Imperial College London

Knowledge & Innovation Community Climate-KIC

Grantham Institute for Climate Change

Exploring policies for the transition towards electric vehicles

What are the consequences of industrial policies on the automotive sector during the transition towards electric cars (EVs)?

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Topic

This PhD project examines

- the **transition process** leading to the shift from conventional vehicles towards sustainable private vehicles, such as hybrids, electric and fuel cell light duty vehicles (LDV),
- the **effects and consequences of governmental policies** on industrial actors with respect to their behaviour (e.g. **company behaviour**),
- the **success of policies** in reaching policy goals (e.g. **industrial goals, growth, employment, diffusion and emission targets**),
- and policy making in United Kingdom, Germany and Europe.

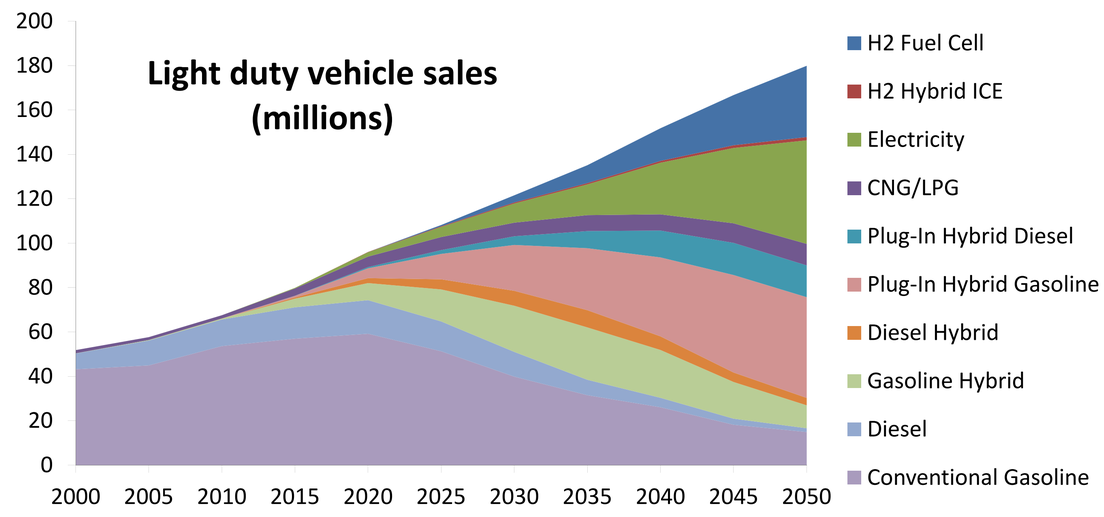
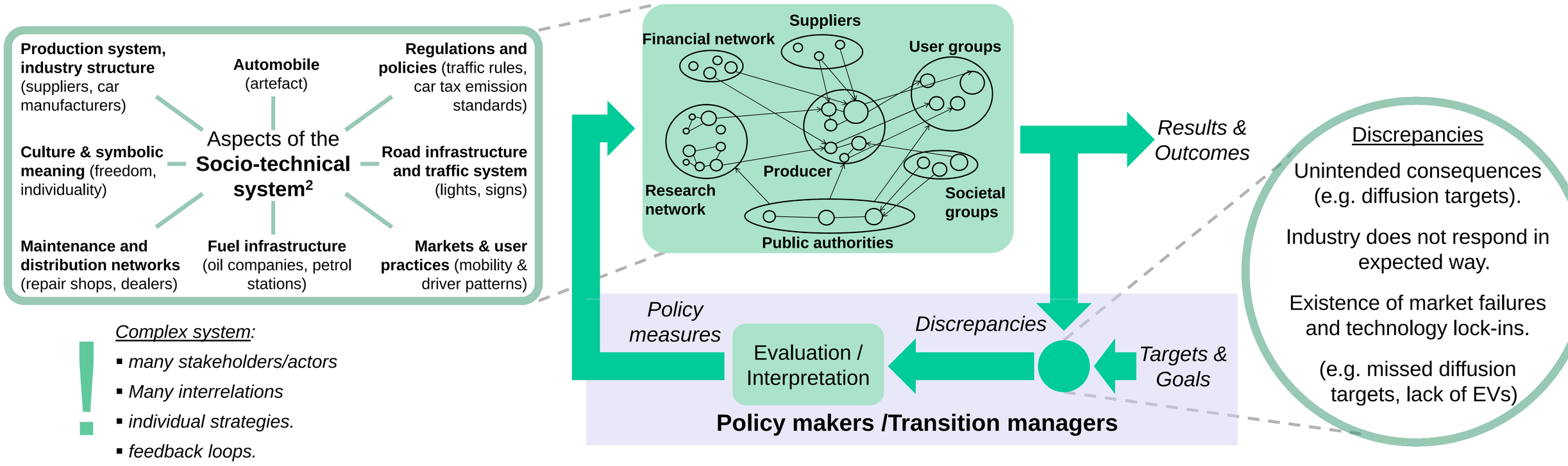


Figure 1: Diffusion scenario for light duty vehicle sales until 2050 (adapted from IEA 2010[1])

The Problem



Actors in the **Socio-technical system[3]**

Results & Outcomes

Policy measures

Evaluation / Interpretation

Discrepancies

Targets & Goals

Policy makers /Transition managers

Discrepancies

Unintended consequences (e.g. diffusion targets).

