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Robo-Taxi Service Design, Modeling and Simulation

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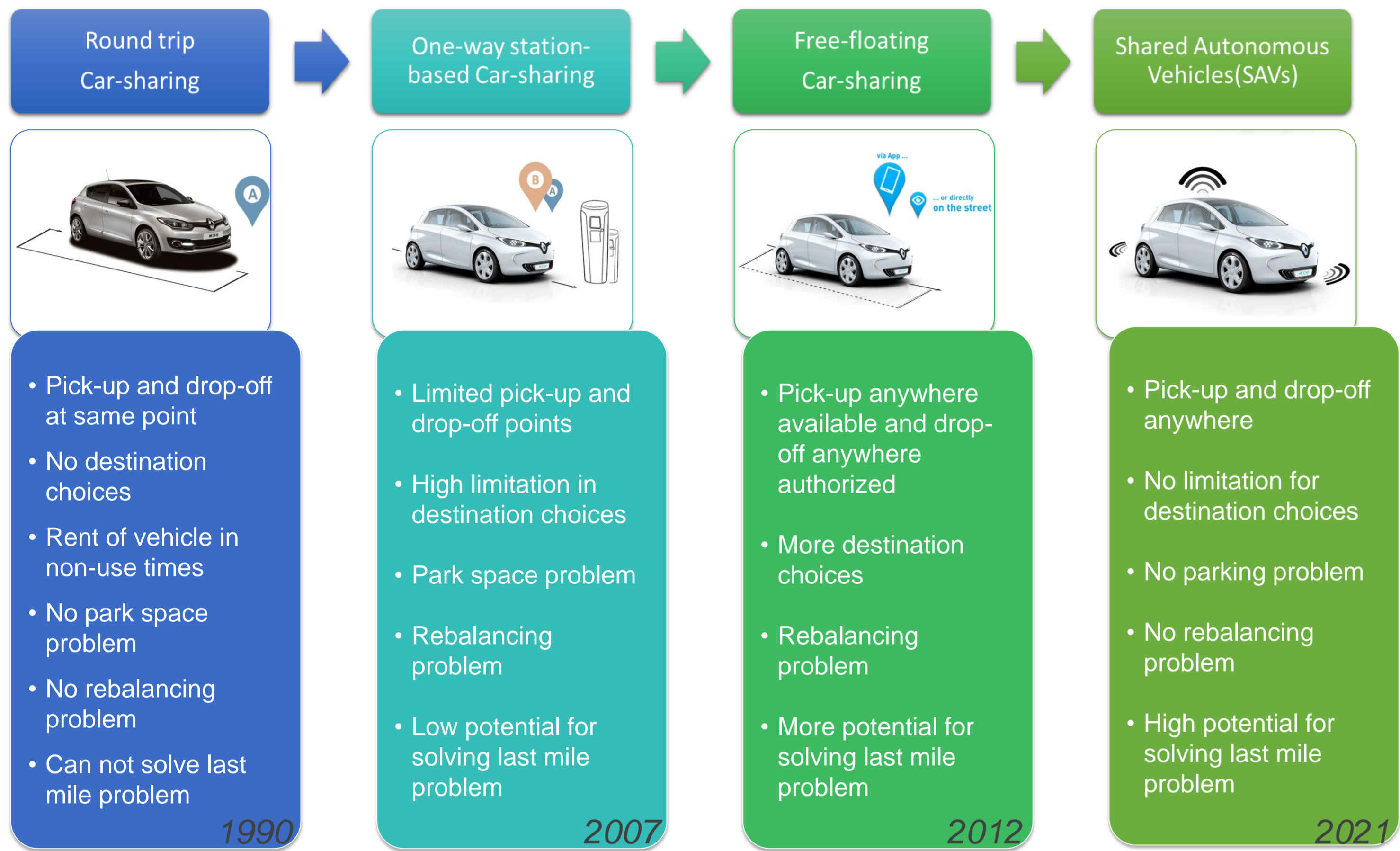
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Context

Bike-sharing
 Car-sharing
 Ride-sharing
 Scooter-sharing
 Ride-hailing
 ...

