HARMONY: Agent-based simulation of emerging mobility systems

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 815269

Part of: 2020 CIVITAS

The HARMONY Consortium

21 partners from 9 European countries / ~7.8million Euro

Academic Institutions

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University of Wolverhampton

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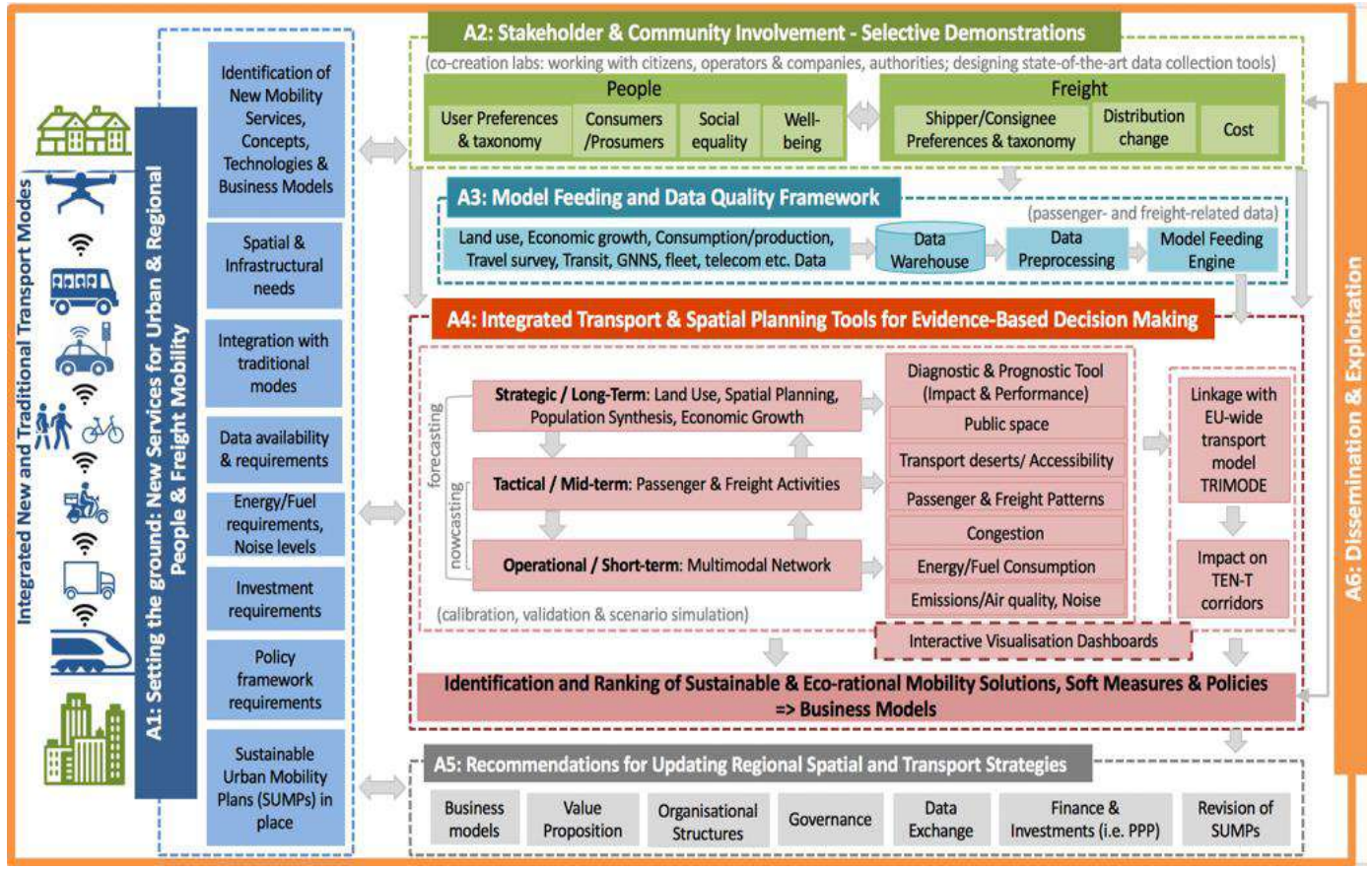
HARMONY

HARMONY Vision

Develop -> a new generation of harmonised spatial and multimodal transport planning tools

Model -> the changing transport and spatial organization dynamics

Why -> to enable metropolitan area authorities to lead the transition to a low carbon new mobility era in a sustainable manner.



