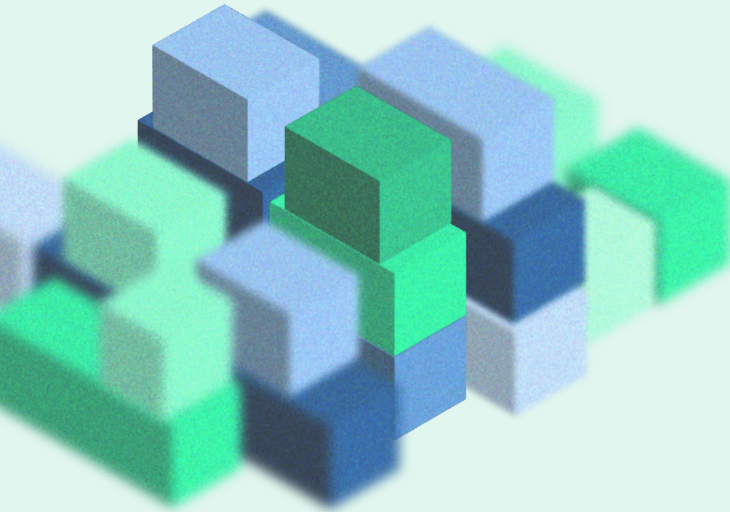




Freight-Efficient Land Use (FELU)

INTERACTIVE GUIDEBOOK

Optimised for Google Chrome

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No [101103812]



Funded by
the European Union

Recommendations on
how to allocate land
uses for an efficient
urban freight. KER3

INDEX

Freight-Efficient Land Use (FELU)

4 – 5

Introduction

6 – 9

Land Use and Interventions

10 – 15

Logistics & Externalities

16 – 19

Land Use & Data

20 – 43

Living Labs & KERs
BMs presentation

INTRODUCTION

This guide is a result produced by the UNCHAIN[®] project, aimed at highlighting how relevant urban planning is in optimizing goods distribution

Urban planning focuses on how land is used within a city, including transportation and mobility. It can therefore be a powerful tool to influence on the impacts related to mobility activities, and consequently to urban logistics. In this guide, we introduce the concept of Freight-Efficient Land Uses¹, a

concept from logistics literature, and connect it with key findings from the UNCHAIN project. Our goal is to offer recommendations for urban planners and logistics professionals to optimize the urban logistics processes.

Freight-Efficient Land Uses (FELUs) are defined as the Land Use patterns that minimize the social costs associated with both the supply chains and the economic activities that consume and produce goods, at all stages of production and consumption; including reverse and waste logistics¹.

Minimize Social Costs: to reduce the private and external costs of supply chains and their stages

Foster Compactness of Supply Chains: to reduce the distance traveled at supply chain stages, up and downstream

Mitigate Supply Chain Externalities: to reduce or eliminate the externalities at supply chain nodes and Large Traffic Generators (LTGs)

Engage Stakeholders, to ensure their points of view and concerns are addressed¹

Seek Appropriate Solutions that recognize and account for local conditions

¹Holguín-Veras, J.; Wang, C.; Ng, J.; Ramírez-Ríos, D.; Wojtowicz, J.; Calderón-Quevedo, O.; Caron, B.; Rivera-González, C.; Pérez, S.; Schmid, J.; et al. Planning Freight-Efficient Land Uses: Methodology,

Strategies, and Tools: Guidebook; NCHRP Project 08-111; Transportation Research Board: Washington, DC, USA, 2020

LAND USE AND INTERVENTIONS

Land Use

To manage the Land Use it is required to adopt some kind of actions or initiatives. The term initiative refers to an entire spectrum of mechanisms — projects, programs, regulations and policies — that the public and private sectors can use to foster sustainable practices. These initiatives can be classified as:

Land use: initiatives involving the management of urban facilities and urban spaces.

Transportation: initiatives involving logistics agencies

Joint initiatives: interventions combining Land Use initiatives and Transportation initiatives.

The identified initiatives involving Land Use can be classified in the following categories:

1

Long term planning
e.g.: Logistic land reserves.

2

Zoning
e.g.: Create special purpose districts.

3

Site/Building design
e.g.: Off-street load and parking areas.

4

Facilities/Infrastructure management
e.g.: Urban consolidation centre.

5

Parking/Loading areas management
e.g.: Truck stops/long term parking.

6

Pricing, incentives, and taxation
e.g.: Use tax incentives.

7

Stakeholders engagement
e.g.: Foster private-public collaboration.

Delphi questionnaire conducted as part of the UNCHAIN project user research  identified stakeholder engagement as a key factor in achieving sustainable urban logistics. When analyzing common barriers, enablers, and recommendations, UNCHAIN partners consistently highlighted the importance of Public Management and Legislation. These findings underscore the need to involve local stakeholders — governments, businesses, and community members — in shaping urban logistics strategies that are both effective and inclusive.

