



LEAD Madrid Living Lab Digital Twin

Digital innovation in Living Lab environments

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



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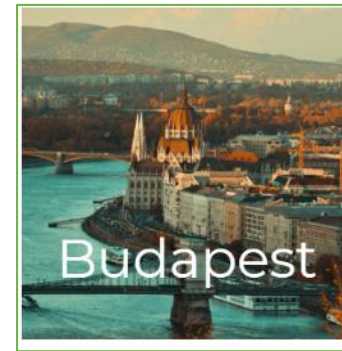
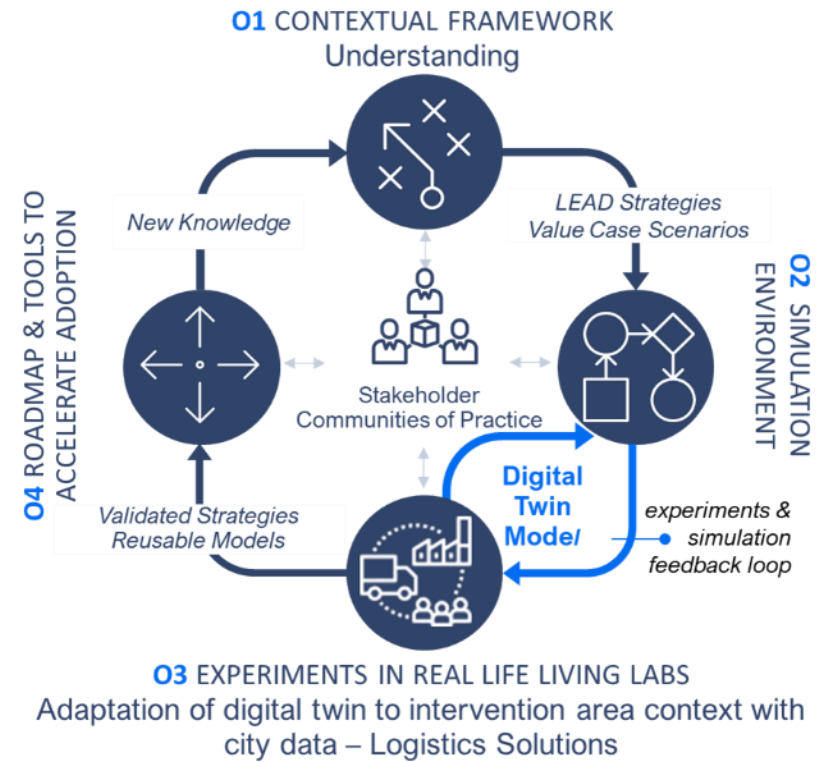
What is LEAD project?

- LEAD: “Low-Emission Adaptive last mile logistics supporting on demand economy through Digital Twins”
- 3.941.625 € (start 1/06/2020, 36 months, **just finished!!**)



Objectives

- Value cases co-design
- Digital Twinning Tools
- Validation in Living labs
- Scaling-up



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Madrid

Transforming a Parking Lot to an Urban Consolidation Centre



Lyon

Validation of last mile distribution models



The Hague

Integrated last-mile logistics with demand-supply matching platforms



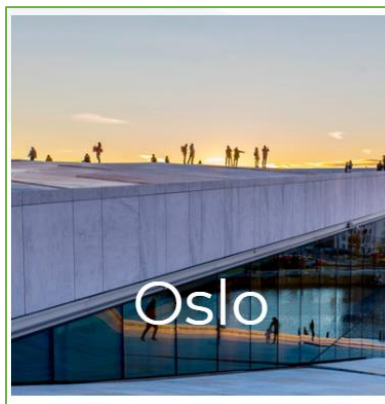
Budapest

Spatial Planning of Inner-City Loading Areas



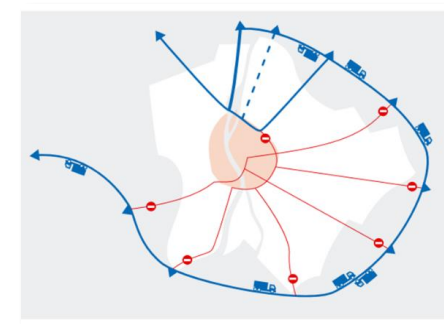
Porto

Turning retail stores to electric mobility nodes



Oslo

Green Crowdshipping through the mass transit network



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LEAD Strategies



1

Innovative business models

with a view to optimising the performance of last mile logistics (based on volatility of demand, delivery life cycles and costs) in response to the challenges posed by the on demand economy