Main Outcomes

- The HARMONY Model Suite (software) and multi-dimensional evaluations of spatial and transport planning use-cases

- Training material and activities for using the HARMONY MS

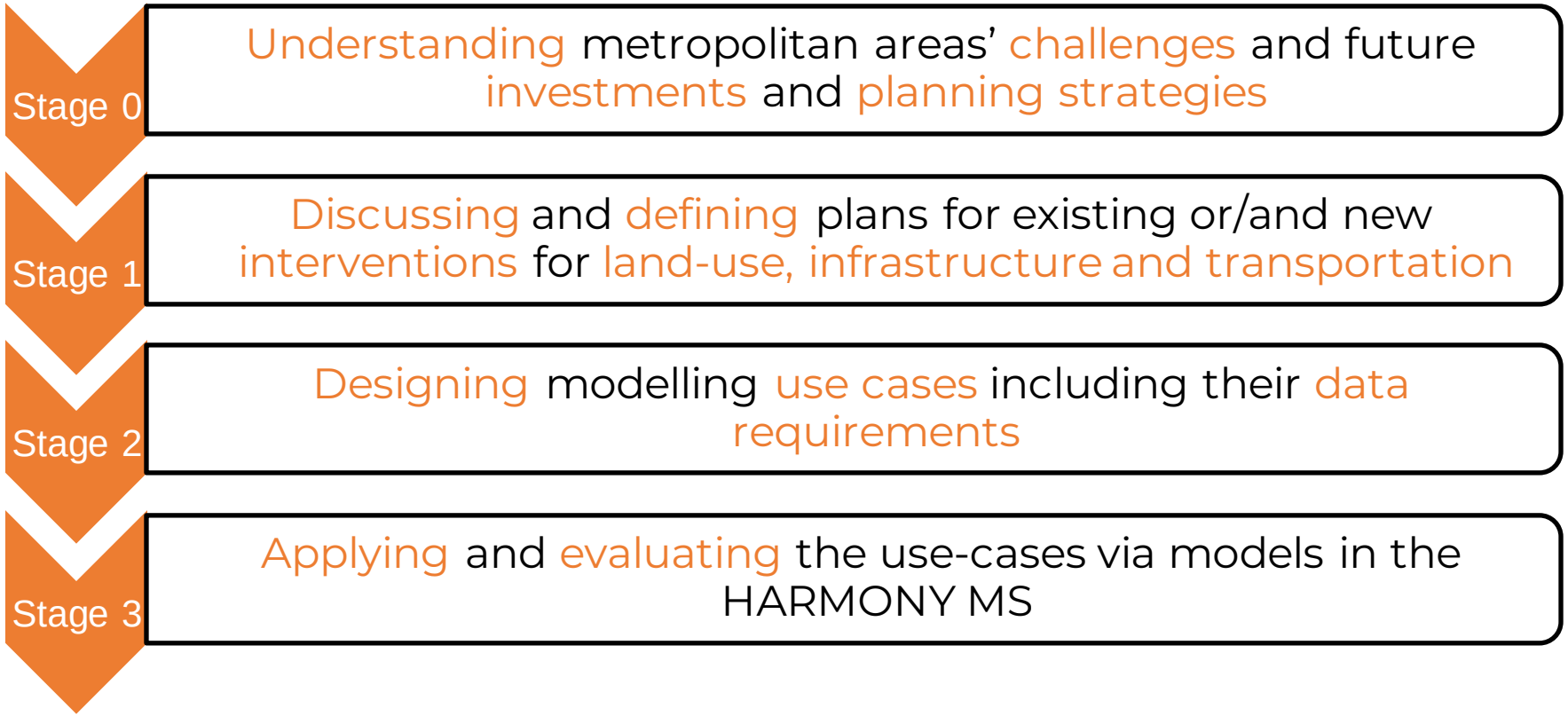
- Recommendations for SUMPs update (AVs & drones included)

Main Activities and Results

1. Modelling scenarios development for HARMONY metropolitan areas
2. New transport technology/service demonstrations
3. The HARMONY Model Suite (MS)