Categories are defined [HERE](#)

	High impact categories	Mid impact categories	Low impact categories
Barriers	- Public management & Legislation - Infrastructure	- Public Private Partnership / Collaboration - Smart city - Business - Infrastructure	Sustainability
Enablers	Public management & Legislation	- Public Private Partnership / Collaboration - Smart city - Business	Sustainability
Recommendations	- Public management & Legislation - Public Private Partnership / Collaboration - Smart city	- Infrastructure - Sustainability - Business	

LAND USE AND INTERVENTIONS

The UNCHAIN project is developing different services and exploitable results, which fall in the categories of both Land Use and Transportation initiatives.

**The Key
Exploitable
Results (KERs)
that are
classified as
Land Use
initiatives are:**

KER2

SUMP and Sulp guidance tool, designed for long-term planning

KER4

UCC location and integrated planning KIT. Facilities / Infrastructure Management

KER5

On-street loading zones planning tool. Facilities / Infrastructure Management

KER11

Logistics operator monitoring system and incentives tool. Pricing, incentives and taxation

KER13

Advanced Management IT Cockpit of Shared Facilities. Parking/Loading areas management

LOGISTICS & EXTERNALITIES

Land Use planning is essential to fostering quality of life and harmony among the myriad social and economic activities that take place and compete for urban space and metropolitan areas. As an economic activity, logistics generate richness for the community, which is a positive

impact or externality, but this activity also creates **negative externalities**.

A Land Use plan that increases the physical separation between the distribution centers and the customers in the city centre will increase the negative externalities, which are:



Reducing the distance is likely to be socially beneficial, as it will reduce the externalities that affect local communities and the environment, but operation

costs will increase, as the use of urban space near the city center increases the business costs.

Land Use patterns have to support logistics in balancing the positive and negative externalities, avoiding negative impacts for local communities, without excessively penalize

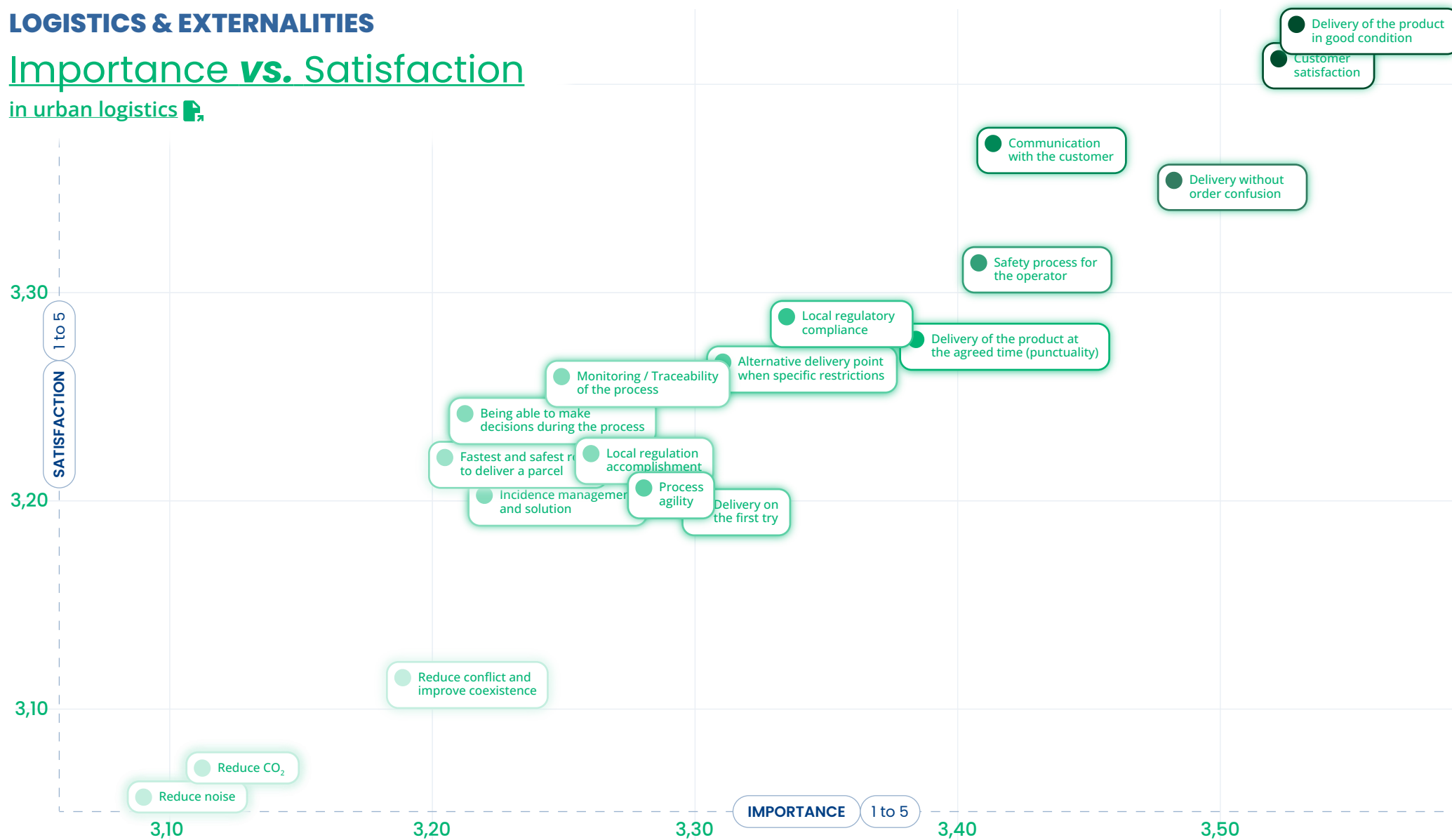
private-sector activity. In addition, all the stakeholders must commit in negative externalities mitigation or even elimination (and their associated costs).

