UCL ENERGY INSTITUTE

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HARMONY SPATIAL & TRANSPORT PLANNING FOR A NEW MOBILITY ERA

MaaS Lab

A holistic impact evaluation framework for autonomous vehicles and drone demonstrations: the case study of Oxfordshire, UK

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Context

To better prepare and inform decision-makers for the potential of such concepts for passenger, freight transport and their expected impact, **the HARMONY project demonstrates, tests and evaluates new types of freight delivery and passenger transport services.**

Context

<u>The main demo stakeholders/actors</u>:

•Oxfordshire County Council (OCC; the demonstration's concept planner and organizer)

•Milton Park (local authority for the demo application)

•UCL-MaaSLab (modelling and data analysis partner),

•Airbus (Air Traffic Manager),

•Griff (UAV Provider & Operator),

•Arrival (AV Manufacturer)

•UPS (logistics operator)

Use cases in Oxfordshire - Milton Park

Image is extracted from https://www.miltonpark.co.uk/2040-vision

Use case 1: Integrated autonomous van and drone freight deliveries

Problem:

The conventional freight deliveries show incompetent and inefficient performance in delivering and collecting parcels in the **countryside areas,**

It usually leads to long drives to deliver/pick-up each parcel, reducing the number of parcels delivered or collected per hour and increase the miles covered for each parcel.