Modelling scenarios for HARMONY metropolitan areas

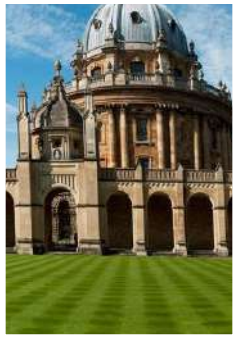
1. Modelling scenarios - Activities



Several rounds of co-creation activities i.e., workshops, meetings, webinars, questionnaires with metropolitan areas' planning authorities

1. Modelling scenarios - Results

Oxford



- New land uses (Housing Developments)
- Emerging mobility for passengers and freight (Autonomous DRT and Crowd-shipping)

Impact scope: regional economy, mobility patterns and flows, network/service performance and energy/emissions (tactical and operational planning)

Rotterdam

- Spatial and Infrastructure Developments (Zero Emission Zones, Microhubs)
- Emerging Freight Transport Services (Electric vehicles, Crowd-shipping, E-bikes)

Impact scope: freight demand analysis, environmental footprint (strategic, tactical and operational planning)

Turin

- New land uses and PT infrastructure
- Mobility as a Service
- Remote working
- Restricted vehicle access zones

Impact scope: Impact on regional economy, transport demand, accessibility and environmental footprint

Athens

- New land uses and investments
- Connected and Autonomous Vehicles

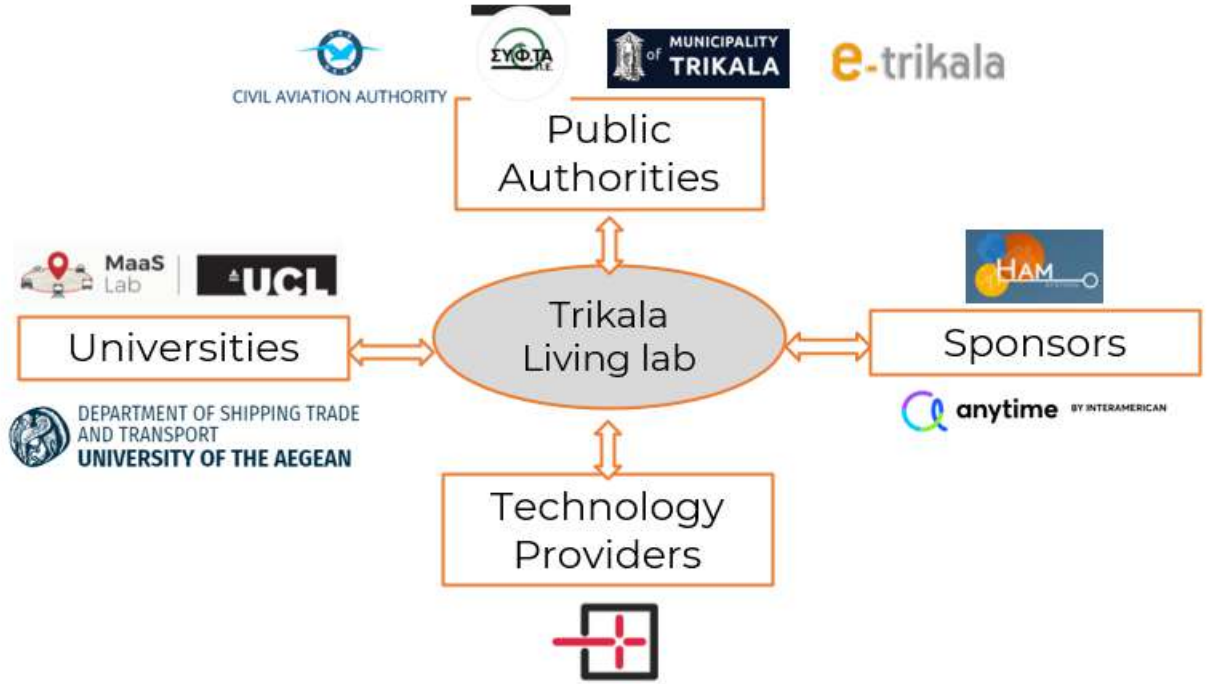
Impact scope: Impact on regional economy, network/service performance and energy/emissions (strategic and operational planning)

New transport technology/service demonstrations

2. Drones Demonstrations – the case of Trikala, Greece

- Use-case

Drone-based medicament delivery services from city storages to surrounding village pharmacies

