do-nothing” scenario
	Noise quality	Decibel savings compared to the “do-nothing” scenario
	Energy consumption	Energy savings compared to the “do-nothing” scenarios
Social	Jobs created	Total number of jobs created in last mile deliveries compared to the “do-nothing” scenario
	Quality of the jobs	Qualitative evaluation of the types of jobs created by the LL according to the opinion of the CoP
	Neighbourhoods quality of life	People satisfied with the neighbourhood where they live in comparison with the “do-nothing” scenario*****.
	Users sustainable behaviour	Ideas suggested to promote more sustainable behaviour on clients and users approved by the CoP
	Cooperative solutions and incentive measures	Cooperative solutions and incentive measures promoted within the framework of the LL and approved by the CoP
Economic	Delivery cost	Delivery cost savings compared to the “do-nothing” scenario
	Idle times	Idle time changes compared to the “do-nothing” scenario
	Public space allocation	Public space required for last mile deliveries (handling, driving, parking) in comparison with the “do-nothing” scenario
	Investment cost	Total investment costs in comparison with the “do-nothing” scenario (facilities, vehicles...).
	Shop/Retails benefits (turnover)	Sales compared to the “do-nothing” scenario (turnover) ******
	Urban delivery time	Average delivery time compared to the “do-nothing” scenario
	Delivery reliability	On-time deliveries compared to the “do-nothing” scenario

** Measured as a psychometric scale employing questionnaires (Likert-scale)*
*** Survey based*

In conclusion, the set of KPIs and the process to create this list presented in this D1.4, are the basis for initiating the upcoming work in WP3 and create the final LEAD LLs KPIs for the project.

10 Summary and outlook

The work during the first months of the project was essential to build the Living Labs' foundations. First, Living Labs set the Communities of Practice (CoP) with external stakeholders from different organizations and entities that enrich the knowledge-sharing space and defined the LEAD Living Labs value case scenarios. Then a consequence analysis was performed. LLs experts filled a survey to identify the scenarios' preliminary impacts on different sustainability consequence indicators. Finally, LLs organized local workshops and bilateral meetings with the newly created CoPs. The feedback was a valuable input to consolidate the value case scenarios and align all the stakeholder groups' interests.

Additionally, the LLs participated in identifying the initial set of KPIs for the project in a two-step process. First, local Living labs members discussed internally and shared their comments with the task leaders. Second, we analysed and presented the results during a proactive meeting with all the LLs owners. The consensus-building process allowed determining an initial set of KPIs understandable by the whole community within and between the LLs. Although the list will be revisited, enhanced, and detailed in the next phase, it still can serve as a consolidated base to shape the direction and track the progress of the work done in the various LLs. Specifically, from the work developed by every LL during this first period, we observe the following insights:

LL1 Madrid aims to install a UCC close to the delivery area (LEZ) to shorten the distance and use electric vehicles. The scenarios propose a different location for the facility and combinations of measures such as parcel lockers or public-private partnerships. From the consequence analyses, we observe that the distance from the micro consolidation centre to the delivery area increases the energy needs while posing limitations to the use of some type of vehicles. At the same time, locating the micro consolidation centre close to the delivery area may benefit local stores. The workshop with a wide variety of internal and external stakeholders confirmed the results and suggests that Madrid's key factors that influence the location of the microhub are the distance, electric vehicle's autonomy, and time windows. The accessibility to the microhub is an essential element as it may constraint the supply vehicles' size. Finally, parcel lockers fit better in highly dense populated areas

LL2 Hague aims to advance towards hyperconnected logistics for the on-demand economy, the pilot aims for a step-change in the connectivity between different platforms. Each scenario will address a new layer of services of different providers to be linked through a platform connector. The consequence analysis suggests that crowd-shipping and an open hyperconnected platform can both help reduce costs. Both require high connectivity among various organizations. Actually, the larger the number of interconnected organizations, the broader the scope of cooperative solutions and users' likelihood to adopt sustainable behaviour. More specifically, while crowd-shipping may increase delivery time, having an open hyperconnected platform may help reduce the delivery time to competitive levels. The bilateral meeting concluded that all the Hague scenarios differ in complexity, ambition and impact, but all of them move towards the connection of different platforms by integrating horizontally and/or vertically the business models. With more platforms being connected, the complexity and potential threats of the pilot increase, as also do the opportunities and value for the city and consumers.

Lyon's LL3 defines the scenarios as a combination of vehicle types for parcel delivery in the designated area, including autonomous vehicles, with increasing incremental complexity. It is expected that the energy needs, logistics space and level of noise may be slightly higher in more complicated scenarios compared to less complicated ones. Moreover, the delivery time and reliability may be negatively affected by the added complexity. However, the expansion to other areas where bikes are not feasible (due to distance concerns) might justify the deployment of a combination of different vehicle types, where the autonomous ones may increase the quality of jobs. The bilateral meetings concluded Lyon's four scenarios represent a progressive approach which supports technical implementations and business models. The first 3 scenarios represent an incremental vision but geographically limited, whether the fourth on proposes a territorial extension which could help to balance the threats identified in the previous ones.

LL4 Budapest defines the scenarios combining the type of facility (fixed, mobile), time-window width and type of vehicles. The consequence analysis suggests the type of facility (mobile, fixed) and time window for deliveries are the key influencing parameters. It is expected that the broader the time window, the higher the potential improvement on the environmental dimension, while the implementation of the mobile depot may decrease traffic congestion but increase the operator's costs. The workshop determined that a wider time window would be preferable, as would be using hydrogen fuel cell trucks for supplying the minihub.

LL5 Oslo plans to explore the microhub concept furtherly and the potential for more crowd-shipping. The scenarios increase complexity gradually with various types of e-vehicles but also being served by other vehicles in non-dedicated trips and public transport (PT) commuters for smaller items. From the consequence analysis, we observe the deployment of electric vehicles is essential to decreasing the negative environmental impact of the increasing demand for last-mile deliveries. The mobility hub might help reduce traffic congestion. Finally, the combination of commuters with e-cars from the mobility hub requires good collaboration and has the potential to increase the number of cooperative solutions, while promoting the users' sustainable behaviour. A major concern that needs to be addressed is related issues of cybersecurity and data privacy. Oslo's bilateral meetings feedback shows a trade-off between feasibility and value. The complexity of the scenarios investigated is incrementally increasing and reflected in the motto "the lower feasibility, the more value".

LL6 Porto's scenarios are based on the "electricity" as the energy source to propel vehicles for the last mile deliveries. However, the scenarios are very singular from one each other. Two of them are about transforming or improving the current situation, while the other two propose new SONAE's business models. The consequence analysis suggests changing the existing delivery business model towards electricity-based ones may have the most positive impact. The workshop confirmed that Porto's most valuable and feasible scenario is highly aligned with the partners' perspective and public strategy. There are some essential parameters to scale this approach for other areas in Portugal.

Thus, the fruitful collaborations and synergies created during the first months of the project help to obtain the significant outcomes achieved so far and generated a foundation for further collaboration. It foresees valuable project results in subsequent years.

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Annexe 1: Setting up the communities of practice

Table below summarizes the projects considered to identify the relevant last mile logistics stakeholders.

Table 16 LEAD CoP Setup: Main projects analysed for identifying interested parties.

Name	Description	Why
Mobility4EU	A Coordination and Support Action funded by the European Commission, started in January 2016 and lasting until 31 December 2018. It delivers a vision for the European transport system in 2030 and an Action Plan to implement it. It focuses on user-centeredness and cross-modality and include the transport of passengers and freight.	The definition of the action plan stems from a participatory process involving a broad type of stakeholders that represent multiple societal drivers and all transport modes. It required a stakeholder analysis that mapped all relevant stakeholder groups and identified their objectives.
SPROUT	SPROUT stands for Sustainable Policy RespOnse to Urban mobility Transition. The project kicked off in September 2019 and will be running for three years. It is a project of real-life implementations, driven by six pilot cities backed by a robust academic support. The overall objective is not just to prove out particular mobility solutions, but to create real improvements in the capacity. of cities worldwide to think through their current and future mobility issues and build policy-making capacity at urban, national and international level.	The project activities rely on a multi-stakeholder model that required pilots identifying the relevant participants, either project partners or external entities, to enrich the pilots' ecosystems. SPROUT created a template to support pilots in the identification of the proper members and the definition of the type of involvement (SPROUT, 2020b).

Name	Description	Why
INDIMO	The INDIMO project is a three-year EU-funded Horizon 2020 project that aims to extend the benefits of digitally interconnected transport systems to people that currently face barriers in using or accessing such solutions. Through the co-design of the INDIMO Inclusive Digital Mobility Toolbox, the project enables developers, policy makers and service operators to always include the user perspective when dealing with digital mobility solutions. There are five pilots situated in cities or regions differing in size, spatial layout, and available transport services, either passengers or freight, that are an integral part of the co-creation process envisaged in INDIMO.	The INDIMO co-creation methodology required every pilot established a CoP. INDIMO created a template to support pilots in the identification of not only the vulnerable transport services users, but also all the relevant stakeholders involved in deploying emerging digital mobility solutions (passengers, freight). It also provided them with different strategies to contact and engage external stakeholders (INDIMO, 2020).

For supporting LEAD Living Labs in the identification, contact and recruitment of internal and external stakeholders for establishing the local Communities of Practice, an Excel file with the template in Table 17 and Table 18 were used. This document was useful to monitor the progress of each Living Lab in this specific activity.

The first column in Table 17 and Table 18 provide with a list of the type of stakeholders may participate in the LEAD Living Labs to enhance the Community of Practice. The Living Lab owners filled in the rest of the columns in orange with the name of the organization/ company, and the type of involvement (activities to participate during the project). Then, LLs updated the yellow columns depending on the progress in contacting and engaging the participants.

For contacting the local external stakeholders, a generic invitation letter (Figure 43) was defined. Living Labs adapted and translated it into the local languages.

Help us creating a more efficient and zero emissions logistics in you city, join our Community of Practice!

Dear XXX,

We received your contact information from XXX, and we would like to reach out for you because we believe you can provide a great added value to the LEAD project, a project funded by the EU that aims to improve the operation and efficiency of last mile parcel delivery, reduce costs and externalities improving decision making. For this, the LEAD Project will create a "3D *digital replica of Madrid urban environments that represent different processes, actors and their interactions" or a* digital twin.

EMT Madrid is the coordinator of the LEAD consortium and the digital twin in Madrid. It will provide valuable background as a manager of facilities that can play a key role in the field of urban logistics that performs as consolidation centres and offers additional services for low-emission mobility such as charging infrastructure for electric vehicles). Likewise, EMT will test a new mobility model for the city, including something as fundamental as urban logistics, which is key to the mobility of our cities.

We believe that you, and your organization, can offer a great added value for making low emissions adaptative last-mile logistics supporting ondemand economy through digital twins for all and to the Community of Practice (CoP) in Madrid. **That is why we would like to invite you to our first meeting on X (name location**), next November XX (possibly a day between xx and yy of November).

As a CoP-member, you will be closely involved in the project's activities for shaping last-mile deliveries efficiency in Madrid Living Lab. You will be invited to project events, interactive workshops where you can express and explore opinions and ideas, to specific interviews, to webinar debates,..

What's in it for you?

Co-creating something is not only about 'giving', it is also about 'getting back'. As a member, you will:

- Help to create more efficient and zero emissions last mile deliveries
- Gain insights in the needs of different urban stakeholders groups regarding last mile deliveries
- Have access to innovative simulation and technology tools solution advanced knowledge
- Be part of a wider European mobility network
- Get visibility within the last mile delivery solutions world through our communication channels

More information about the project can be found on the LEAD-project website and LinkedIn

We truly hope that you are willing to join the LEAD Community of Practice in X (name pilot). Please feel free to contact me in case you have any additional questions

Best wishes,

Figure 43. LEAD Invitation letter: contacting external stakeholders.

Table 17. Template for identifying, contacting, engaging stakeholders for the CoP (part 1).

Policy Makers – Mobility and logistics	Insert name of specific local stakeholder/ organisation	Describe the type of Involvement	LEAD Partners (yes/ no/ n.a)	Already contacted? (yes/ no/n.a.)	Contact strategy (description/ n.a.)	Engagement strategy (description/ n.a.)
Governmental bodies responsible for transport planning, public works, infrastructure, environment, public space, urban planning, and social services	Madrid city council	Facilitator, providing input and support and incorporating lessons learned to SULPs and SUMP. CoP.	no	**Yes**	Proposal phase	n.a.
NGOs, local associations spreading knowledge, practitioners, social and	UPM	Business models design and sustainability	yes	**n.a.**	n.a.	n.a.
Operators - Urban Logistics						
Infrastructure service providers (warehousing, consolidation centers,	**EMT Madrid**	Parking facilities owner/ manager. Mobility model	yes	**n.a.**	n.a.	n.a.
Local businesses (shippers and receivers of goods)	Panasonic	BAU vs new business models simulation. Data	yes	n.a.	n.a.	n.a.
Operators - New delivery services						
Drones and autonomous ground vehicles						
Crowdshipping						
Electric cargobikes	CityLogin	Logistic operator. Vehicles, clients and operational data provider	yes	**n.a.**	n.a.	n.a.
Same-day delivery						
Collaborated transportation and brokering						
Potential users – Residents/ consumers						
Civil society organisations representing residents (e.g. neighbourhood committees)	TBD	Participation in the CoP. Collaboration in responding surveys,	no	**no**	snowball referall, media channels advertising	TBD

Table 18.Template for identifying, contacting, engaging stakeholders for the CoP (part 2).

Policy Makers – Mobility and logistics	Insert name of specific local stakeholder/ organisation	Describe the type of Involvement	LEAD Partners (yes/ no/ n.a)	Already contacted? (yes/ no/n.a.)	Contact strategy (description/ n.a.)	Engagement strategy (description/ n.a.)
Potential Users - Local businesses/						
Federations of business owners (e.g.	? Some local commercial	CoP				
Energy providers						
Petrol station owners						
Electricity providers	?					
Providers of electric vehicle charging	?					
Developers - Data/Tech companies						
Wayfinding and route planning providers (e.g. Google Maps, Waze, TomTom, JoynJoyn)	LastMile Team	route optimisation application and route modelling	yes	**n.a.**	**n.a.**	**n.a.**
Mobility as a Service providers (e.g.						
Providers of smart technology for traffic management (e.g. Intelligent traffic						
Operators - Conventional public transport						
Operators of local transport (local bus,						
Conventional taxi companies						
Operators of national or regional transport						
Others						
Logistics research centre	ZLC	coordination of the LL	yes	**n.a.**	n.a.	n.a.
Spanish association for T&L.	UNO	Engage other courier companies and relevant	no	**yes**	n.a.	n.a.

Annexe 2: Value case scenarios definition

List of logistics measures

Table 19. LEAD Urban freight logistics measures: Typologies of agile storage & last-mile distribution schemes: consolidation.

Typologies of agile storage & last-mile distribution schemes: consolidation	
Name	**Description**
Urban Consolidation Centre	Warehouse (permanent facilities) with inventory and handling/ packaging operations.
Micro-hubs	Cross-dock permanent facilities with no inventory and minimal handling operations (change the type of vehicle/ mode of transport)
Mobile depots	Cross-dock trailers/ vans with not inventory and minimal handling operation (change the type of vehicle/ mode of transport) - last leg vehicles on board
Central Innovation District	Hub to connect consumers, operators (lockers), carriers, crowdshipping services
Logistics hotels	Multiuse, multi-storey urban warehouses (parcel operation; multimodal; parking).
Physical Internet hub	UCC with Physical Internet technology

Table 20. LEAD Urban freight logistics measures: delivery mode.

Delivery locations	
Name	**Description**
B2B - Retailer	Deliveries to commercial locations (local shops, restaurants, etc.)
B2C - Home deliveries	Deliveries to consumers at home
B2C -Nano-stores	Deliveries to consumers at commercial locations (Pickup points)
B2C - Parcel locker	Deliveries from business to consumers at parcel lockers
B2C – Door to car	Deliver the products directly to the consumer's car (based on blockchain technology)
C2C - Parcel locker	Deliveries from consumers to consumers at parcel lockers

Table 21.LEAD Urban freight logistics measures: type of vehicles charging stations.

Type of vehicles charging stations	
Name	**Description**
Retail stores with EVs charging stations	Conventional retail stores with parking services that incorporate electric charging stations for their customers.
Electric Vehicle (fast) charging points	Logistic facilities (Table 19) that incorporate EV charging points for electric delivery vehicles.
Liquified/ Compressed Natural Gas (LNG/ CNG) filling stations	Infrastructure designed for filling a vehicle with LNG/ CNG fuel. It can be part of a station for fossil fuel refuelling or an independent infrastructure.
Hydrogen filling stations	Infrastructure designed for filling a vehicle with hydrogen fuel. It can be part of a station for fossil fuel refuelling or an independent infrastructure.

Table 22. LEAD Urban freight logistics measures: type of vehicle entering in the LEZ/ distributing in the LEZ.

Type of Vehicle (distributing in the LEZ, entering the LEZ)	
Name	**Description**
Delivery robots	Autonomous vehicles used for delivering goods
Autonomous vehicles	An autonomous vehicle is one that can drive itself from a starting point to a predetermined destination in “autopilot” mode using various in-vehicle technologies and sensors, including adaptive cruise control, active steering (steer by wire), anti-lock braking systems (brake by wire), GPS navigation technology, lasers and radar[29].
Light electric freight vehicles (bikes, tricycles, scooters)	Wide variety of types with limited payloads ($0.5m^3$-$3m^3$), limited speed (<25km/h) and electrical motor assistance (typically cycling). It offers some benefits to the parcels/ mail (limited size) deliveries in cities as easy to park, manoeuvrable and do not produce emissions. It reduces vans high operating costs for low value mail items[30].
Proper Electric Van (eg. Kangoo ZE)	Electric van with up to 3 passengers and payloads between ($3.5m^3$ and $4.6m^3$)
CNG truck < 3.5 tonnes	Light vehicle truck propelled with CNG.

[29] https://www.gartner.com/en/information-technology/glossary/autonomous-vehicles
[30] https://ctl.mit.edu/sites/ctl.mit.edu/files/theses/43799155-RVeldman_Research_Fest.pdf

Table 23.LEAD Urban freight logistics measures: others.

Other categories	
Name	Description
Route optimization	Route optimization is the process of finding the most cost-effective route for a set of stops.
Eco-driving	The practice of driving in such a way as to minimize fuel consumption and the emission of carbon dioxide.
Vehicles maintenance	It refers to a practice where an automobile is serviced on a regular basis to prevent a major breakdown or the need for major repair.
Consumer incentives programmes	It is an offering for potential new business local exchange customers and to existing business local exchange customers to encourage the retention or continuation of existing services by those existing customers.
Dynamic pricing application[31]	An approach to setting the cost for a product or service that is highly flexible. The goal of dynamic pricing is to allow a company that sells goods or services over the Internet to adjust prices on the fly in response to market demands.
Off-hour deliveries	Allow to delivery freight during the off-peak hours of 7 pm to 6 am in efforts to decrease congestion and truck emission. D1.1 refers to this measure as Night deliveries
Crowdshipping	It is a delivery mode. It leverages networks of local, non-professional couriers to deliver packages to customers' doors.
Try & Buy	It is a delivery mode which involves ordering one or more online products, testing the product in a physical store, and purchasing it.
Click & collect	It is a delivery mode. It consists of a purchase of a product online and consequent pick up in the e-retailer store.
Public Private Partnership[32]	Cooperative arrangement between two or more public and private sectors, typically of a long-term nature. It involves government(s) and business(es) that work together to complete a project and/or to provide services to the population. They are an example of multistakeholder governance which is a key target of United Nations Sustainable Development Goal 17. Public–private partnerships have been implemented in multiple countries, are primarily used for infrastructure projects, such as the building and equipping of schools, hospitals, transport systems, and water and sewerage systems.
Cloud Computing, Artificial Intelligence (AI) and Data Collection through the Internet of Things (IoT)	These new technologies enable real-time data analysis that is then used in machine learning for robotic warehouse management, demand planning, peak management, and finally for inventory management (Euromonitor, 2018).

[31] *https://whatis.techtarget.com/definition/dynamic-pricing*
[3232] *https://en.wikipedia.org/wiki/Public%E2%80%93private_partnership*

Table 24. Template for defining the future scenarios (part 1)

			Baseline Scenario (AS IS)	Scenario TO BE 1	Scenario TO BE 2	Scenario TO BE 3	Scenario TO BE 4
Type of Facility to meet freight demand/ logisitcs services - split the network							
	UCC	Warehouse (permanent facilities) with inventory and handling/ packaging operations.					
	Minihubs	Cross-dock permanent facilities with no inventory and minimal handling operations (change the type of vehicle/ mode of transport)					
	Mobile depots	Cross-dock trailers/ vans with not inventory and minimal hadling operation (change the type of vehicle/ mode of transport) - last leg vehicles onboard					
	Mobile depots	Cross-dock trailers/ vans with not inventory and minimal hadling operation (change the type of vehicle/ mode of transport) - last leg vehicles not onboard		Parking Wanda Metropolitano - Height/ capacity/ electricity charging point	same as scenario to be 1	Parking Calle Mayor (characteristics)	same as scenario to be 2
	Central Innovation District	Hub to connect consumers, operators (lockers), carriers, crowshipping services					
	Logistics hotels	Multiuse, multistorey urban warehouses (parcel operation; multimodal; parking)					
	PI hub	UCC with PI technology					
Type of business delivery models							
	B2B - retailer	Deliveries to commercial locations (local shops, restaurants, etc.)					
	B2C - Home deliveries	Deliveries to consumers at home	x	x	x	x	x
	B2C -Nano-stores	Deliveries to consumers at commercial locations					
	B2C - Parcel locker	Deliveries from business to consumers at parcel lockers					
	C2C - Parcel locker	Deliveries from consumers to consumers at parcel lockers					

Table 25. Template for defining the future scenarios (part 2)

			Baseline Scenario (AS IS)	Scenario TO BE 1	Scenario TO BE 2	Scenario TO BE 3	Scenario TO BE 4
Type of vehicles - LEZ (third echelon - ditributing in the LEZ)							
	Delivery robots				x		x
	Autonomous vehicles						
	Electric vehicles (bikes, tricycles, skooters)			x		x	
Type of vehicles - LEZ (second echelon - entering in the LEZ)							
	Electric van		n.a	n.a.	n.a.	n.a.	n.a.
	Electric kangoo		n.a	n.a.	n.a.	n.a.	n.a.
	CNG truck < 3.5 tonnes		n.a	n.a.	n.a.	n.a.	n.a.
Type Electric vehicles charging stations							
	Retail stores with EDVs charging stations						
	Electric Vehicle fast charging points			Available at the parking	Available at the parking		
Type of network							
	2 -echelon		x				
	3 -echelon			x	x	x	x
other categories							
	route optimization (including the slope??)						
	eco-driving						
	vehicles mantainance						
	Consumer incentives			x		x	
	Dynamic pricing application						
	Off-hour deliveries						
	Crowdshiping	Crowdsourced delivery [that] doesn't require processing facilities or fleets of trucks, and can be scaled quickly and cheaply					
	public private partnership			x	x	x	x

Annexe 3: Sustainability impact analysis

This section further details the sustainability consequence areas, the corresponding lists of CIs shown in Figure 3 and the continuum performance of each CI.

Consequence areas and consequence indicators description

1 Sustainability dimension: Economic

1.1 *Consequence area – costs*: This area concerns the potential impacts on the delivery costs required for developing and operating the current/ future last mile scenarios. Some indicative assessment questions in order to better identify which the related impacts are: *Will this scenario require additional private investments (% of existing daily operational costs) or not?*

Table 26. Economic dimension: Cost consequence indicators description.

Consequence indicator	Description	Unit of measurement
Operational delivery cost	Daily average operational cost for a carrier	Euro (€)
Total delivery costs	Daily Average total cost (operational and non-operational)	Euro (€)

Consequence area – need of space: This area concerns the need of public space required by the last mile distribution activities. Some indicative assessment questions to better identify which will be the related impacts are : *Will this scenario require additional urban space for handling operations/ parking/ transport?*

Table 27. Economic dimension: urban space needs consequence indicators description.

Consequence indicator	Description	Unit of measurement
Logistics space	Logistical activities of storage, freight transport require substantial amounts of land. Logistics land involves distribution, logistics and warehouse (DLW), mainly includes storage land, land for external traffic and land for public facilities, of which warehousing has the greatest demand for land[33].	Square meters (m2)

1.2 *Consequence area – idle time*: This area refers to the time lost by slower speeds, longer trips or traffic jams. Some indicative assessment questions to better identify which will be the related impacts are : *Will this scenario increase the time lost by traffic congestion? Will this scenario increase the travel times? Will this scenario increase the vehicles' speed?*

[33] Woudsma, C.; Jensen, J.F. Accessibility and Freight: Transportation and Land Use—Exploring Spatial-Temporal Dimensions; Levinson, D.M., Krizek, K.J., Eds.; Emerald Group Publishing Limited: Bingley, UK, 2005;pp. 267–295.

Table 28. Economic dimension: idle time consequence indicators description.

Consequence indicator	Description	Unit of measurement
Traffic congestion	Daily average time lost caused by congestion.	Minutes (min)

1.3 *Consequence area – urban freight transport service level*: This area refers to the service level of the urban freight transport services providers. Some indicative assessment questions to better identify which will be the related impacts are : *Will this scenario increase the time required for delivering goods in the city? Will this scenario increase the number of parcels delivered in time and good conditions?*

Table 29. Economic dimension: urban freight transport service level indicators description.

Consequence indicator	Description	Unit of measurement
Urban delivery price	Average price for last mile deliveries per parcel.	Euros per parcel (€/ parcel)
Urban delivery time	Average time required for delivering a parcel	Minutes per parcel (€/ parcel)
Urban delivery reliability	Daily average percentage of parcels delivered in time and good conditions	Percentage of packages delivered in time and good conditions compared to the total number of packages (daily)

1.4 *Consequence area – willingness to collaborate among different players*: This area refers to the level of influence or social incentive/ pressure to collaborate and promote users' sustainable behaviour. Some indicative assessment questions to better identify which will be the related impacts are : *Will this scenario increase the number of ideas suggested to promote more sustainable behaviour on clients and users approved by them? Will this scenario increase the number of cooperative solutions and incentive measures ?*

Table 30. Economic dimension: willingness to collaborate among different players consequence indicators description.

Consequence indicator	Description	Unit of measurement
Users sustainable behaviour	Number of ideas suggested to promote more sustainable behaviour on clients and users approved by them.	Number (#)
Cooperative solutions and incentive measures	Number of solutions and incentive measures offered collaboratively	Number (#)

2 Sustainability dimension: Environmental

2.1 *Consequence area – climate change*: This area concerns the changes related to climate change.

Table 31. Environmental dimension: Climate change consequence indicators description.

Consequence indicator	Description	Unit of measurement
Greenhouse gas emissions (GHG)	CO2 equivalent or GHG emission produced by urban distribution activities	% of GHG emissions produced by last mile operations

2.2 *Consequence area – air quality index (AQI)*: This area concerns the level of increase/ decrease of the air quality index of a city as a result of urban logistics operations. The AQI is a number used to report the quality of the air on any given day. The index is based on measurement of particular matter (PM10 and PM2.5), Ozone (O3), Nitrogen dioxide (NO2) and Sulphur Dioxide (SO2)

Table 32. Environmental dimension: air quality consequence indicators description.