The correlation between **Importance** and **Satisfaction** for logistics requirements is presented in the next pages' graph. The following graph, showing the results generated in a survey participated by logistics professionals within the UNCHAIN project, clearly shows the high correlation level between **Delivery of the product in good condition** and **Customer satisfaction**, but also reveals what stands out as less important and less properly solved. Indeed, **Reduce noise** and **Reduce CO₂** have the lowest **Satisfaction** level, and the lowest **Importance** level, manifesting a weak commitment of the market with sustainable values. These two topics emerge as relevant innovation factors for the urban logistics.

LOGISTICS & EXTERNALITIES

Importance vs. Satisfaction

in urban logistics 🏠



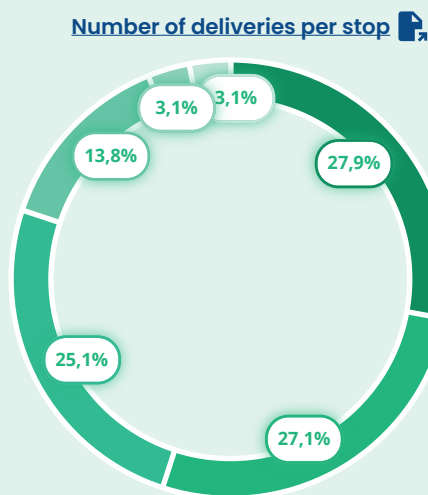
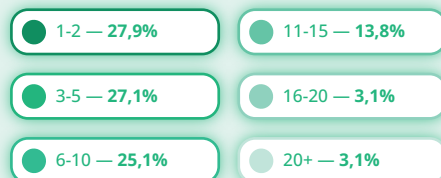
LOGISTICS & EXTERNALITIES

Urban logistics support two main types of economic activity: business-to-customer (B2C, such as online purchases), and business-to-business (B2B, such as supplier deliveries). While both activities account for a similar share of deliveries and shipments (B2C represents

51%, while B2B represents the remaining 49%), their impact on freight traffic is different. The difference is driven by the number of vendors and carriers involved, and the density of deliveries and pick-up locations.

For B2C deliveries, publicly available data is limited. Delivery volumes vary widely, from single-package trips to routes with up to 20 stops, often in large buildings.

Question: If you make more than one delivery per parking lot, what average number of deliveries do you make each time you stop (for example, every time I park the vehicle I make 3-5 deliveries)?



For B2B, retail trade is estimated to produce between 30% and 40% of the freight activity in metro areas, accommodation and food another 10% to 20%, and service-intensive sectors another 5% to 10% of the commercial freight traffic. Anyway, the distribution of the freight activity will depend on cities' land occupation density and land uses, according to local urbanism and urban's singularity.

Land use in UNCHAIN cities

UNCHAIN's Living Labs UNCHAIN's Follower Cities

	MADRID	FLORENCE	BERLIN	PRAGUE	FUNCHAL	RIGA	MECHELEN
Residential Area	10,5%	36%	29,5%	12%	29,5%	21,8%	15,6%
Commercial & Industrial Area	6,1%	14%	5,4%	8,5%	1,6%	17%	4,6%
Leisure Area	10,2%	8%	5,1%	9%	4%	19%	5,4%
Central Core with Suburban & Industrial Zone							
Central Core with Districts & Efficient Logistics Infrastructure							
Central Core with Limited Logistics Infrastructure & Micro-Logistics							

Logistics system

LAND USE & DATA

The availability of data spaces to share datasets among urban managers, logistics operators and technology developers is a very relevant asset to improve the urban logistics. These datasets can feed applications and services operating in real time, to improve daily logistics operations, but also to calculate indicators to reveal the performance of logistics in the urban environment.

Regarding datasets, some of the most relevant for urban logistics are those presented in the following table. These datasets are critical to address not only *Land Use initiatives*, but also *Transportation initiatives* like *Traffic Management* or *Logistical Management*.