2

Agile freight storage and distribution

Agile schemes for urban freight storage and last mile distribution, including crowdsourced shipping, capacity sharing, multi-echelon and Physical Internet inspired approaches



3

Low emission delivery vehicles

including Electric Delivery Vehicles (EDVs), hybrid and automated vehicles for freight delivery like cargo-bikes, delivery robots and droids -walkers will also be considered



4

Smart data-driven logistics solutions

for shared, connected and low-emission logistics operations, empowered by an adaptive modelling approach and Digital Twin models, applied in real-life environments

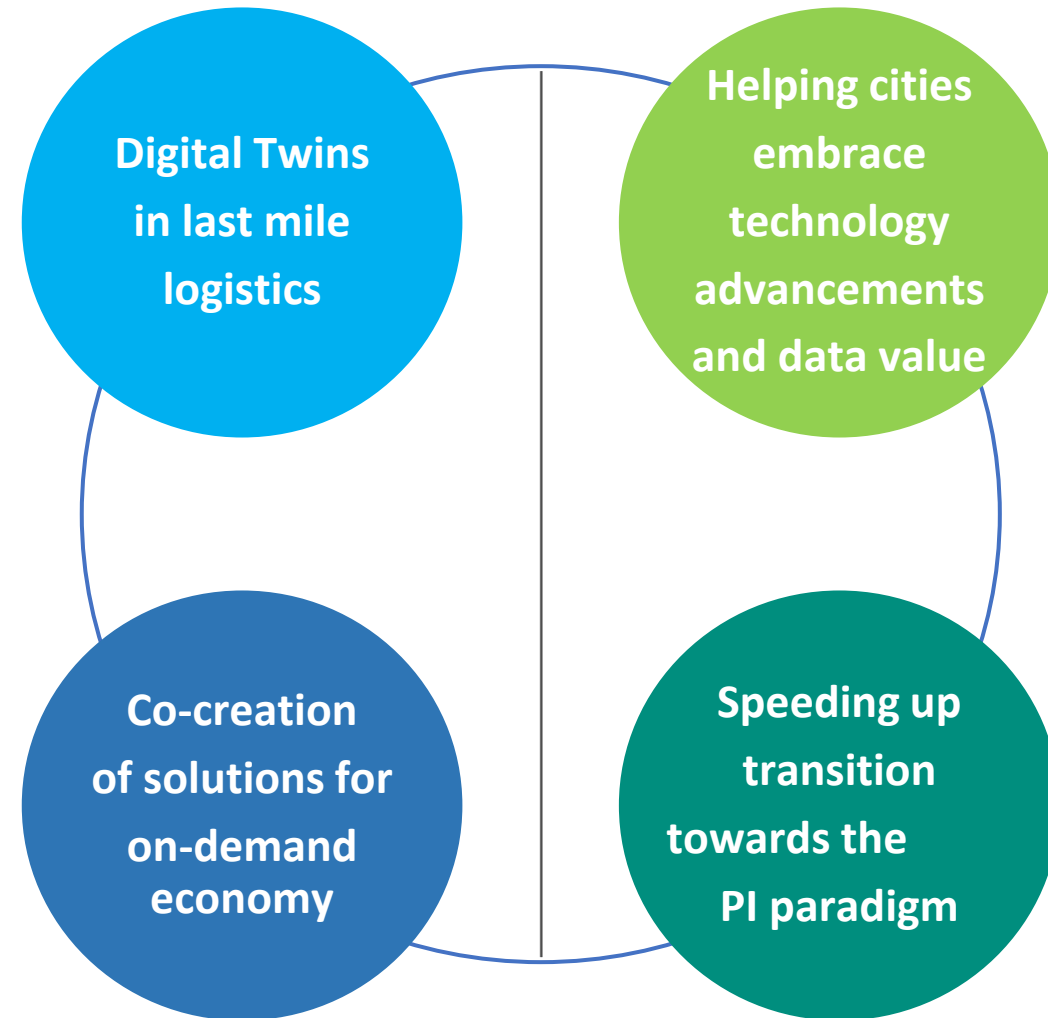


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LEAD Innovations

The Living Lab (LL) is a stakeholder-centred ecosystem, operating in an urban node context, for the systematic evaluation of innovative ideas and technological solutions in real use cases