Consequence indicator	Description	Unit of measurement
Air quality index	The amount of expected increase/ decrease or the air quality index[34].	European air quality index

2.3 *Consequence area – Noise*: This area concerns the amount of expected increase/ decrease of the noise emissions in a city, as a result of urban logistics operations.

Table 33. Environmental dimension: noise consequence indicators description.

Consequence indicator	Description	Unit of measurement
Noise	Noise level produced by logistics operation, for both day and night	Decibels

2.4 *Consequence area – Energy needs*: This area refers to the expected increase/ decrease of energy to perform logistics operations (transport, handling).

Table 34. Environmental dimension: energy consumption indicators description.

Consequence indicator	Description	Unit of measurement
Energy consumption	Average level of energy consumption on a daily basis from any source for logistic operations	Litres/ day KwH/ day

3 Sustainability dimension: Social

3.1 *Consequence area – Jobs created*: This area concerns the potential changes to the structure, types of employment and to the social security levels and benefits. Some indicative assessment questions to identify which are the related impacts are: *Do you expect changes in the current levels of urban mobility employment? Do you expect changes in the current levels of urban mobility employment?*

[34] https://www.eea.europa.eu/highlights/european-air-quality-index-current

Table 35. Social dimension: Employment consequence indicators description.

Consequence indicator	Description	Unit of measurement
Quality of the jobs	Full-time employment in urban freight transport	number of employees
Quality of the jobs	Gig economy[35] (external contractor) employment	% of total employees

3.2 <u>*Consequence area – Data privacy and cybersecurity concerns*</u>: This area concerns the potential data privacy and cybersecurity requests from consumers due to the increase level of digital technology for last mile deliveries, including drones, autonomous vehicles, mobile applications asking for personal data and bank accounts. Some indicative assessment questions to identify which are the related impacts are: *Do you expect more people will be concerned of the increased level of drones/ autonomous vehicles; Do you expect more people will be concerned of how their personal information and bank accounts are used, stored and protected?*

Table 36. Social dimension: Data privacy and cybersecurity concerns consequence indicators description.

Consequence indicator	Description	Unit of measurement
Cybersecurity and data privacy level	Number of cybersecurity and data privacy requests	Number of requests (#)

<u>*Consequence area – Social acceptance*</u>: This area concerns the level of acceptance from local stores and citizens (neighbourhoods). Some indicative assessment questions to identify which are the related impacts are: *Do you expect an increase in local stores'/ retail's sector turnover? Do you expect the changes will increase the neighbourhood liveability?*

Table 37. Social dimension: Social acceptance consequence indicators description.

Consequence indicator	Description	Unit of measurement
Neighbourhoods quality of life	Number of people satisfied with the area where they live	% citizens
Shop/ retails benefits	Number of local stores/ retails increasing the daily sales (turnover)	% local stores increasing sales

[35] *https://www.eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/gig-economy*

The Consequence matrix

The following table presents the final list of consequence areas and indicators along with their continuum performance. The second column in the table indicated the sources that were used for selecting the most appropriate continuum performance for each indicator.

Table 38 . Environmental dimension: CIs continuum performance.

Expected impact on	Source	Increase			Not impact	Decrease		
		High	Medium	Low		Low	Medium	High
Environmental dimension: Climate change consequence area								
GHG emissions	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%
Environmental dimension: Air quality index consequence area								
Air quality Index	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%
Environmental dimension: Noise consequence area								
Noise	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%
Environmental dimension: Energy needs index consequence area								
Energy consumption	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%

Table 39.Social dimension: CIs continuum performance.

Expected impacto n	Source	Increase			Not impact	Decrease		
		High	Medium	Low		Low	Medium	High
Social dimension: Employment consequence area								
Jobs created	LEAD document of agreement Part B, page 10, table 10	<5%	5-2.5%	<2.5%	-	<2.5%	5-2.5%	<5%
Quality of the jobs		>50%	25-50%	<25%		<25%	25-50%	>50%
Social dimension: Data privacy and cybersecurity concerns consequence area								
Cybersecurity and data privacy level	Consensus building among the LEAD partners (T1.4)	>50%	25-50%	<25%		<25%	25-50%	>50%
Social dimension: Social acceptance consequence area								
Neighbourhoods quality of life	LEAD document of agreement Part B, page 10, table 10	>50%	25-50%	<25%		<25%	25-50%	>50%
Shop/ retails benefits		>50%	25-50%	<25%		<25%	25-50%	>50%

Table 40. Economic dimension: CIs continuum performance.

Expected impact n	Source	Increase			Not impact	Decrease		
		High	Medium	Low		Low	Medium	High
Economic dimension: Costs consequence area								
Operational delivery cost	LEAD document of agreement Part B, page 10, table 10	>5%	1-5%	<1%	-	<1%	1-5%	>5%
Total delivery cost	Consensus building among the LEAD partners	>10%	5-10%	<5%		<5%	5-10%	>10%
Economic dimension: Idle time consequence area								
Traffic congestion	LEAD document of agreement Part B, page 10, table 10	>20%	10-20%	<10%		<10%	10-20%	20%
Economic dimension: Urban space allocation consequence area								
Logistic space	LEAD document of agreement Part B, page 10, table 10	>10%	5-10%	<5%		<5%	5-10%	>10%
Economic dimension: Willingness to collaborate among different players consequence area								
Users sustainable behaviour	LEAD document of agreement Part B, page 10, table 10	>2	2	1				
Cooperative solutions and incentive measures		>5	5-3	<3				
Economic dimension: urban freight transport service level consequence area								
Urban delivery price	LEAD document of agreement Part B, page 10, table 10	>5%	5-1%	<1%		<1%	1-5%	>5%
Urban delivery time		>5%	5-1%	<1%		<1%	1-5%	>5%
Urban delivery reliability		>10%	10%-5%	<5%		<5%	5-10%	>10%

Survey

Example with the LL2 Hague. It only includes the questions for the S1, as the same questions were repeated for the four scenarios. They only changed the narrative texts. The other LLs used the same structure but adapting the description of the scenarios to the LLs text.

LEAD Consequence Analysis Questionnaire - T1.4 | LL2 The Hague

LEAD project will create Digital Twins of urban logistics networks in six cities, to support experimentation and decision making with on-demand logistics operations in a public-private urban setting. Innovative solutions for city logistics will be represented by a set of value case scenarios, that address the requirements of the on-demand economy while aligning competing interests and creating value for all different stakeholders.

This survey is conducted in the framework of the EU-funded LEAD project (https://www.leadproject.eu/).

Your input is vital to our study. We guarantee that your data and answers will be kept anonymous and will only be used for the purposes of this research and will not be shared with other entities, in full compliance with GDPR regulation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 861598

Why this survey?

The objective of this questionnaire is to help the LEAD pilot in the Hague to define strategies to ameliorate the negative impacts of the increasing freight transport flows in the city.

For this, the pilot has drawn four future scenarios as a result of the combination of different measures. Once these scenarios are defined, the LEAD project will simulate 3D digital replicas of the Haghe urban environments that represent a set of processes, actors and their interactions, and evaluate the impacts.

As a preliminary step to create the 3D replicas, the LEAD pilot in the Hague needs to understand the expected sustainability impacts of each scenario. Possible effects include positive and negative outcomes in terms of urban mobility system's economic, environmental and social dimensions.

The objective of this survey is to ask the logistics community in the Hague for his valuable opinion on how the effects of the future scenarios will impact on the city.

How this survey works?

The survey has four sections representing each one of the planned scenarios that ask for the same type of inquests. Each section begins with a description of the future scene. Then, the questionnaire contains four segments with a list of questions. First, it addresses the environmental impacts; secondly the social effects, and finally, the economic dimension split into two connotations, cost and behaviour.

For every question, you have to select only one of the options available. These options are the following:

1) Not applicable - If you think the scenario has nothing to do with the questions
2) Highly decrease – If you think the scenario will decrease the effect requested highly
3) Moderately decrease- If you think the scenario will decrease the effect requested moderately
4) Slightly decrease– If you think the scenario will decrease the effect requested slightly
5)Slightly increase– If you think the scenario will increase the effect requested slightly
6) Moderately increase- If you think the scenario will increase the effect requested moderately
7) Highly increase – If you think the scenario will increase the effect requested highly

Please, use the link below to consider the quantitative values corresponding to the qualitative scale values above. https://drive.google.com/file/d/1xMJ1esFed93bFLOQdqB5I4_EAQmPMkBE/view?usp=sharing (https://drive.google.com/file/d/1xMJ1esFed93bFLOQdqB5I4_EAQmPMkBE/view?usp=sharing)

Just in case you do not know the response or do not understand the question, please, leave the question empty.

Once we obtain all the responses, we will analyse them and discuss the results in local workshops, where we will have the chance to meet with additional stakeholders to enhance this initial definition, and identifying the opportunities and threats, and key performance indicators.

Look forward to receiving your valuable feedback!

For any questions and further clarification you may need, please do not hesitate to contact us:

LL leader
Beatriz Royo (broyo@zlc.edu.es (mailto:broyo@zlc.edu.es))
Carolina Ciprés (ccipres@zlc.edu.es (mailto:ccipres@zlc.edu.es))

Thank you for your valuable collaboration.

1

Please, indicate the name of the company/organization. If you are a partner of the LEAD project, please, include your role in the pilot in the Hague. *

2

Please, indicate your email address. *

3

By clicking the button "Yes", you consent LEAD consortium members to store and treat your data only with project execution purposes. Your data will not be given to third parties, unless there is a legal obligation. *

○ Yes

SCENARIO 1: NIMBER's PLATFORM

To mitigate the urban freight externalities and get a more efficient logistic this scenario suggests:

1) Implement crowdshipping within the CID.

4

EXPECTED ENVIRONMENTAL IMPACT

How will the new scenario impact on

	Not applicable	Highly decrease	Moderately decrease	Slightly decrease	Slightly increase	Moderately increase	Highly increase
the GHG emission (kg CO2e)?	○	○	○	○	○	○	○
on the local air quality (PM, Nox and other pollutants daily average in µg/m3)?	○	○	○	○	○	○	○
on the noise levels (Lden daily decibel level for day, evening and night periods)?	○	○	○	○	○	○	○
on the energy consumption (fuel, elecrtricity daily consumption for moving vehicles or logistics operations)?	○	○	○	○	○	○	○

5

EXPECTED SOCIAL IMPACT

How will the new scenario impact on

	Not applicable	Highly decrease	Moderately decrease	Slightly decrease	Slightly increase	Moderately increase	Highly increase
the current levels of urban freight transport (Last mile deliveries) employment (%)?	○	○	○	○	○	○	○
jobs quality (% independent contractors with no insurance & benefits)?	○	○	○	○	○	○	○
the level of cybersecurity and data privacy people concerns (number of peoples requesting for more secure drones, ordering/ payment methods, identification methods)?	○	○	○	○	○	○	○
the neighbourhoods quality of life (number of people satisfied with the neigbourhood)?	○	○	○	○	○	○	○
the local shops/ retails daily number of sales?	○	○	○	○	○	○	○
the user acceptance (number of citizens satisfied with the new scenario)?	○	○	○	○	○	○	○

6

EXPECTED ECONOMIC IMPACT- COST

How will the new scenario impact on

	Not applicable	Highly decrease	Moderatel ydecrease	Slightly decrease	Slightly increase	Moderatel y increase	Highly increase
the logistics service provider/ carrier's delivery costs?	○	○	○	○	○	○	○
the traffic congestion (daily lost time driving in the area)?	○	○	○	○	○	○	○
the public space required for logistics operation (daily pubic space required for handling operations, parking, driving - m2) ?	○	○	○	○	○	○	○
the logistics service provider/ carrier's total delivery costs?	○	○	○	○	○	○	○

7

EXPECTED ECONOMIC IMPACT - BEHAVIOUR

How will the new scenario impact on

	Not applicable	Highly decrease	Moderately decrease	Slightly decrease	Slightly increase	Moderately increase	Highly increase
the number of ideas suggested to promote more sustainable behaviour on clients and users approved by them?	○	○	○	○	○	○	○
the number of cooperative solutions and incentive measures approved by the majority of stakeholders participating in last mile (operatos, retails, policymakers)?	○	○	○	○	○	○	○
the average urban delivery price per parcel/package/order (%)?	○	○	○	○	○	○	○
the urban delivery time (average time required for deliverying a parcel/package/order)?	○	○	○	○	○	○	○
the daily number of packages deliver in time and good conditions?	○	○	○	○	○	○	○

8

Comments about this Scenario

Please, consider this section if you want to include any clarification about your responses indicating the dimension.

Annexe 5: Living labs details

LL1 Madrid: detailed information

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: Microplatform in San Fernando de Henares

In scenario 1, there are four CIs where the consensus was not reached (Figure 44) further detailed below.

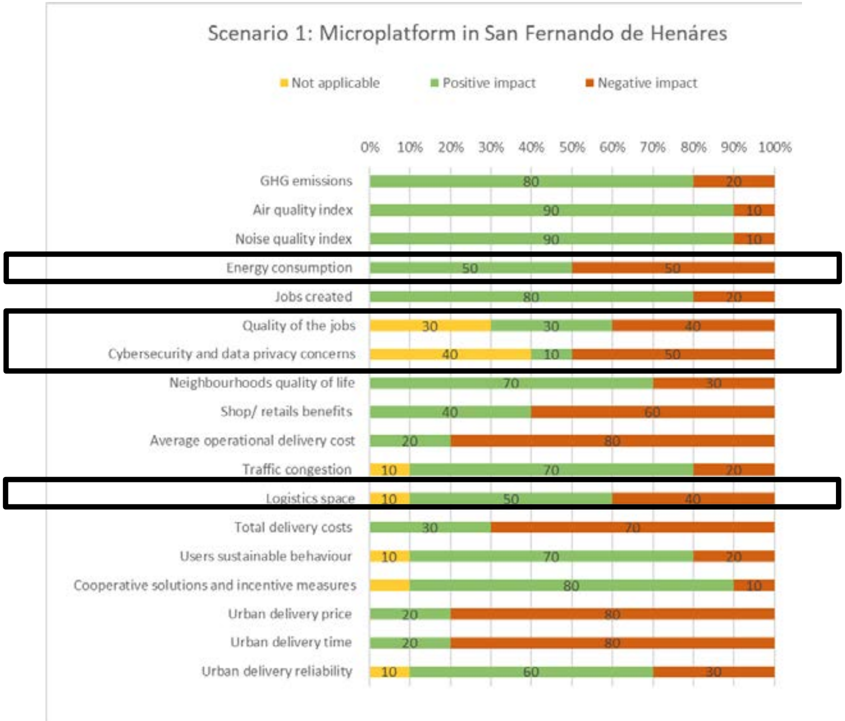

Figure 44. LL1 Madrid consequence analysis (scenario 1, overall results)

As shown in Figure 45, most stakeholders expect a moderate decrease of the GHG emissions and noise, and a medium improvement of the air quality. About the energy consumption, the consensus rule is not applicable as the median value does not provide a clear result.

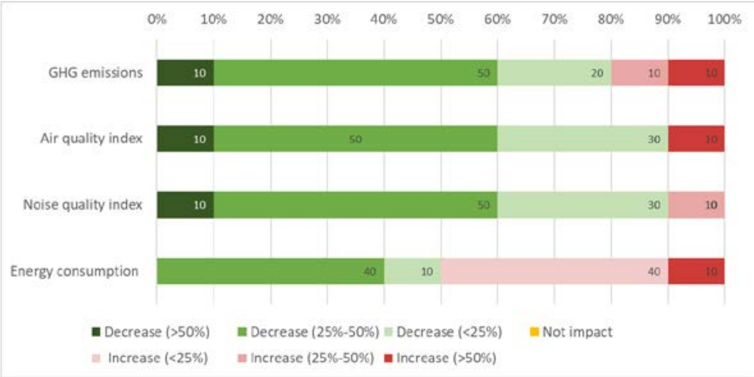

Figure 45. LL1 Madrid: Consequence Analysis - Environmental dimension (Scenario 1)

About the social dimension, jobs created and neighbourhood quality of life may slightly improve, while cybersecurity concerns and shop retails benefits may get lightly worse by 2030 increase. Finally, the quality of jobs, the median value indicates that most participants think this CI will remain as it is.

Figure 46. LL1 Madrid: Consequence Analysis - Social dimension (Scenario 1).

The majority of the stakeholders think this scenario will negatively impact on the price, time, operational and total delivery cost while it will have a light positive effect on the rest of the economic CIs.

Figure 47. LL1 Madrid: Consequence Analysis - Economic dimension (Scenario 1).

Table 41.LL1 Madrid: Consequence Analysis - Comments (Scenario 1)

Comments
Due the location out of the city, stakeholders may have expected perhaps an increase in the environmental performance due to alternative fuels, but not significant changes regarding the operation or impact on traffic.

Scenario 2: Microplatform in the city centre

Based on the consensus criteria (over 60% of the respondents agreed on the impact direction (either negative or positive), there are only two CIs where the consensus was not reached (figure below).

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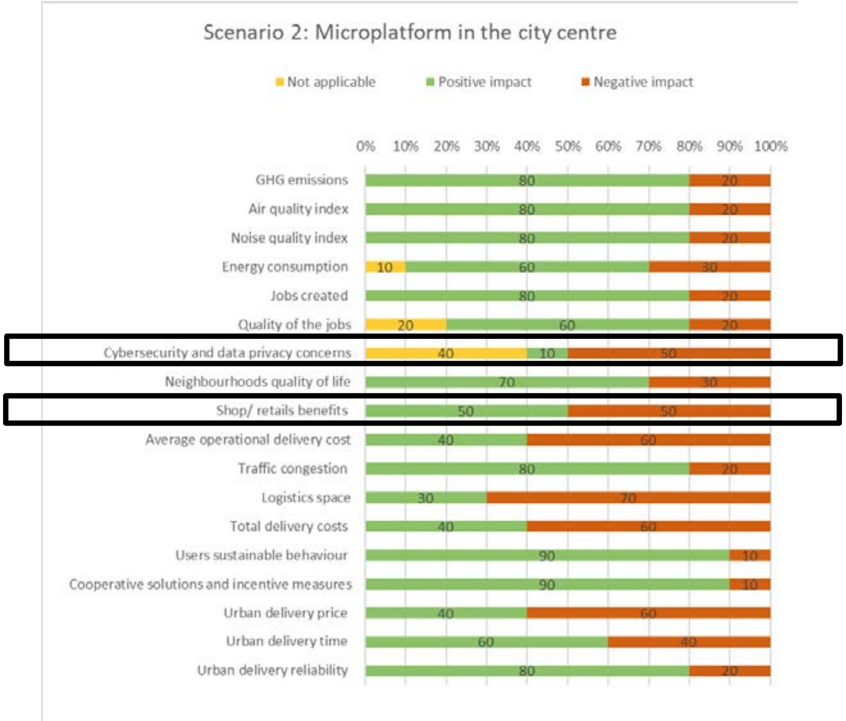


Figure 48. LL1 Madrid consequence analysis (scenario 2, overall results)

In this scenario, most stakeholders expect that all the environmental CIs moderately improve.

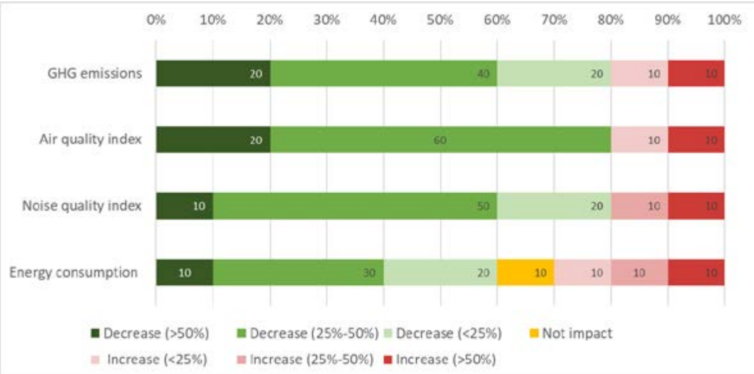


Figure 49. LL1 Madrid: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, jobs created, quality of jobs, it appears to be a slight positive impact with the new scenario; neighbourhoods' life quality may moderately increase. The cybersecurity concerns may slightly increase by 2030. Finally, for the local stores benefits, the consensus rule is not applicable as the median value does not provide a clear result.

Figure 50. LL1 Madrid: Consequence Analysis - Social dimension (Scenario 2).

The majority of the stakeholders think that this scenario will negatively impact on the price, operational and total delivery cost and logistics space, while it will have a small positive effect on the rest of the economic CIs.

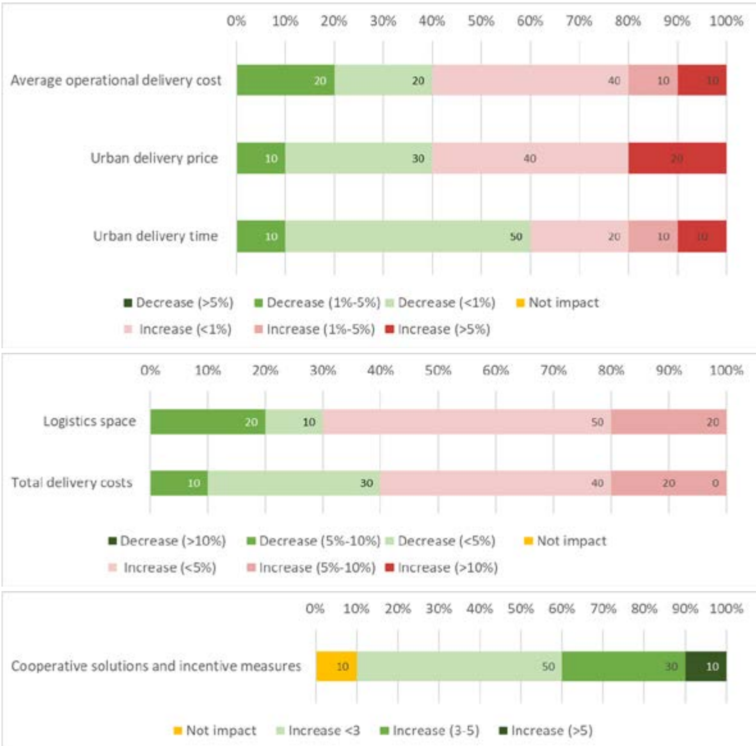


Figure 51. LL1 Madrid: Consequence Analysis - Economic dimension (Scenario 2).

Table 42.LL1 Madrid: Consequence Analysis - Comments (Scenario 2)

Comments
As it happened with the previous scenarios, there are parameters difficult to determine (for instance, the quality of the employment)

Scenario 3: Microplatform in M30

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive), there are only two CIs where the consensus was not reached (figure below).

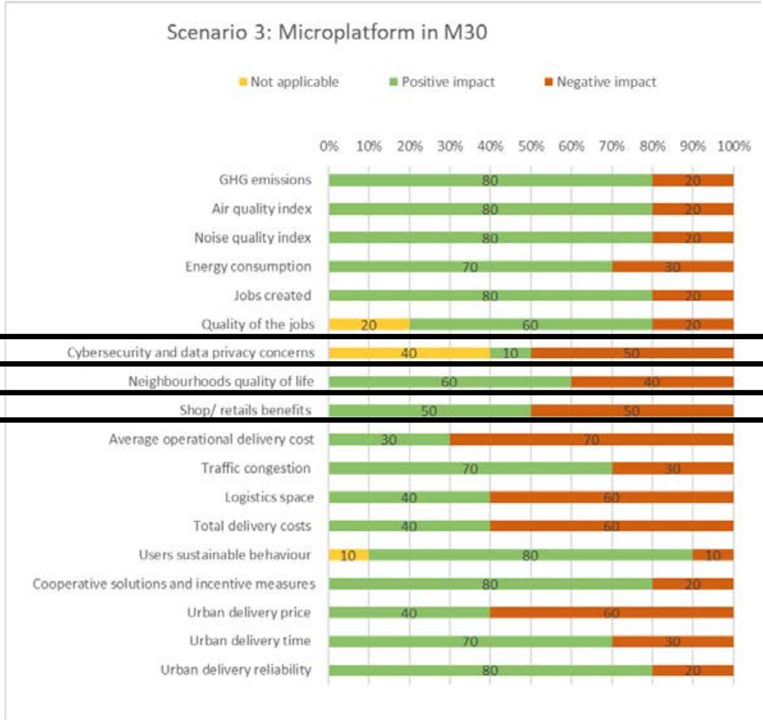


Figure 52. LL1 Madrid consequence analysis (scenario 3, overall results)

In this scenario, GHG emission and AQI may moderately improve. The noise and energy consumption will slightly decrease.

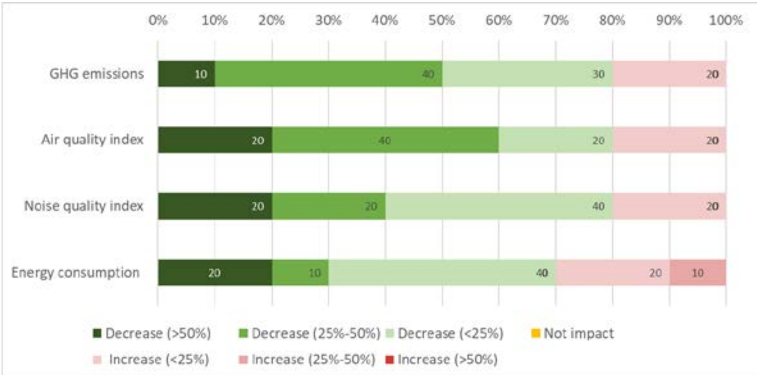


Figure 53. LL1 Madrid: Consequence Analysis - Environmental dimension (Scenario 3)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario. However, cybersecurity concerns would slightly increase by 2030. About the local stores benefits, the consensus rule is not applicable as the median value does not provide a clear result.

.

Figure 54. LL1 Madrid: Consequence Analysis - Social dimension (Scenario 3).

Most stakeholders think this scenario will negatively impact on the price, operational and total delivery cost and logistics space while it will have a light positive effect on the rest of the economic CIs.

Figure 55. LL1 Madrid: Consequence Analysis - Economic dimension (Scenario 3).

Table 43.LL1 Madrid: Consequence Analysis - Comments (Scenario 3)

Comments
"It happens the same as previously. The GHG emissions may be reduced locally but overall may increase depending on the energy mix used for charging veh"

Scenario 4: Microplatform close to the city centre

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are only two CIs where the consensus was not reached (figure below).