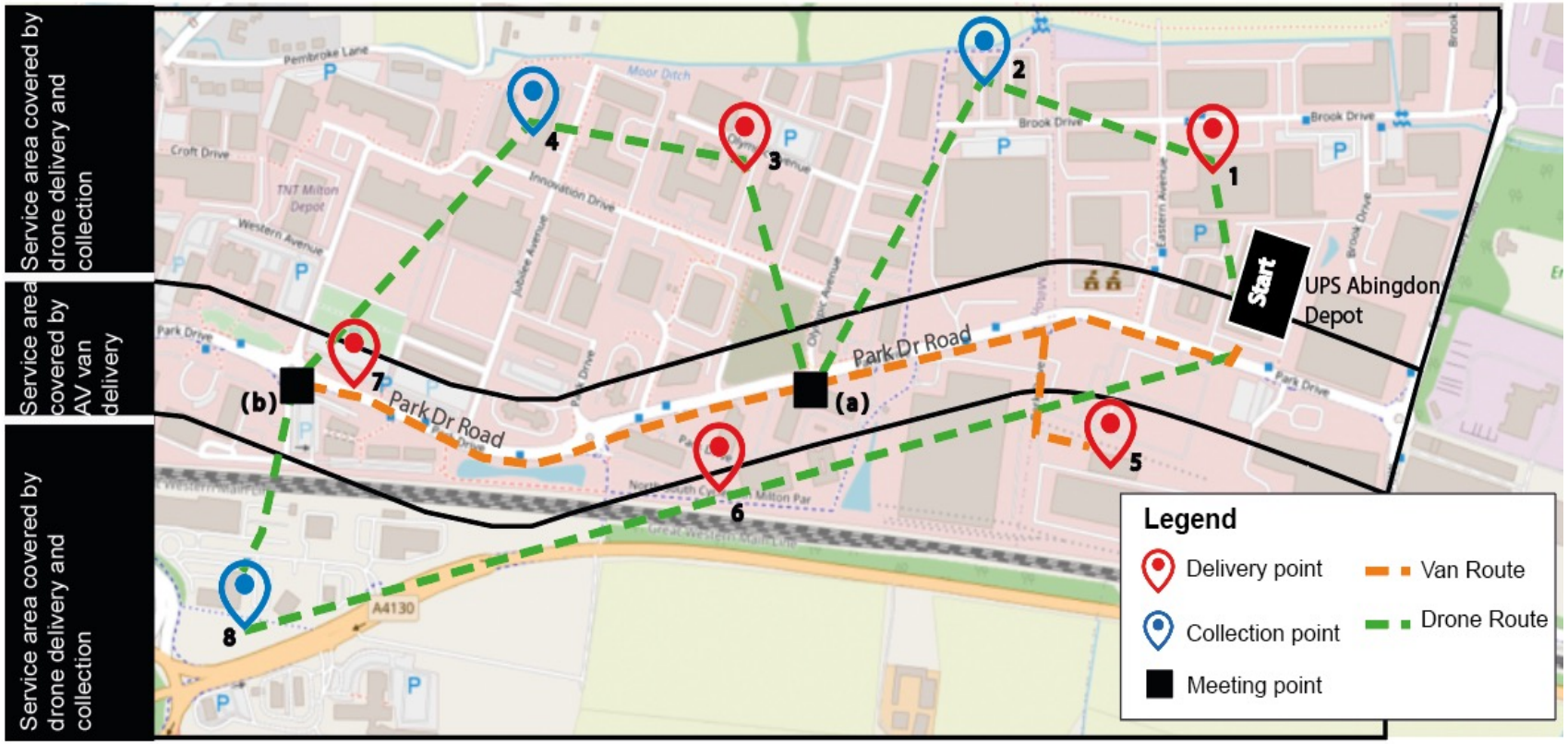
Case-specific objectives

- Verify feasibility of drone deliveries and gain insights on new business models
- Gain insights on regulatory and operational requirements for operating of integrated way of delivery services
- Understand public acceptance for integrated autonomous van and drone deliveries

Use cases in Oxfordshire: AVs & Drones

Demonstration 1:

Integrated Drone-based and Autonomous van-based Freight Transport



The AV van and Drone delivery plan

Use case 2: Autonomous buses (passengers)

Problem:

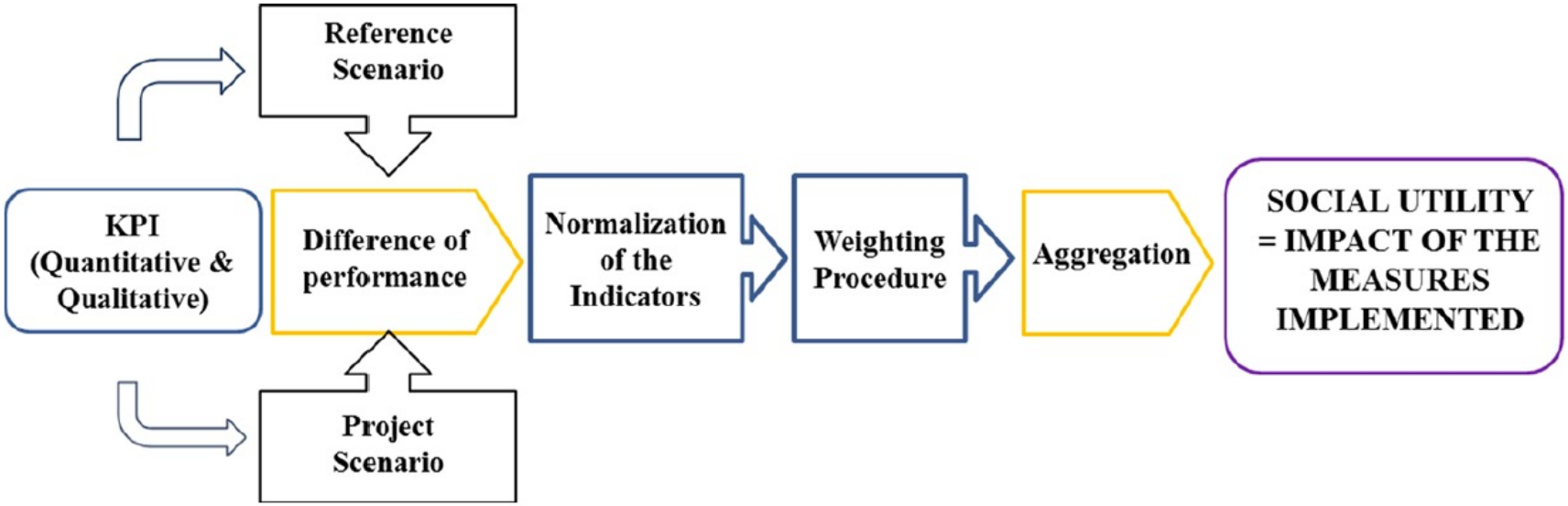
- There is no comprehensive understanding on the practical operation of AV bus, either in terms of feasibility examination or the potential drivers and barriers of AV bus popularisation.
- Public's attitudes and acceptance for AV buses is not well-studied as real-life demonstrations are limited.

Case-specific Objectives

- Verify feasibility of introducing AV buses in Oxfordshire.
- Understand public attitudes and acceptance for AV buses.
- Investigate the difference in attitudes of citizens and stakeholders by comparing their responses about AV buses before they experience an AV bus and when they will have actually experienced them.

