Transport Policy and Technology Innovation Assessment in [Freight] Transport

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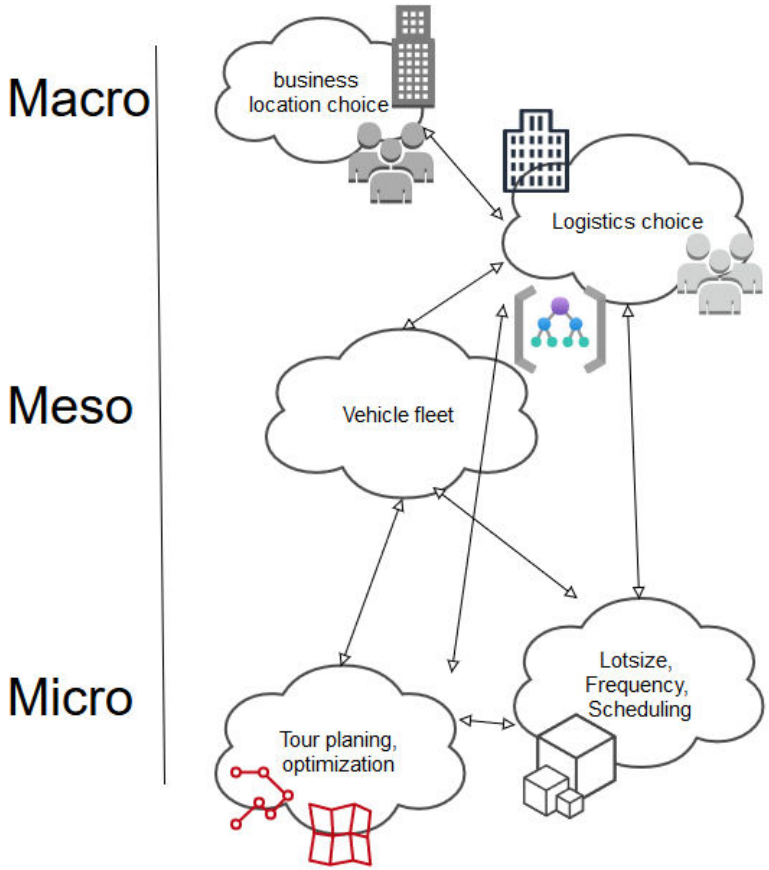
Challenges in freight transport – in general

- CO2 emissions
- Shortage of drivers
- Noise, ….
- …..

Technology and Measures in Freight Transport

Physical and Information technology	
▪ Alternative vehicle concepts (delivery robots, e-truck types, e-load bicycles) Alternative engines (electric,hydrogen)	▪ Telematics/luk technology ▪ 5G/Blockchain/ERP
Organizational/regulatory/operational measures.	
▪ Flexible transport times ▪ Freight platforms ▪ Warehousing cooperation ▪ Distribution cooperation ▪ Shift models ▪ Replenishment	▪ Truck pooling ▪ Logistics concepts for handling and storage ▪ Bundling of goods flows ▪ Routing and scheduling
Regulatory measures	
▪ Environmental zones (low, zero emission zones) ▪ Loading zones ▪ Speed limit ▪ Access restrictions	▪ Special truck lanes ▪ Truck routing concepts ▪ Long trucks ▪ Combined transport measures
Pricing policy measures	
▪ City toll	▪ Transport infrastructure investments

Freight Transport Policy and Technology Assessment



Spatial Planning

Transport Policy

Technology Assessment

Motivation:

- In order to achieve the overall assessment of **logistic chain**, the use of **technologies** in the **subprocesses** needs to be taken into account.
- Even if a wide range of **technologies** already exists, there is still very hard to measure the **effects** of these **technologies** for the **entire logistics chain**
  - First, a **modeling tool** is needed that represents this overall system.
  - To simulate and assess the effects of existing technologies, various **methods** may provide the basis for decision-making

Goal: Develop a modeling toolset that allows an impact assessment of technologies and/or policies