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Mid to long term expected impacts

Impact 1

- Clear understanding of cost-effective strategies, measures and tools to achieve essentially zero emission city logistics in major European urban centres by 2030.

Impact 2

- New tested, demonstrated practices and solutions for better cooperation between suppliers, shippers and urban/regions policy makers (planners)

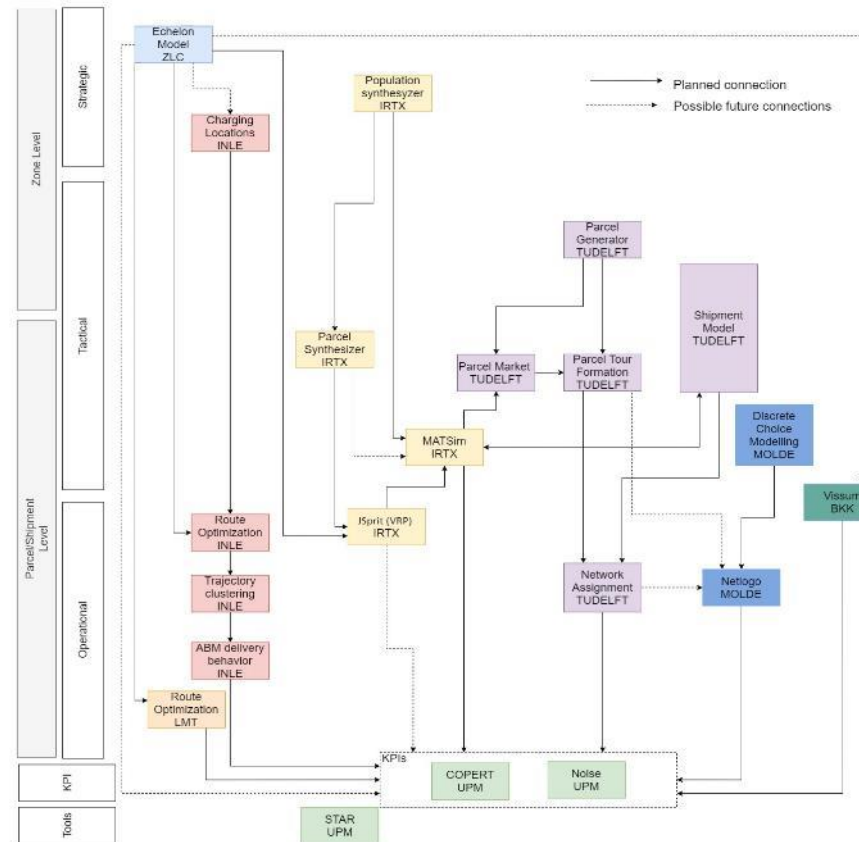
Impact 3

- Clearly provide inputs for the preparation and implementation of SULPs, SUMP's and other planning tools (big data and real-time traffic management)



DT model library overview

Number	Model name	Model owner
1	Route optimization	LMT
2	Synthetic population	IRTX
3	Parcel synthesizer	IRTX
4	MATSim	IRTX
5	JSprit	IRTX
6	Echelon	ZLC
7	Parcel Market	TUD
8	Parcel generation	TUD
9	Parcel tour formation	TUD
10	Shipment model	TUD
11	Network Assignment	TUD
12	STAR	UPM
13	COPERT	UPM
14	NOISE	UPM
15	VISSUM	BKK/SZE
16	Charging station	INLE
17	Route optimization	INLE
18	Trajectory clustering	INLE
19	ABM delivery behaviour	INLE
20	NetLogo	Molde
21	Discrete Choice Modelling	Molde



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Living Lab

Transforming a
Parking Lot to an
Urban Consolidation
Centre

Madrid

Status Quo

- Madrid is an important logistics hub (between the Atlantic and the Mediterranean TEN-T corridors),
- Occasional air quality and congestion challenges,
- Madrid LEZ and current regulations (Madrid360),
- Rise of e-commerce and home delivery (even more due to COVID19 and post-COVID19 challenges).