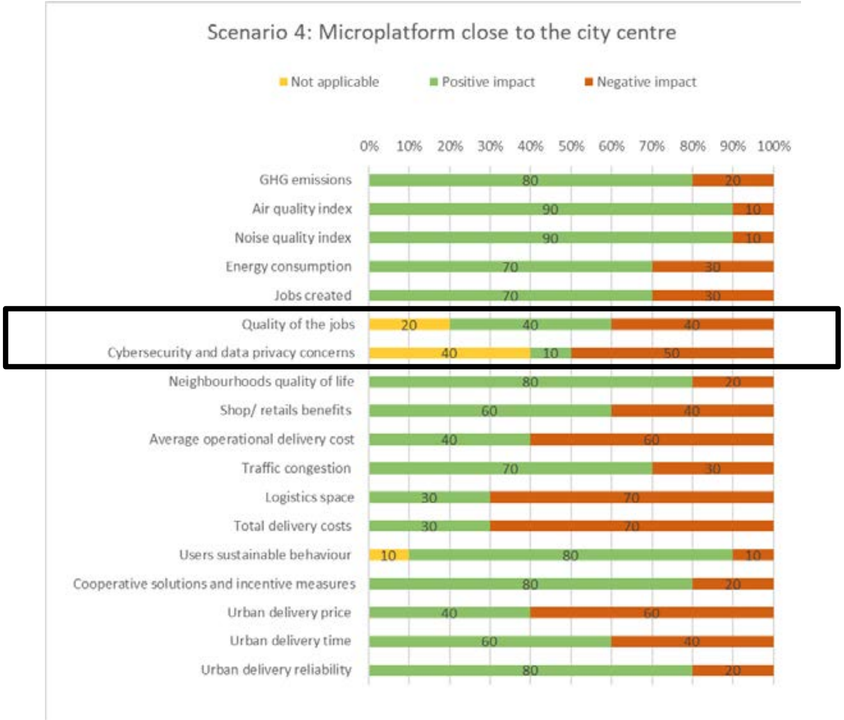


Figure 56. LL1 Madrid consequence analysis (scenario 4, overall results)

In this scenario, GHG emission and AQI may moderately improve. The noise and energy consumption will slightly decrease.

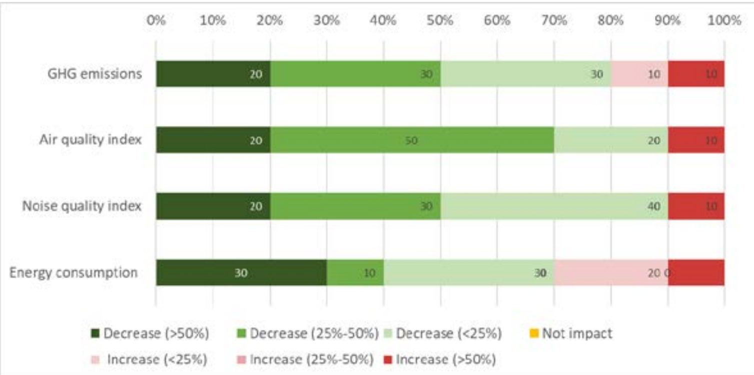


Figure 57. LL1 Madrid: Consequence Analysis - Environmental dimension (Scenario 4)

About the social dimension, jobs created and neighbourhoods' quality of life may get a slightly positive impact with the new scenario, while local stores may moderately increase their sales. Cybersecurity concerns may slightly increase by 2030.

Figure 58. LL1 Madrid: Consequence Analysis - Social dimension (Scenario 4).

The majority of the stakeholders think this scenario will negatively impact on price, operational and total delivery cost and logistics space while it will have a light positive effect on the rest of the economic CIs.

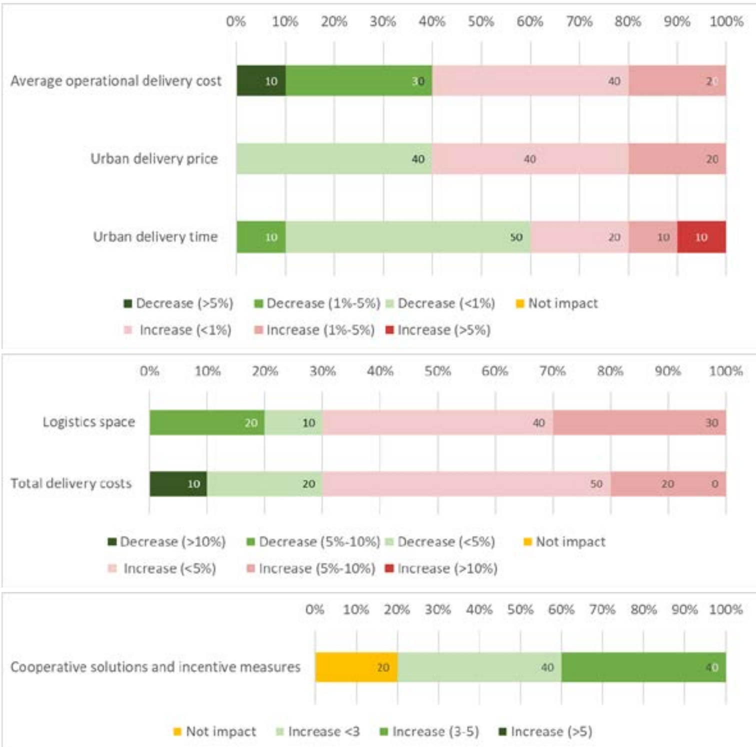


Figure 59. LL1 Madrid: Consequence Analysis - Economic dimension (Scenario 4, part 6).

Table 44.LL1 Madrid: Consequence Analysis - Comments (Scenario 4)

Comments
"Very similar to the number 2 but just allowing bigger vehicles to enter the facility. Same concerns regarding the previous comments "

Workshop

Development and implementation process

LL1 Madrid organized its second web-workshop (due to the COVID-19 pandemic) with the local stakeholders and the CIVINET[36] network on December 17th. The aim of this workshop was to revalidate the value case scenarios and support the identification of the most valuable one, with a threefold objective.

1. Consolidate external stakeholders' engagement,
2. Understand the opportunities & threats of the four value case scenarios from the different perspectives of the LL1 Madrid key stakeholders' groups,
3. Evaluate the business value and feasibility of the four value case scenarios from the viewpoints of different stakeholders' groups.

Before the workshop, the key stakeholders' groups along with their interests/ objectives in redesigning the urban last mile deliveries were identified (Table 3).
The attendees were contacted by email. An invitation was sent to the LL1 CoP members who had already participated in the LL1 kick off meeting celebrated on November the 17th, the CIVINET network and other relevant LEAD partner contacts. The key stakeholders' groups and the objectives were built upon the experience of the LL1 LEAD partners and after several iterations for preparing the workshop materials.

[36] *https://civitas.eu/civinet/civinet-espa%C3%B1a-y-portugal*

In parallel, the LL LEAD partners worked in defining and preparing the materials to present and validate the value case scenarios with the CoP. For this, a ppt with clear description of the activities and the scenarios were developed in Spanish. Every scenario was coded with colour to facilitate stakeholders' scenarios identification (Figure 60).

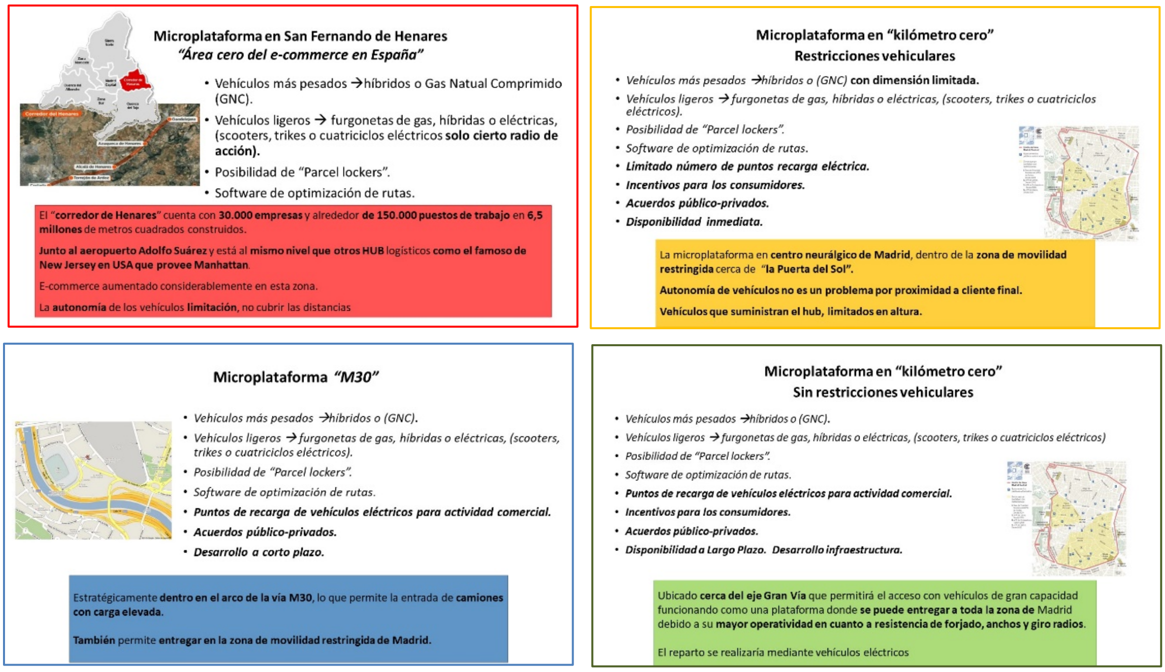


Figure 60. LL1 Madrid: Workshop scenarios description and colour-code.

For dynamizing the workshop and facilitating the compilation of required information, the LL used the ideaClouds [37]tool. The number of attendees with permission to use this online platform is limited to 20, therefore they were informed about the limited capacity in advance. Once the final list of participants was confirmed and they have given their consent to introduce the email account in the tool, they received an email to access to the platform.

The ideaClouds tool allowed the LL to design a two-phases workshop. During the first phase or brainstorming phase, the participants were requested to introduce arguments concerning the positive or negative (opportunities and threats) aspects of each scenario with notes on a shared board, and according to the allocated role. After providing feedback during 6 minutes per scenario, the notes were organized and presented to the attendees. Finally, during the second phase or evaluation phase, participants rated the business value and the feasibility of each scenario according to the role allocated and the interests identified before the workshop (Table 3). They were able to include any additional comment or suggestion to justify the score or align their interests.

Attendees

There were 17 attendees from 12 different entities and organizations (Table 45). As the objective was to compile inputs from all the roles described in Chapter 3, the workshop organizers uniformly allocated the missing roles to the workshop attendees. After the workshop, a Spanish report was

[37] https://www.ideaclouds.net/

shared with the whole CoP to give the opportunity to all the members to provide additional feedback to the results.

Table 45. LL1 Workshop attendees' organizations/ companies.

AEDISMA	Asociación de Empresas De Distribución de la Comunidad De Madrid Distribution companies association of the Community of Madrid
AYUNTAMIENTO DE LEON	Leon City Hall (Mobility Department)
CITYLOGIN	Sustainable urban freight distribution company.
EMT	Empresa Municipal de Transportes de Madrid Municipal Transport Company of Madrid
FENANDISMER	Federación Nacional de Asociaciones de Transporte de España Spanish federation of transport associations
AYUNTAMIENTO DE MADRID	Madrid City Hall (Mobility and environment department)
LAST MILE	Software developer specialized in last-mile digital transformation
MUNICIPIO DE BRAGA	Braga's City Hall (Smart, sustainable and inclusive mobility department -Portugal)
ML CLUSTER	Logistic and mobility cluster (MLC ITS Euskadi)
UPM	University of Madrid
UNO LOGISTICA	Transport and logistics companies organization
ZARAGOZA LOGISTICS CENTER	Supply chain and logistics education and research centre.

Results: Brainstorming phase

Table 46 ompiles the most relevant contributions by attendees during the brainstorming phase. The inputs are classified by role, scenario and type of argument (opportunity and threat). Every scenario is coded with the colour used during the workshop.

From the table, we observe the distance from the UCC to the delivery area is the fundamental factor for all the scenarios and stakeholders. The majority of stakeholder groups think the longer the distance between the UCC and the target delivery area, the lower the possibility to use eco-friendly vehicles. For the riders, the distance and the availability of dedicated or safe lanes are essential. The location, far away from the delivery area, has some advantages for all the actors such as: more and cheaper space available for the facility and electric charging points, reduction of the number of HGV within the city, less noise, less congestion and higher load factors (tkm). The technical specifications of the location are essential attributes for making a choice (policymakers, operator). About other measures such as parcel lockers, it is well-accepted by all the stakeholders. For the operators, the closest it is to the target area, the better. The complexity of defining public-private partnerships are considered a threat by the operators. Finally, the incentives are well accepted by the users.

Table 46. LL1 Madrid: Opportunities and threats.

<table>
<tr><th></th><th colspan="2">Scenario 1</th><th colspan="2">Scenario 2</th><th colspan="2">Scenario 3</th><th colspan="2">Scenario 4</th></tr>
<tr><th></th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th></tr>
<tr><td rowspan="3">Policymaker</td><td>Facility close to the delivery area is a good idea.</td><td>Long distance: limit for the use of eco-friendly vehicles.</td><td>Distance close to the delivery area.</td><td>Difficult to provide access to the electric supply network.</td><td>Distance quite close to the delivery area.</td><td>Lack of locations with enough capacity and required accessibility.</td><td>Distance close to the delivery area.</td><td>Complex coordination to avoid a large number of vehicles.</td></tr>
<tr><td rowspan="2">Location outside the city more attractive for setting charging station (cheaper, space)</td><td>Distance from the delivery area.</td><td rowspan="2">Short distance: facilitates the use of eco-friendly vehicles.</td><td>Find a facility with enough capacity.</td><td>Short distance: facilitates the use of eco-friendly vehicles.</td><td>More convenient for the users.</td><td>Similar to S2 but with more accessibility to HGV.</td><td>Similar to S2: Find a location with enough capacity.</td></tr>
<tr><td></td><td>Difficult access to HGV.</td><td>Easy access to HGV to supply the UCC.</td><td>Reduce the number of HGV.</td><td></td><td></td></tr>
</table>

<table>
<tr><th></th><th colspan="2">Scenario 1</th><th colspan="2">Scenario 2</th><th colspan="2">Scenario 3</th><th colspan="2">Scenario 4</th></tr>
<tr><th></th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th><th>Opportunity</th><th>Threat</th></tr>
<tr><th rowspan="4">User</th><td rowspan="4">No disturbances (outside the city)</td><td>Long distances do not allow to receive 100% eco-friendly services.</td><td>Shorter distances allow to receive 100% eco-friendly services.</td><td rowspan="4"></td><td rowspan="4">Avoid the access to HGV to the city centre.</td><td rowspan="4"></td><td>Incentives are interesting.</td><td rowspan="4"></td></tr>
<tr><td>Delays: distance and traffic congestions</td><td rowspan="2">Incentives are interesting.</td><td>Avoid the access to HGV.</td></tr>
<tr><td rowspan="2"></td><td>Close to the city centre allows 100% eco-friendly services.</td></tr>
<tr><td>Parcel lockers are convenient.</td><td>Parcel lockers are convenient.</td></tr>
<tr><th rowspan="2">Rider</th><td>Longer distances, more riders.</td><td>Distance from the UCC to the delivery area too long: coverage area.</td><td>Distance and lanes appropriate.</td><td rowspan="2"></td><td>Parcel lockers facilitate the work.</td><td rowspan="2"></td><td rowspan="2">Similar to S2 (distance and lanes appropriate)</td><td rowspan="2"></td></tr>
<tr><td>Parcel lockers facilitate the work.</td><td>Bike lane not existing or not appropriate,</td><td>Parcel lockers facilitate the work.</td><td>The location is more convenient that S1 but less than S2.</td></tr>
</table>

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Opportunity	**Threat**	**Opportunity**	**Threat**	**Opportunity**	**Threat**	**Opportunity**	**Threat**
		Distance from the UCC to de the delivery area too long, time for delivering not acceptable.			Possible to deliver in the target area.			
Operator	More space for the facility.	Distance from the UCC to de the delivery area too long is too long	Distance: Close to the delivery area	Lower space for electric charging point.	Distance quite close to the delivery area.	Public partnershipr deffinition.	Distance close to the delivery area**.**	Lack of space for supplying.
	Model similar to today's model.	Not possible to reduce traffic congestion.	Facilitate fleet replacement	HGV dimension is limited (facility accessibility constraints)	Parcel locker more accesible.	Investment required.	Parcel locker: the most convenient location.	Infrastructure development.
	More space for the parcel lockers.	Major investment for fleet replacement.	Parcel lockers make more sense in S2 than in S1.		Available in the short-term.			Available in the long term.
Local store		Long distances may affect the time windows.	Shorter distances may increase the time windows.		HGV operating outside the city centre reduce traffic congestion		Direct deliveries from the store to the consumer.	HGV not accessible to LEZ or calmed areas.
		Higher prices due to longer distances.	Lower prices due to shorter distances.					

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Opportunity	Threat	Opportunity	Threat	Opportunity	Threat	Opportunity	Threat
Not identified	Best scenario for optimizing the load factor (tkm)		Close to the delivery area-	Lack of space, more tension in the logistics chain.				

Results: Evaluation phase

Table 47 shows the score obtain by each scenario for the feasibility, the business value and the average used for the graph. The definition of the feasibility and business values is detailed in section 2.4.

Table 47. LL1 Madrid: Evaluation phase: business value and feasibility scores.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Feasibility	2	2.91	2.89	2.12
Business value	2.89	2.78	3.27	2.82
Average	**2.445**	**2.845**	**3.08**	**2.47**
Comments	Similar to the current situtation		The most interesting for the local stores.	Access to HGV is difficult.

Results: Additional contributions after the workshop

The M30 is an ideal location with many commercial spaces, which could be used for the installation of a consolidation and deconsolidation centre for merchandise. The use of municipal markets as consolidation centres could also be considered, since they have all the useful characteristics to work properly, although it would be necessary to see what their administrative organization and relationship with the City Council are like. The example of the Sales market is mentioned.
The transport sector is critical to the viability of alternative energies in the short term.

- Necessity of amortization of electric vehicles.
- Flexibility of hours and places of access. In the case of central Madrid, 60% of the fleet is type D. The delivery window is limited to the morning, producing a high concentration of vehicles.

Although the M30 is not within EMT's range of action, this type of multi-stakeholder multi-value exercises allows to give visibility to potential locations that allow improving the urban distribution of goods beyond the scope of LEAD application.

LL2 Hague detailed information

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: NIMBER Platform

In scenario 1, there are four CIs where the consensus was not reached (Figure 44) further detailed below.

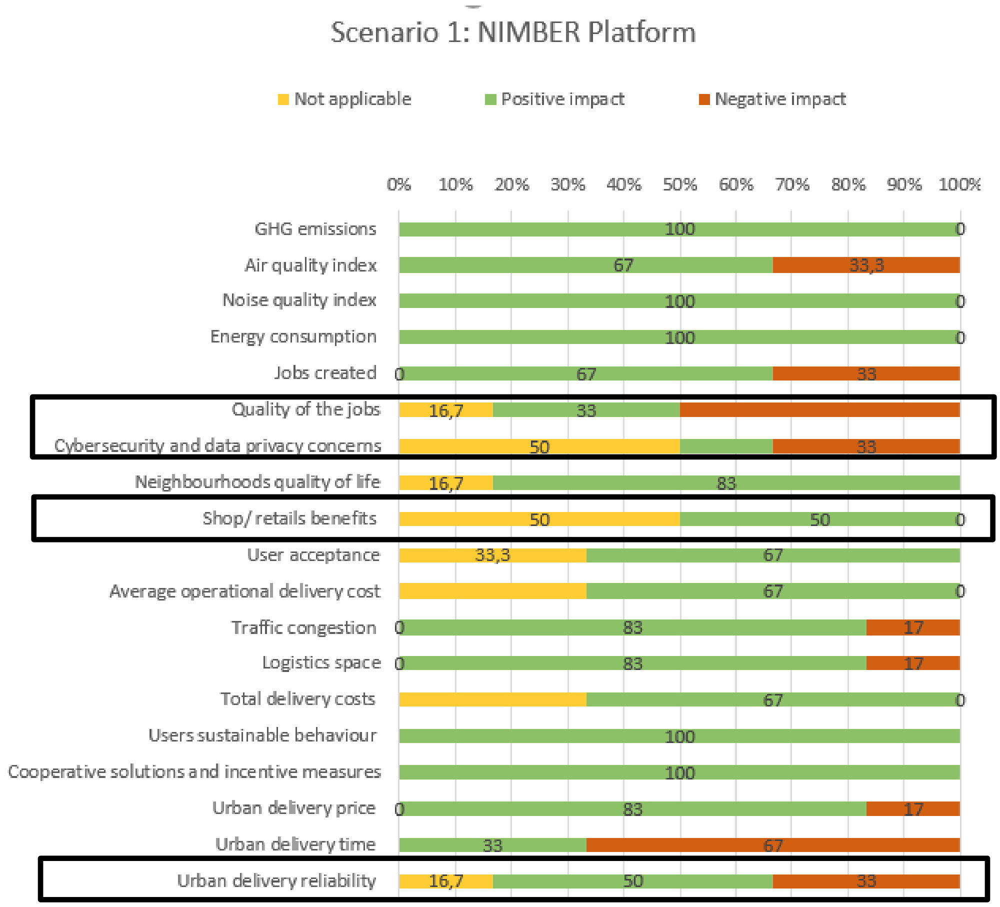


Figure 61. LL2 The Hague consequence analysis (scenario 1, overall results)

As shown in Figure 45, most stakeholders expect a slight decrease of all the environmental CIs.

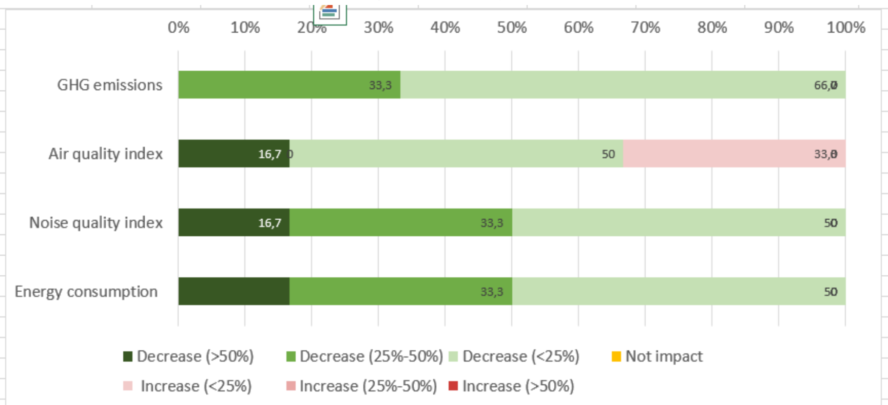
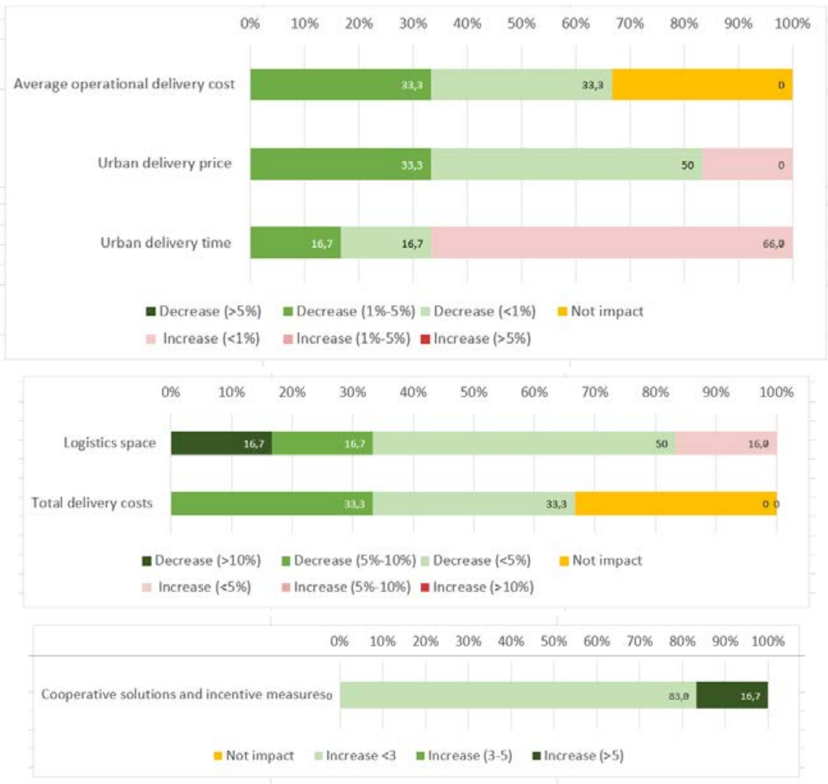


Figure 62. LL2 The Hague: Consequence Analysis - Environmental dimension (Scenario 1)

About the social dimension, jobs created and neighbourhood quality of life may slightly improve. The median rule applies to all the other social CIs, where no impact is found on cybersecurity. According to this median rule, quality of jobs will slightly decrease whereas shop benefits will slightly improve.

Figure 63. LL2 The Hague: Consequence Analysis - Social dimension (Scenario 1).

The majority of the stakeholders think this scenario will positively impact on the price, operational and total delivery costs, as well as on logistics space. The delivery time will be slightly worse off. It will impact positively on all the other economic CIs. For the urban delivery reliability, the median rule applies, showing a slight improvement.



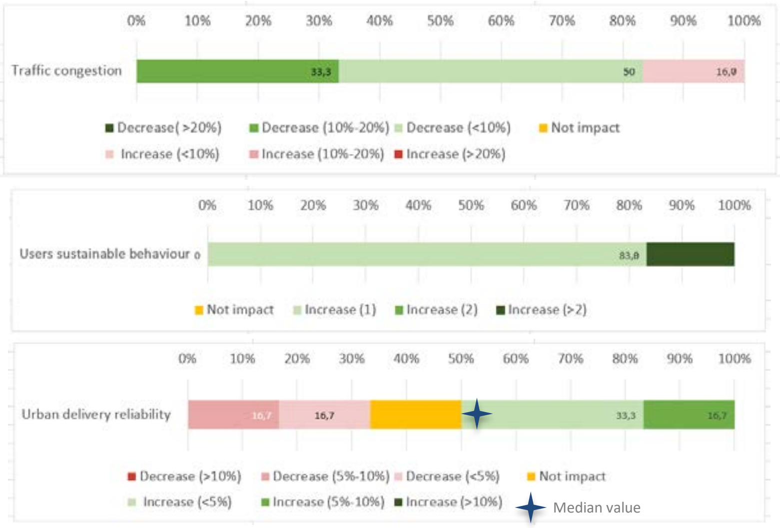


Figure 64. LL2 The Hague: Consequence Analysis - Economic dimension (Scenario 1).

Scenario 2: NIMBER platform + parcel lockers

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are 3 CIs where the consensus was not reached (figure below).

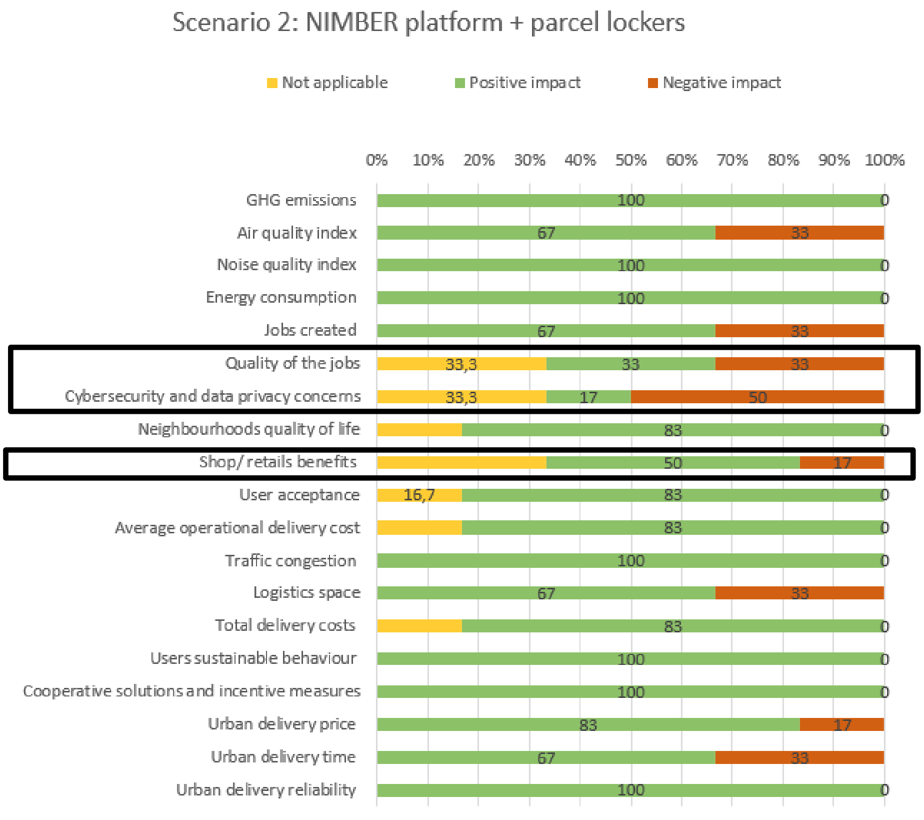


Figure 65. LL2 The Hague consequence analysis (scenario 2, overall results)

In this scenario, most stakeholders expect that all the environmental CIs improve moderately.