SHARED-USE VEHICLE SYSTEMS
 shifting the *private mobility* from *ownership* to *service use*

Shared-use vehicle systems evolution



Advantages of SAVs (Robot Taxis) over non-automated shared vehicles

- Obviating the need for continuing the rental while at their destination
- Not worrying about whether a shared vehicle will be available when the traveler is ready to departing.
- Anticipate future demand and relocate in advance to better match vehicle supply and travel demand.

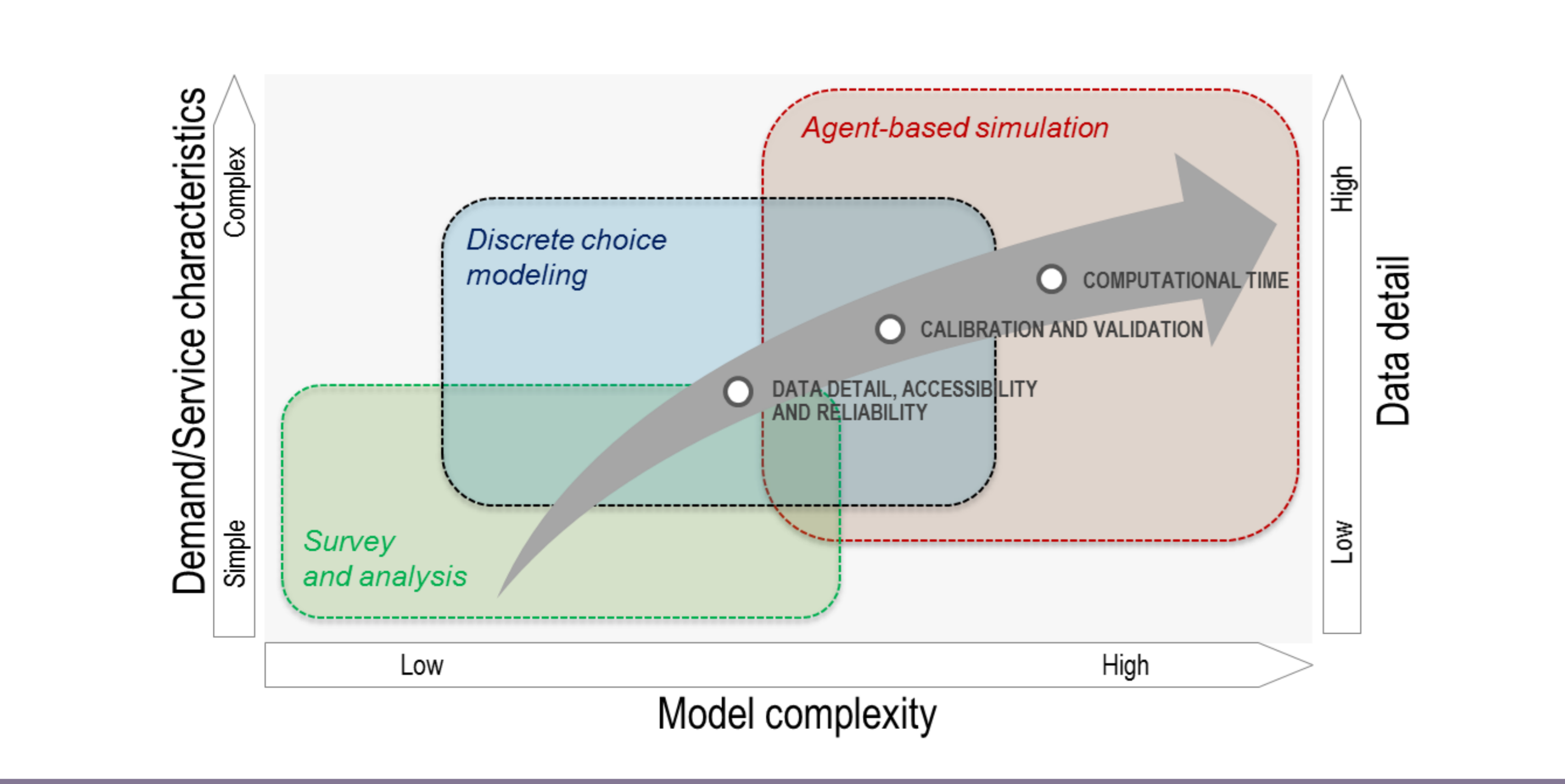
Objectives

Two major research axes:

- Develop a design methodology for Robot Taxis systems
- Conduct sensitivity analysis by using multi-modal traffic simulation environment

Current studies	Expected results
<ul style="list-style-type: none"> Predicting the usefulness of autonomous vehicles Estimating the number of shared autonomous vehicles needed to serve an existing demand 	<ul style="list-style-type: none"> How the new travel mode would interact with existing travel options? How customer preferences influence the mode choice?