Ambition

- Demonstrate the **better efficiencies** in using a UCC connected to the TEN-T to deliver to the city center;
- Assess flows and congestion. **Route optimization engine** in many-to-many and many-to-one scenarios, combining vehicles of different fleets. Improving of environmental indicators;
- Explore **alternative (and sustainable) business models**;
- **Public-private cooperation mechanisms**, identifying new ideas for cooperation and evaluating the costs and benefits of implementation;
- The economic **efficiency and reliability** for courier companies, and henceforth for clients, of using the LEAD strategies compared to conventional freight delivery approaches;
- Explore potential **incentives. Data management.**

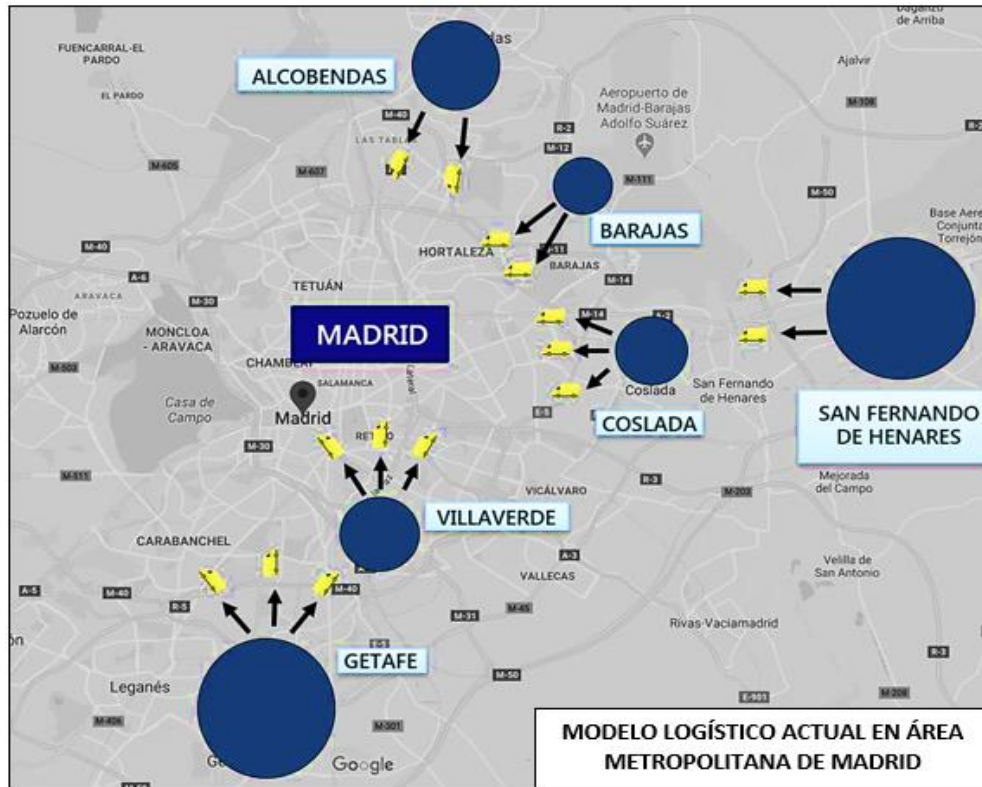
Partners:



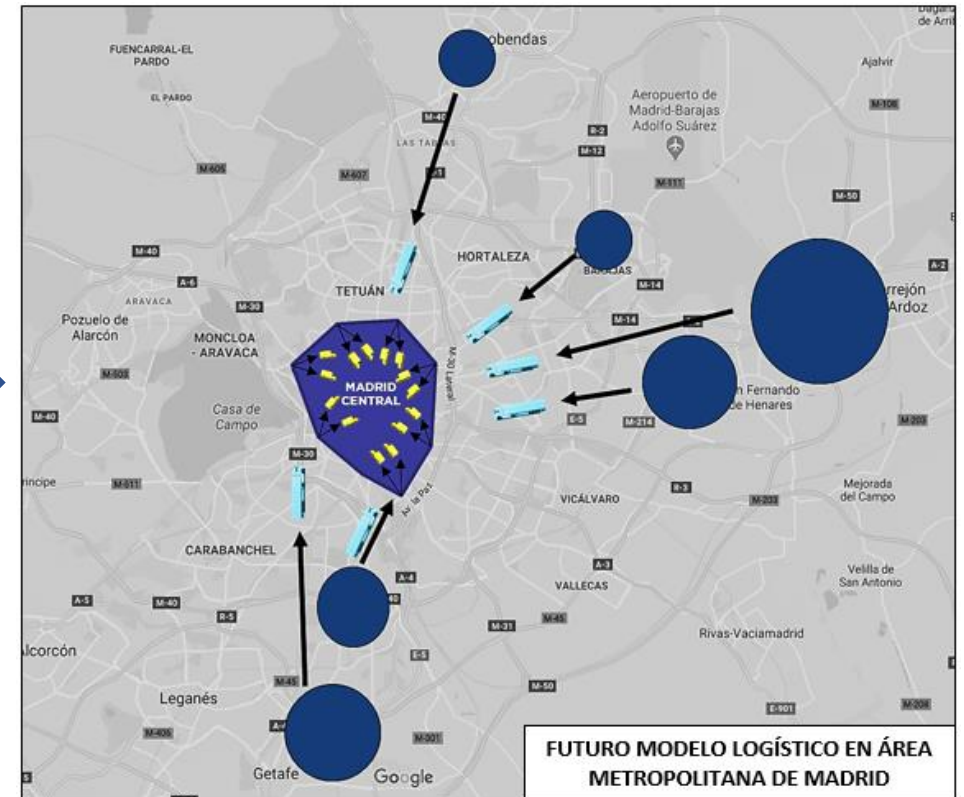
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Living Lab Madrid

Business as usual (BaU)



Desired status (TO BE, UCC)

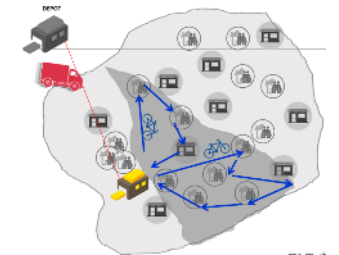


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Value case scenarios

- 4 different ones based on location, mostly:
 - #1: Microplatform at San Fernando de Henares (“Hotspot for the e-commerce in Spain”)
 - #2: Microplatform at city centre (with vehicle restrictions)
 - #3: Microplatform at Ring Road “M30”
 - #4: Microplatform at city centre (without vehicle restrictions)



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Pilot setting

- Location decided (Plaza Mayor underground parking)
- Paperwork required (contract EMT-CityLogin) – starting on 4/12/2020