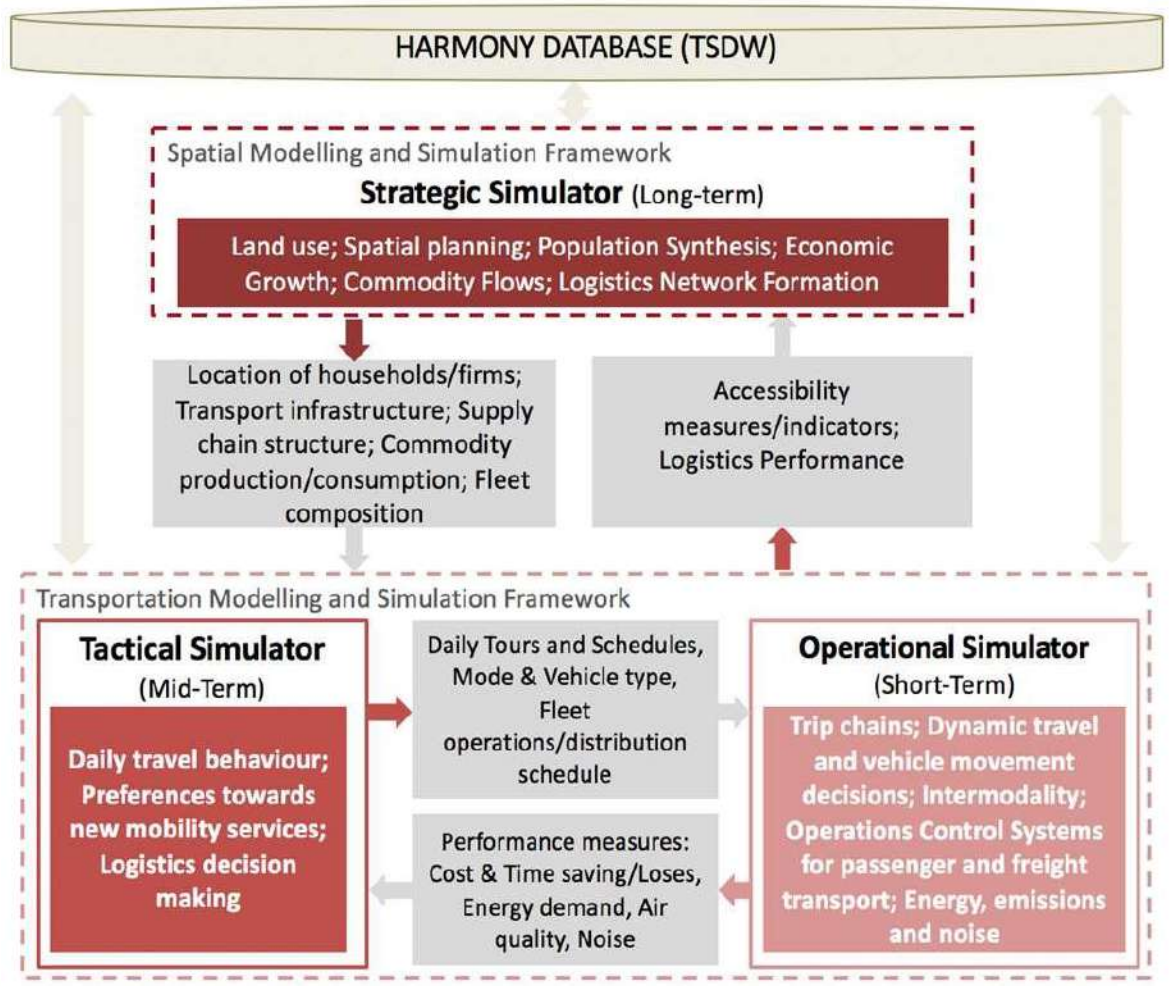


2. Drones Demonstrations – Initial Insights

- ✓ **Training requirements:** a module needs to be prepared for the pharmacists on how to approach the UAV safely and to operate the transportation box.
- ✓ **Traffic management requirements**: A re-routing of the evacuated roads (drone route) had to take place
- ✓ **Technology requirements**: GPS tracker interfaces were available as apps or web-interfaces for pharmacists. Effort is needed to make the transition to the medication recipients themselves