UNCHAIN's data space to foster logistics in the cities

KER1 

Data Driven Urban Logistics
Cooperation Framework

DATA	Facilities and Infrastructure Management	Traffic Management	Parking / Loading Areas Management	Logistical Management	Pricing Incentives and Taxation
Loading and unloading street locations	✓		✓	✓	✓
Usage info of loading and unloading street locations	✓		✓	✓	✓
Inhabitants per building or small zones	✓				✓
Zones for hardware installation			✓		
Special dates calendars				✓	✓
Delivery planning	✓		✓	✓	✓
Traffic data	✓	✓	✓	✓	✓
Road shape and specifications	✓	✓		✓	✓
Number of available parking space	✓		✓	✓	✓
Special restrictions based on council land use rules	✓	✓	✓	✓	✓
Accident hotspots / areas to be avoided		✓		✓	
Forecast data on events related to traffic		✓		✓	
Information on construction sites		✓		✓	
Environmental impacts in the hub's neighbourhood	✓				

LAND USE & DATA

The UNCHAIN project has identified key performance indicators (KPIs) 📄, that help evaluate how land use decisions affect urban logistics. These indicators provide valuable insights for urban planners, policymakers, and logistics professionals aiming to make data-driven decisions.

- 1 Number of logistics centres, platforms, hubs, lockers
- 2 Ratio of loading / unloading areas - public space dedicated to urban logistics
- 3 Policy related
- 4 Stakeholder engagement
- 5 Energy use and infrastructure available at warehouses, microplatforms, etc.
- 6 Time window in city for urban logistics
- 7 Revenue from LEZ access fee (EUR)
- 8 Number of commercial outlets having a cargo area within a 75 m radius

To calculate these KPIs accurately, access to reliable and up-to-date datasets 📄 is essential. For example, the table on the following page lists the datasets required to compute the first KPI

mentioned earlier. These datasets enable the calculation of validated sub-indicators, which together provide a comprehensive view of the selected KPI's performance.

Number of logistics centres, platforms, hubs, lockers

- Types and characteristics of logistics centers
- Number of logistic centres
- Number of microplatforms
- Number of lockers
- Sustainability of the urban distribution of goods (last mile): $\text{Number of centers in the city} / \text{Urban area (km}^2\text{)} \times 100$
- Multi modal hubs
- Number of pickup micro hubs
- Interoperability

DEMONSTRATION IN BERLIN

KER4

UCC location and integrated planning KIT. UCCs, UDCs

Medium urban density. High residential use.



Daytime delivery

Facilities/Infrastructure management

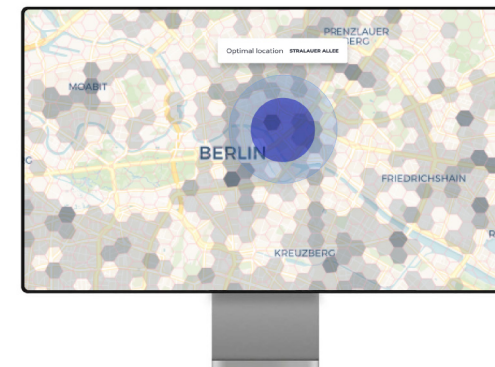
Joint initiatives / Land Use initiatives

Major improvements

KER contribution:

To optimize UCC planning through better land use, flexible spaces, and supply chain integration.

Optimization of UCC location in urban planning



BUSINESS MODEL PRESENTATION – KER 4

The Business

PARTNERS

VMZ

Local Authority

Logistics Operators

Real Estate

Delivery companies

ACTIVITIES & RESOURCES

To identify optimal location for UCC and micro-depots

Datasets such as traffic levels, population density, Land Use, or number of parcels delivered

Available Loading/Unloading areas

The Value

To simplify UCC planning in urban areas

To improve land use and flexible use of public spaces

To account for entire chain of supply to identify optimal location

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authority & Real Estate

Marketing events to attract Local Authority

SEGMENTS

Local Authority

Tool developers

Logistics Operators and other private business

The Flow

Out

UCC leasing and maintenance cost

Software cost

In

Tool licensing

DEMONSTRATION IN FLORENCE 🌐

KERI1 🌐

Logistics Operator
monitoring system and
incentives tool.