Case study „road pricing in urban areas“

Prof. Dr. Gernot Liedtke

Challenges

Congestion

- Ressource losses
- Inefficient utilisation of infrastructures

Urban freight transport

- 10-15% of total traffic
- Tremendous grow

Negative impacts of freight trucks

- Vibrations, noise
- NO_x, particle matter
- Micro congestion

DLR

Challenges also elsewhere

Tokyo – Mega agglomeration

NY – Third-row unloading

Policies and solutions

Berlin – E-Bikes

Berlin – Environmental zone

Singapur – City Toll

NY – Unloading bays

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Desired effects and undesired side effects of urban freight transport policies

Assuming, there is a city toll (cordon toll) for heavy trucks between 7.00 and 19.00. What would happen?

- Touren werden zeitlich anders geplant
- Touren werden räumlich anders geplant
- kleine Lkw werden eingesetzt
- Empfänger ändern Bestellpolitik
- (langfristige logistische, wirtschaftliche und städtebauliche Wirkungen)

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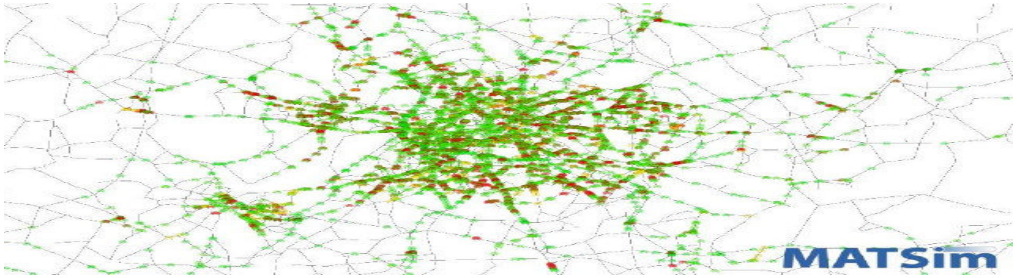
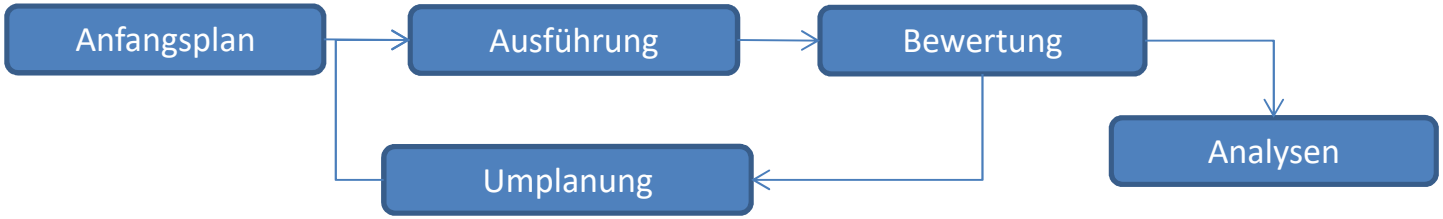
MATSim-Simulationsmodell

Ebene der
Verkehrsflüsse



Ebene
eines Agenten



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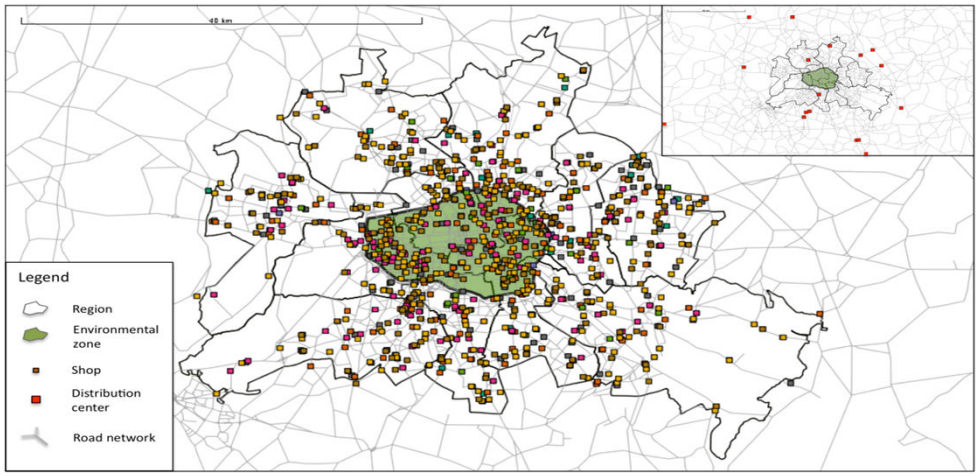
Güterverkehrs-Agenten