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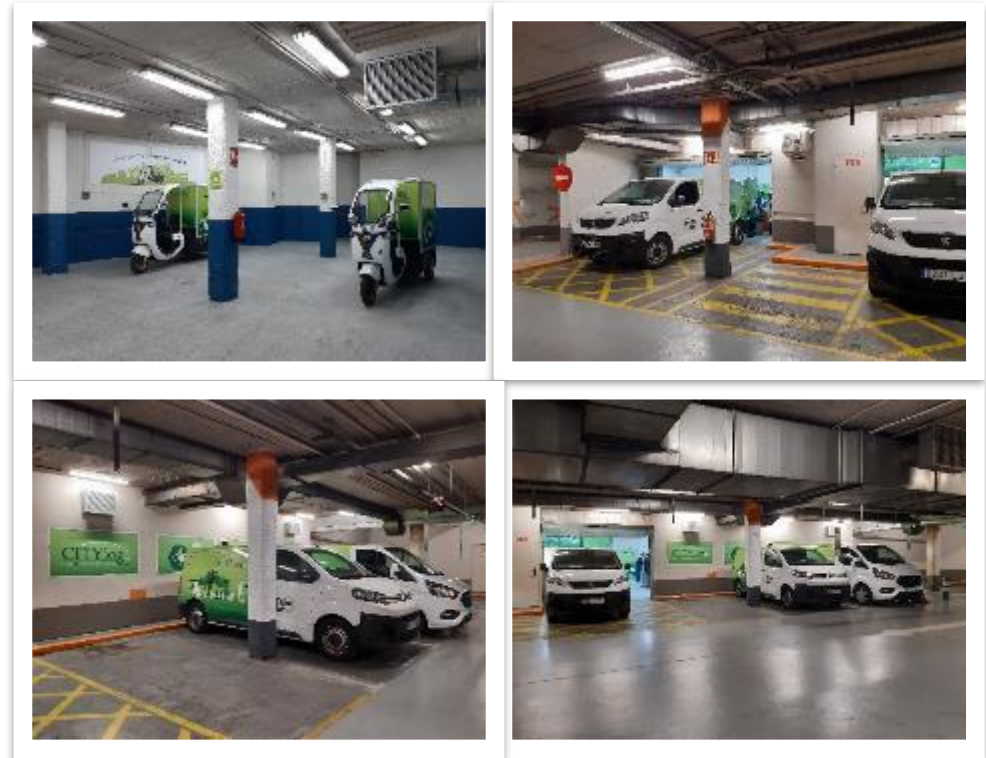


Pilot Results

Demonstrate the **better efficiencies** in using a UCC connected to the TEN-T, to deliver to the city centre

LAUNCH: OCTOBER 6TH, 2021

ENDING OPERATION: 1st June 2023



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How has it worked?

Steps	Timetable	Where	Vehicles
Reception and classification	02:00 am 10:00 am	San Fernando Hub	6m3 van (due to height limitation at the parking)
Distribution (Delivery)	11:00 am 21:00 pm	Plaza Mayor Microhub	Electric three wheeler
Reverse logistics	21:00 pm 22:00 pm	Plaza Mayor + San Fernando	6m3 van



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“What if” (value cases) scenarios

Scenario	Vehicles	Parcel capacity	EV Energy consumption (kWh/100km)
BaU	Diesel van	161	
	E-van	161	
UCC	Hybrid van + E-scooter	161	
		34	8.7
	E-van + E-scooter	161	22.7
		34	8.7
	Big E-van + E-scooter	284	25.0
34		8.7	



Digital Twin workflow

Data Sources



Distrito Centro
geospatial LEZ characteristics

Vehicles



Traffic speed
history



Available
personnel



Daily
services

All 5 use cases route optimization

BaU Scenario
Service from
S. Fernando

- 1 - Diesel van
- 2 - E-van

UCC Scenario
Service from
Plaza Mayor

- 3 - Hybrid van + E-scooter
- 4 - E-van + E-scooter
- 5 - Big E-van + E-scooter

Analysis

ICE vehicles
emissions

E vehicles
emissions

Input to noise
model

Routes
executorial
plan

Outputs



User
dashboard



Open Data
repository



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Business-as-Usual (BaU) scenario

- One-echelon routing
- Direct delivery from a periurban DC located at 25 km from city center



Engine type	Payload	Max n° parcels
Euro6CI	878 kg	161



Urban Consolidation Center (UCC) scenario

- Two-echelon routing
- Consolidated delivery to the UCC from the periurban DC located at 25 km from city center
 - With two different van sizes
- Final delivery with E-scooters



Engine type	Payload	Max n° parcels
Electric	250 kg	34



Urban Consolidation Centre vs. Business-as-Usual

Scenario	Vehicles	Total Journey (hours)	Driving time (hours)	Serve time (hours)	Km driven	Nº of Vehicles	Energy per delivery (kWh)	CO ₂ per delivery (grams)	PM _{2.5} per delivery (grams)	NO ₂ per delivery (grams)
BaU	Diesel van	1.151	293	792	10.980	148	1,39	372,86	0,04	0,46
	E-van	-	-	-	-	-	-96%	-100%	-100%	-100%
UCC	Hybrid van + E-scooter	-23%	-8 %	-28%	-22%	14%	-81%	-84%	-75%	-100%
	E-van + E-scooter	-23%	-8%	-28%	-22%	14%	-95%	-100%	-100%	-100%
	Big E-van + E-scooter	-25%	-14%	-28%	-33%	1%	-95%	-100%	-100%	-100%