Industry does not respond in expected way.

Existence of market failures and technology lock-ins.

(e.g. missed diffusion targets, lack of EVs)

Complex system:

- *many stakeholders/actors*
- *Many interrelations*
- *individual strategies.*
- *feedback loops.*

Nature of the system leads to high uncertainty for the expected results of policies or industry.

Theory

- **Innovation management** and **system** theory for company level.
- **System thinking** for system description.
- **Transition science** for description, decomposition and understanding of the transition of socio-technical systems.
- **Diffusion economics** for quantification of transition results.

Methods and tasks

- **Formalization and definition of system (boundaries)** with insights from theory.
- **Modelling** of system (e.g. system dynamics, agent-based).
- Extraction **of parameters from empiric data and theory**.
- **Interviews** with experts from industry and policy.
- Differentiation between **individual stakeholders** (e.g. single supplier or OEMs) and **whole sectors/branches**.
- **Simulation of different scenarios, cases and policies**.

Expected outcomes

- **Understanding of system** and its nature.
- **Consequences of specific policies** on the system, its stakeholders and policy goals.
- Assessment of **industrial policies**.
- Assessment of **industry's strategies**.
- **Recommendations for policy makers and industry to take advantage of transition towards electric vehicles and meeting goals.**

Example: Effects of policies on a small electric vehicle enterprise

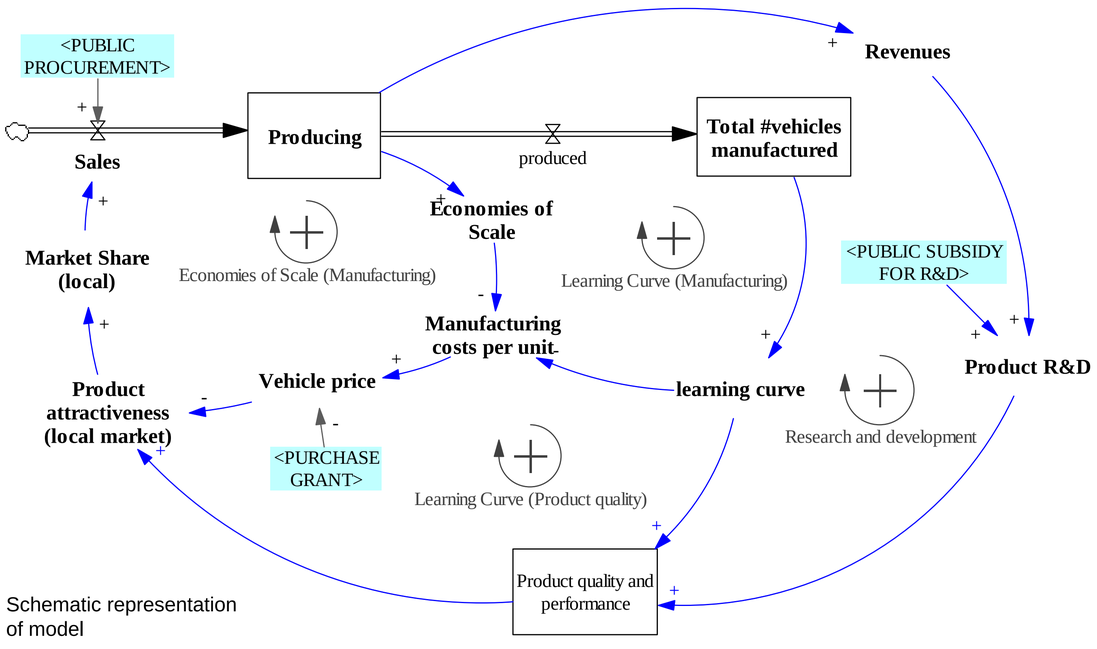
Case study:

Effects of policy measures on R&D, sales and employment.

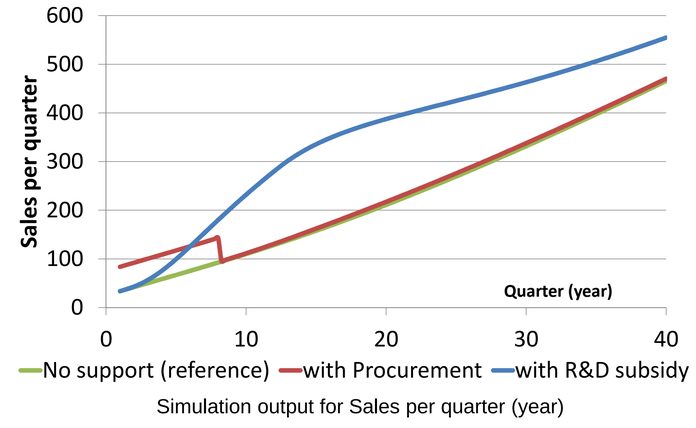
Test cases with cost of GBP 5,000,000 each:

- Procurement (100 cars per anno for two years)
- Direct R&D subsidy

Focus on product quality and manufacturing. (Economies of scale, learning curves, etc.)



Schematic representation of model



Simulation output for Sales per quarter (year)

Simulation results (10 years)

- Reference case: 8522 vehicles produced
  26 jobs in R&D and 125 in manufacturing
- Procurement: 9041vehicles produced
  26 jobs in R&D and 126 in manufacturing
- R&D subsidy: 13165 vehicles produced
  34 jobs in R&D and 139 in manufacturing

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