The HARMONY Model Suite

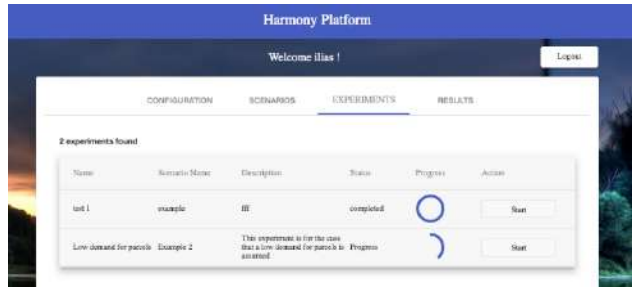
3. The MS Architecture



3. MS Software Architecture

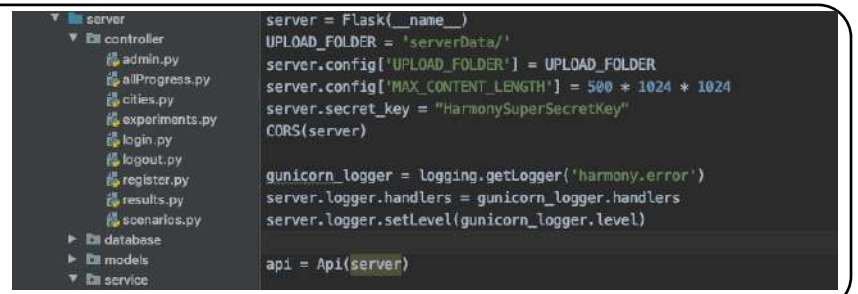
Web-based interface

User can choose which transport interventions to evaluate and compare on a concrete setting



Platform core

Upon a user's request, runs a specific workflow that consists of one or more simulators/models



Platform plugins

Simulators and models that can be plugged in to the platform and used in workflows

3. MS Innovative Features

Flexible integration of new simulators and/or models

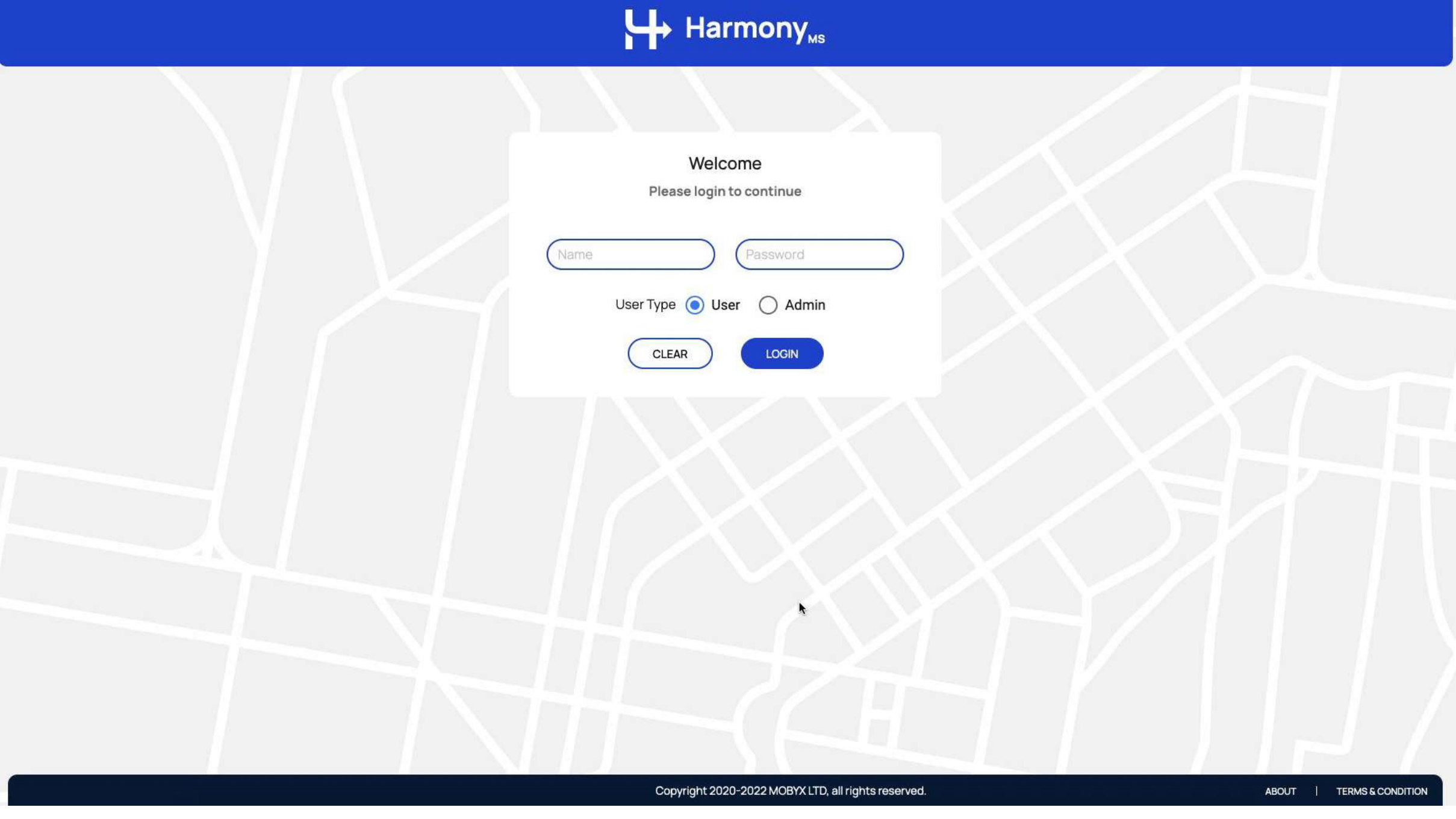
An end-user-friendly platform for managing data, algorithms, and tools for policy making