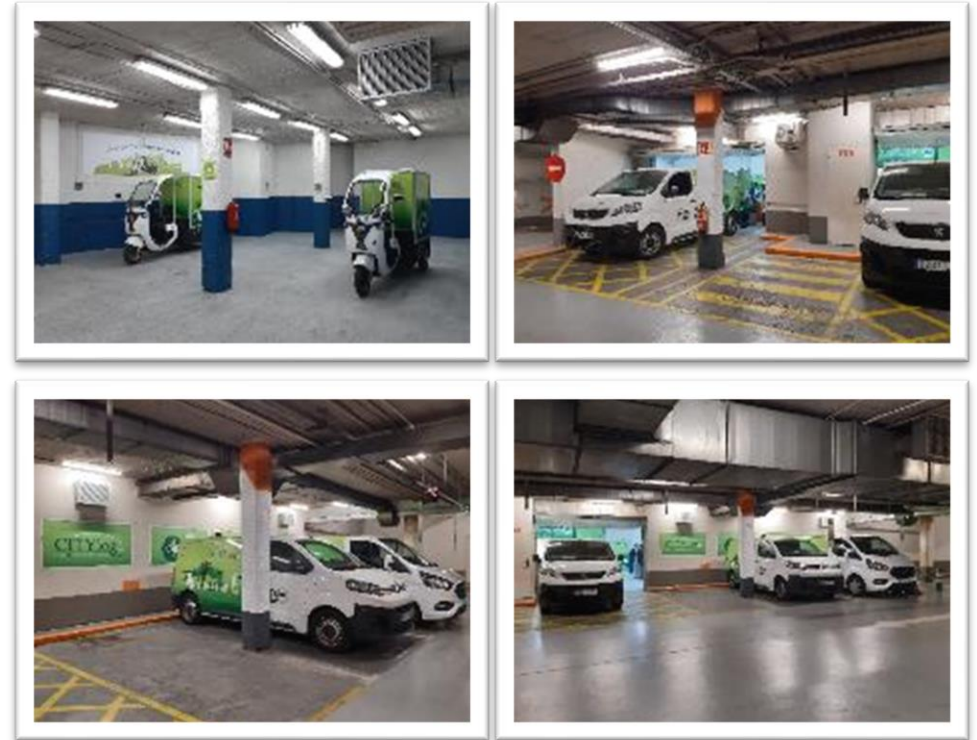


Acknowledge

Madrid's Living Lab was selected as a **European Best Practice in Sustainable Urban Logistics** by EIT Urban Mobility in **2022**



This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation



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Learnings & findings/ Steps forwards

- Real Pilot: advisable to **start as soon as possible**
- Matching the needs of the local administration with the requirements of the logistics operator: **sustainability** (at all levels)
- **Taking advantage** of the policies established in the city (regulatory framework, strategies, etc.) to promote this type of activities
- Establishment of objectives and KPIs must be **useful** for the operator
- Collaborative scenarios **do not impact** the transport efficiency and emissions while the service quality is improved
- **Synchronous** planning: manufacturers may benefit from real-time digital twins to enable collaborative distribution schemes with local businesses
- **Effective collaboration between public and private** entities has been identified as a key strength of Madrid LL