Recognition programs

High urban density. Historical centre

Daytime delivery

Pricing, incentives and taxation

Land Use initiatives

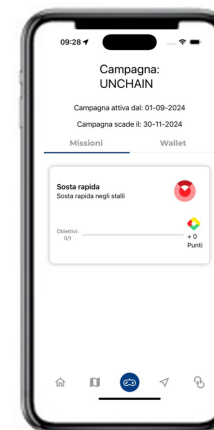
Pricing

HISTORICAL CENTRE,
FIRENZE



KER contribution:

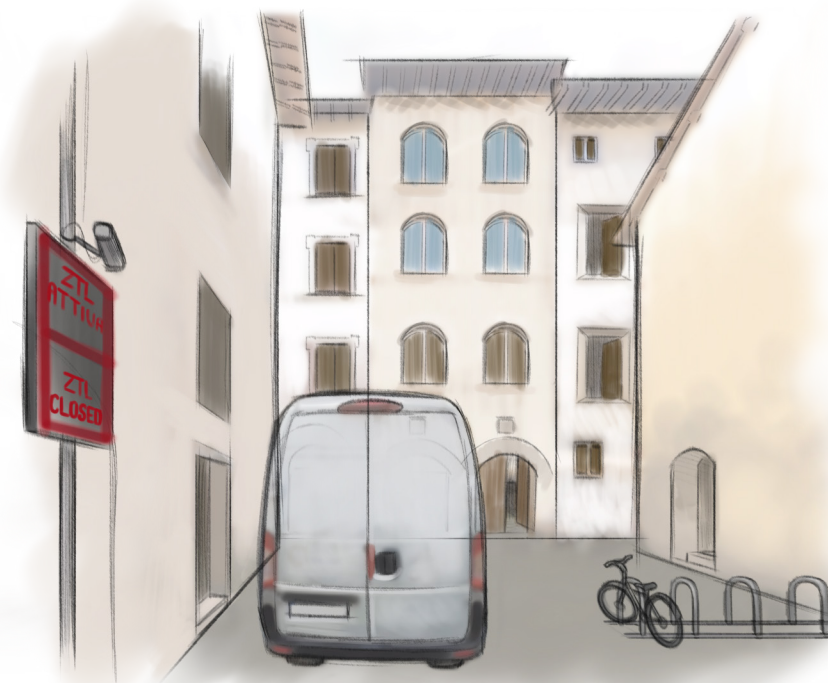
To analyze delivery data, to
optimize sustainable routes,
and to improve restriction
planning.



Low emissions zone

Reward policies
management

Behavioral
Tracking-Social
Nudging



BUSINESS MODEL PRESENTATION – KER 11

The Business

PARTNERS

MUNICIPIA and Lancaster University

Local Authority

Logistics Operators

Real Estate

ACTIVITIES & RESOURCES

To provide a reward system

MCDM² framework for ULO assessment (PLIAS ULO)

Datasets including UVAR restrictions, vehicle emissions and dimensions

Sensors, cameras, electronic boards

²MCDM: Multi-Criteria Decision Making

The Value

Data on delivery flows and effectiveness of restrictions

More sustainable delivery routes

To plan restrictions' improvements

The Flow

Out

Tool cost and maintenance

Management of parking space

Sensors and camera installation

Parking space costs

Rewards

In

Tool licensing

Revenue from penalties

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authority & MUNICIPIA

Local Authority & Real Estate

Marketing events to attract Local Authority

Advertisement campaign to engage Logistics Operators

SEGMENTS

Local Authority

Tool developers

Logistics Operators

DEMONSTRATION IN MADRID

KER13

Advanced Management IT Cockpit of Shared Facilities. Upgrade Off-street Parking Areas and Loading Docks

High urban density. Commercial area with intensive use of small to medium size businesses.

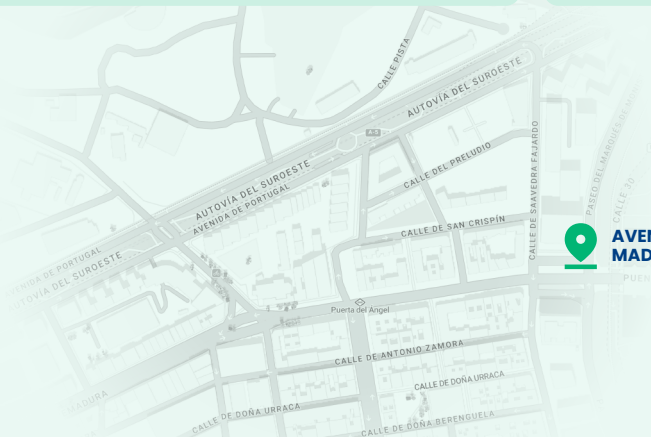


Daytime delivery

Parking/Loading areas management

Joint initiatives / Land Use initiatives

Off-street parking & loading



AVENIDA PORTUGAL, MADRID

KER contribution:

To foster collaboration among operators, to prevent parking misuse, and to organize shared parking spaces.