Figure 66. LL2 The Hague: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, jobs created and neighbourhoods' life may get a slight and moderately positive impact respectively. According to the median value, the cybersecurity concerns may slightly increase by 2030. On the other hand, the local stores' benefits will slightly increase applying the median rule. This rule shows no impact on the quality of jobs.

Figure 67. LL2 The Hague: Consequence Analysis - Social dimension (Scenario 2).

According to the majority of stakeholders, this scenario will have a slightly positive impact on all the economic CIs.

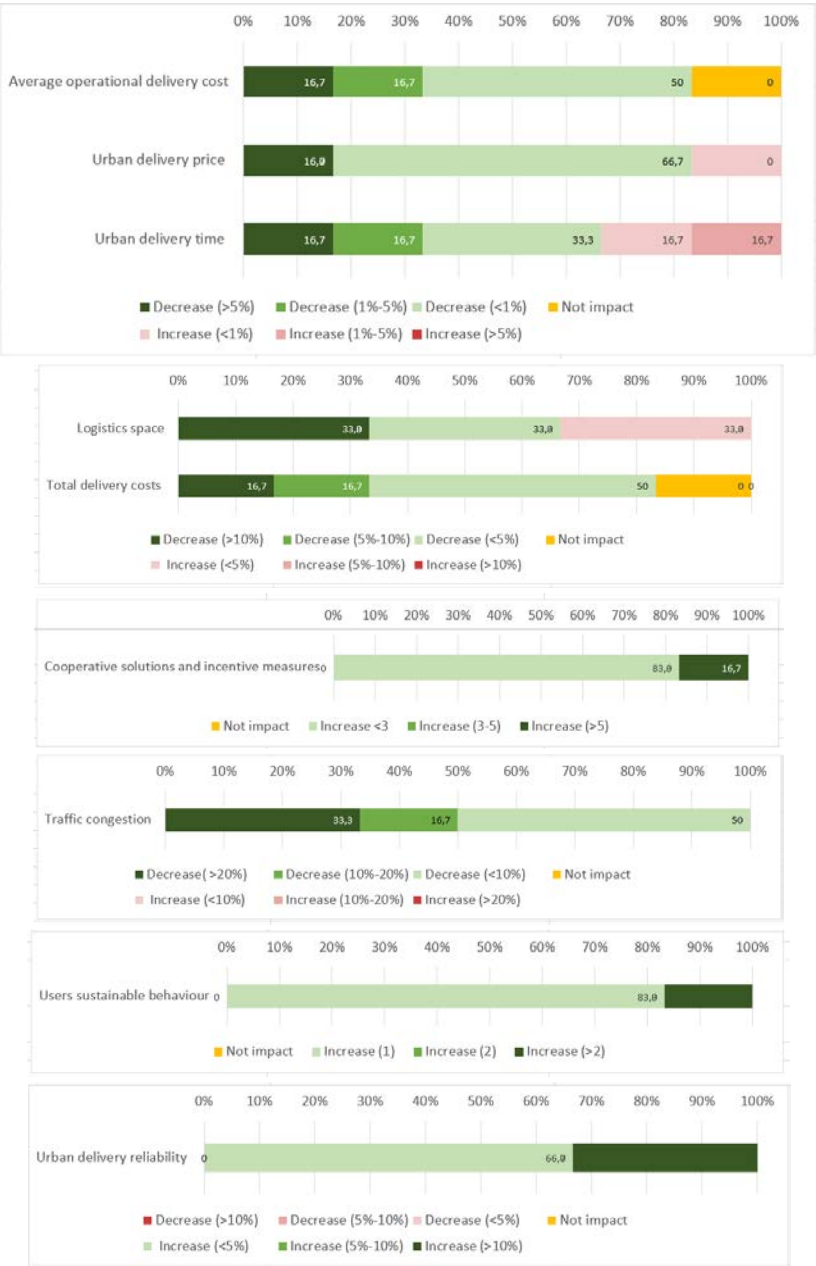


Figure 68. LL2 The Hague: Consequence Analysis - Economic dimension (Scenario 2).

Scenario 3: Platform integration: crowdshipping and bringers

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are 2 CIs where the consensus was not reached (figure below).

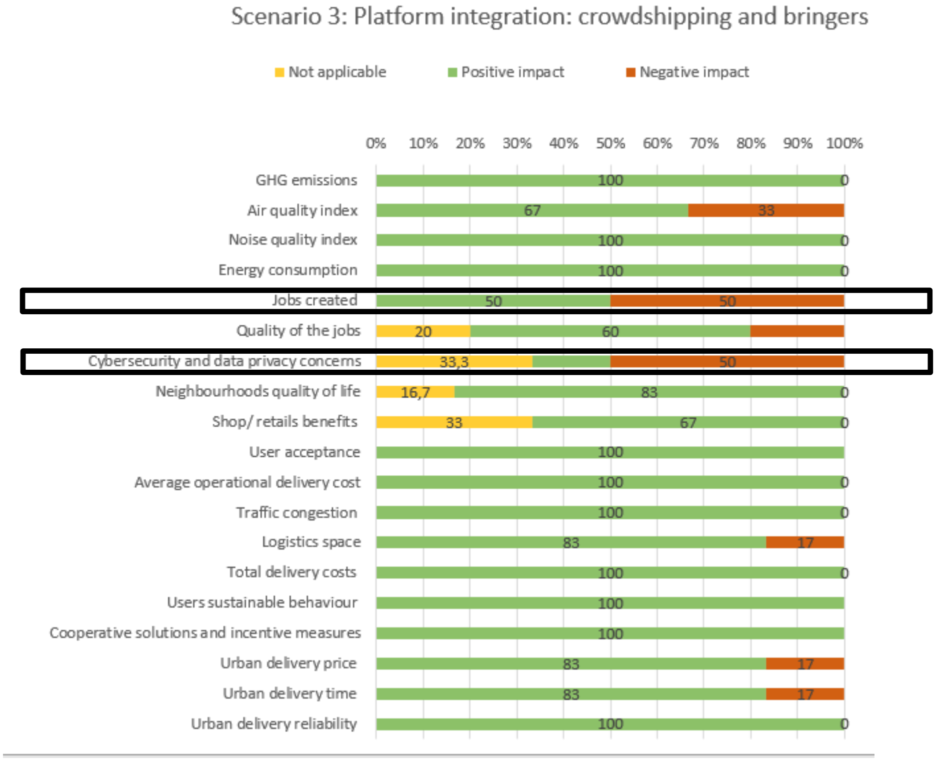


Figure 69. LL2 The Hague consequence analysis (scenario 3, overall results)

In this scenario, all environmental CIs will moderately improve.

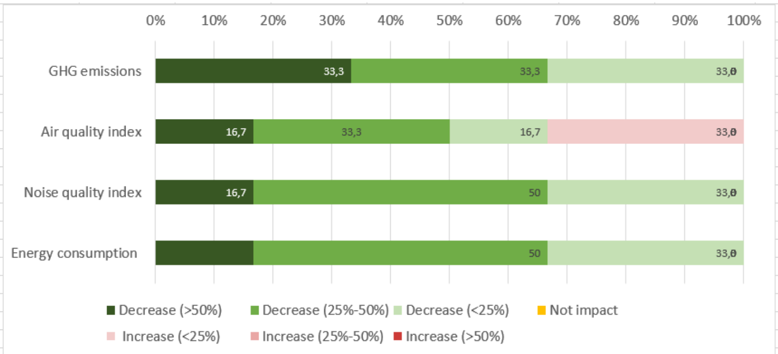
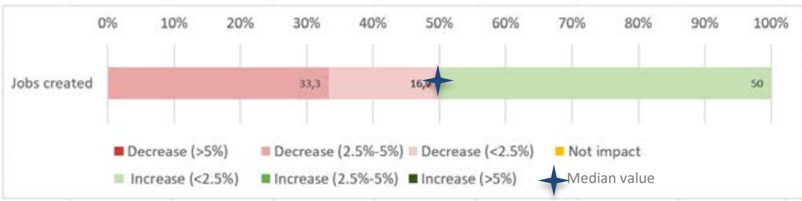


Figure 70. LL2 The Hague: Consequence Analysis - Environmental dimension (Scenario 3)

About the social dimension, most of the indicators may get a slight positive impact (quality of jobs and shop retails) or moderately positive (quality of life) with the new scenario. The median value provides a slightly negative result on cybersecurity and no conclusive impact on jobs created.



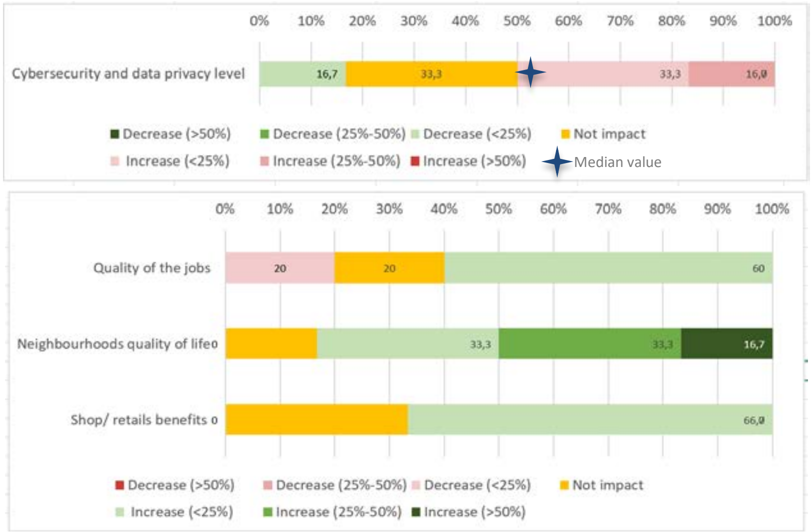


Figure 71. LL2 The Hague: Consequence Analysis - Social dimension (Scenario 3).

According to the majority of stakeholders, this scenario will have a slightly positive impact on all the economic CIs, with a moderated positive impact on logistics space.

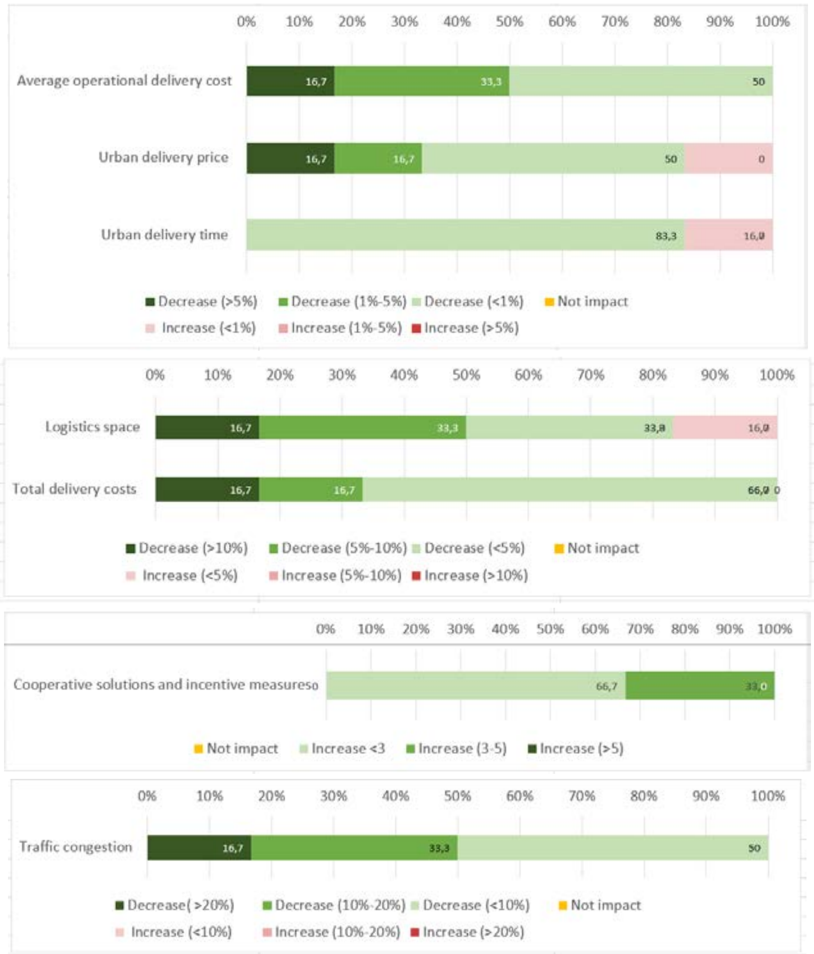


Figure 72. LL2 The Hague: Consequence Analysis - Economic dimension (Scenario 3).

Scenario 4: Open hyperconnected platform

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are two CIs where the consensus was not reached (figure below).

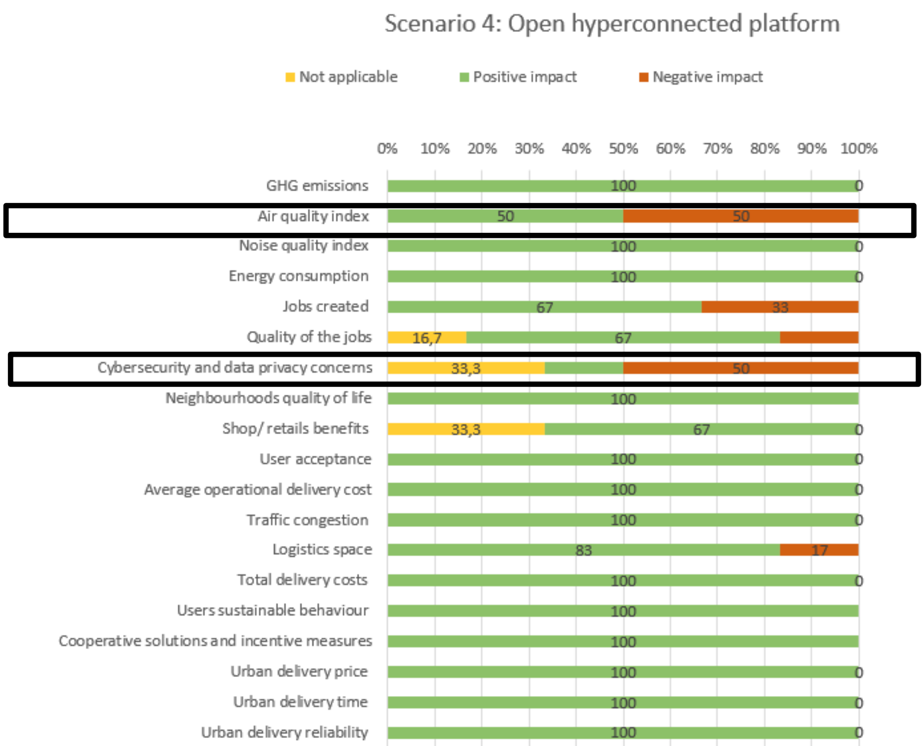


Figure 73. LL2 The Hague consequence analysis (scenario 4, overall results)

In this scenario, GHG emissions, noise quality and energy consumption will moderately improve. The median rule applies to the air quality index, showing that no conclusion on impact can be derived.

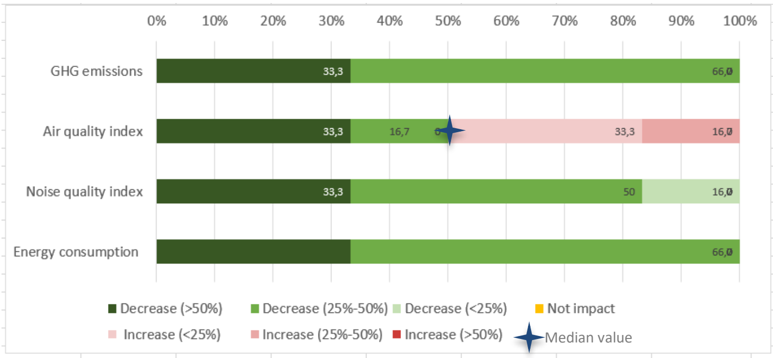


Figure 74. LL2 The Hague: Consequence Analysis - Environmental dimension (Scenario 4)

About the social dimension, jobs created, quality of jobs and neighbourhoods' quality of life may get a slightly positive impact with the new scenario, while local stores will have a moderately positive impact. According to the median values, cybersecurity concerns may slightly increase by 2030.

Figure 75. LL2 The Hague: Consequence Analysis - Social dimension (Scenario 4).

The majority of the stakeholders think this scenario will positively impact on time and traffic congestion (slightly) and moderately on all the other economic CIs.

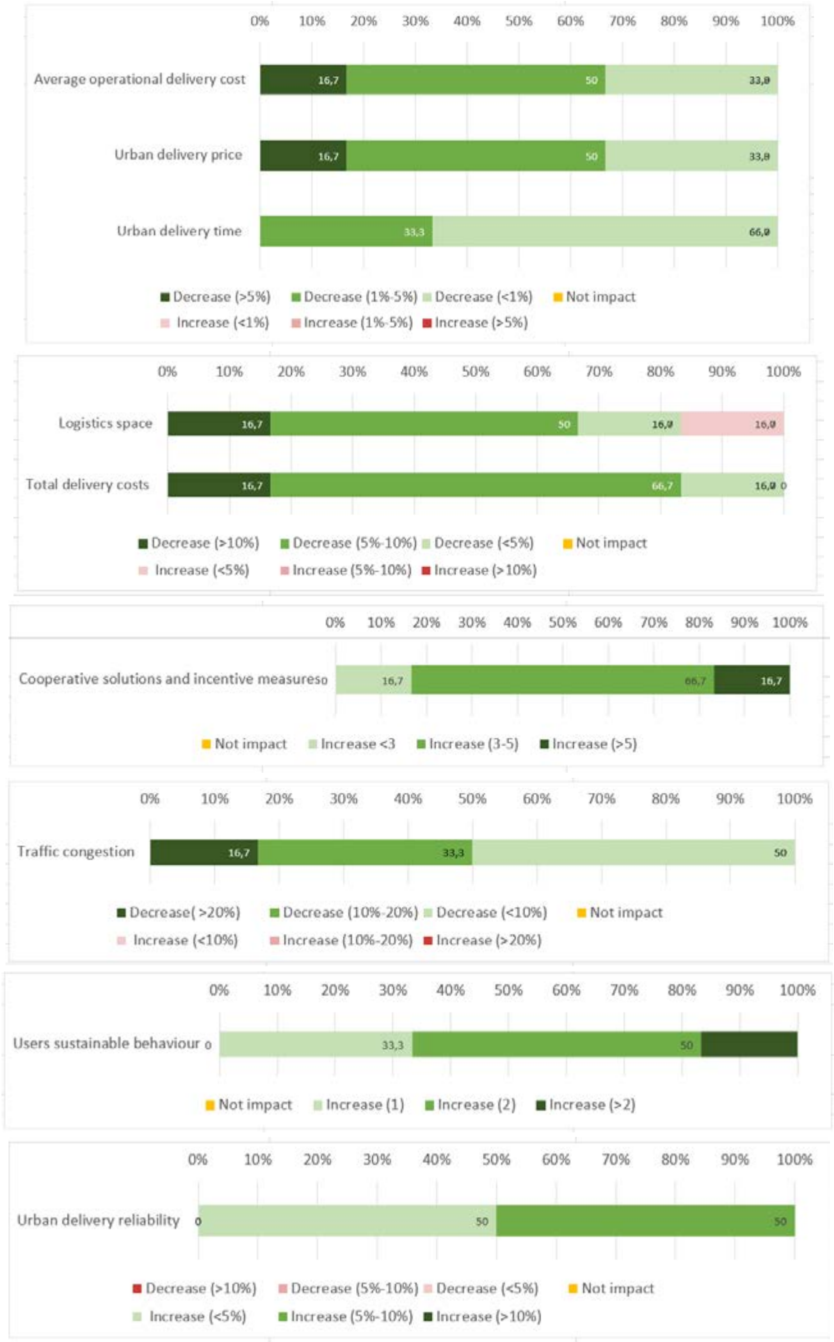


Figure 76. LL2 The Hague: Consequence Analysis - Economic dimension (Scenario 4).

LL3 Lyon detailed information

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: Urban Consolidation Centre + Cargo Bikes

In scenario 1, there is just one CI where the consensus was not reached (Figure 44) further detailed below.

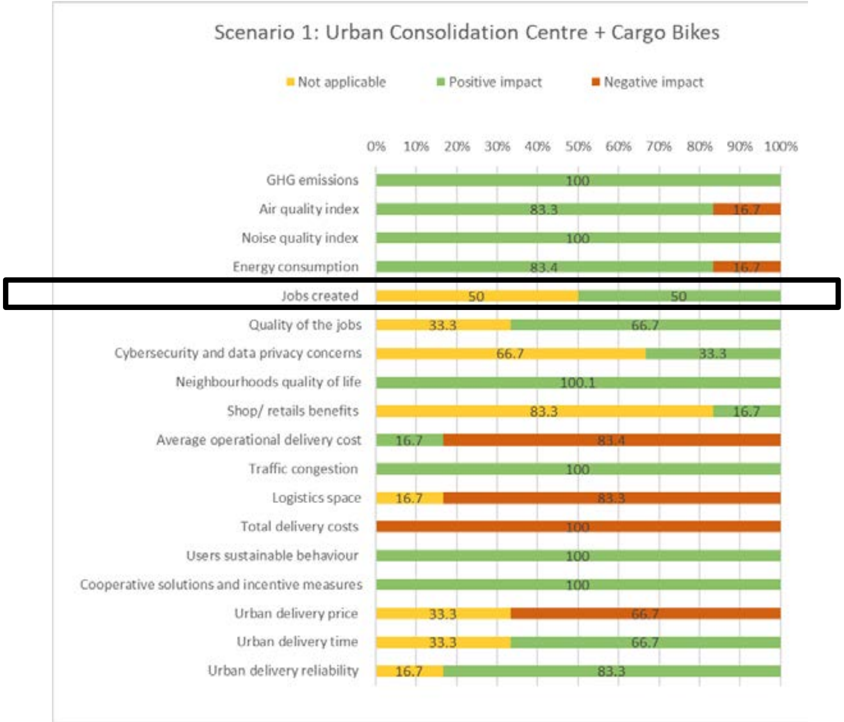


Figure 77. LL3 Lyon consequence analysis (scenario 1, overall results)

As shown in Figure 45, most of the indicators may moderately improve with scenario 1. According to the participants' responses, noise may be over 50% lower than now.

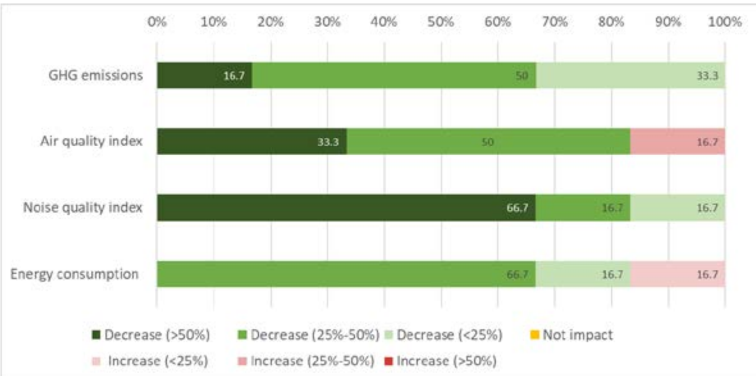


Figure 78. LL3 Lyon: Consequence Analysis - Environmental dimension (Scenario 1)

Jobs created and its quality may slightly increase with this scenario by 2030. However, the combination of measures may have neither impact on the cybersecurity and data privacy concerns nor shops/ retail benefits. Finally, this scenario will have a moderate effect on neighbourhoods quality of life perception.

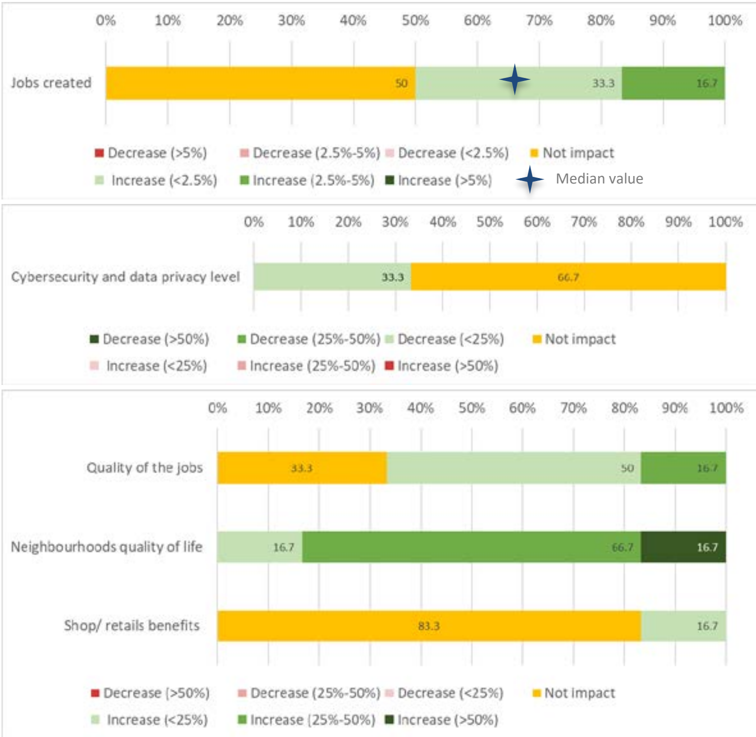


Figure 79. LL3 Lyon: Consequence Analysis - Social dimension (Scenario 1).

Most of the stakeholders think this scenario will negatively impact on the price, operational and total delivery cost while it will have a positive effect on the rest of the economic CIs, specially on the traffic congestion.

Figure 80. LL3 Lyon: Consequence Analysis - Economic dimension (Scenario 1).

Scenario 2: Urban Consolidation Centre + cargo bikes + light electric vehicles

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are only three CIs where the consensus was not reached (figure below).