Exchanging and synergies



Senator



alice | Alliance for Logistics Innovation through Collaboration in Europe



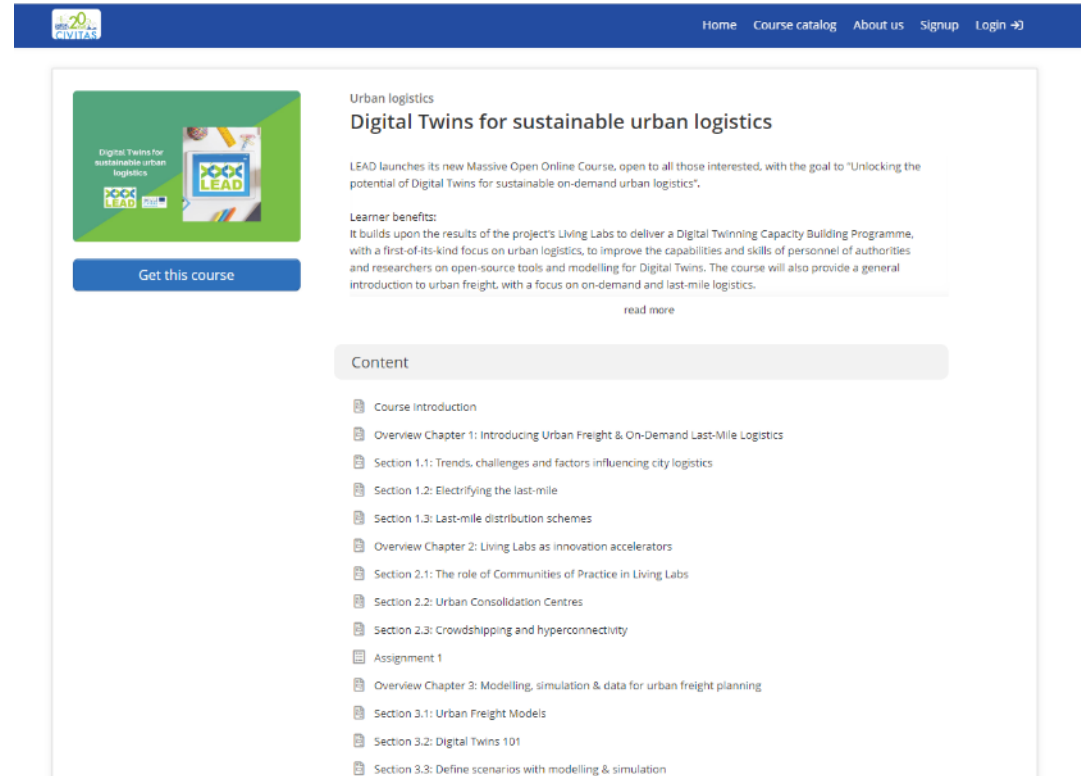
- Synergies with ST4W, IW-NET,
- Living.in-EU Initiative (DG CONNECT/ENoLL)



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Exchange of knowledge



The screenshot shows a web page for a Massive Open Online Course (MOOC) titled "Digital Twins for sustainable urban logistics". The page is part of the CIVITAS e-learning centre. At the top, there is a navigation bar with links for Home, Course catalog, About us, Signup, and Login. The main content area features a course card with a green and blue background, a "Get this course" button, and a "read more" link. Below the course card, there is a "Content" section with a list of course topics and sections, including "Course Introduction", "Overview Chapter 1: Introducing Urban Freight & On-Demand Last-Mile Logistics", "Section 1.1: Trends, challenges and factors influencing city logistics", "Section 1.2: Electrifying the last-mile", "Section 1.3: Last-mile distribution schemes", "Overview Chapter 2: Living Labs as innovation accelerators", "Section 2.1: The role of Communities of Practice in Living Labs", "Section 2.2: Urban Consolidation Centres", "Section 2.3: Crowdshipping and hyperconnectivity", "Assignment 1", "Overview Chapter 3: Modelling, simulation & data for urban freight planning", "Section 3.1: Urban Freight Models", "Section 3.2: Digital Twins 101", and "Section 3.3: Define scenarios with modelling & simulation".

“Massive Online Open Course” (MOOC) available at the CIVITAS e-learning centre



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Just finished!



SAVE THE DATE

Urban Logistics Innovation Day

26 September 2023, Brussels (BE)
Info on registration soon

This in-person event is organised as the final conference of the **EU-funded LEAD project**, in cooperation with **ALICE-ETP** and **POLIS**, bringing together other urban logistics innovative projects, to showcase innovative solutions.

This will also include live demonstrations on the digital innovative solutions for Digital Twins and Urban Logistics planning developed by LEAD.



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Thank you!

- Website: <https://www.leadproject.eu/>
- LinkedIn: [lead-h2020](#)