Users can browse though the results of similar experiments in other cities, reproduce results, and perform several what-if analyses

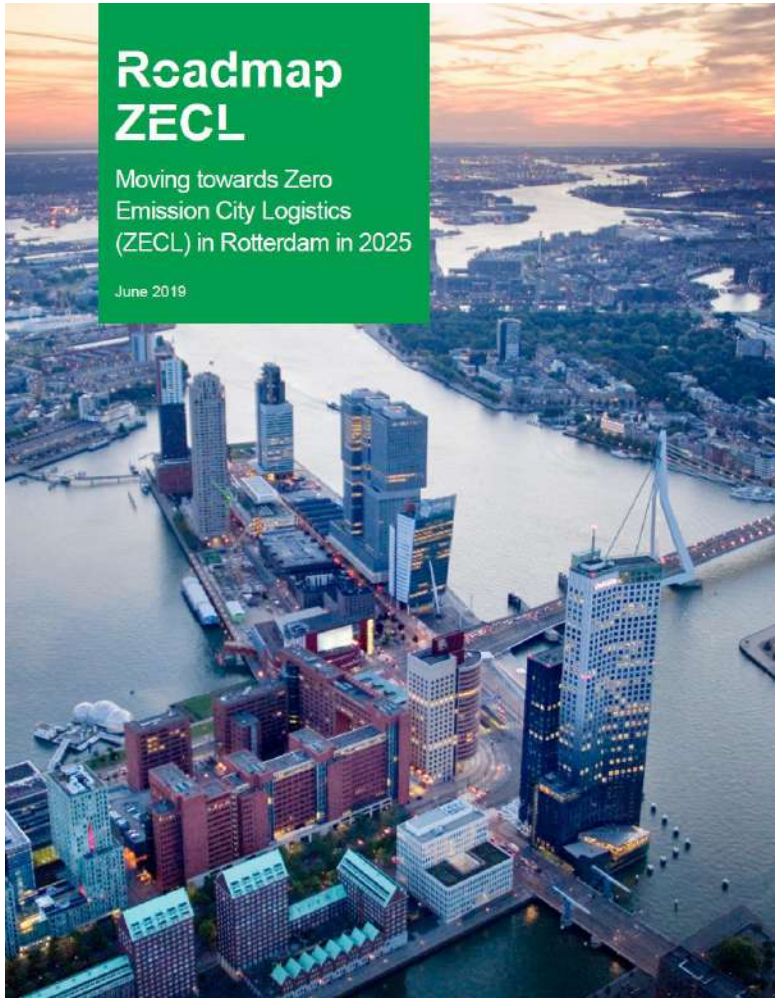
An activity-based transport simulation framework with adaptors for highly-used traffic modelling tools (Aimsun, PTV)

Users can leverage already integrated simulators + extend the capabilities of the platform (new workflows + templates)

Simulation of multimodal ecosystem dynamics for new mobility concepts


Harmony MS
Welcome
Please login to continue
Name
Password
User Type
User
Admin
CLEAR
LOGIN
Copyright 2020-2022 MOBYX LTD, all rights reserved.
ABOUT
|
TERMS & CONDITION

3. MS Application for Freight



Jan Boeve, Director of TLN:

"As soon as possible, the City of Rotterdam must communicate where the zero emission zone for city logistics will be from 2025, so that transport business owners know where they stand and can prepare their business model accordingly."