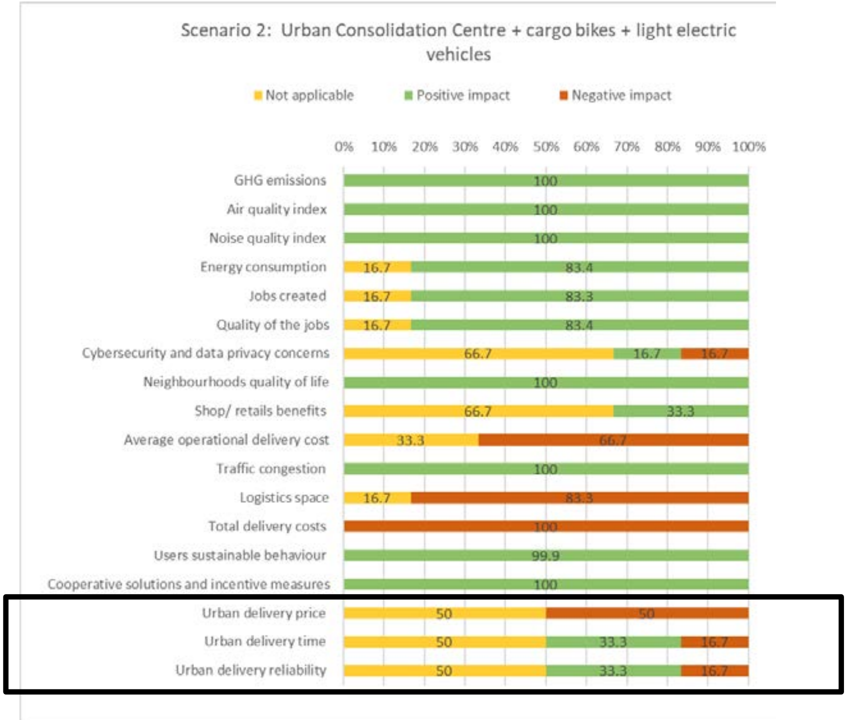


Figure 81. LL3 Lyon consequence analysis (scenario 2, overall results)

In this scenario, most of the indicators may moderately improve with scenario 1. According to the participants' responses, noise may be over 50% lower than now.

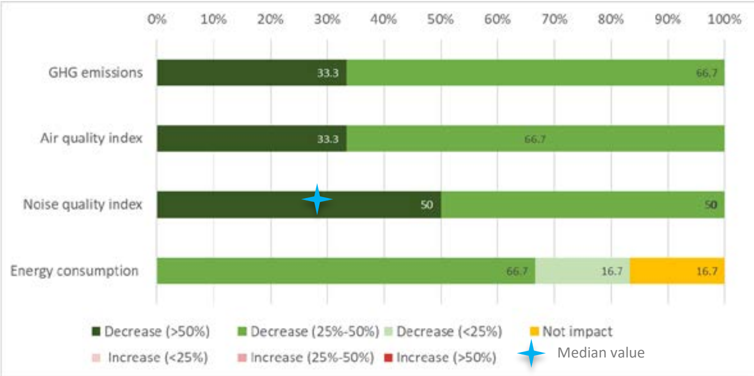


Figure 82. LL3 Lyon: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, jobs created, quality of jobs may get a slight positive impact with the new scenario; neighbourhoods' life quality may highly increase. The cybersecurity concerns and local stores benefits may remain as now.

Figure 83. LL3 Lyon: Consequence Analysis - Social dimension (Scenario 2).

The majority of the stakeholders think this scenario will negatively impact on the price, operational and total delivery cost and logistics space while it will have a light positive effect on the rest of the economic CIs.

Figure 84. LL3 Lyon: Consequence Analysis - Economic dimension (Scenario 2).

Scenario 3: Urban Consolidation Centre + cargo bikes + light electric vehicles + light autonomous vehicles for final deliveries

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there is just one CI where the consensus was not reached (figure below).

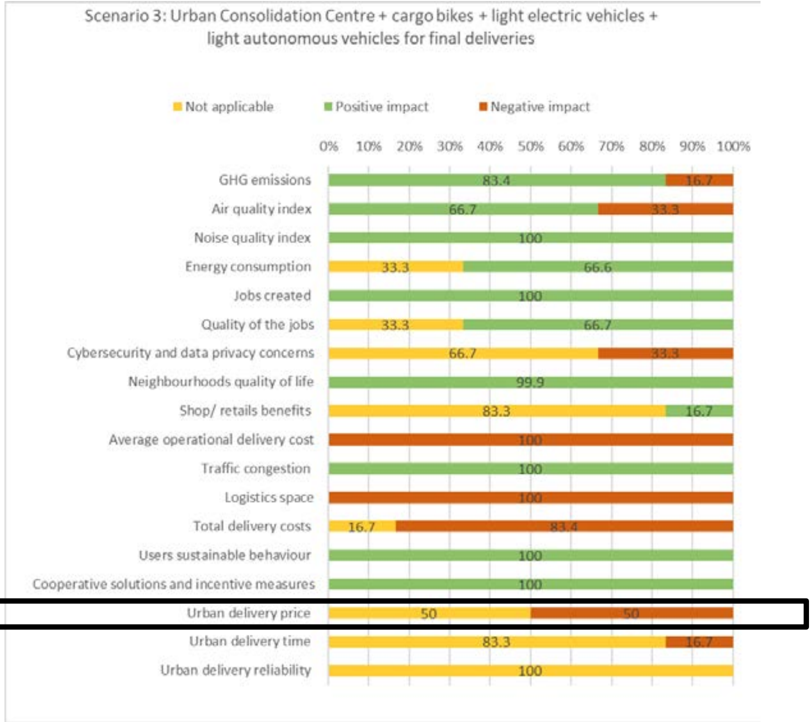


Figure 85. LL3 Lyon consequence analysis (scenario 3, overall results)

In this scenario, most of CIs may moderately improve. The energy consumption will slightly decrease.

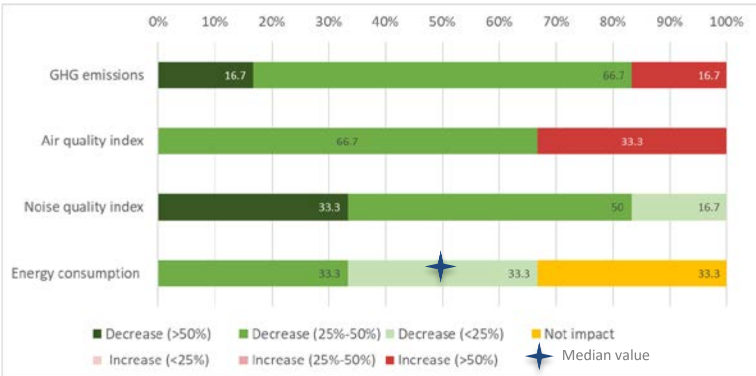


Figure 86. LL3 Lyon: Consequence Analysis - Environmental dimension (Scenario 3)

Jobs created, jobs' quality and neighbourhoods quality of life perception may moderately increase with this scenario by 2030. However, the combination of measures may have neither impact on the cybersecurity and data privacy concerns nor shops/ retail benefits.

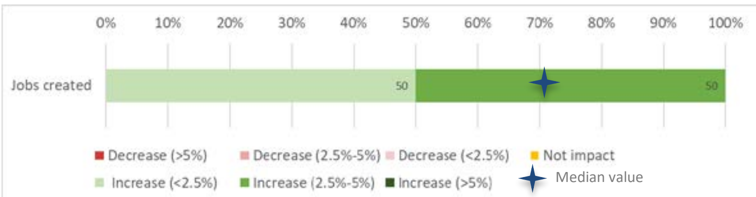


Figure 87. LL3 Lyon: Consequence Analysis - Social dimension (Scenario 3).

The majority of the stakeholders think this scenario will negatively impact on the price, operational and total delivery cost and logistics space. It will have a positive effect on the users sustainable behaviour, the number of collaborative solution and traffic congestion. The reliability and time may remain as now.

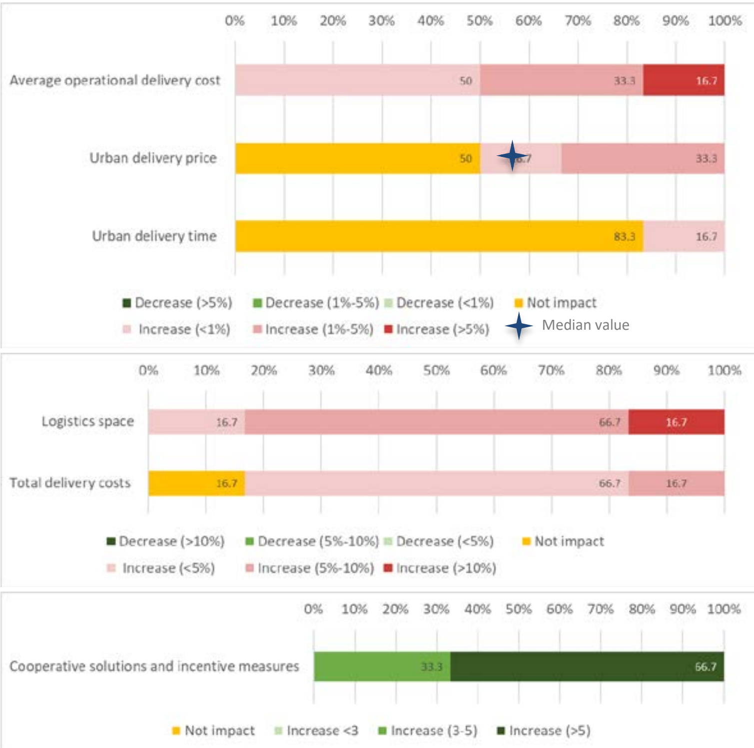


Figure 88. LL3 Lyon: Consequence Analysis - Economic dimension (Scenario 3).

Scenario 4: Scenario 3 + extension of catchment area through northern districts

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are only two CIs where the consensus was not reached (figure below).

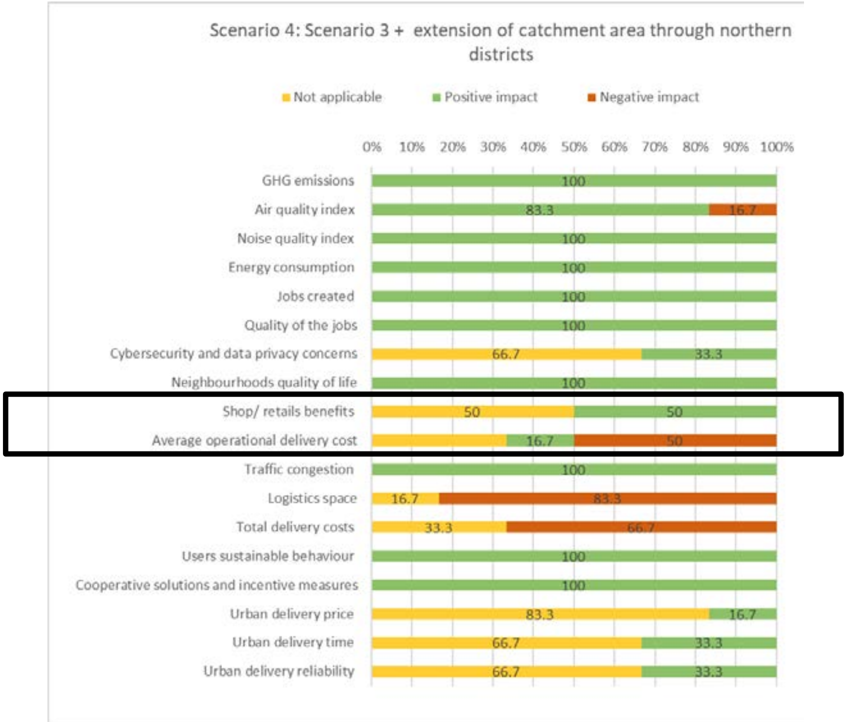


Figure 89. LL3 Lyon consequence analysis (scenario 4, overall results)

In this scenario, GHG emission, AQI and noise may moderately improve. The energy consumption will moderately decrease.

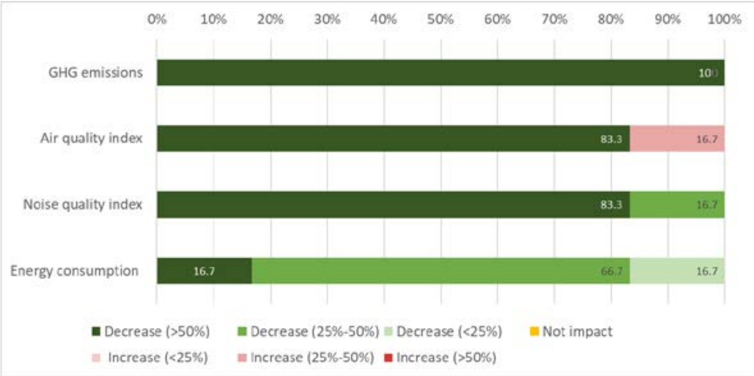


Figure 90. LL3 Lyon: Consequence Analysis - Environmental dimension (Scenario 4)

Jobs created, jobs' quality and shops' benefits may slightly increase with this scenario by 2030. The neighbourhoods' life quality will highly improve. However, the combination of measures may have not impact on the cybersecurity and data privacy concerns.

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Figure 91. LL3 Lyon: Consequence Analysis - Social dimension (Scenario 4).

The majority of the stakeholders think this scenario will negatively impact on the operational and total delivery cost and logistics space. The price may not be affected while it will have a light positive effect on the rest of the economic CIs.

Figure 92. LL3 Lyon: Consequence Analysis - Economic dimension (Scenario 4).

LL4 Budapest detailed information

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: Permanent microhub – 24h

In scenario 1, there are six CIs where the consensus was not reached (Figure 44) further detailed below.

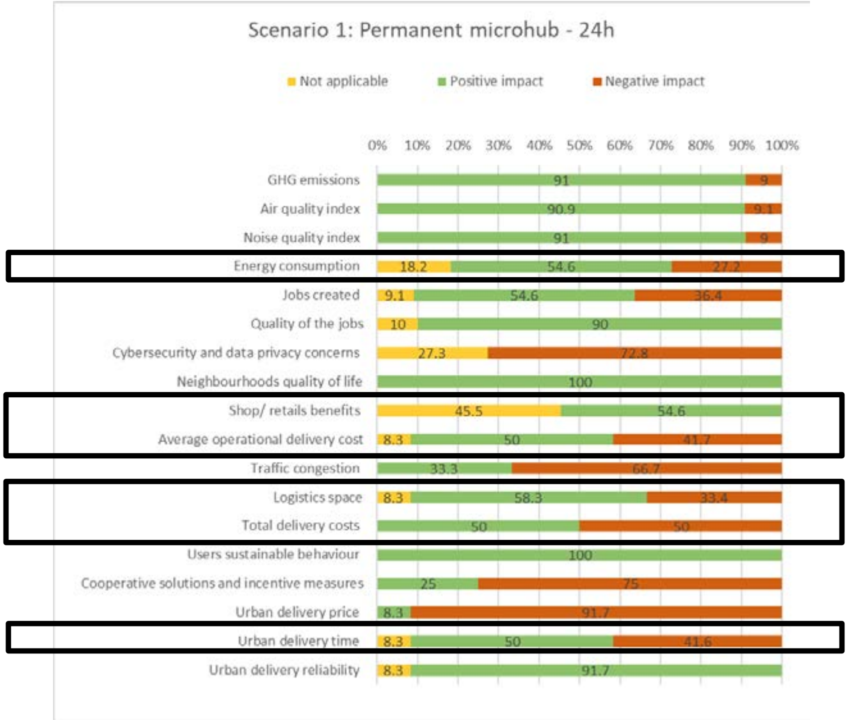

Figure 93. LL4 Budapest consequence analysis (scenario 1, overall results)

As shown in Figure 45, most stakeholders expect a moderate decrease of the GHG emissions and a medium improvement of the air quality. About the noise level and energy consumption, participants think they will slightly decrease.

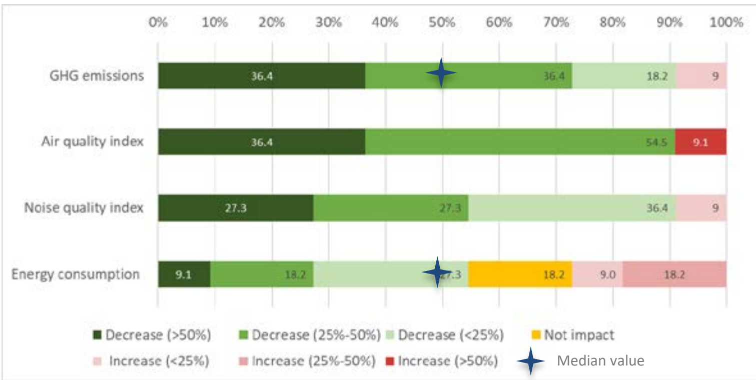

Figure 94. LL4 Budapest: Consequence Analysis - Environmental dimension (Scenario 1)

About the social dimension, most of the indicators may get a slightly positive impact with the new scenario, however, the cybersecurity concerns may slightly increase by 2030.

Figure 95. LL4 Budapest: Consequence Analysis - Social dimension (Scenario 1).

The majority of the stakeholders think this scenario will impact negatively on the price and traffic congestion.

About the total costs, the consensus rule is not applicable as the median value does not provide a clear result. Most of the participants believe the cooperative solutions and incentive measures will remain the same. Finally, the time, logistics space, reliability and users' sustainable behaviour may slightly improve.

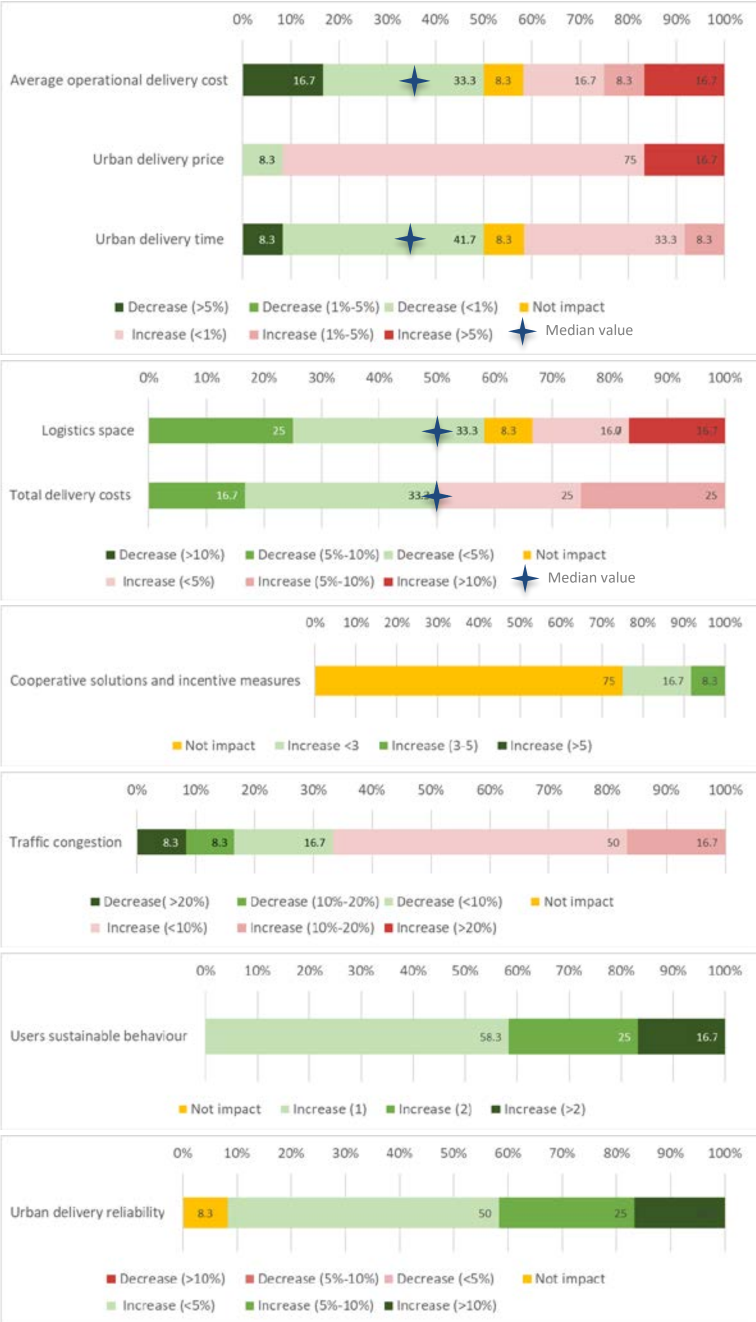

Figure 96. LL4 Budapest: Consequence Analysis - Economic dimension (Scenario 1).

Table 48.LL4 Budapest: Consequence Analysis - Comments (Scenario 1)

Comments
The location of the minihub can significantly affect the transport cost and the number of deliveries.

Scenario 2: Permanent microhub – 7/12h

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are seven CIs where the consensus was not reached (figure below).

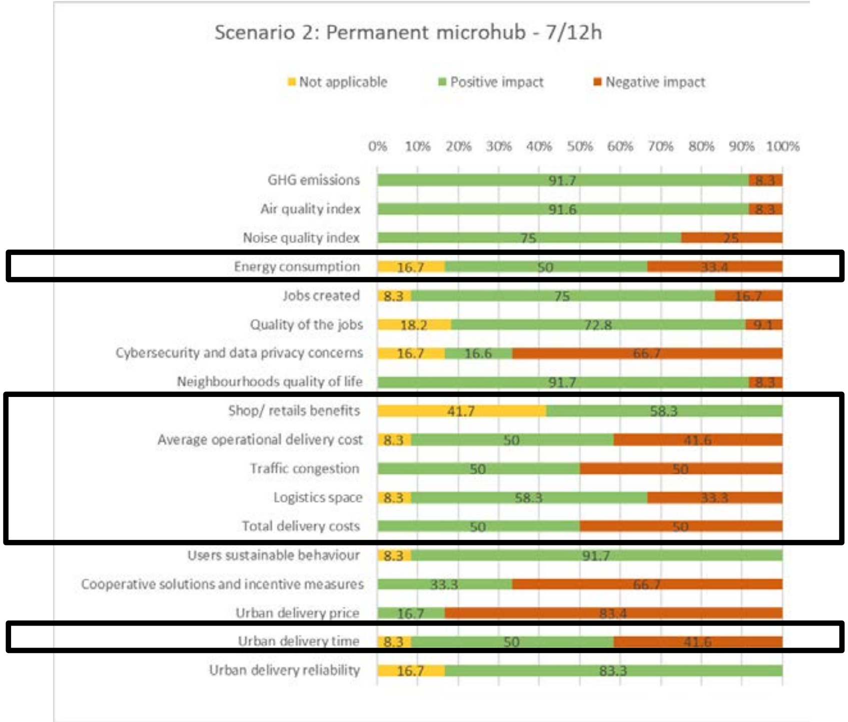

Figure 97. LL4 Budapest consequence analysis (scenario 2, overall results)

In this scenario, most stakeholders expect that all the environmental CIs slightly improve.

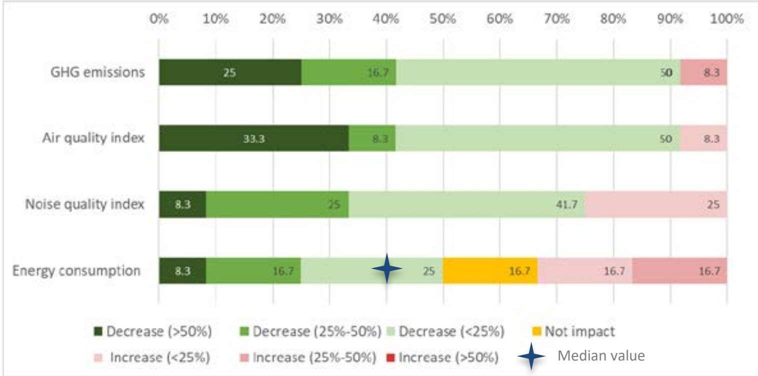

Figure 98. LL4 Budapest: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario, however the cybersecurity concerns may slightly increase by 2030.

Figure 99. LL4 Budapest: Consequence Analysis - Social dimension (Scenario 2).

The majority of the stakeholders think this scenario will impact negatively on the price. About the total costs and traffic congestion, the consensus rule is not applicable as the median value does not provide a clear result. Most of the participants believe the cooperative solutions and incentive measures will remain the same. Finally, operational costs, the time, logistics space, reliability and users sustainable behaviour may slightly improve.

Figure 100. LL4 Budapest: Consequence Analysis - Economic dimension (Scenario 2).

Table 49.LL4 Budapest: Consequence Analysis - Comments (Scenario 2)

Comments
The 7-12 time window can be too tight. The minihub should be near to the delivery area and requires good organization of the processes.

Scenario 3: Mobile microhub – 24h

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are six CIs where the consensus was not reached (figure below).

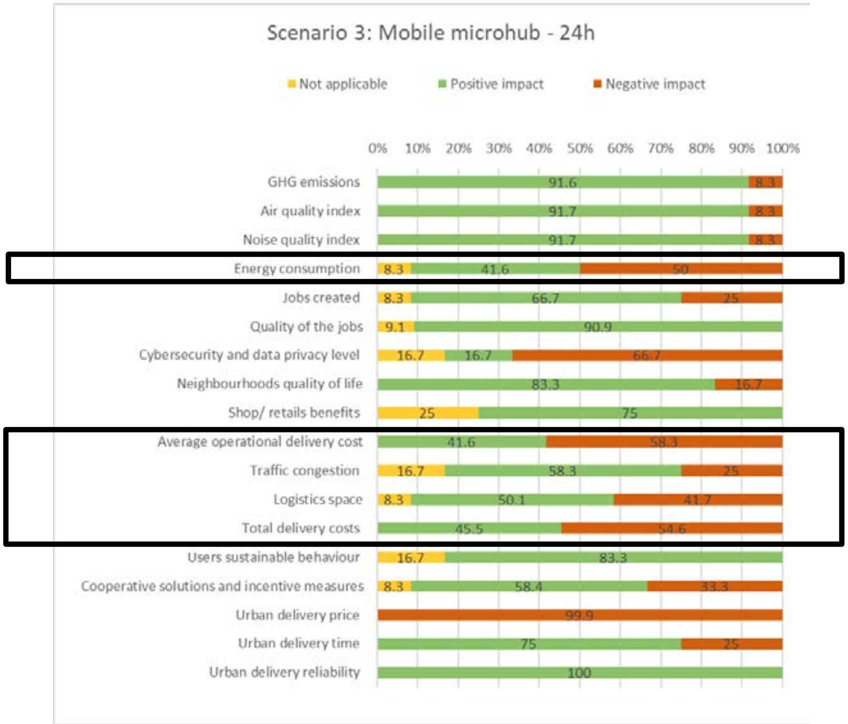

Figure 101. LL4 Budapest consequence analysis (scenario 3, overall results)

In this scenario, GHG emission and AQI may moderately improve. The noise will slightly get better while energy consumption may get worse.

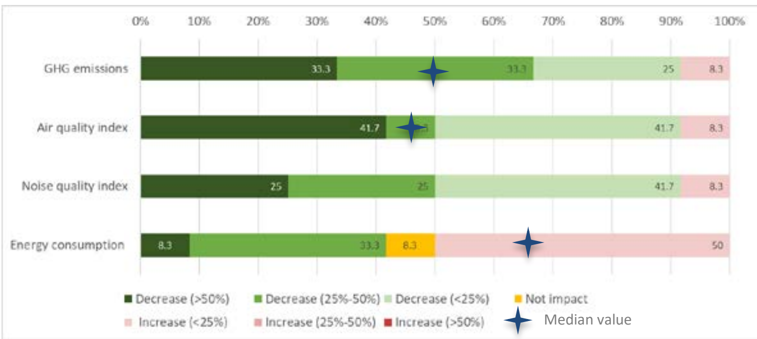

Figure 102. LL4 Budapest: Consequence Analysis - Environmental dimension (Scenario 3)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario, however the cybersecurity concerns may slightly increase by 2030.