Methods

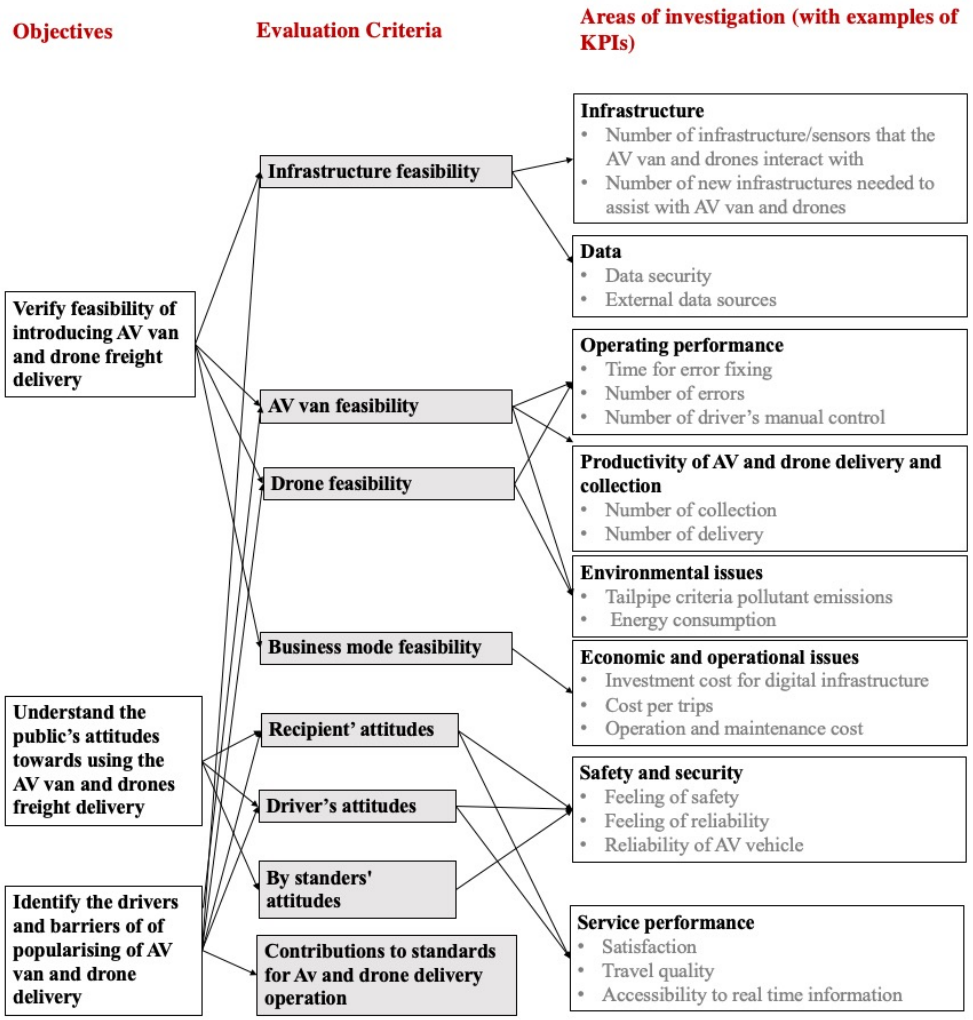
The analysis method is based on **a multicriteria analysis (MCA).** The MCA, originated from the field of operations research (Charnes and Cooper, 1961) is widely used in transport studies to reflect the decision maker's interventions. In Oxfordshire's cases, MCA is utilised to measure the impact of the two use cases.



Evaluation scheme of the measures implemented. In Oxfordshire's use cases (adopted from Cascajo and Monzon, 2014).