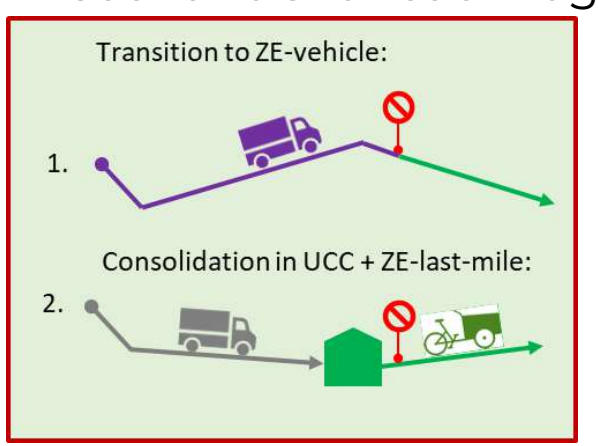
Best Research Paper award @TRB !

Paper "*Application of the HARMONY tactical freight simulator to a case study for zero emission zones in Rotterdam*", presented at TRB conference jan 2021, and published in TRR (open access)

3. Zero Emission Scenario: Geography

Assumptions:

- Only ZE vehicles may enter the zero-emission zone
- A proportion of shipments are redistributed via 7 UCC's
- Delivery and collection from the UCC takes place with dedicated ZE vehicles
- Analysis based on transitions scenario's for each logistic segment



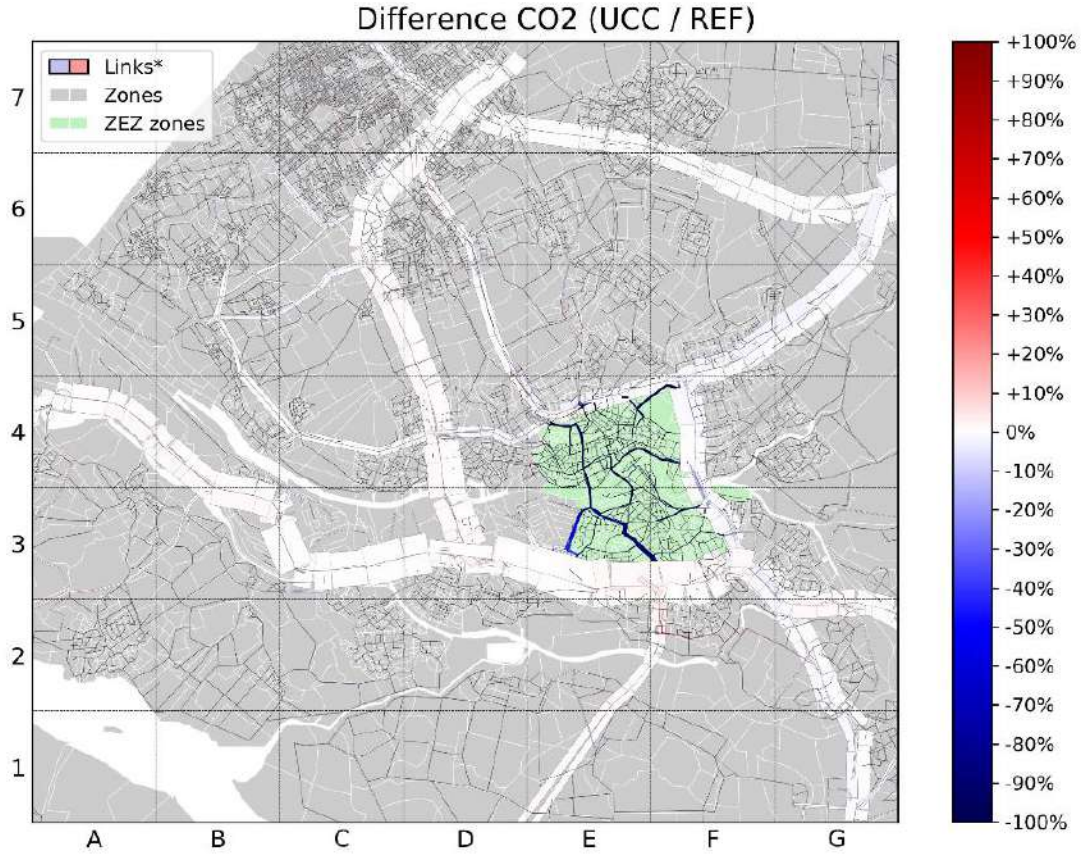
Possible configuration of the zero-emission zone, and 7 Urban Consolidation Centers

3. Results: impact on emissions at network level

- Reduction in total emissions within the municipality of Rotterdam: ca. 8%. This includes all the freight traffic to and from the port area.