Figure 103. LL4 Budapest: Consequence Analysis - Social dimension (Scenario 3).

About the economic dimension, majority of the stakeholders think that this scenario will have a negative impact on the price, the operational and total costs.

The majority of the stakeholders think this scenario will negatively impact on the price, the operation and total costs while the rest of CIs may slightly improve.

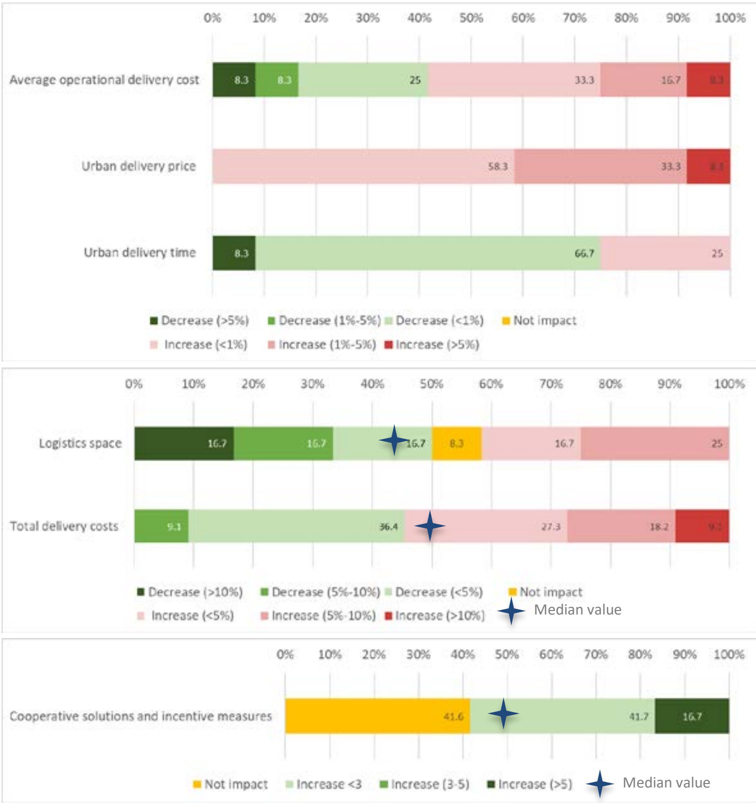

Figure 104. LL4 Budapest: Consequence Analysis - Economic dimension (Scenario 3).

Table 50.LL4 Budapest: Consequence Analysis - Comments (Scenario 3)

Comments
Same as for previous scenario.

Scenario 4: Mobile microhub – 7/12h

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are seven CIs where the consensus was not reached (figure below).

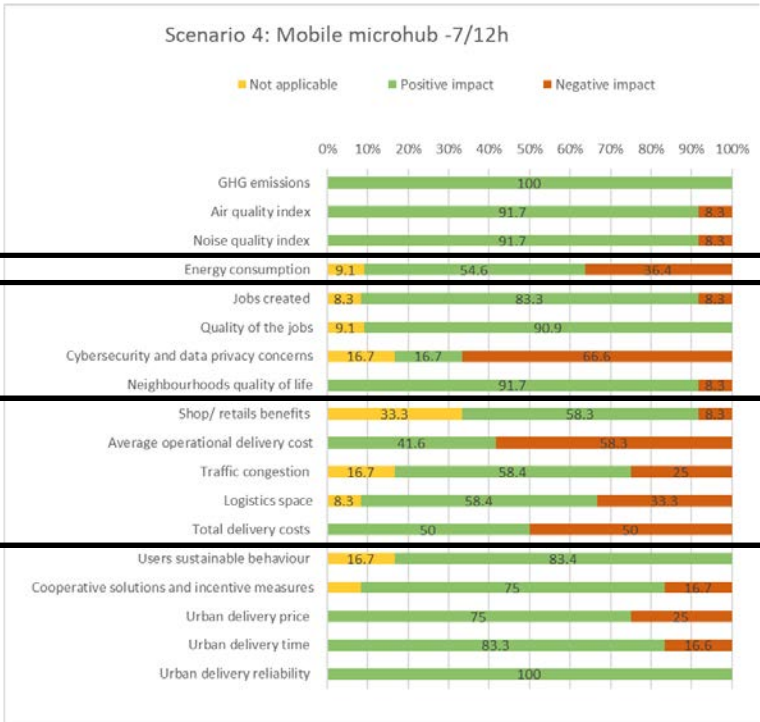

Figure 105. LL4 Budapest consequence analysis (scenario 4, overall results)

In this scenario, all the environmental CIs may slightly improve.

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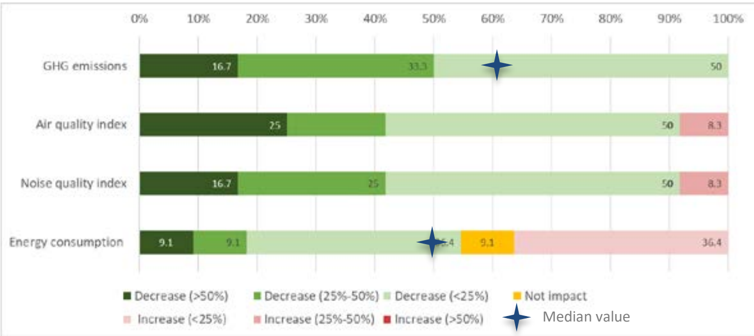

Figure 106. LL4 Budapest: Consequence Analysis - Environmental dimension (Scenario 4)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario, however the cybersecurity concerns may slightly increase by 2030.

Figure 107. LL4 Budapest: Consequence Analysis - Social dimension (Scenario 4).

The majority of the stakeholders think this scenario will negatively impact on the price. About the total costs, the consensus rule is not applicable as the median value does not provide a clear result. Finally, the rest of CIs may slightly improve.

Figure 108. LL4 Budapest: Consequence Analysis - Economic dimension (Scenario 4).

Table 51.LL4 Budapest: Consequence Analysis - Comments (Scenario 4)

Comments
The question of the location of the minihub and the problem of short time window and organization of processes also true for this scenario.

Workshop

Development and implementation process

LL4 Budapest organized its first online workshop (due to the COVID-19 pandemic) with the local stakeholders on the 12th of January 2021. The aim of this workshop was to validate the value case scenarios and support the identification of the most valuable one, with a threefold objective.

1. Consolidate external stakeholders engagement,
2. Understand the opportunities & threats of the four value case scenarios from the different perspectives of the LL4 Budapest key stakeholder groups,
3. Evaluate the business value and feasibility of the four value case scenarios from the different stakeholders' viewpoints.

Before the workshop, the key stakeholder groups along with their interests / objectives in redesigning the urban last mile deliveries were identified.
The attendees were contacted by email and phone. LL4 organized preliminary discussion with the attendees by online bilateral calls. An invitation was sent to the LL4 stakeholders. The key stakeholder groups and the objectives were built upon the experience of the LL4 LEAD partners and after several iterations for preparing the workshop materials.
In parallel, the LL LEAD partners worked in defining and preparing the materials to present and validate the value case scenarios with the CoP. For this, a ppt with clear description of the activities and the scenarios were developed in Hungarian. Every scenario was coded with colour to facilitate stakeholders' scenarios identification (Figure 109).

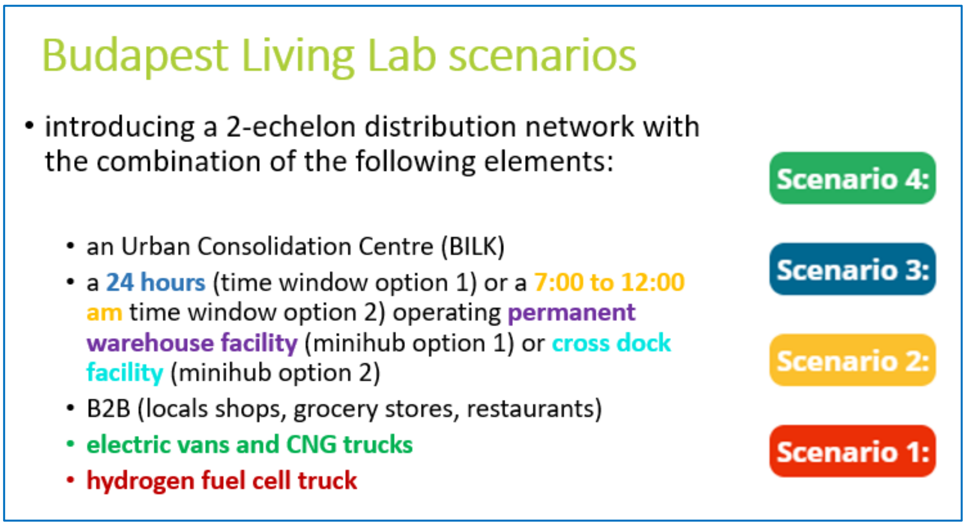

Figure 109. LL4 Budapest: Workshop scenarios description and colour-code.

For dynamizing the workshop and facilitating the compilation of required information, the LL used the ideaClouds [38]tool. The number of attendees with permission to use this online platform is limited to 20, therefore they were informed about the limited capacity in advance. Once the final list of participants was confirmed and they have given their consent to introduce the email account in the tool, they received an email to access to the platform.

[38] https://www.ideaclouds.net/

The ideaClouds tool allowed the LL to design a two-phases workshop. During the first phase or brainstorming phase, the participants were requested to introduce arguments concerning the positive or negative (opportunities and threats) aspects of each scenario with notes on a shared board, and according to the allocated role. After providing feedback during 6 minutes per scenario, the notes were organized and presented to the attendees. Finally, during the second phase or evaluation phase, participants rated the business value and the feasibility of each scenario. They were able to include any additional comment or suggestion to justify the score or align their interests.

Attendees

There were 20 attendees from 12 different entities and organizations (Table 52). The objective was to compile inputs from all the roles described in Chapter 6. After the workshop, a Hungarian report was shared with the whole CoP giving the opportunity to all the members to provide the results with additional feedback.

Table 52.LL4 Workshop attendees' organizations/ companies.

Organization	Description
BKK Centre for Budapest Transport, project partner	Budapest LL coordinator, local mobility manager, decision support for the municipality, responsible for SUMP
Széchenyi István University (SZE), project partner	academics in disciplines of urban mobility, logistics, data science, computer science
Waberer's-Szemerey Logisztika Kft. (WSZLK), project partner	service provider (warehousing, consolidation centres)
Municipality of Budapest	regulator and general decision maker, providing input and support
Budapest Roads	public road operator
MVM Zrt.	energy provider
Hungarian Association of Logistics, Purchasing and Inventory Management (MLBKT)	association for logistics, inventory management
NiT Hungary	federation of national private transporters
BME / Technical University of Budapest, Department of Material Handling and Logistics Systems	academics in disciplines of urban mobility, logistics, data science, computer science
SAP Hungary Kft.,	systems, applications, and products in data processing
EX ANTE Consulting Ltd.	extensive international experience supporting successful development and efficient public services
Hajtás Pajtás	courier service

Results: Brainstorming phase

Table 53 compiles the most relevant workshop attendees' contributions during the brainstorming phase. The inputs are classified by role, scenario and type of argument (opportunity and threat). Every scenario is coded with the colour used during the workshop.
To summarize the results and the contribution of stakeholders provided during the first Budapest LL workshop, the following key aspects and suggestions should be considered:

- hydrogen vehicles are expensive and not widespread, their use need to be carefully considered

- CNG and e-vehicles can be used well, e-vehicles are available in small sizes, that gives flexibility
- to locate the minihub to rust zones would be very beneficial
- the 7-12 time window is not long enough, earlier opening is and so the earlier start for delivery would be more desirable
- the 0-24 time window serves better the avoiding of peak periods
- creating groupings for goods and specifying different time windows for the shipping of each groups
- it is worth to design the minihub with the possibility of later enlargement (capacity, activity, etc.)
- it would be useful to develop a concept for pricing that makes the retailers and shops interested, as well

Table 53. LL4 Budapest: Opportunities and threats.

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
	Opportunity	**Threat**	**Opportunity**	**Threat**	**Opportunity**	**Threat**	**Opportunity**	**Threat**
BME (R&D+i)	With smaller cars the use of bike roads could be useful	The wrong location of the minihub is inefficient.	The same as Scenario 1	The narrower time window can cause more cars.	The activity of minihub is flexible with gates.	The shops not use the full lenght of time windows.		The narrow time window and the cross dock minihub provide a low flexibility.
Exante (R&D+i)	The wide time window results higher efficientcy in transportation.		The same as Scenario 1	Charging of vehicles can be problematic, all vehicles will work in the same time.			Several type of vehicles increase efficiency.	Not all orders can be delivered due to tight time window.
MVM (Energy)	Both CNG and e-load infrastructure is far-reaching.	The aquisition cost of e-vehicles is high.	The same as Scenario 1	The hydrogen cell infrastructure is poor.			Both CNG and e-load infrastructure is far-reaching.	The aquisition cost of e-vehicles is high.
Hajtás Pajtás (Logistic service providers, operators, carriers)	Minihubs represent great potential.	Cargobikes fall out due to low load capacity.	The same as Scenario 1	The short time window is not effective.				
MLBKT (R&D+i)	Transportaton of various goods can be separeted.	Cost sharing is problem between actors.	The same as Scenario 1	The short time window is not effective.	Prepicking of orders speeds up the delivery.	Without appropriate IT infrastucture the cost will be high.		

Mayor Office (Policymaker)	Pollution decrease, supply of small shops better.	Delivery during peak hours is possible.	Afternoon freight traffic decreases.	Hydrogen technology is expensive.					
NiT (Business models)		More loading increases the cost		More loading increases the possibility of injury the orders.					
SZE (R&D+i)	The smoothing of deliveries is a possibility	The developement of charging infrastructure	The use of hydrogen technology is forward looking.	The time window trammels the smoothing of deliveries		Growing costs.		Growing costs	
SAP (R&D+i)	Wide range of e-vehicles give agility					The parking space occupacy may deteriorate			

Results: Evaluation phase

Table 54 shows the score obtained by each scenario for the feasibility, the business value and the average used for the graph. The definition of the feasibility and business values is detailed in section 2.4.

Table 54.LL4 Budapest: Evaluation phase: business value and feasibility scores.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Feasibility	3.14	1.93	2.71	2.36
Business value	2.5	1.43	2.5	1.85
Average	**2.82**	**1.68**	**2.61**	**2.11**
Comments	Sustainable on the long term E-mobility is supported on the long term	The availability of hydrogen technology is the main barrier	The availability of hydrogen technology is the main barrier. The lack of available buildings makes the implementation unreliable	The electric and CNG technology is sustainable on the long term

Results: Additional contributions after the workshop

Having the results and feedback from the CoP, we have a clear consensus on using a minihub. Loading the minihub from the UCC goes with less extra effort than starting the shipments directly from the UCC. Starting the distribution of deliveries of goods from the minihub increases the service/timing accuracy of shops and goes with more efficient utilization of the fleet. It is preferable keeping a longer time window for scheduling deliveries, taking into account the lower traffic periods of the day.
The use of smaller electric and CNG vehicles would help to achieve less environmental impact and more flexible occupancy of parking space. The location and infrastructural possibilities of the minihub can be a barrier. Altogether, the wide range of stakeholders ensures that the system we build will be beneficial for everyone.

LL5 Oslo detailed information

Context description detailed information

The Skøyen LEAD demo site

The base of the Oslo LL will be a hub for exchange of transport modes in the Skøyen area, a couple of kilometres west of the CBD. The area is currently being regulated for housing and it will see a major redevelopment in the coming decades. About 21,000 people currently work within a 10-minute walking distance from the location. Skøyen has direct access to the main highway network and is very well connected to the whole city with public transport. Several bus lines depart from here and with local passenger ferries and the National Theatre train station (train, metro, tram, bus) in close proximity. Skøyen is close to some of the most densely populated areas of Oslo as well as the area of the Car Free City Programme encompassing the city centre dominated by office buildings and commerce. Skøyen e-mobility point located close to one of the main westbound arterial roads (E18) and a bus stop. Residential areas, offices and warehouses are located close to this point.

Freight transport activities

Tables below present the freight transport activities. References to all tables are given ***(Casepersen & Ørving, 2018)***. The numbers are based on the most recent surveys and secondary data.

Table 55. LL5 Oslo LGV (<3.5tonnes): number of vehicles, million kms and thousands of tonnes moved within the city 2014 - 2015.

Number of vehicles, million kms driven, and freight in 1000 tonnes with transported with vehicles < 3.5 tonnes within Oslo, by vehicle type and type of transport. The numbers represent Q3&4 2014 and Q1&2 2015.						
	Freight deliveries			**Other services**		
	Cars	**Mill. km (in total)**	**1000 tonnes**	**Cars**	**Mill. km (in total)**	**1000 tonnes**
Smaller vans	32 608	320	362	7 127	52	704
Larger vans	13 632	131	468	4 866	72	375
Smaller combined vans	886	4	12	355	2	53
Larger combined vans	593	4	8	-	-	-
Trucks < 3,5 tonnes payload	973	7	74	1 170	12	193
Unknown	1 207	27	8	41	0	1
Total	**49 898**	**493**	**931**	**13 560**	**138**	**1 326**

Table 56. LL5 Oslo smaller freight vehicles: number of vehicles, million kms and thousands of tonnes moved within the city 2014 - 2015.

Freight in 1000 tones and vehicle kms driven in total and with cargo for smaller freight vehicles within Oslo by cargo type and transport type. The numbers represent Q3&4 2014 and Q1&2 2015.		
	Other services	**Freight deliveries**

	Mill km (total)	Mill km (with cargo)	1000 tonnes	Mill km (total)	Mill km (with cargo)	1000 tonnes
Food, beverages	-	-	-	26	24	726
Mixed cargo	15	6	20	12	10	48
Post and parcels	2	2	1	18	16	44
Paper, prints	0	0	0	11	10	130
Products for construction	164	114	445	11	8	59
Machinery, equipment	99	86	174	6	6	60
Other categories	105	98	291	53	46	260
Empty positioning	108	-	-	-	-	-
Totalt	493	306	931	138	120	1 326

Table 57. LL5 Oslo smaller freight vehicles: number and driven million km by vehicle type and Euro Emission class within the city 2014 - 2015.

Number of small freight vehicles and their driven million kms by vehicle type and Euro Emission Class moved within Oslo. The numbers represent Q3&4 2014 and Q1&2 2015.								
	Euro1	**Euro2**	**Euro3**	**Euro4**	**Euro5**	**Euro 6**	**Unknown**	**Total**
Smaller vans		886 (9.6)	1 289 (4.8)	2 782 (16.7)	2 007 (19.3)	163 (1.5)		7 127 (51.9)
Larger vans			326 (0.8)	1 572 (22.3)	2 945 (48.7)	23 (0.1)		4 866 (71.9)
Smaller combined vans		355 (2.2)						355 (2.2)
Larger combined vans	51 (0.3)	148 (1.5)	377 (2.3)	396 (5.3)	198 (2.3)			1 170 (11.6)
Trucks < 3,5 tonnes							41 (0.3)	41 (0.3)
Total	**51 (0.3)**	**1 389 (13.3)**	**1 992 (7.9)**	**4 751 (44.3)**	**5 150 (70.2)**	**186 (1.6)**	**41 (0.3)**	**13 560 (137.9)**

Table 58. LL5 Oslo: Tonnes transported and number of trips with larger Norwegian-registered vehicles to, from and within Oslo by cargo type, 2015. Numbers in 1000.

	To Oslo		**From Oslo**		**Within Oslo**	
	Number of trips	**Thousand tonnes**	**Number of trips**	**Thousand tonnes**	**Number of trips**	**Thousand tonnes**
Food and beverages	112	1 092	89	1 041	49	307
Termo transports	108	1 254	76	967	88	365
Consumer goods	152	1 670	182	2 030	105	703

Products for construc-tion	73	1 332	68	1 031	118	1 358
Industrial goods	124	1 004	127	950	61	296
Chemicals	1	42	6	111	0	0
Dry bulk and waste	186	3 730	300	7 078	388	5 868
Wet bulk	16	261	70	1 358	35	714
Empty positioning	684	-	556	-	458	-
Not included/ not known	40	168	36	132	8	54
Total	1 497	10 552	1 508	14 699	1 311	9 666

The figures below show the most important vehicle types that are used in some of the tables.

Figure 110. LL5 Oslo: Small van and small combined vehicle.

Figure 111. LL5 Oslo: Larger vans and truck with < 3.5 t payload.

Figure 112. LL5 Oslo: HGVs, purpose-built and general.

Oslo's climate strategy and climate budget

Since 2017 the City of Oslo has had a distinct climate budget. Both the development and the subsequent use of the climate budget have made fundamental changes as a municipal governing tool. The climate budgets show measures implemented or planned for Oslo to reach its climate targets and become a low-carbon city. An ordinary budget has an upper limit for how much money can be spent. Similarly, a climate budget shows an upper limit for how much greenhouse gases can be emitted. The climate budget is presented together with the regular municipal budget. The Department of Climate is responsible for the development of the academic basis for the climate budget.

Oslo has very ambitious goals for reducing emission, and plans are developed for actions towards the target of 95% reductions in emissions within 2030. Oslo's Climate Strategy is the most prominent plan, but also other plans and projects mentioned below are relevant.

The municipal climate and energy strategy have been developed in dialogue and interaction with 40 stakeholders from the business sector, along with the local and national government. The strategy is the basis for the climate budget. The City Council can only adopt budget plans that will provide climate cuts in accordance with the climate strategy. In this way, climate measures are highly prioritized in budget negotiations.

As previously mentioned, the ambitious climate strategy has a target of 95% reduction in climate emissions by 2030. This requires an emission free transport sector where passenger cars and vans run on zero emission fuels and where heavy goods vehicles (HGV) use zero emission or sustainable renewable energy. Taxis will be emission free in 2024 and buses likewise in 2028. By 2030 private car traffic should be reduced with one third.

Part of this strategy is to introduce **zero emission zones** in the downtown area where only zero emission vehicles are allowed. The purpose is to reduce emissions and improve the air quality of Oslo. At this stage the work is still in the planning phase where benefits and consequences are assessed.

Table 59. LL5 Oslo: Emissions in tonnes from freight transport with smaller vehicles within Oslo, Q1&2 2014 - Q3&4 2015.

	Petrol		***Diesel***		
Gas	**Service**	**Cargo**	**Service**	**Cargo**	**Total**
CO_2	4 810	292	82 178	24 861	112 141
CO	27	2	15	6	50
HC	2	0	4	1	7
NOx	2	0	280	86	368
PM	0	0	10	3	14

Table 60. LL5 Oslo: Emissions in tonnes from freight transport with HGV driving through Oslo by Euro Emission Class, 2016.

Gas	**Euro0**	**Euro-I**	**Euro-II**	**Euro-III**	**Euro-IV**	**Euro-V**	**Euro-VI**	**Total**
CO_2	-	36	41	375	2 770	7 576	4 998	15 796
CO	-	0	0	1	5	11	1	18
HC	-	0	0	0	0	1	0	1
NOx	-	0	0	3	18	36	2	59
PM	-	0	0	0	0	0	0	1

Table 61. LL5 Oslo: Emissions in tonnes from freight transport with HGVs within Oslo by Euro Emission Class, 2016.

Gas	Euro0	Euro-I	Euro-II	Euro-III	Euro-IV	Euro-V	Euro-VI	Totalt
CO2	-	-	770	2 056	10 484	24 382	22 055	59 747
CO	-	-	2	6	18	36	5	67
HC	-	-	0	1	1	2	1	5
NOx	-	-	8	18	77	142	11	257
PM	-	-	0	0	1	1	0	3

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: Direct shipments from IKEA

In scenario 1, there are three CIs where the consensus was not reached (Figure 44) further detailed below.

Figure 113. LL5 Oslo consequence analysis (scenario 1, overall results)

As shown in Figure 45, most stakeholders expect a moderate decrease of the GHG emissions and noise level. About the air quality and energy consumption, participants think they will slightly improve.

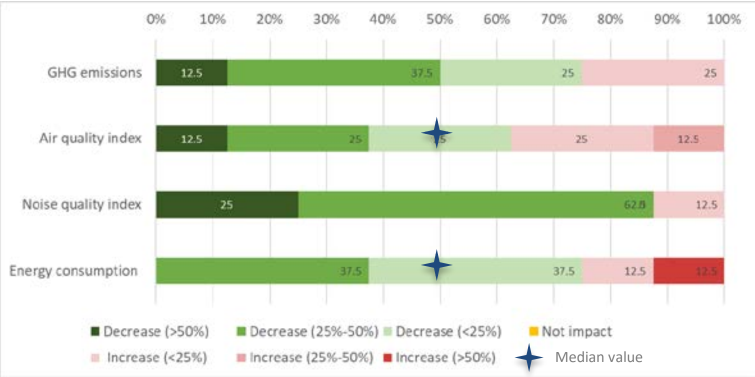

Figure 114. LL5 Oslo: Consequence Analysis - Environmental dimension (Scenario 1)

About the social dimension, most of the indicators may get a slightly positive impact with the new scenario, except cybersecurity concerns and jobs' quality that may remain as now by 2030.

Figure 115. LL5 Oslo: Consequence Analysis - Social dimension (Scenario 1).

The majority of the stakeholders think this scenario will impact negatively on the costs, price and time. About the public logistics space, the participants think the CI may moderately improve by 2030. Finally, the remaining economic CIs may slightly improve.

Figure 116. LL5 Oslo: Consequence Analysis - Economic dimension (Scenario 1).

Table 62.LL5 Oslo: Consequence Analysis - Comments (Scenario 1)

Comments
Please note that the comparisons are made towards a base case where the customers are transporting the items by means of their more or less packed cars with/without own or hired trailers for bigger items. Delivery costs may increase for the supplier. Still, the generalized delivery costs for the consumer (including time and hazzle) may still be reduced even if the delivery time in itself may increase. (*This comment was made by one of the respondents. It may not be entirely clear for all respondents)*

Scenario 2: Direct Shipments from IKEA + Filipstad/ Skøyen hub

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive), there are three CIs where the consensus was not reached (figure below).