Key performance indicators

Impact analysis based on KPIs for delivery



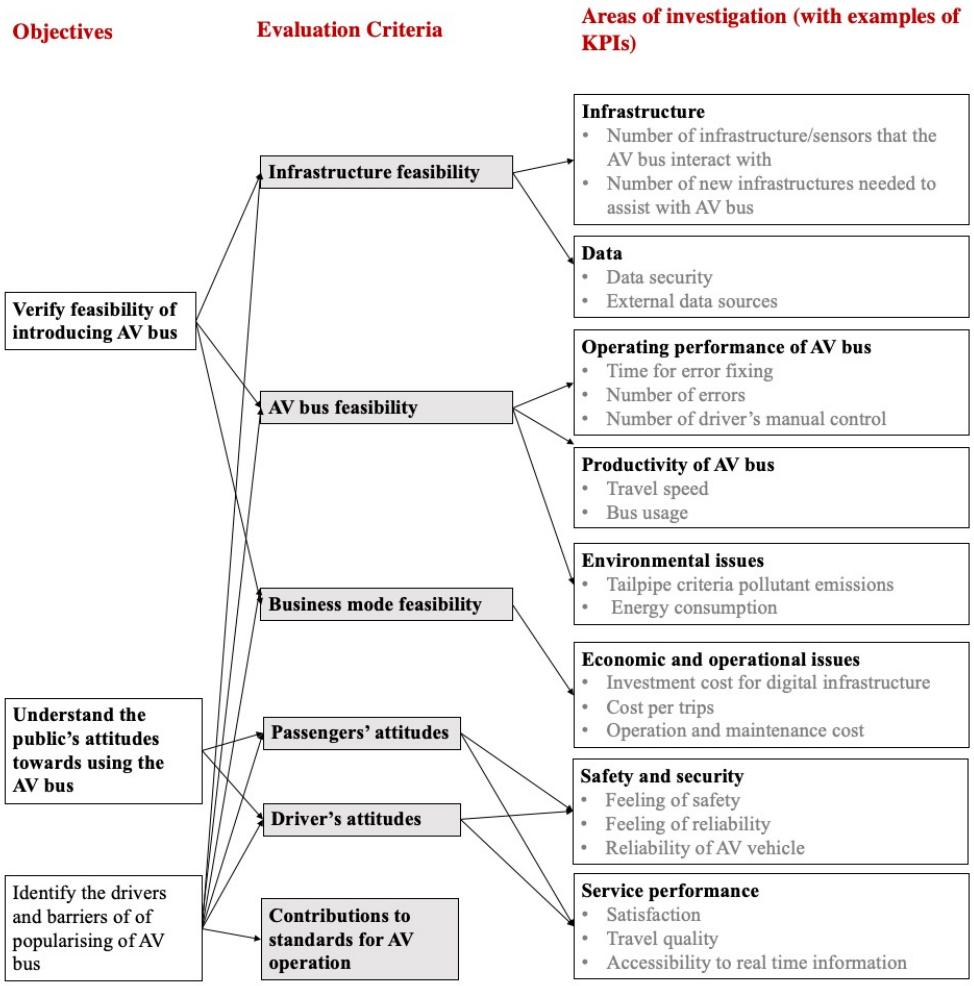
Relationship between objectives, evaluation criterion and areas of investigation (with examples of KPIs) in integrated Drone-based and Autonomous van-based Freight Delivery Demonstration.

The eight evaluation criteria are:

1) infrastructure feasibility,
2) AV van feasibility,
3) drone feasibility,
4) business mode feasibility,
5) driver's attitudes,
6) recipient's attitudes,
7) by-stander's attitudes
8) Contributions to standards for Av and drone delivery operation.

Key performance indicators

Impact analysis based on KPIs for AV bus



Relationship between objectives, evaluation criterion and areas of investigation (with examples of KPIs) in integrated AV bus Demonstration.

The six evaluation criteria are:

1) infrastructure feasibility,
2) AV bus feasibility,
3) business mode feasibility,
4) driver's attitudes,
5) passenger's attitudes,
6) Contributions to standards for Av bus operation.

Innovative aspects

- It has been built following **a co-creation approach by involving multiple actors** that are affected by such technologies and services (citizens, authorities, industry and research).

- It covers criteria and KPIs about **infrastructure, society, economy, environment, equity, standards** etc.

- It provides criteria and KPIs not only for AV demonstrations, but also for demonstrations where AVs collaborate with drones.

- It covers both **freight and passenger** AV demonstrations.

- It is applicable to several areas and not custom made only for Oxfordshire.

- It is useful for:
  - public authorities: to support them in decision making and planning for AVs and drones
  - industry: it includes KPIs about economy and society and reveals opportunities for investments
  - Researchers: provides new insights for research.

Results achieved

- **Specify the two use cases by involving all the relevant stakeholders.**

- **Understand the objectives of each stakeholders and what they want to measure.**

- Co-creation activities to understand the multiple stakeholders' attitudes towards AVs and drones.

- Understand the public attitudes towards using the AV buses and AV and drone parcel delivery services – before they start using the services.

- **Finalise the impact evaluation framework for AVs and drones.**

Lessons learned

- Several actors are involved in developing such impact evaluation frameworks. Especially, in the case where AVs are combined with drones, authorities that have never collaborated before should start collaborating.

- The involved actors have usually different priorities in terms of evaluating the impact.

- Several criteria should be taken into account in the impact evaluation frameworks in order for authorities to give the green light for such technologies and services to become part of our daily life.

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Thank you!

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