Availability of parking spaces

Avenida Portugal, Madrid

A03 (Base 2) 3.3 km



10:00

11 Apr, 2025

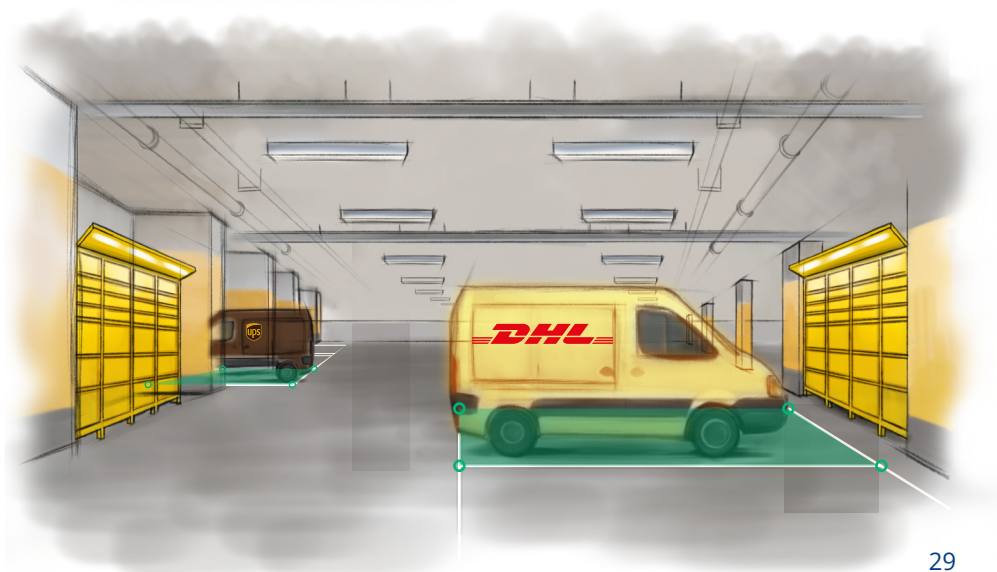
11:00

11 Apr, 2025



AI video analysis to manage spot occupation

Dynamic management of parking spaces in shared parking lots



BUSINESS MODEL PRESENTATION – KER 13

The Business

PARTNERS

ETRA

Local Authority

Real Estate

Logistics Operators

ACTIVITIES & RESOURCES

Management of shared parking facilities/UCCs

Check spaces availability in real time

Cameras and sensors

Parking space

Datasets, including authorised vehicles and DUM data

The Value

To promote collaboration among competing operators

To address misuse of parking spaces

To organise shared parking spaces

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authority & ETRA

Marketing events to attract Local Authority

Advertisement campaign to engage Logistics Operators

SEGMENTS

Local authority and Traffic managers

Logistics Operators

Tool developers

The Flow

Out

Tool cost and maintenance

Car park cost and maintenance

Installation of cameras and sensors

In

Tool licensing

DEMONSTRATION IN BERLIN

KER12

Road condition and safe route planning.

Dynamic Routing

Medium urban density. High residential use.



Daytime delivery

Logistical management

Transportation initiatives

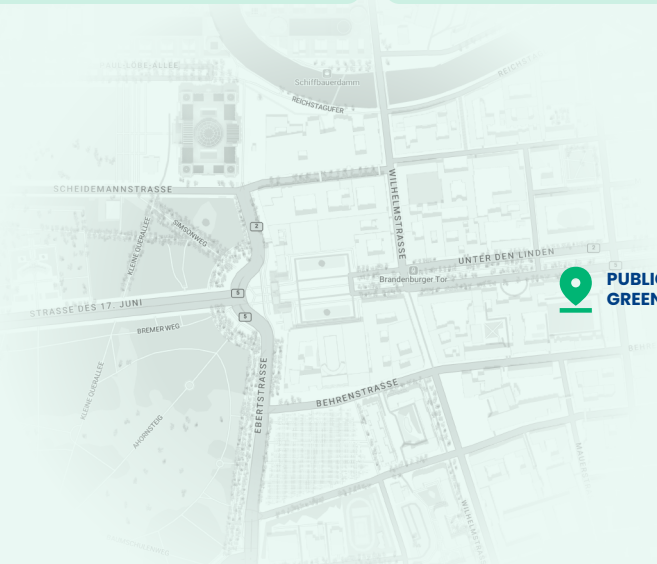
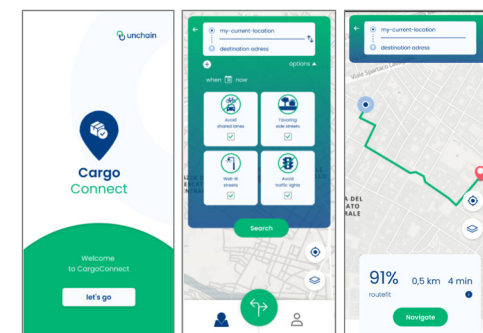
Intelligent transportation systems

KER contribution:

To optimize delivery efficiency and safety by analyzing flows, time, and routes while minimizing external risks.