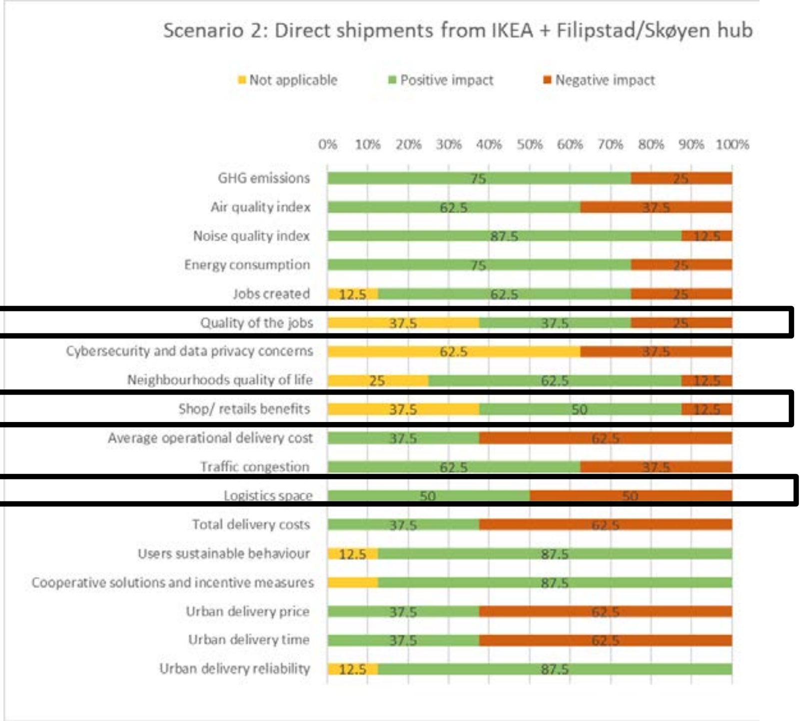

Figure 117. LL5 Oslo consequence analysis (scenario 2, overall results)

In this scenario, most stakeholders expect that all the environmental CIs slightly improve.

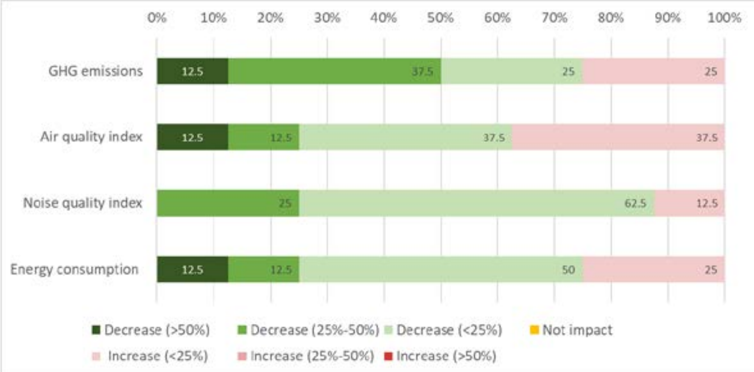

Figure 118. LL5 Oslo: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario, however the cybersecurity concerns and jobs' quality may remain the same by 2030.

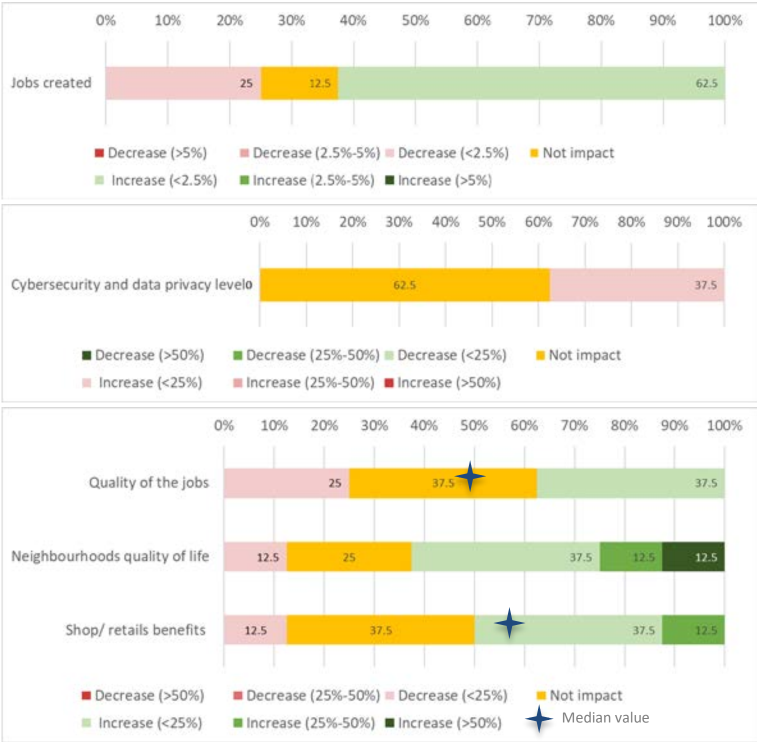

Figure 119. LL5 Oslo: Consequence Analysis - Social dimension (Scenario 2).

The majority of the stakeholders think this scenario will impact negatively on the costs, price and time. About the public logistics space, the consensus rule is not applicable as the median value does not provide a clear result. Most of the participants believe traffic congestion may moderately decrease. Finally, the remaining economic CIs may slightly improve.

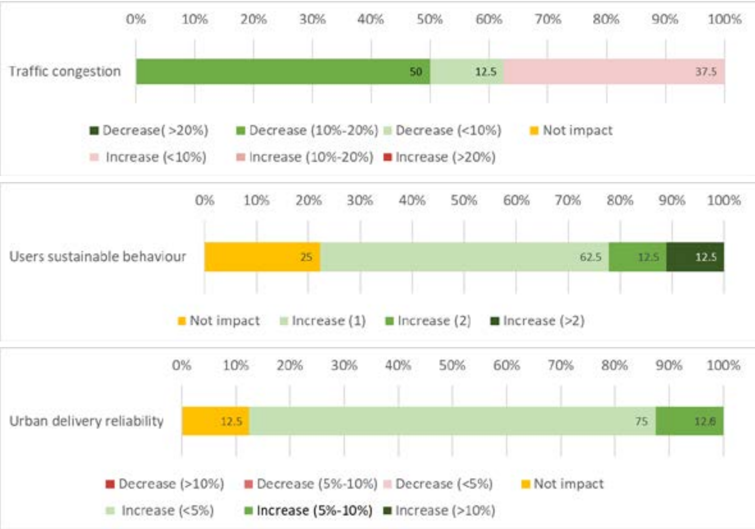

Figure 120. LL5 Oslo: Consequence Analysis - Economic dimension (Scenario 2).

Table 63.LL5 Oslo: Consequence Analysis - Comments (Scenario 2)

Comments
More flexibility to the end users without any higher cost of delivery
Will the shipment from Ikea to Filipstad or Skøyen mobility hub will also be with electric vans?

Scenario 3: Direct shipments from IKEA + Filipstad/Skøyen hub + commuters (NIMBER members)

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive), there are four CIs where the consensus was not reached (figure below).

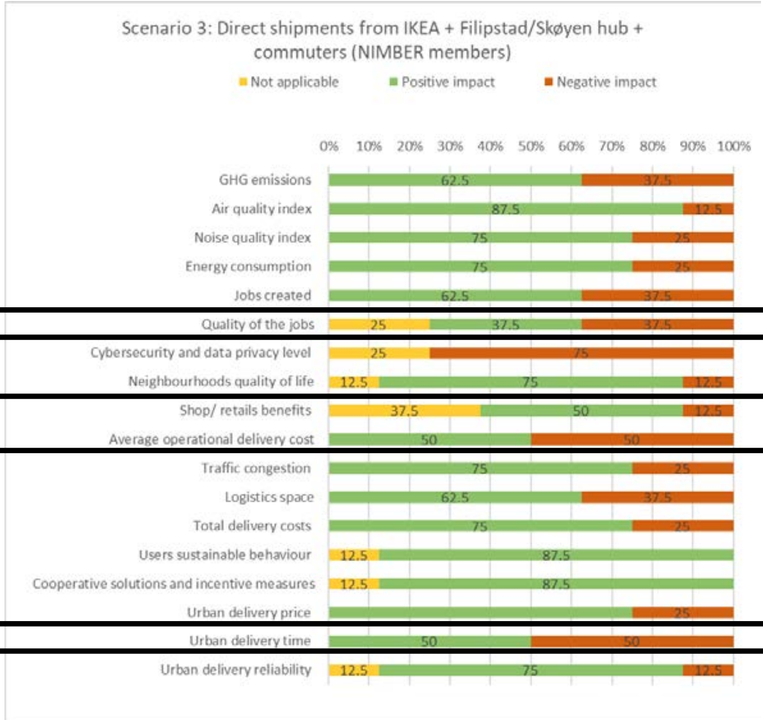

Figure 121. LL5 Oslo consequence analysis (scenario 3, overall results)

In this scenario, GHG emission may highly decrease. The rest of the environmental CI may moderately improve.

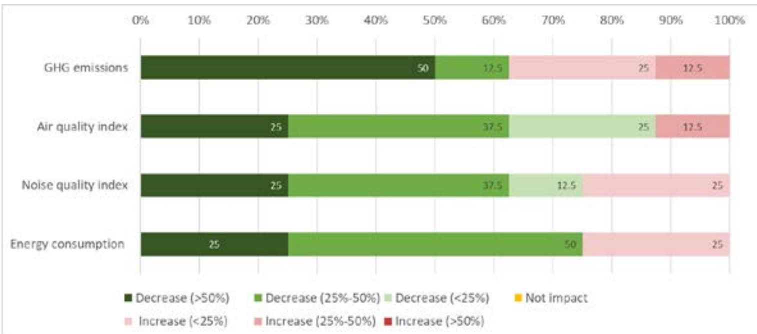

Figure 122. LL5 Oslo: Consequence Analysis - Environmental dimension (Scenario 3)

About the social dimension, most of the indicators may get a slight positive impact with the new scenario, however the cybersecurity concerns may slightly increase by 2030. Finally, the quality of jobs may remain the same.

Figure 123. LL5 Oslo: Consequence Analysis - Social dimension (Scenario 3).

About the economic dimension, majority of the stakeholders think that this scenario will have a negative impact average operation costs while the total delivery costs may slightly decrease. The price, logistics space and reliability may slightly improve too. Finally, this scenario may have a moderate positive impact on the remaining CIs.

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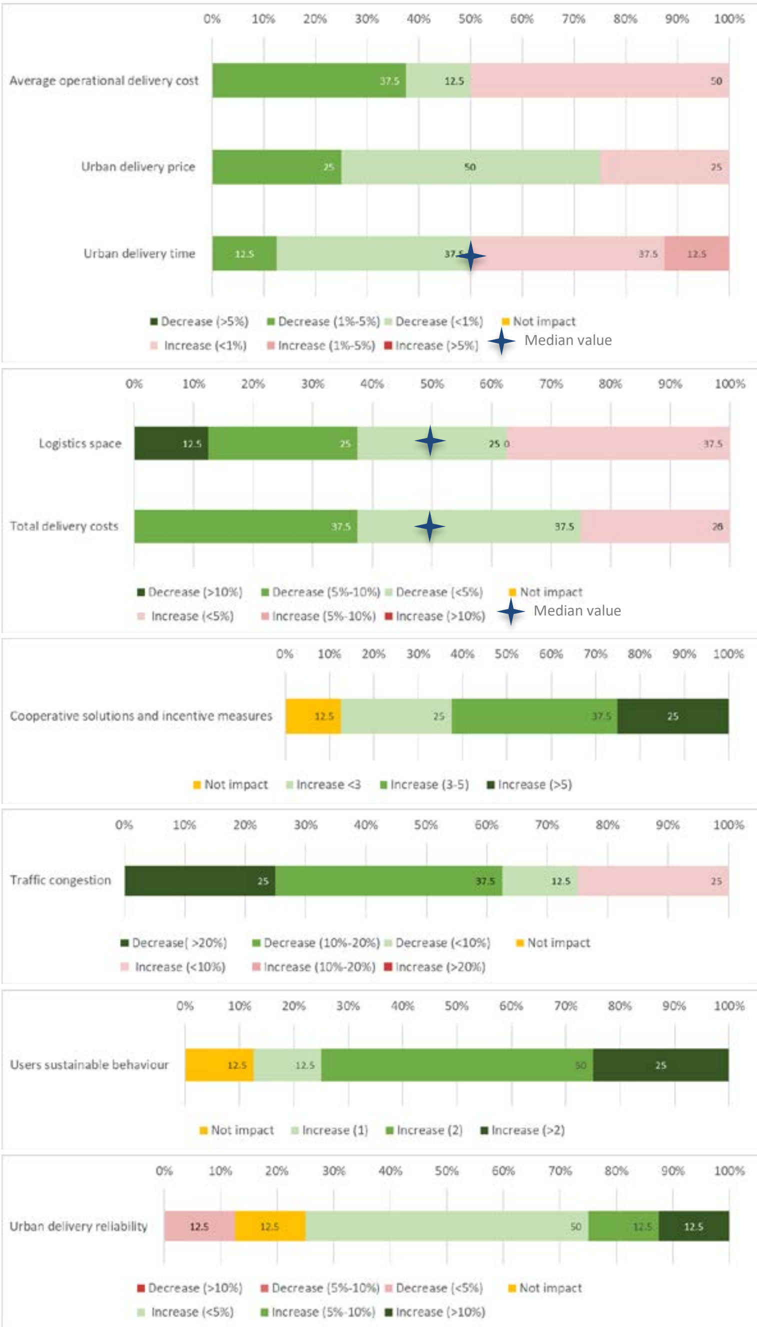

Figure 124. LL5 Oslo: Consequence Analysis - Economic dimension (Scenario 3).

Table 64.LL5 Oslo: Consequence Analysis - Comments (Scenario 3)

Comments
The number of ideas and solutions may increase as more people becomes involved in the last mile distribution processes.
How are things done today? What is the scenario replacing?

Scenario 4: Direct shipments from IKEA + Filipstad/Skøyen hub + commuters (NIMBER members) + other B2C items

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive), there are five CIs where the consensus was not reached (figure below).

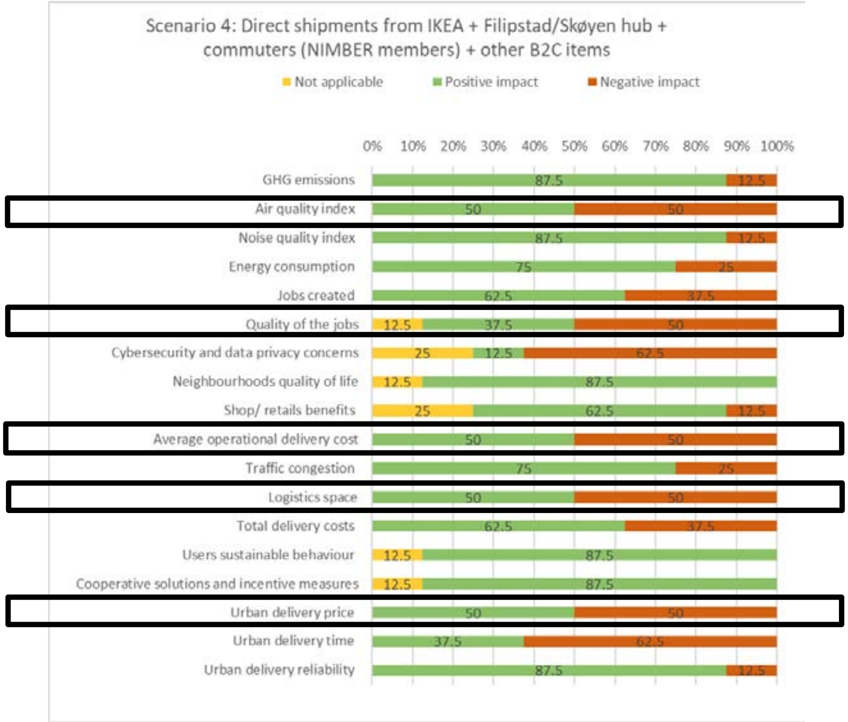

Figure 125. LL5 Oslo consequence analysis (scenario 4, overall results)

In this scenario, most of the environmental CIs may moderately improve, except AQI, applying the median, the results obtained indicates the participants think this scenario may have a medium positive impact on the AQI.

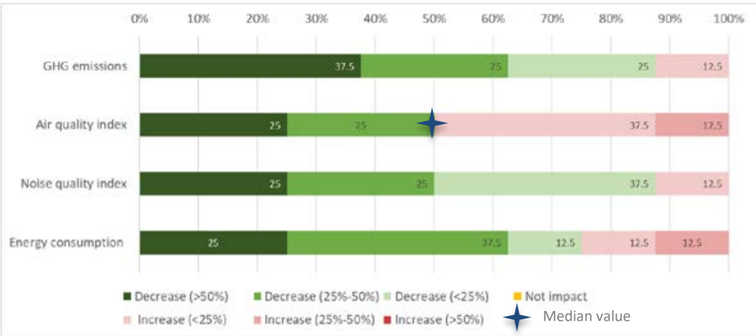

Figure 126. LL5 Oslo: Consequence Analysis - Environmental dimension (Scenario 4)

About the social dimension, number of jobs created and neighbourhoods' quality of life may moderately increase. Cybersecurity concerns may moderately increase with this scenario. Finally, quality of jobs may slightly decrease.

Figure 127. LL5 Oslo: Consequence Analysis - Social dimension (Scenario 4, part 3).

The majority of the stakeholders think this scenario will negatively impact on the price, operational costs and time. About the total costs and reliability, this scenario may slightly improve these CIs. The consensus rule is not applicable for the logistics space as the median value does not provide a clear result. Traffic congestion and users' sustainable behaviour may highly improve with this scenario while the number of cooperative solutions may improve, but moderately.

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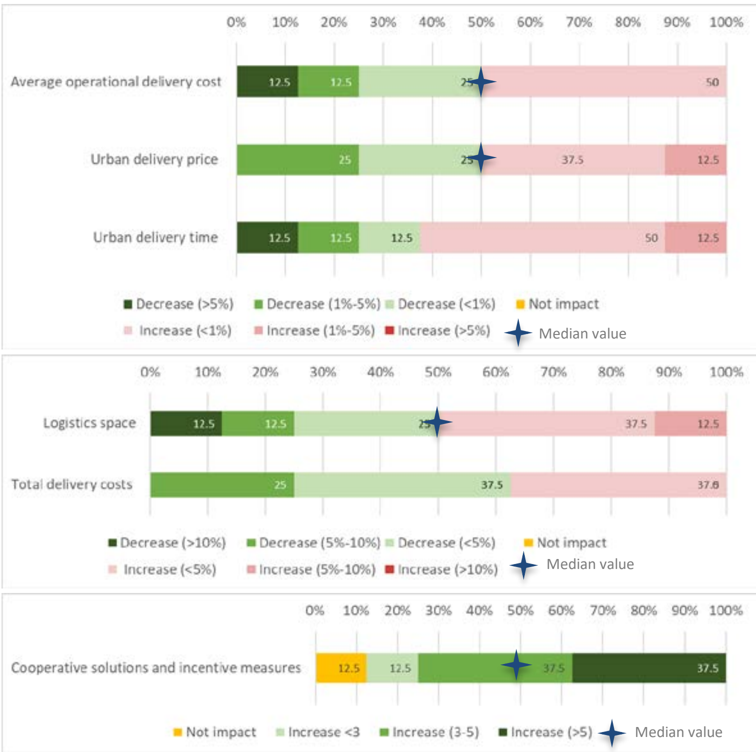

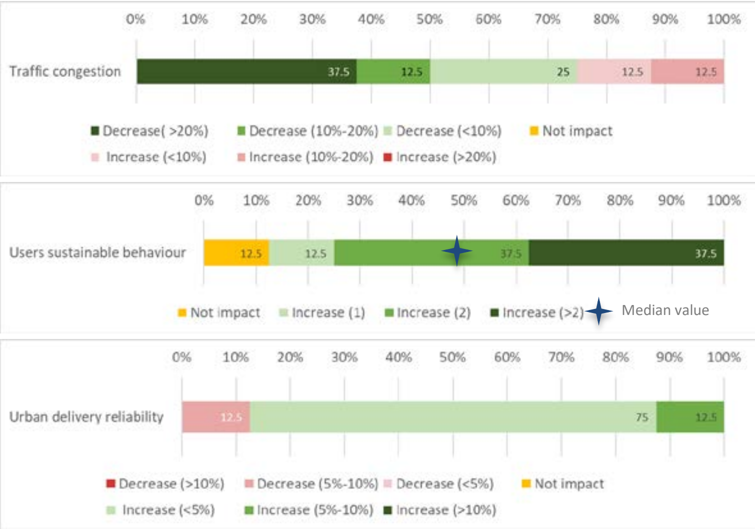

Figure 128. LL5 Oslo: Consequence Analysis - Economic dimension (Scenario 4).

Table 65.LL5 Oslo: Consequence Analysis - Comments (Scenario 4)

Comments
If the base case for some of the items shipped are other ways of dedicated distribution then the monetary costs may be reduced. If the base case is the customers' own cars/trailers then they may increase. But still the customer may prefer this way of doing last-mile operations because of presumably reduced generalised delivery costs for them.

Bilateral meetings

DHL Express is performing parcel services with direct home deliveries, whereas TÖI has been involved in various EU projects within this professional area, like Citylab and Straightsol. They are now working with the EU/H2020-project ULaaDs (Urban Logistics as an on-Demand Service), where the primary objective is to facilitate and accelerate the integration of novel, feasible, shared and ZE (Zero Emissions) solutions addressing major upcoming challenges generated by the rising on-demand economy in future urban logistics scenarios, ultimately contributing towards ZE city logistics in the EU by 2030. We have decided to cooperate in order to exploit the economies of scope between LEAD and ULaaDS).

LL6 Porto detailed information

Consequence analysis

For the indicators where consensus has been reached and the 60% majority rule was applied, the following analysis focuses on the majority group of respondents, while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

Scenario 1: Electric transition – last mile

In scenario 1, there are five CIs where the consensus was not reached (Figure 44) further detailed below.

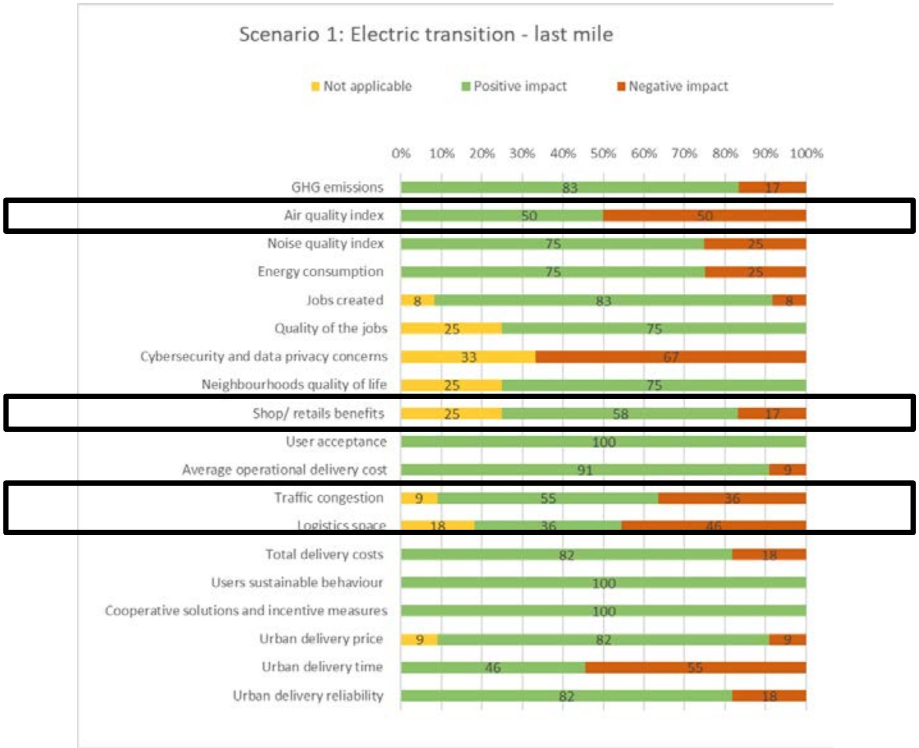

Figure 129. LL6 Porto consequence analysis (scenario 1, overall results)

As shown in Figure 45, most stakeholders expect a moderate decrease of the GHG emissions, and a slight improvement in noise reduction and energy consumption. About air quality, the consensus rule is not applicable as the median value does not provide a clear result.

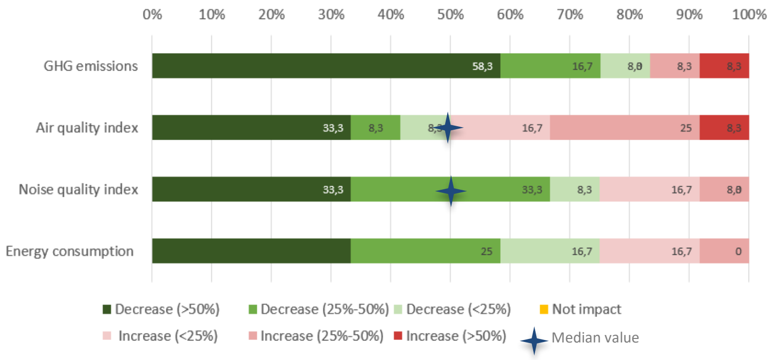

Figure 130. LL6 Porto: Consequence Analysis - Environmental dimension (Scenario 1)

About the social dimension, jobs created, quality of jobs may slightly improve, and neighbourhood quality of life will moderately improve, while cybersecurity concerns may get lightly worse by 2030. The shop/retail benefits tend to be slightly positive if we apply the median rule.

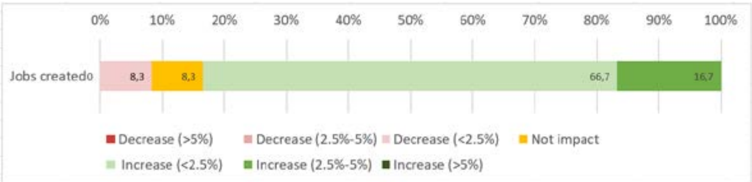

Figure 131. LL6 Porto: Consequence Analysis - Social dimension (Scenario 1).

The majority of the stakeholders think this scenario will positively impact on the price, operational and total delivery costs. The delivery time and the logistics space will be slightly worse off if we consider the median of the answers, whereas applying this same rule the traffic congestion will slightly improve. It will impact positively on all the other economic CIs.

Figure 132. LL6 Porto: Consequence Analysis - Economic dimension (Scenario 1).

Scenario 2: Food delivery service

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are 5 CIs where the consensus was not reached (figure below).

Figure 133. LL6 Porto consequence analysis (scenario 2, overall results)

In this scenario, most stakeholders expect that all the environmental CIs improve moderately except for energy consumption that will only slightly improve.

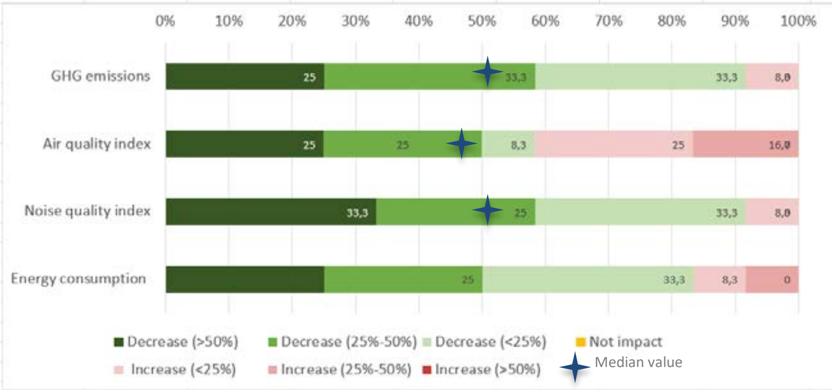

Figure 134. LL6 Porto: Consequence Analysis - Environmental dimension (Scenario 2)

About the social dimension, jobs created, quality of jobs and neighbourhoods' life may get a slight positive impact with the new scenario. According to the median value, the cybersecurity concerns may slightly increase by 2030. On the other hand, the local stores' benefits will slightly increase applying the median rule.