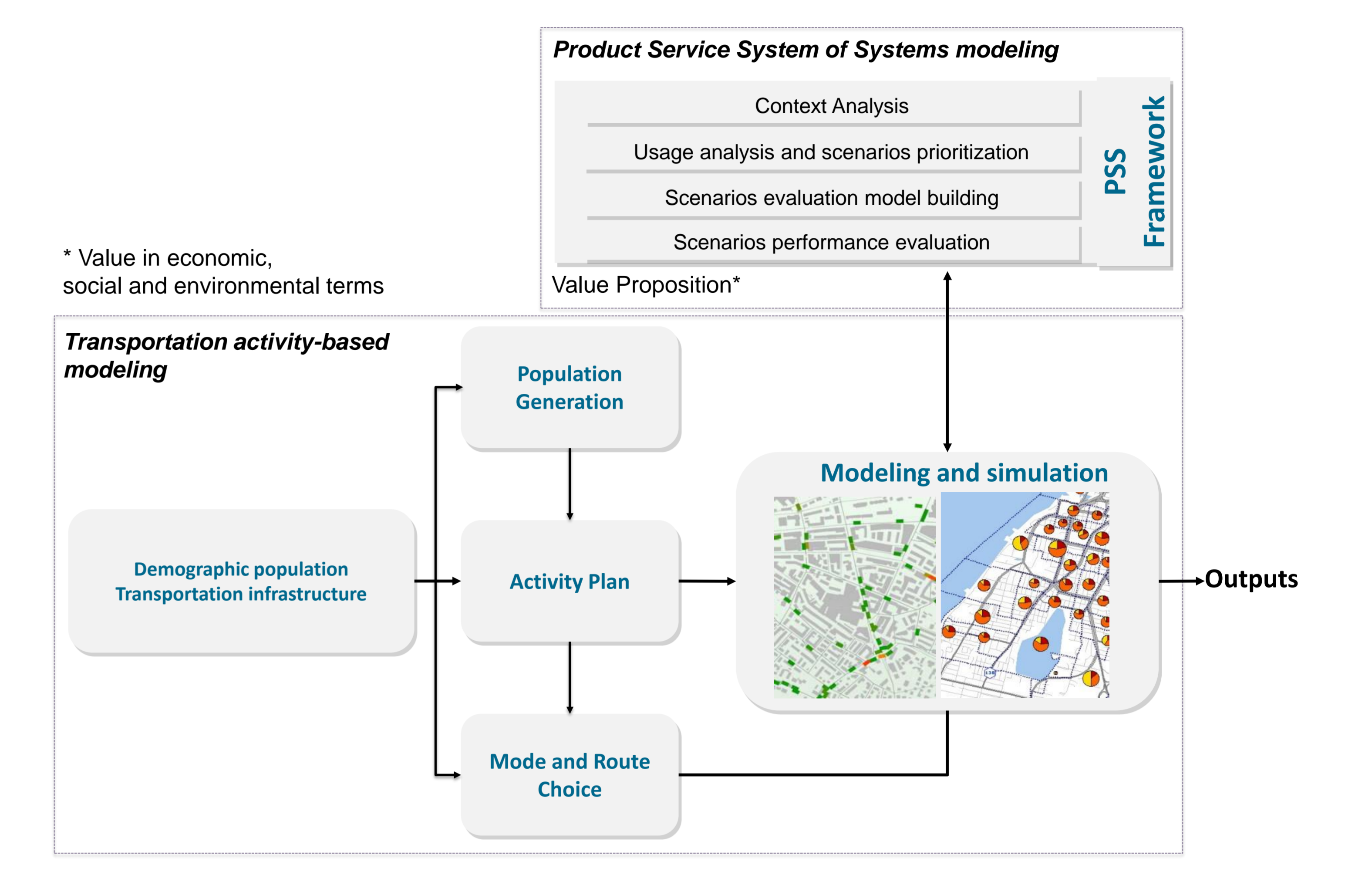
Approaches



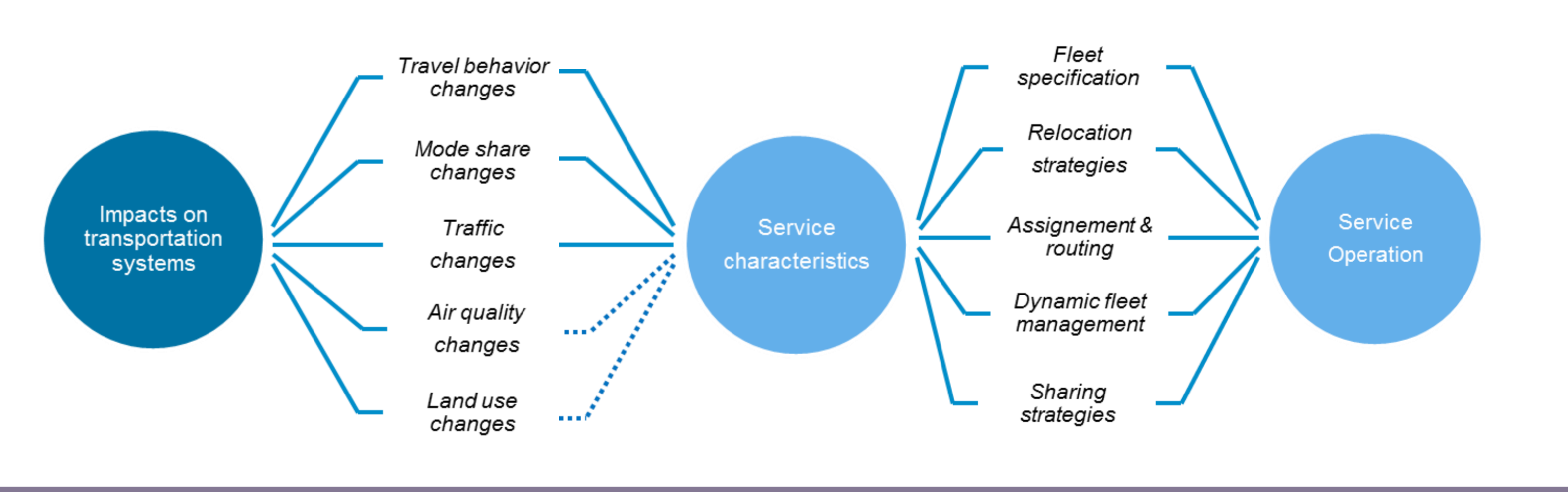
Challenges

- DATA DETAIL**: Travel should be modeled at the individual level with explicit modeling of the modal choice. It requires *individual socio-demographic data*.
- DATA RELIABILITY**: These systems are not in operation yet so a stated preferences (SP) survey would be needed. It could be *costly and not necessarily result in reliable and complete model*
- MACROSCOPIC MODELING WITH MICROSCOPIC DETAILS**: Model should be sensitive to short-distance trips so *extremely fine-grained spatial information at the parcel level is needed*