Optimal route for customer's address



PUBLIC PARKS AND GREEN AREAS, BERLIN

BUSINESS MODEL PRESENTATION – KER 12

The Business

PARTNERS

VMZ

Local Authority

Logistics Operators

ACTIVITIES & RESOURCES

To provide an optimised route, considering congestion and road condition

Datasets, including congestion, road conditions, UVAR

The Value

Data on delivery flows, and time spent carrying them out

Operations efficiency and safety

Sustainable delivery routes

To reduce risk of external factors affecting the delivery

The Flow

Out

Tool cost and maintenance

In

Tool licensing

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authorities to share datasets

Marketing events to attract Local Authority

Advertisement campaign to encourage Logistics Operators

SEGMENTS

Local Authorities and Traffic Managers

Logistics Operators

Tool developers

DEMONSTRATION IN FLORENCE 🌐

KER6 🌐

Active UVARs and city regulations tools.

Low emissions zones

High urban density. Historical centre

Daytime delivery

Traffic management

Transportation initiatives

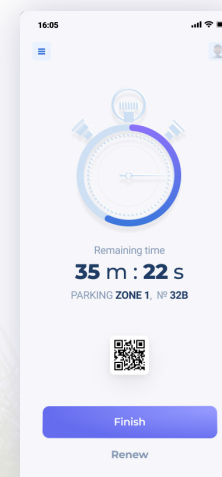
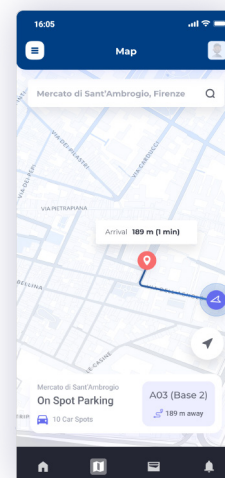
Access and vehicle-related restrictions



SANT'AMBROGIO, FIRENZE

KER contribution:

To evaluate and optimize regulated zones, to enforce rules, and to digitalize regulations.



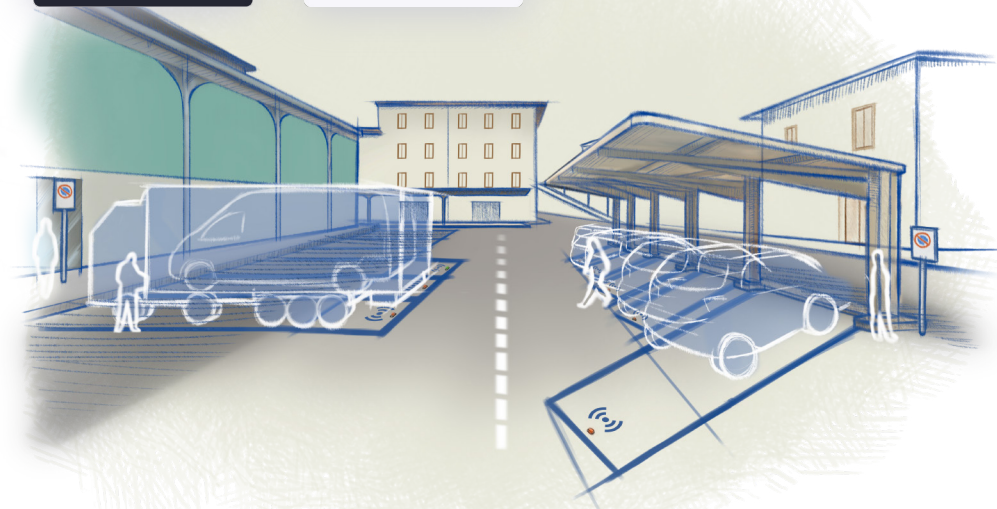
Availability of parking spaces

Mercato di Sant'Ambrogio, Firenze
A03 (Base 2) 3.3 km

10:00 11:00
11 Apr, 2025 11 Apr, 2025



- PLIAS UVAR tool
- Management of access, transit and parking permit. Local administration
- Delivery of access, transit and parking permits. Logistics operators
- Route planning. Logistics operators



BUSINESS MODEL PRESENTATION – KER 6

The Business

PARTNERS

MUNICIPIA & Lancaster University

Local Authority

Logistics Operators

ACTIVITIES & RESOURCES

To verify access to restricted zones; to authorise and to monitor datasets including UVAR areas, parking space or loading areas

Sensors, cameras, electronic boards

MCDM framework for UVARs assessment (PLIAS UVAR)

The Value

To assess the efficacy of regulated zones and to optimise the management

To enforce regulations

To digitalise regulations

Policy making and monitoring

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authority & MUNICIPIA

Logistics Operator

Marketing events to attract Local Authority

Advertisement campaign to engage Logistics Operators

SEGMENTS

Local Authority

Tool developers

Logistics Operators

The Flow

Out

Tool cost and maintenance

Additional components for UVAR system

Cameras and UVAR access control infrastructure

In

Tool licensing

Enforcement revenue

DEMONSTRATION IN MADRID

KER8

Dynamic curb side management. Peak hour clearways

High urban density. Commercial area with intensive use of small to medium size businesses