- Carrier Agenten wählen:
  - Fahrzeuge nach Typ
  - Allokation der Läden
  - Tourensequenzen
  - Startzeit
  - Strecke im phys. Netzwerk

- Und minimieren:

$$\min\left[C_{Fixed} + C_{Variable}\right]$$

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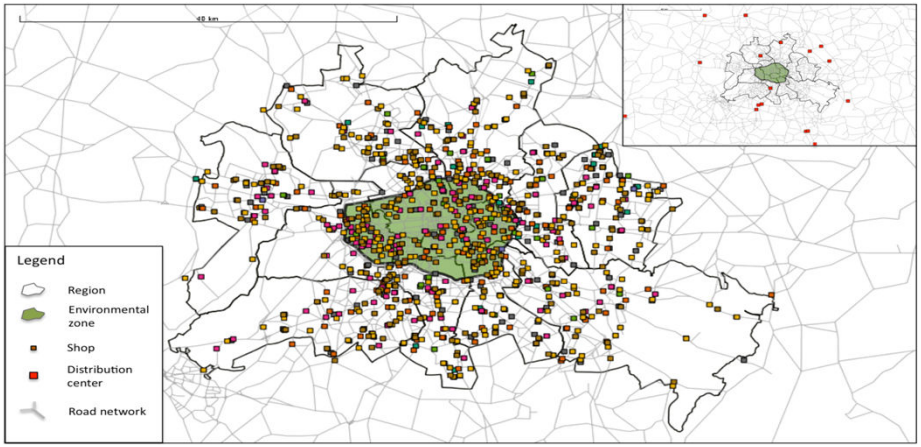
Szenarien



- Politik 1: **Cordon-Maut** für schwere Lkw (20€ pro Fahrzeug.)
- Politik 2: **Distanzabhängige Maut** für schwere Lkw (1€/km)
- Politik 3: **Einfahrverbot** für schwere Lkw
- Politik 4: **Nachtfahrverbot** für schwere Lkw zum Lärmschutz (22-7 h).