- HIGH COMPUTATIONAL TIME**: Model computes probabilities for a large number of alternatives at the individual level. Simulation procedures for real size networks would result in *very long computation times*
- CALIBRATION AND VALIDATION**: For SAVs services there are no real data at hands. It would be difficult to validate if *the model run correctly or not*

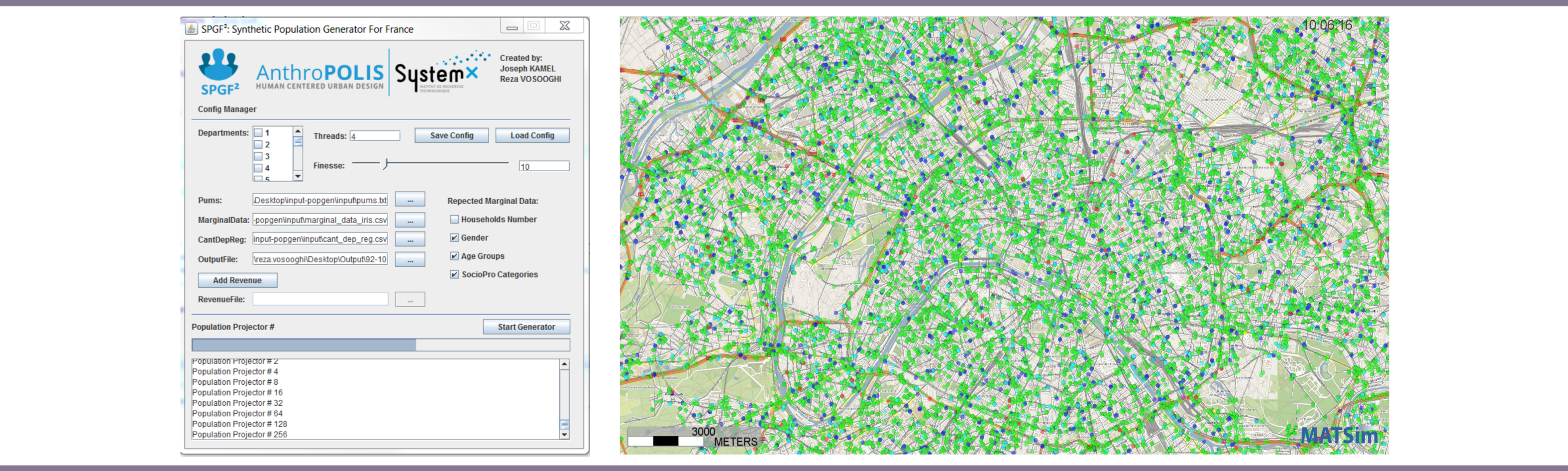
Design and Modeling Framework



Expected Results



Contributions



Bibliography

- M. Barth, & S. Shaheen, "Shared-Use Vehicle Systems: A Framework for Classifying Carsharing, Station Cars, and Combined Approaches," in *Transportation Research Record: Journal of the Transportation Research Board*, No. 1791, pp. 105-112.
- R. Vosooghi, J. Puchinger, M. Jankovic, and G. Sirin, "A Critical Analysis of Travel Demand Estimation for New One-Way Carsharing Systems," in *2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC2017)*, pp. 193-199.
- J. Kamel, R. Vosooghi, J. Puchinger, F. Ksontini, G. Sirin, "Exploring the Impact of User Preferences on Autonomous Vehicle Modal Share: A Multi-Agent Simulation Approach," *21st EURO Working Group on Transportation Meeting (EWGT2018)*.