

# Evaluating IAM through the lens of System of Systems

## State of the Art and Highlight of IAM-OSA

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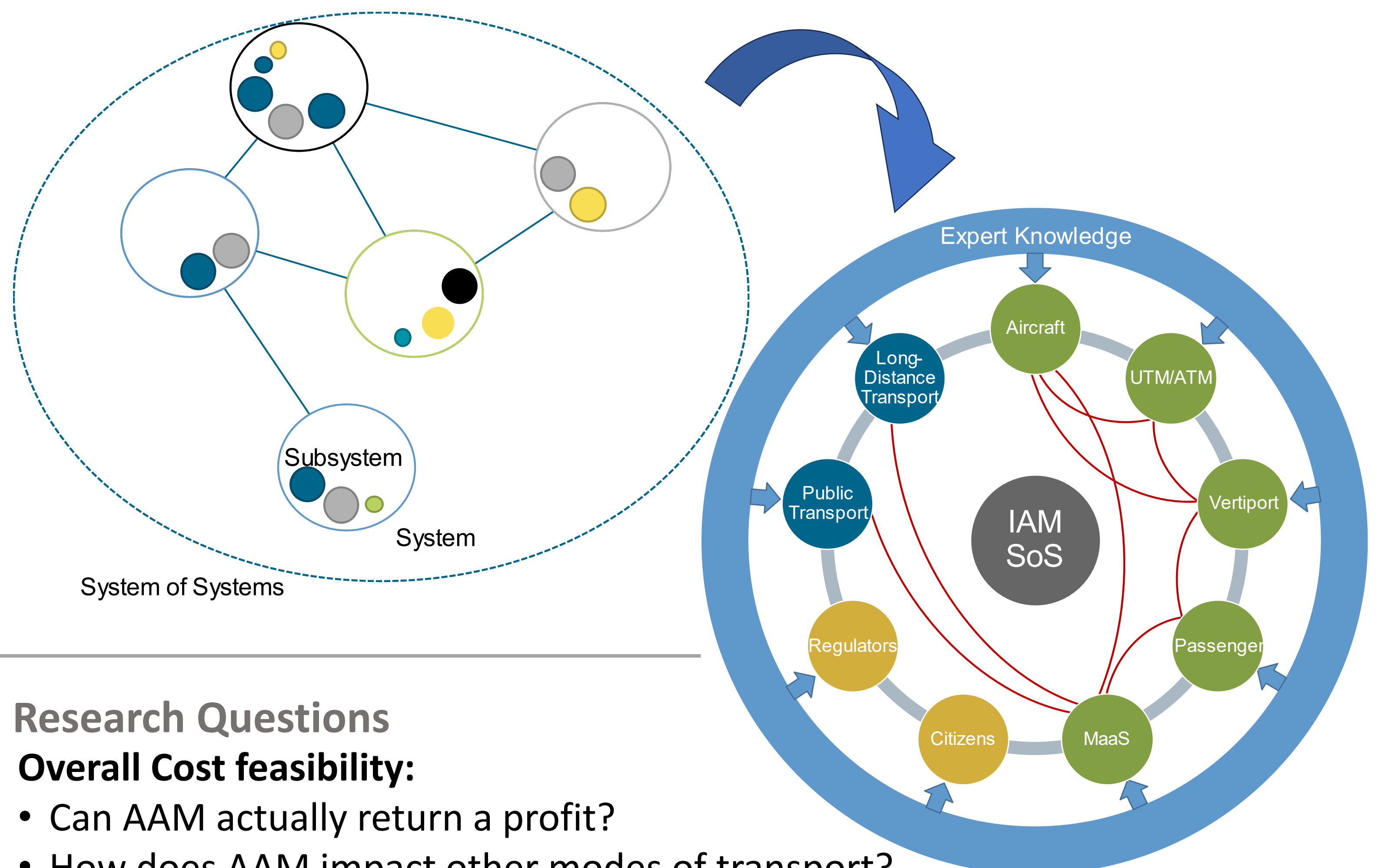
### What is a System of Systems?

*“A System of Systems (SoS) is a collection of independent systems, integrated into a larger system that delivers unique capabilities.*

*The independent constituent systems collaborate to produce global behavior that they cannot produce alone.”*

#### Key Traits of an SoS

- Operational Independence of Elements
- Managerial Independence of Elements
- Evolutionary Development
- Emergent Behaviour
- Geographical Distribution of Elements
- Heterogeneity of Elements



### System of Systems in IAM-OSA

#### Objective

IAM can only be realized with the collaboration of many stakeholders across disciplines. The objective of the System of Systems architecting & analysis in IAM-OSA is to develop a Collaborative Simulation integrating expert domain models into a coherent Agent-Based Simulation of IAM. The Collaborative Simulation directly models the Concept of Operations and captures the interconnections of the involved stakeholders. It enables the identification of trends, and ideal architectures. The primary goal being to answer the research questions identified alongside the experts. Enabling technologies such as RCE are leveraged to connect tools hosted across the different DLR institutes with the SoSID Toolkit.