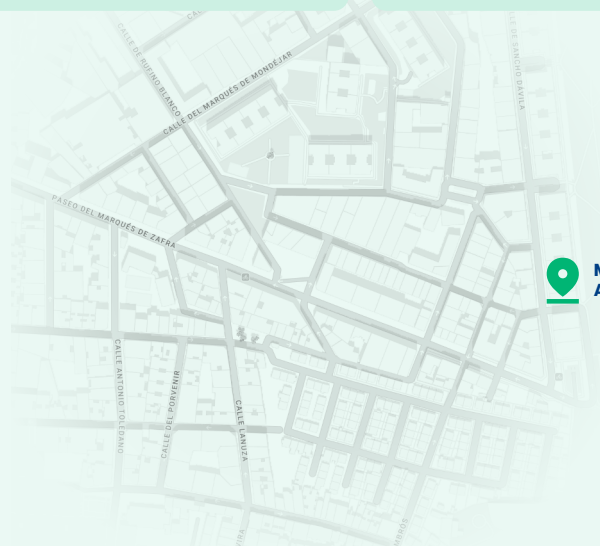


Daytime delivery

Parking/Loading areas management

Transportation initiatives

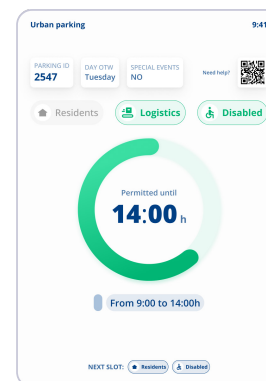
On-street parking & loading



MARQUÉS DE ZAFRA
AREA, MADRID

KER contribution:

To enhance parking management, to create flexible public spaces and to optimize delivery routes.



Dynamic management of parking spaces depending on:

Time slot

Time of the day

Special events / holidays

Logistics operator

Disabled

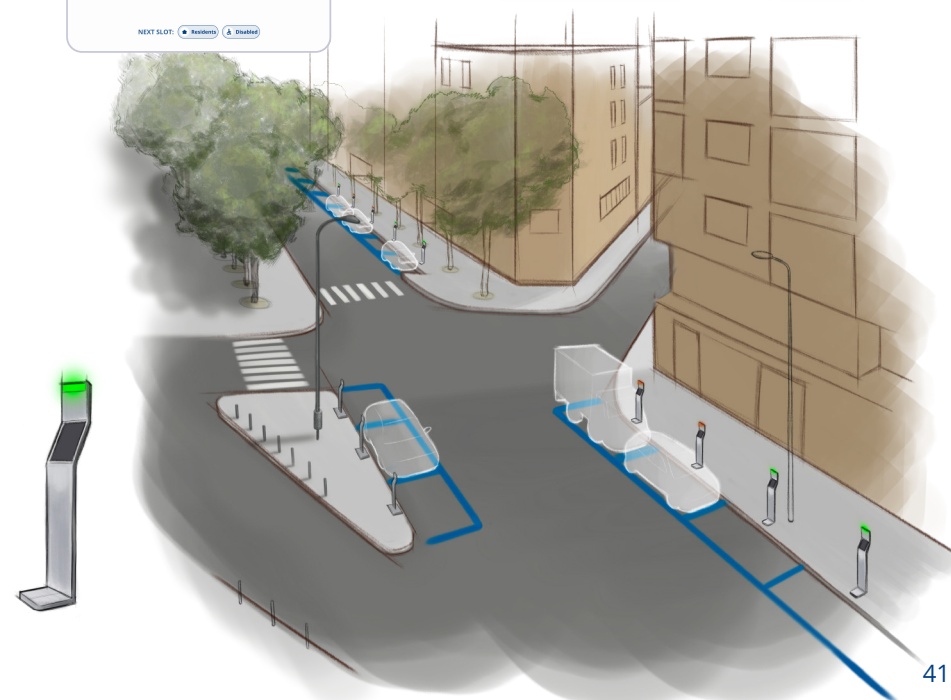
Residents

Leisure centers

Health services

School

...



BUSINESS MODEL PRESENTATION – KER 8

The Business

PARTNERS

ETRA

Local Authority

Logistics Operators

Residents

ACTIVITIES & RESOURCES

To change throughout the day into uses such as disabled parking or residents parking

Dynamic management

The Value

Better management of parking spaces

To create flexible and more liveable public spaces

More efficient delivery routes

The Market

RELATIONSHIP & CHANNELS

Logistics Operators & Local Authority

Local Authority & ETRA

Logistics Operator

Marketing events to attract Local Authority

Advertisement campaign to engage Logistics Operators

SEGMENTS

Local Authority

Tool developers

Logistics Operators

The Flow

Out

Curbside land costs

Operation cost for enforcing curbside management

Tool cost and maintenance

Sensors and camera installation

In

Tool licensing

Enforcement revenue



<https://unchainproject.eu/>



Juan Giménez



juanfernando.gimenez@ibv.org



Amparo López



amparo.lopez@ibv.org

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No [101103812]



INSTITUTO DE
BIOMECÁNICA
DE VALENCIA



**Funded by
the European Union**