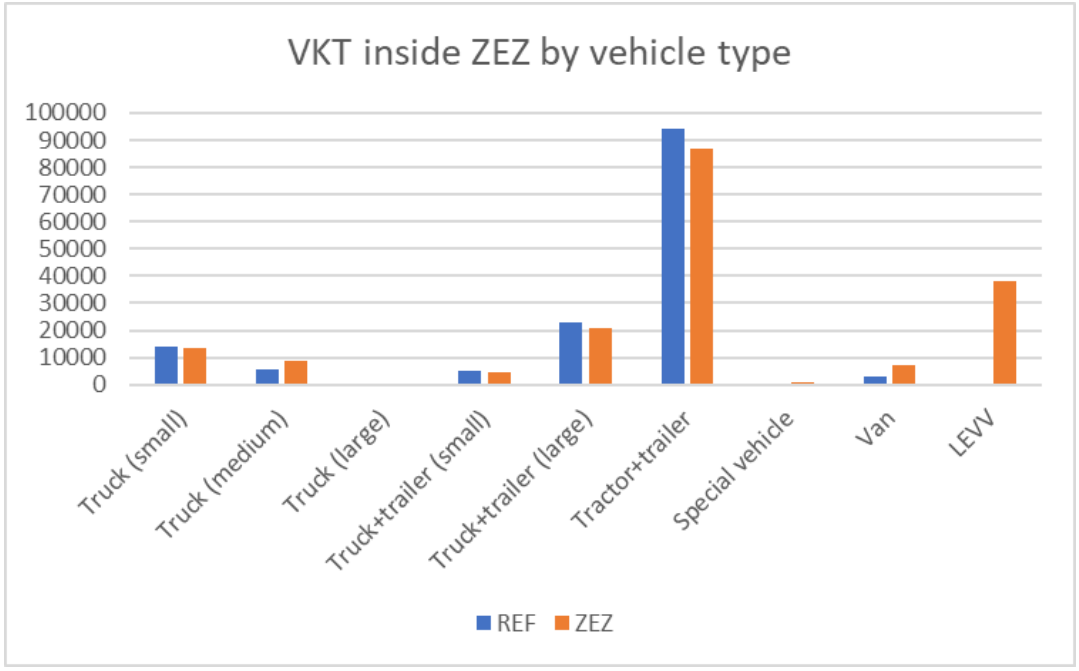
Type	Inside the ZEZ	City of Rotterdam	Study area (prov. South Holland)
CO2	-91%	-8%	-1%
SO2	-91%	-8%	-1%
PM	-89%	-8%	-1%
NOX	-91%	-9%	-1%

- Rerouting of shipments to the hubs also leads to small increases of emissions in the surrounding area.



3. Results: impact on vehicle use in the ZEZ

The composition of vehicle kilometers inside the ZE-zone will change in the Zero-emission scenario (ZEZ):



- Decrease in use of Tractor+trailer combinations (or with hybrid driveline)
- The share of new ZE-vehicles (LEVV and e-moped) is expected to be 10% in total vkms
- A large share of the reduction of emission will be the result of a shift to cleaner combustion types (electric, hybrid, hydrogen, biofuel)

Med- & Long-term impact

- ✓ **Technological**: HARMONY MS (available in the market in mid-2023)
- ✓ **Environmental, economic, societal**: Planning tool to support eco-rational policies and measurements development and a range of KPIs; KPIs from use-case evaluations
- ✓ **Business**: at least 4 outputs will be commercialised after the project (HARMONY MS, HARMONY MS Lite, MOBYapp, Airbus UTM platform)
- ✓ **Skills**: 6 training courses
- ✓ **Input to policy making**: Lessons learned from use-case evaluations; drones and robot demonstrations; Impact of COVID-19 on travel demand and transport operations

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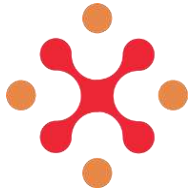

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