#### Research Questions

##### Overall Cost feasibility:

- Can AAM actually return a profit?
- How does AAM impact other modes of transport?

##### Sustainability + Noise:

- What are the goals for sustainability & noise and how can they be adhered to?

##### Vertiport Management:

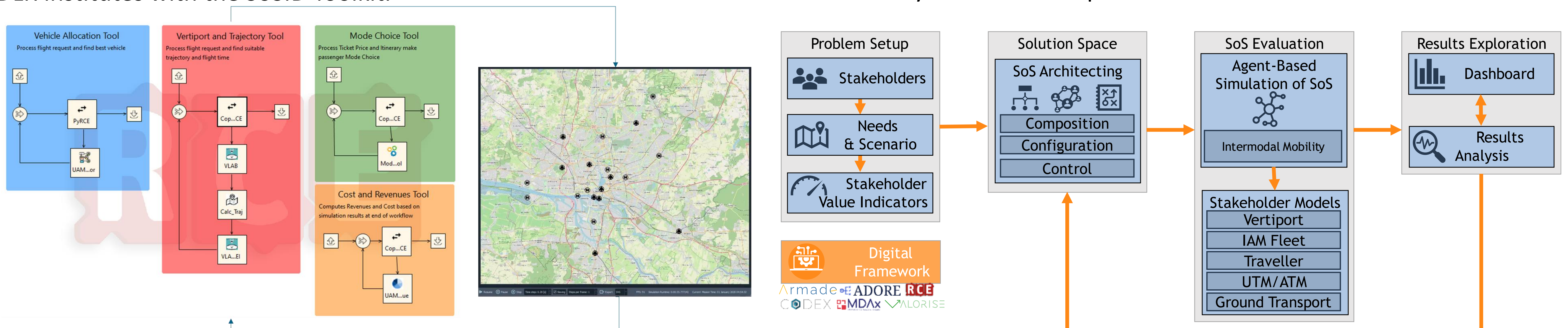
- How many should there be and where should they be placed?
- Impact of capacity/ other constraints or regulations?

##### Utility of AAM:

- Benefit to passengers and city transport utilization and MaaS?

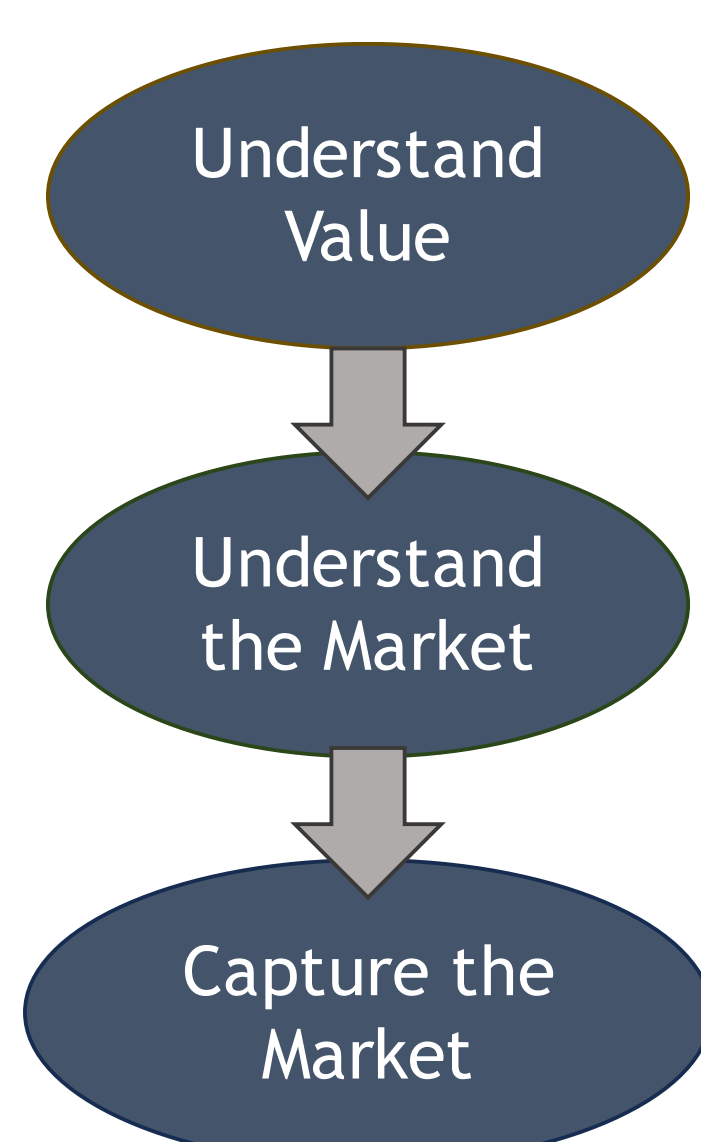
##### Trajectory/ Transport Management:

- How to effectively architect transport of AAM to reduce traffic burden?



### System of Systems in COLOSSUS

#### Product Push Paradigm



**Objective:** “How can IAM be made profitable, effective and sustainable from the perspective of the IAM Fleet Operator?”