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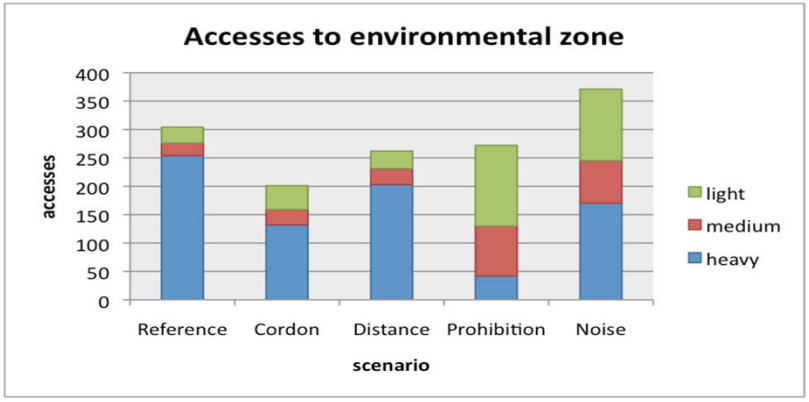
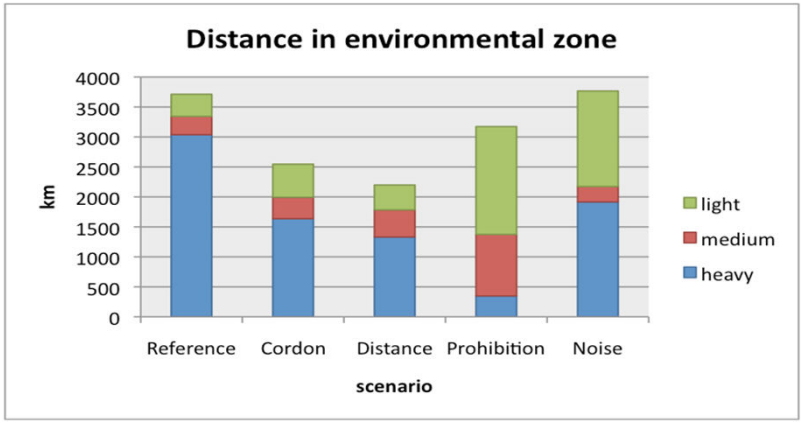
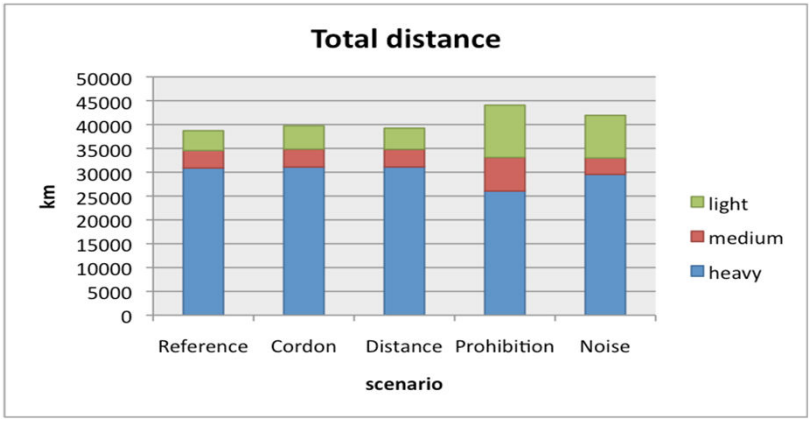
Results and discussion







Case study „road pricing in urban areas“

Elija Deineko

Freight Transport Technology Assessment

Motivation for Case Study:

- Freight transport is responsible for a high percentage of global **CO2 emissions**
- **automation and digitalization** is becoming increasingly relevant in freight transport sector

Research question:

- Can **automation** in **freight transport** reduce greenhouse gas emissions in the future?

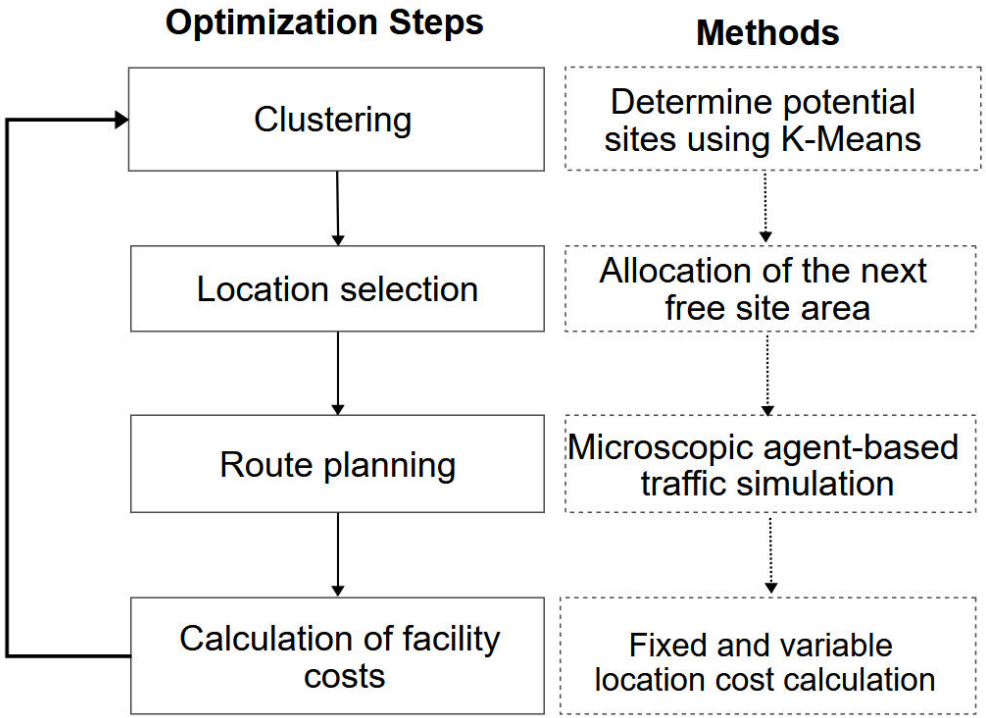
Goals:

- Focus on automated road transport
- Assessment and analysis of the impact of automation on the modal split and **logistic network structures**

Freight Transport Technology Assessment

Development of a semi-combined approach

to solve large-scale location routing problems (LRP) in plausible time incorporating logistics behavior model for route planning



Freight Transport Technology Assessment
Case Study

Base scenario:

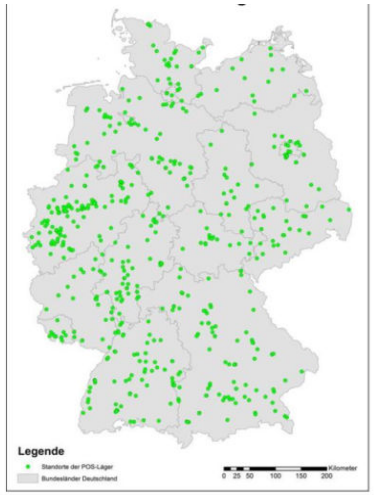
- 3050 retail stores from one food retail chain in Germany
- 35 warehouse locations

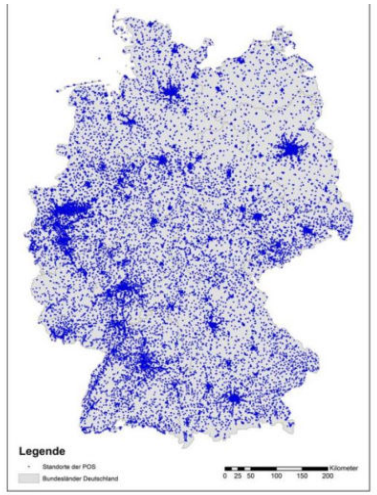
Automation scenario:

- 3050 retail stores
- Warehouses (variable)
- Driver costs: 0.0
- Time windows: 24h
- Reduction of stop times by 50%

Additional Input Data:

- 11 000 potential sites for depots
- 4 Lkw types (7,5t, 18t, 26t 40t)
- 3 carriers (dry, fresh and frozen products)





Freight Transport Technology Assessment
Case Study

- Base scenario (35 locations)
- Automatio scenario (23 sites)