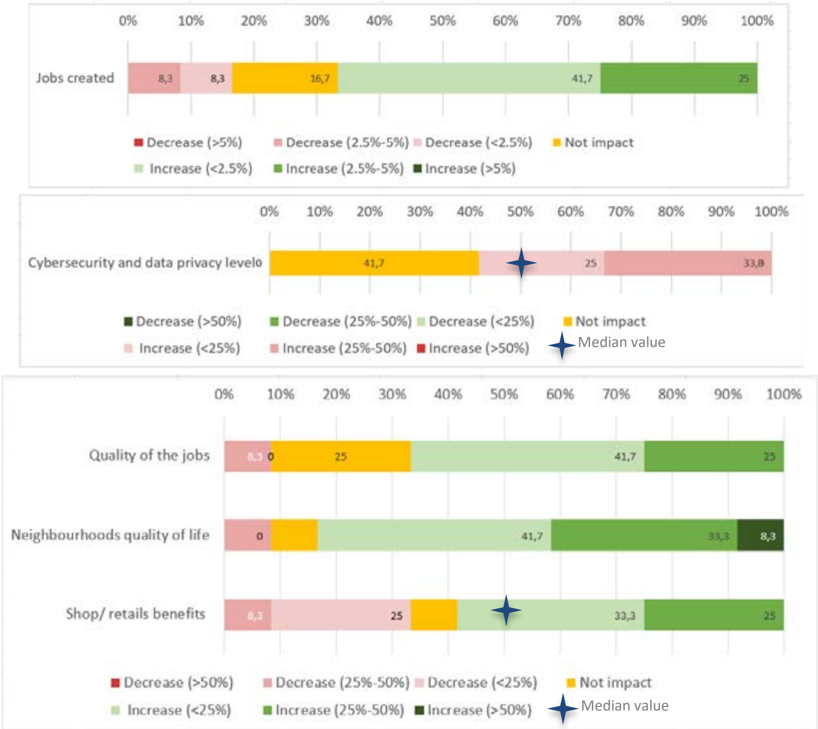

Figure 135. LL6 Porto: Consequence Analysis - Social dimension (Scenario 2).

According to the median of answers, this scenario will positively impact on the operational cost, and slightly positively on time and total costs. It will impact positively on all the other economic CIs except for price and logistics space where the median value shows that it has no impact.

Figure 136. LL6 Porto: Consequence Analysis - Economic dimension (Scenario 2).

Scenario 3: Rescheduling

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive)), there are nine CIs where the consensus was not reached (figure below).

Figure 137. LL6 Porto consequence analysis (scenario 3, overall results)

In this scenario, GHG emission and noise may slightly improve. According to the median value, energy consumption will slightly decrease. The median value shows that there is no impact on AQI.

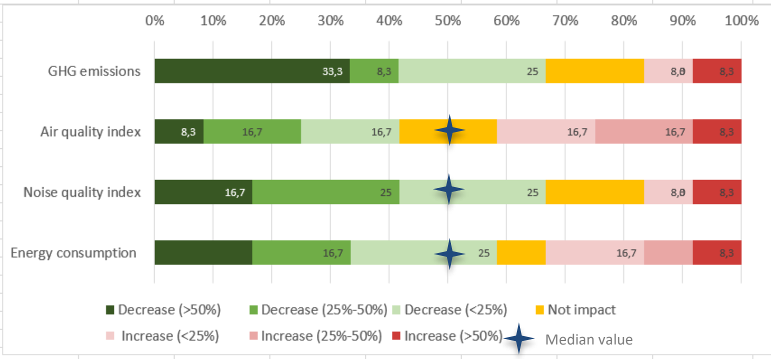

Figure 138. LL6 Porto: Consequence Analysis - Environmental dimension (Scenario 3)

About the social dimension, most of the indicators may get a slight positive impact (jobs created, quality of jobs and quality of life) with the new scenario; however, the cybersecurity concerns may moderately increase by 2030. About the local stores benefits, the median value provides a slightly positive result.

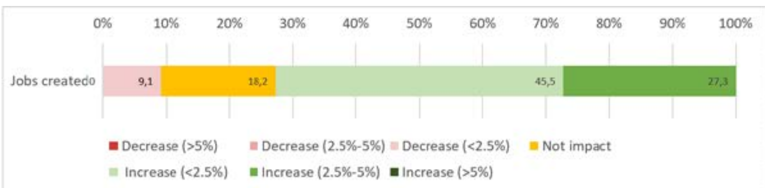

Figure 139. LL6 Porto: Consequence Analysis - Social dimension (Scenario 3).

The majority of the stakeholders think this scenario will negatively impact on the operational cost. The median also shows a slight negative impact on price, logistics space and total costs, with a slight positive impact on time. It will impact positively on all the other economic CIs, except for traffic congestion, that will slightly increase.

Figure 140. LL6 Porto: Consequence Analysis - Economic dimension (Scenario 3).

Scenario 4: Load/Unload

Based on the consensus criteria (over 60% of the respondents to agree on the impact direction (negative, positive), there are nine CIs where the consensus was not reached (figure below).

Figure 141. LL6 Porto consequence analysis (scenario 4, overall results)

In this scenario, the median rule applies to all environmental CIs, showing that there is no impact on them.

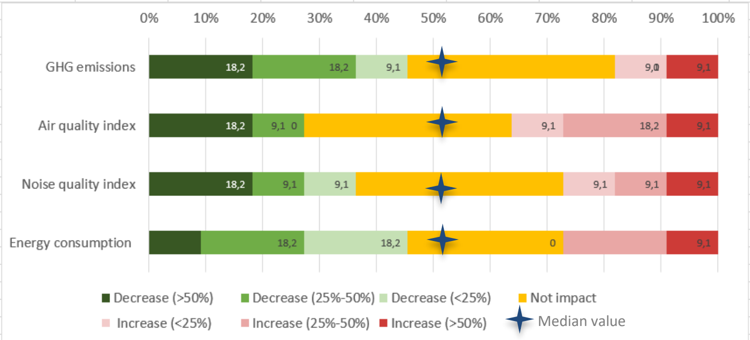

Figure 142. LL6 Porto: Consequence Analysis - Environmental dimension (Scenario 4)

About the social dimension, jobs created and neighbourhoods' quality of life may get a slightly positive impact with the new scenario, with quality of jobs having a moderately positive impact. According to the median values, local stores may have no impact on their sales and cybersecurity concerns may slightly increase by 2030.

Figure 143. LL6 Porto: Consequence Analysis - Social dimension (Scenario 4).

The majority of the stakeholders think this scenario will positively impact on time (slightly) and on the price and operational and total cost (moderately). According to the median value, it will have a slightly negative effect on the logistics space. It will impact positively on all the other economic CIs.

Figure 144. LL6 Porto: Consequence Analysis - Economic dimension (Scenario 4).

Workshop

LL6 Porto organized its first web-workshop (due to the COVID-19 pandemic) with the local stakeholders in Portuguese on December the 16h. This workshop aimed to understand the current value case scenarios to transform SONAE's last-mile deliveries towards more environmental business models with a threefold objective.

1. Consolidate external stakeholders' engagement,
2. Understand the opportunities & threats and strengths & weaknesses of the four value case scenarios from the different perspectives of the LL6 Porto key stakeholders' groups,
3. Evaluate the business value and feasibility of the four value case scenarios from the different stakeholders' groups viewpoints.

Before the workshop, the key stakeholders that belong to the LL6 CoP were contacted and invited by email. They were divided into different roles and their interests/ objectives defined and built upon the LL6 LEAD partners (

In parallel, the LL LEAD partners developed the materials (slides describing the activities and scenarios coded with specific colours) to present and validate the value case scenarios with the workshop attendees (Table 14).

For dynamizing the workshop and facilitating the compilation of required information, the LL used the ideaClouds tool. The number of attendees with permission to use this online platform is limited to 20, therefore they were informed about the limited capacity in advance. Once the final list of participants was confirmed and they have given their consent to introduce the email account in the tool, they received an email to access to the platform.

The ideaClouds tool allowed the LL to design a two-phases workshop. During the first phase or brainstorming phase, the participants were requested to introduce arguments concerning the positive or negative (opportunities and threats) aspects of each scenario with notes on a shared board, and according to the allocated role (Figure 145). After providing feedback during 6 minutes per scenario, the notes were organized and presented to the attendees. Finally, during the second phase or evaluation phase, participants rated the business value and the feasibility of each scenario according to the role allocated and the interests identified before the workshop (Table 45). They were able to include any additional comment or suggestion to justify the score or align their interests.

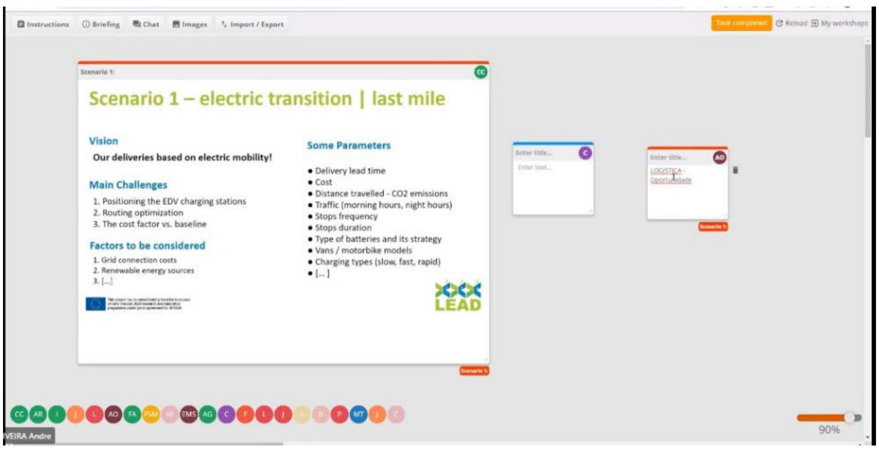

Figure 145. LL6 Porto: Workshop - Brainstorming phase (ideaClouds dashboard).

Attendees

There were 20 attendees from 9 different entities and organizations (Table 45, Figure 146). As the objective was to compile inputs from all the roles presented in Table 14, SONAE tried to uniformly recruit participants representing the key roles.

Table 66. LL6 Workshop attendees' organizations/ companies.

AMPORTO	Porto Metropolitan Area. Public Administration
Delivery Express	Distribution services provider
INEGI	Institute of Science and Innovation in Mechanical and Industrial Engineering
INESC	Institute for Systems and Computer Engineering, Technology and Science
EFACEC	Electricity provider
MSG	Mobility solutions provider
LTPLabs	Analytical-driven management consultancy company
SONAE	Multinational company with a diversified portfolio of businesses in retail, financial services, technology, shopping centres, telecommunication
ZARAGOZA LOGISTICS CENTER	Supply chain and logistics education and research centre.

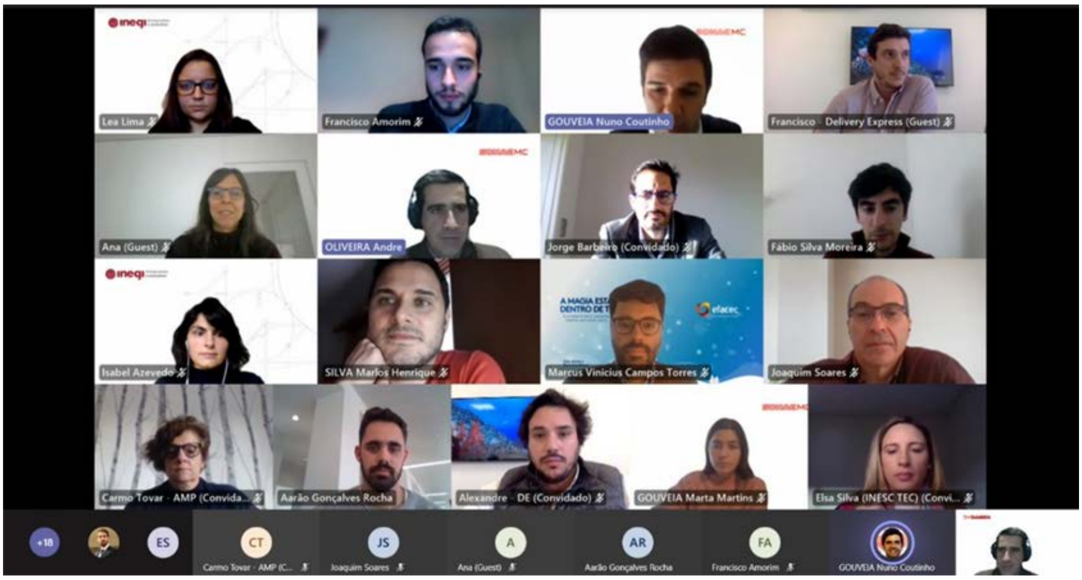

Figure 146.LL6 Porto: Workshop attendees.

Table 67. LL6 Porto – Scenario 1: Opportunities &threats; strengths & weaknesses.

	Scenario 1: Electric transition			
AP	**OP**	Creation of local carbon market with bonus for carbon neutral deliveries. Interest of transport entities in learning from the results of the project about the optimization of routes, since the model can be applied to the "last mile" mobility of public transport users. In line with the AMP objectives.	**TH**	
	ST	CO_2 reduction and noise pollution reduction - meets national strategy and objectives. (Strength)	**WK**	
R&D+I	**OP**	Consider the number of electric vehicles in the area before deciding where to create charging stations available to consumers. Integrated GPS system to determine the nearest charging station. There are already plenty of models for locating charging stations in literature. Testing solutions for integrating renewables into mobility, which can be transferable to urban mobility cases. Incorporate in the optimization of routes the relationship between the occupancy rate (volume / weight), the energy consumption and the CO_2 emissions. Future / current urban restrictions for non-electric vehicles.	**TH**	Dimensioning the area and number of charging stations is important in order to avoid congestion in the operation (ex: a large number of vehicles stopped waiting to load). Consider parameters of quality of cargo transport. Route time may be longer than the vehicle's autonomy. Geography of the land - the impact of geography (uphill, downhill) in the consumption of vehicles.
	ST	Significant contribution to reducing polluting gases (in addition to CO_2) and noise in an urban environment.(S)	**WK**	Maintenance costs for an electric vehicle can be difficult to measure correctly.(W)
Logistics	**OP**	The average definition of volumes and weights to be delivered is an important point to consider.	**TH**	Need to ensure availability of charging stations. Distribution with electric vehicles is essentially for urban centres.
	ST		**WK**	Positioning and routing challenges must be addressed in one step and not sequentially.(W)

	Scenario 1: Electric transition			
Energy	**OP**	Charger type decision (slow, fast or ultra-fast) should take into account used vehicles (AC or DC). Charger type decision (slow, fast or ultrafast) should take into account charging time (night or "SOS"). SONAE should think of a night charging system where it is possible to use the existing car parks for an EV parking and charging service.	**TH**	
	ST		**WK**	
Mobility	**OP**	Creating vehicles adapted to each type of delivery – it is easier to adapt an electric chassis than a conventional combustion chassis.	**TH**	
	ST		**WK**	
New Business model	**OP**		**TH**	The footprint of stores (particularly the smallest ones found in urban areas) may not allow the installation of charging stations.
	ST	Emission-free deliveries can be used as a strong ecommerce selling point. A customer may have a greater willingness to pay for a delivery service if he knows that it is 100% electric.	**WK**	

Table 68. LL6 Porto – Scenario 2: Opportunities &threats; strengths & weaknesses.

	Scenario 2: Food delivery services			
AP	**OP**	Reduced congestion with the elimination of individual transport and widespread use of motorbikes.	**TH**	
	ST		**WK**	
R&D+I	**OP**	Fleet size optimization at each point. Delivery rate lower than the competition.	**TH**	Range of action related to vehicle autonomy. Saturated market. What is the differentiating point in face of

		Scenario 2: Food delivery services		
		Calculation of the associated energy savings along the route (points system related to the selection of delivery service in electric vehicles). Given the diversity of SONAE services, this would create a possibility of integrating food delivery with other immediate delivery services (e.g. pharmacy). There are beginning to exist approaches that allow pricing and routing in last mile 30min of delivery real time (author: Marlin Ulmer).		competition? How is the platform different from the competition?
	ST	Reduction in travel time and reduction of emissions associated with this service.(S)	**WK**	It can be complicated to implement platforms (software) that surpass current players (like Uber, Glovo, etc).(W)
Logistics	**OP**	Innovative service in Portugal. Last mile 30min delivery. Great potential. Phasing the delivery rays in phases. Set expansion zones gradually. Personalized customer service. Benefits: Response time, convenience. Satisfy the customer's needs, who increasingly want its needs to be met on time. Independence of platforms and creation of a personalized service. Closer proximity to the customer. Food delivery is a growing market and the few significant players that exist dominate the market.	**TH**	
	ST		**WK**	
Energy	**OP**	Creation of a 100% electric fleet accelerating SONAE’s decarbonization process. With this service, SONAE could have lower costs, creating synergies with Elergone for night charging at Group stations. Subsequently make more aggressive partnerships with large catering chains and compete with the main players in the sector.	**TH**	There’s "daily seasonality" that’s incompatible with the number of available chargers. This way the charging moments should be off peak in order to level.

		Scenario 2: Food delivery services		
		Charging points close to the main order collection points (taking advantage of waiting time to load).		
	ST		WK	
Mobility	OP	Capillarity reduces vehicle costs because it allows the use of smaller capacity batteries.	TH	
	ST		WK	
New Business model	OP	Consider partnerships with existing players in the go-to-market of this initiative. Crowdsourcing of delivery capacity.	TH	The food delivery market needs scale to ensure customer adoption. Food delivery market saturated by the countless existing players.
	ST	Capillarity of SONAE's stores.(S)	WK	

Table 69. LL6 Porto – Scenario 3: Opportunities &threats; strengths & weaknesses.

		Scenario 3: Rescheduling		
AP	OP	Partnership with public entities for the creation of electric charging stations.	TH	
	ST		WK	
R&D+I	OP	Optimization of fleet size. Optimization of delivery times. Considering location data, it might be possible to select the store closest to the destination. Coordinate this service with the food delivery service (scenario 2) - in order to optimize travel.	TH	Types of articles to be delivered (food product and other product - incompatible types). Opening hours of this service? Driver availability for 24 hours? What is the minimum shipping cost? What is the minimum purchase price?

		Scenario 3: Rescheduling		
		It might make sense to have the store's own customers (who have EV) making some deliveries		It can be difficult to assess the perceived value of the consumer vs complications created at the operations level.
	ST		WK	Solve a problem (in the event that missing items are delivered). The use of mopeds limits the type of service provided (given the load limitation).(W)
Logistics	OP	Identify the average daily volumes of re-deliveries vs urgency vs vehicles. Reduce waste, reduce complaints. Response time for re-delivery is critical to customer satisfaction.	TH	
	ST		WK	
Energy	OP	Use of low consumption and fast charging EV for small volumes of goods.	TH	
	ST		WK	
Mobility	OP	Electric vehicles can be perfectly adapted to each type of service, thus improving efficiency and lowering costs.	TH	
	ST		WK	
New Business model	OP	It may make sense the following logic: a convenience store that operates after hours. There will be more delivery slots open and there will be another channel for scheduling. Promote a number of fast deliveries to more loyal customers.	TH	
	ST		WK	

Table 70. LL6 Porto – Scenario 4: Opportunities &threats; strengths & weaknesses.

		Scenario 4: Load/ Unload		
AP	OP	Opportunity to optimize the electric charging schedule. Models of urban planning and mobility management in cities	TH	

		Scenario 4: Load/ Unload		
		should seek to eliminate constraints in delivery periods. The future of loading cargo vehicles may pass through ultra-fast loaders / pantograph, where the loading or unloading of goods is the ideal time to charge the vehicle for the scheduled route of the day. It would optimize fuel costs and there would be the possibility of synergies with Solar / Storage in the event of a power outage.		
	ST		WK	
R&D+I	OP	Define vehicle load planning. Ensure the synchronization of the cargo loading operation with the battery charging operation (distance required).	TH	Battery charging time should be considerably longer than loading time. Required loading time may not be equal to the vehicle charging time.
	ST		WK	The discharge time may not be enough to complete charging the battery, causing congestion.(W)
Logistics	OP	It is essential to have a partner with know-how in batteries / quick chargers to help identify the timing required to charge the vehicles / batteries in each warehouse.	TH	Light vehicles vs motorcycles: they have different needs for charging / battery / autonomy / capacity / response time. The challenge is to assess and assign the type of orders / volumes for each vehicle.
	ST		WK	
Energy	OP	SONAE with the logistic partners can create an exclusive loading platform for this type of vehicles and with this commercialize to other transport / logistics companies in order to increase its profitability. Specialized fast and ultra-fast charging solutions for heavy EV.	TH	
	ST		WK	
Mobility	OP		TH	
	ST		WK	
	OP	Finding compensation for vehicle loading from logistics partners.	TH	Unloading time of the goods may not be compatible with adequate loading.

	Scenario 4: Load/ Unload			
	ST		WK	Difficult to load and unload the same vehicle.(W)

Results: Evaluation phase

Table 47 shows the score obtain by each scenario for the feasibility, the business value and the average used for the graph. The definition of the feasibility and business values is detailed in section 2.4.

Table 71. LL1 Porto: Evaluation phase: business value and feasibility scores.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Feasibility	3.8	3.27	3.13	2.5
Business value	3.75	2.94	2.88	2.69
Average	3.78	3.11	3.01	2.60
Comments	Opportunity to speed up and make real this transition. Based on the DNA of Sonae, there is a great potential to scale this scenario in Porto area to different geographies in Portugal.	Opportunity to create a pioneer and innovative service in Portugal.	Great potential to respond quickly to a current need with a particularly positive impact on customer level.	The flow and procedures of this theme will be fundamental for the future of distribution.

Annexe 6: KPIs identification

Analysis of KPIs questionnaire

The final list of KPIs (see Table 15) came out from the consensus reached during a proactive and efficient meeting with the LLs coordinators, along with INLECOM as LEAD technical coordinator, UPM as leader of the LLs impact and validation frameworks and ZLC as the LEAD LLs coordinator.
During the meeting, UPM presented the analysis of the questionnaires compiled during the second step of the process (see Figure 42). To display the results, tables with different colours (see Figure 147) were used. After a fruitful discussion, a preliminary list of KPIs with their initial definition was agreed.
The main points and conclusion of the meeting were the following ones:

- Table 15 (page 83) shows a common outline of the most important KPIs acknowledged by the LLs, allowing for possible variations that may be suggested during WP3. This list of KPIs and the new ones proposed by the LLs in their local exercises will be reviewed and discussed together in the next phase.
- We agreed on not defining yet specific metrics and units for the KPIs. They will be decided in the next phase together with the LLs. For this reason, the final list of KPIs does not include metrics.
- There was a large agreement on the definition of all proposed environmental KPIs (Table 72. All the KPIs were considered mostly representative of the LLs. Only the Air Quality Index may have problems for its calculation.
- Concerning economic KPIs (Table 74), there was a general agreement on the definition of all of them. As some economic KPIs are stakeholder specific, we agreed to make them more specific and explicit in the next phase.
- The most controversial KPIs were the social ones (Table 73).

o Job quality was widely discussed. Many LL proposed to re-define and measure it in a qualitative way through the CoP.

o The cybersecurity and privacy concerns may be based on the LLs perception. The agreement was to remove from the global KPIs, but each LLs will analyse how the new business models will impact on it.

o The user’s sustainable behaviour and collaborative solutions are difficult to calibrate. So, further attention will be given in the next steps.

Green	More than 2/3 of LLs responded positively
Orange	Less than 2/3 and more than 1/3 of LLs responded positively
Red	Less than 1/3 of LLs responded positively

Figure 147. 1st step: KPIs colour code

Table 72. 2nd step Environmental KPIs

KPI	Definition	Agree with definition?	Possible to calculate?	Representative for LLs?
GHG emissions	Daily absolute tons of CO2e savings compared to the “do-nothing” scenario	100%	100%	100%
Air quality index	Daily µg/m3 of pollutants [PM10, PM2.5, NO2, O3] savings compared to the “do-nothing” scenario	100%	0%	80%
Noise quality index	Daily decibel savings* compared to the “do-nothing” scenario	100%	60%	80%
Energy consumption	Daily kWh of energy savings compared to the “do-nothing” scenario	100%	100%	80%

Table 73. 2nd step Social KPIs

KPI	Definition	Agree with definition?	Possible to calculate?	Representative for LLs?
Jobs created	Total number of yearly jobs created in last mile deliveries compared to the “do-nothing” scenario	80%	40%	60%
Job quality	The ratio of self-employed workers in the last mile distribution sector compared to the “do-nothing” scenario	60%	20%	40%
Data privacy and cybersecurity concerns	Number of cybersecurity and data privacy information requests*2 compared to the “do-nothing” scenario	100%	60%	40%
Neighbourhoods quality of life	Number of people satisfied with the neighbourhood where they live in comparison with the “do-nothing” scenario.	100%	100%	100%
Users sustainable behaviour	Number of ideas suggested to promote more sustainable behaviour on clients and users approved by them compared to the “do-nothing” scenario	80%	60%	80%
Cooperative solutions and incentive measures	Number of cooperative solutions and incentive measures compared to the “do-nothing” scenario	80%	80%	80%

Table 74. 2nd step Economic KPIs.

KPI	Definition	Agree with definition?	Possible to calculate?	Representative for LLs?
Operator's delivery cost	Daily operational delivery cost savings compared to the "do-nothing" scenario (operator)	60%	100%	100%
Operator's idle times	Daily congestion time saved compared to the "do-nothing" scenario	60%	40%	100%
Public space allocation	Public space (m2) required for last mile deliveries (handling, driving, parking) in comparison with the "do-nothing" scenario.	100%	80%	100%
Operator's investment cost	Total investment costs in comparison with the "do-nothing" scenario (facilities, vehicles)	100%	80%	100%
Shop/ retails benefits (turnover)	Yearly sales*2 compared to the "do-nothing" scenario (turnover)	80%	60%	80%
Operator's urban delivery time	Average daily delivery time compared to the "do-nothing" scenario	100%	100%	100%
Operator's delivery reliability	Percentage of on-time deliveries compared to the "do-nothing" scenario	100%	100%	80%
Operator's cybersecurity vulnerability	Probability of cybersecurity attacks compared to the "do-nothing" scenario (e.g. By including drones)	80%	60%	40%

List of proposed KPIs

During the definition and the agreement of the global KPIs, some LLs suggested new KPIs (see Table 75). These KPIs will be further analysed in WP3.

Table 75. 3rd step list of proposed KPIs

KPI	Description
Load factor	Use of the capacity of each vehicle
Freight efficiency	Vehicle km; travel times; lead times
Occupancy rate	The use of the assets, such as lockers, rent bikes, etc.
Customer satisfaction	Maybe included in reliability, probably survey based
New clients	Increase in MS, crowd shippers drawn; deliveries through platform
Delivery flexibility, opening hours and rescheduling (can be split)	Changes in delivery time windows compared to the “do-nothing” scenario. This should be measured in 1. Changes in opening hours. 2. Changes in rescheduling possibilities. Must be mapped by the operators, but could also be surveyed amongst the customers.
Delivery flexibility, other changes (can be split)	1. Changes in reordering possibilities (like adding more items to the delivery). 2. Changes in the possibilities to order value added services (like carrying, assembly, return logistics). Must be mapped by the operators, but could also be surveyed amongst the customers.
Changes in modal split	Changes in the use of regular cars, trucks with and without ZE technology, cargo bikes, public transit.