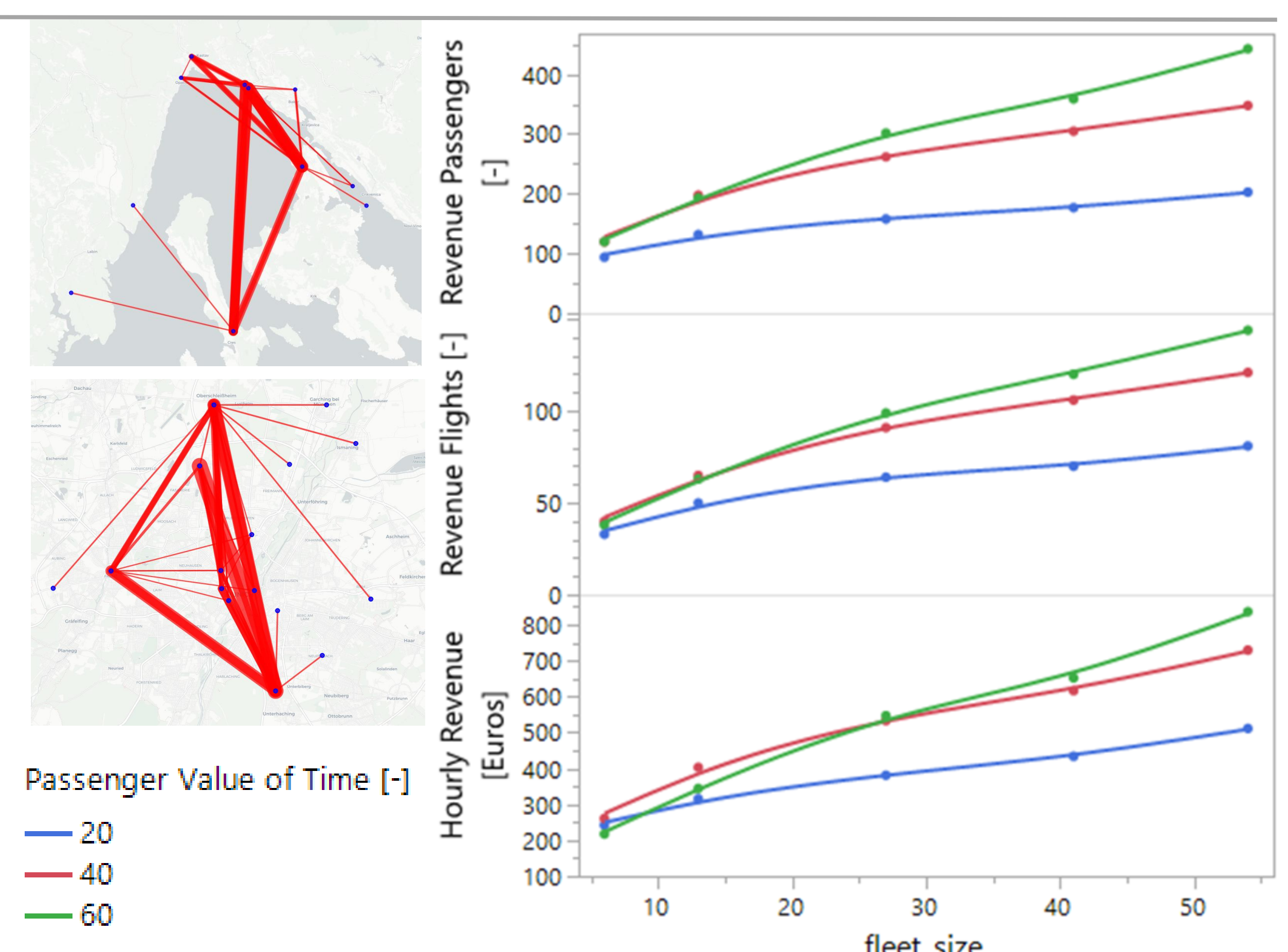
- Which conditions are needed?
- How can other stakeholders be satisfied?

**Approach:** Develop a collaborative SOS framework that can rapidly and broadly explore the design space

- Enable sensitivity studies and explore knock-on effects
- Perform multi-level optimization

**Constraints:** From the perspective of the Fleet Operator and through their architecture choices achieve the objective.

**Takeaways:** The SoS Framework enables the three-step product push paradigm, and identification of the target market for IAM. Preliminary results from Munich-Croatia case study indicate high-density and low-price operations are challenging to achieve profit, however low-density targeting high value of time (business/long-distance) travelers increase profitability.



### Focus in IAM-OSA

In IAM-OSA the different stakeholders are represented by the domain experts in the consortium enabling an in-depth investigation into the stakeholder decisions. One of the advantages of the SoS approach, is that the interconnections between stakeholders are accounted for. Therefore, domain specific studies can be carried out and evaluated considering the impact on other stakeholders.

In addition, the evaluations can be considered at a System-of-Systems level, where high-level impact of stakeholder decisions can be understood. Whereas in the COLOSSUS Project the focus was to broadly and rapidly explore the IAM SoS to understand the impactful variables, in IAM-OSA a complementary in-depth analysis will be performed.