Fig.1: Warehouses

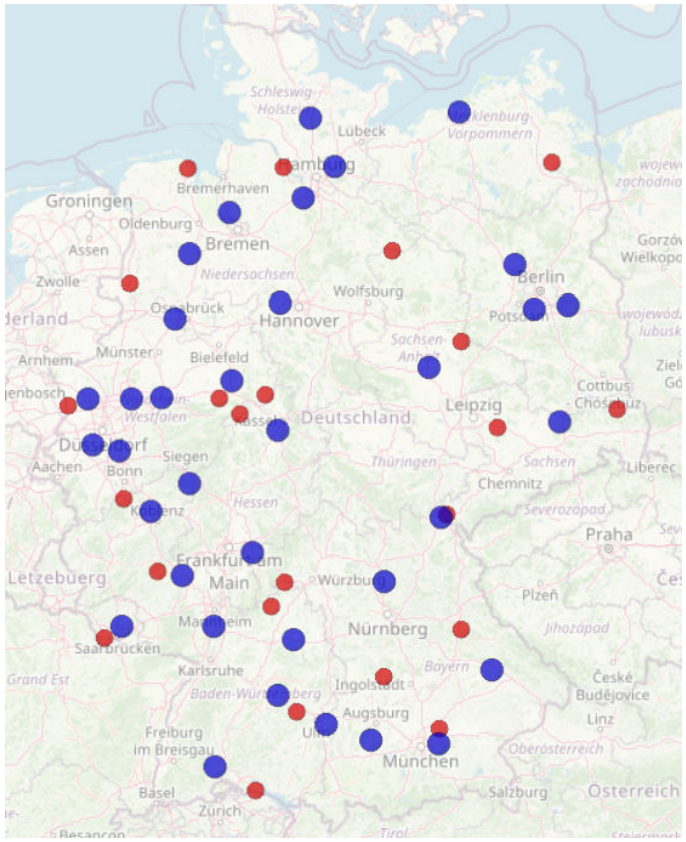
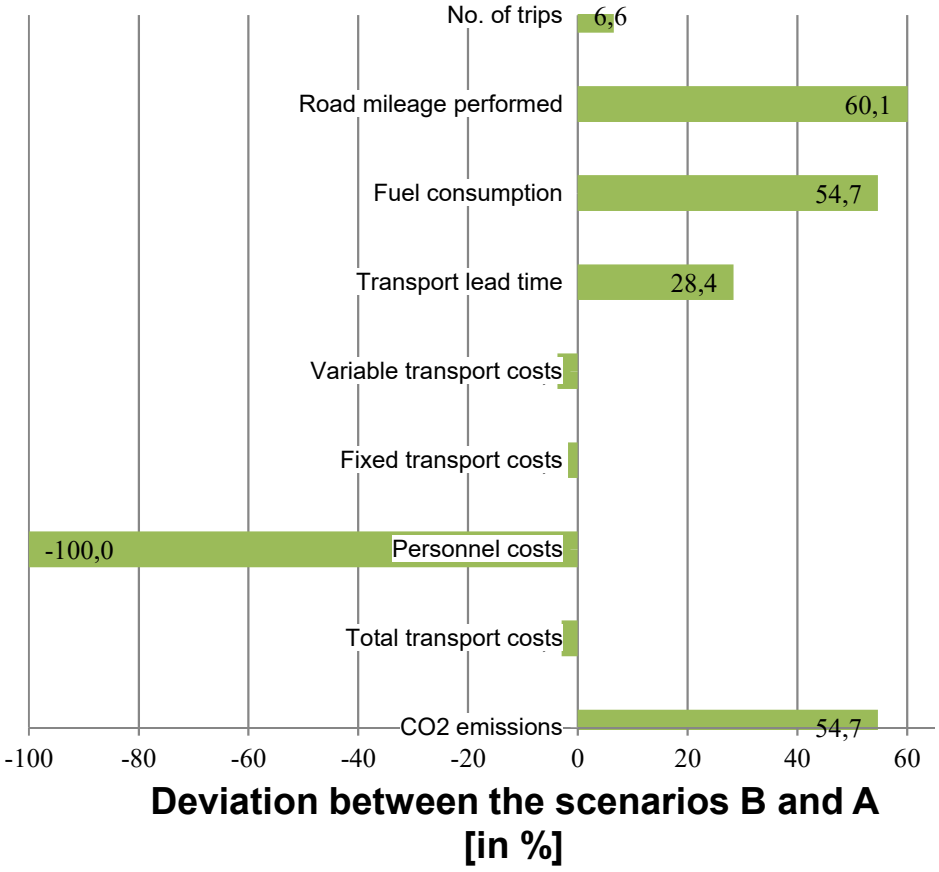


Fig.2: 3050 Store

Freight Transport Technology Assessment
Case Study

- Reduction in the number of locations (from 35 to 23 warehouses)
- Shift of warehouse locations outside the customer clusters
- Increase in direct transport (light vehicles <7.5 t, +33%)
- Increase in total vehicle usage and vehicle mileage
- Increase in total CO2 emissions (+55%)
- Reduction in variable costs and total costs (-3%)



Expected Impacts of automatization in road freight transport

- Reduction of labor cost
- The increase of the daily operating hours
- Greater safety and reliability
- Better performance of logistic flows
- Smaller shipment sizes
- Extended time windows for delivery

- Higher frequency
- Increase in the number of trips
- Increase of direct traffic share
- Increase in total vehicle utilization i.e. vehicle mileage
- Higher facility fix cost through utilization of new technologies
- Reorganization of vehicle fleet
- Reorganization of total logistic network: new facility location and customer allocation