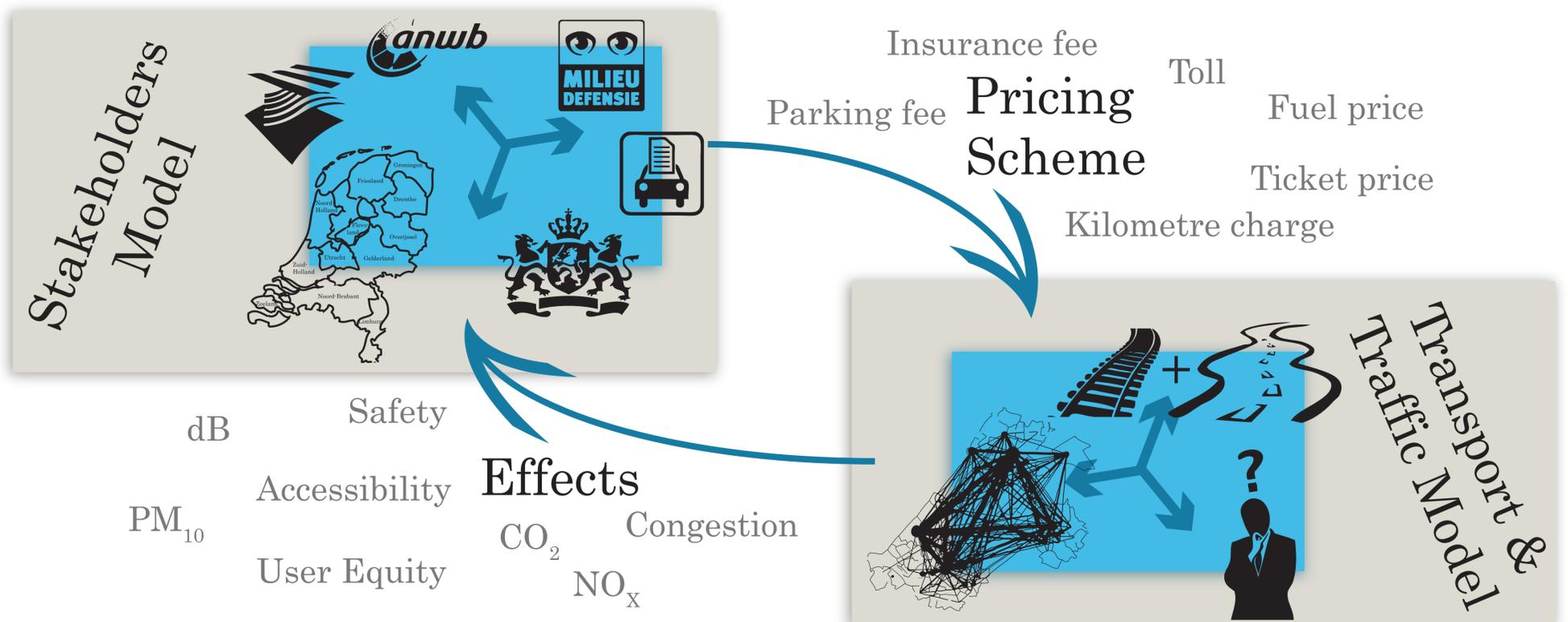


# INNOVATIVE ROAD PRICING

## 'The Quest for the Optimal Pricing Scheme'

In this study we aim to provide a framework for finding optimal pricing strategies for multiple stakeholders, taking a multitude of externalities (congestion, safety, emissions, etc.) into account, considering both private and public modes. Stakeholder preferences and interactions, a phase-wise implementation and the application to the Randstad area are explicitly considered.



Schematic overview the intended model for generating optimal pricing schemes.

## Model Setup

Pricing measures as well as stakeholder preferences and interactions are the main element of the proposed model set up. They are supplemented with a transport & traffic model. This combination leads to a comprehensive model to consider pricing measures and their implementation. The two optimization models and their interaction lead to a bi-level framework.

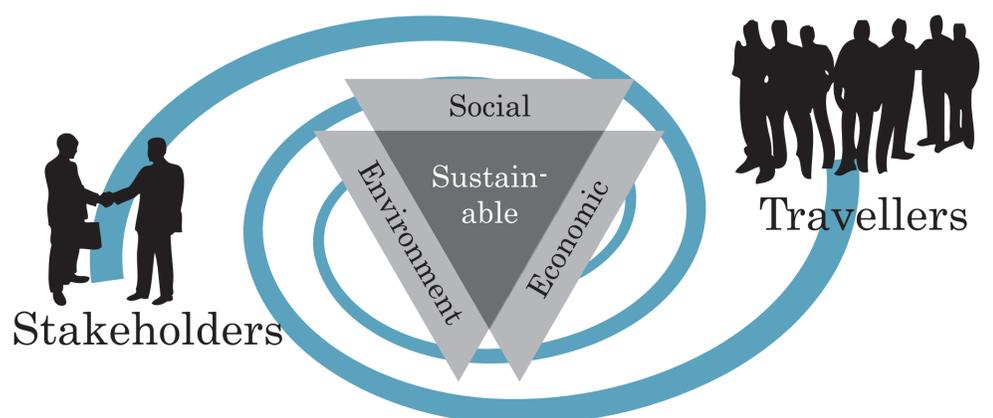
The **stakeholders model** considers the effects that emanate from a network situation and will deliver an (optimal) pricing scheme. In the scheme a wide variety of types of pricing measures can be included. Stakeholder's preferences, hierarchy and executive control lead to a problem with multiple objective functions that can be approached with game theory. The optimality definition ensues from it.

The pricing scheme is assessed in the **transport & traffic model**, this model determines which displacements arise and how they load the network. There are two components, the demand model and the assignment model. The first generates travel demand matrices using discrete choice models for trip, mode, destination and departure time choice. The second considers route choice and network loading. It is dynamic, multi modal and has to take multiple user classes, spillback and shockwaves into account.

The results of the transport & traffic model are processed with the effects model. It derives the congestion levels, emissions ( $\text{CO}_2$ ,  $\text{NO}_x$ ,  $\text{PM}_{10}$ ), safety levels, accessibility and user equity from the traffic flows, times and costs. It basically quantifies the externalities of the transport & traffic model. The modelled effects are input for the stakeholders models, thus resulting in a feedback loop.

## Relevance and Innovations

- Multiple stakeholders (e.g. governments, road authorities, road associations, insurance companies, environmental organisations) with mutual interactions and objectives.
- Real network (Randstad) instead of an artificial study network.
- Several types of pricing measures.
- Phase-wise implementation of pricing schemes.
- Road traffic as well as public transport.
- The impact of decisions of a single stakeholder can be assessed to the whole network. The model can discover if choices out of self-interest of a stakeholder can lead to large (negative) results on ignored effects.



Involvement of stakeholders and travellers in sustainability aspects.