eceee summer study 2022

Stakeholder expectations as a barrier or success factor for alternative drive technologies

- the case of Electric Road Systems in Europe

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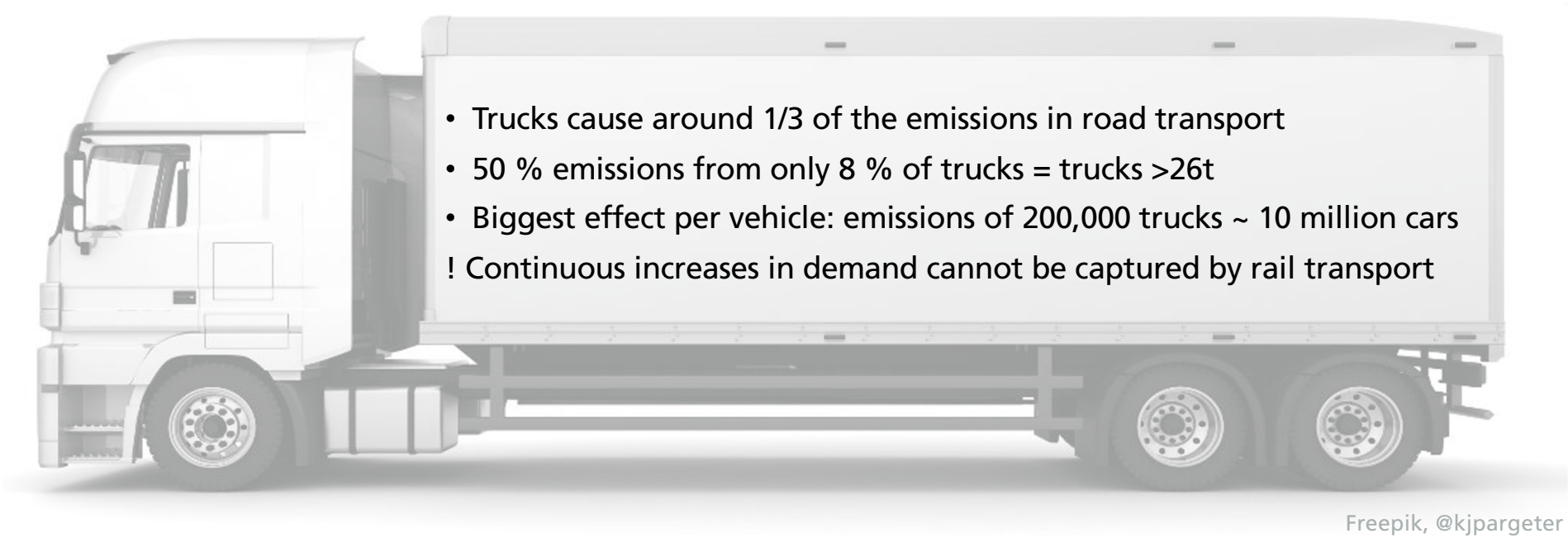
Continuous growth of CO_2 emissions in heavy-duty road transport presents a great challenge



- Trucks cause around 1/3 of the emissions in road transport
- 50 % emissions from only 8 % of trucks = trucks >26t
- Biggest effect per vehicle: emissions of 200,000 trucks ~ 10 million cars

! Continuous increases in demand cannot be captured by rail transport

Freepik, @kjpargeter

Policy solution:

- **CO_2 reduction targets for fleet emissions by the EU** (compared to 2019/20) (Regulation (EU) 2019/1242)
  - Target 1: 15 % reduction after 2025;
  - Target 2: 30 % reduction after 2030

➢ **Radical technology change** is necessary to meet these targets

Electric Road Systems (ERS) and catenary trucks as a zero-emission alternative to diesel

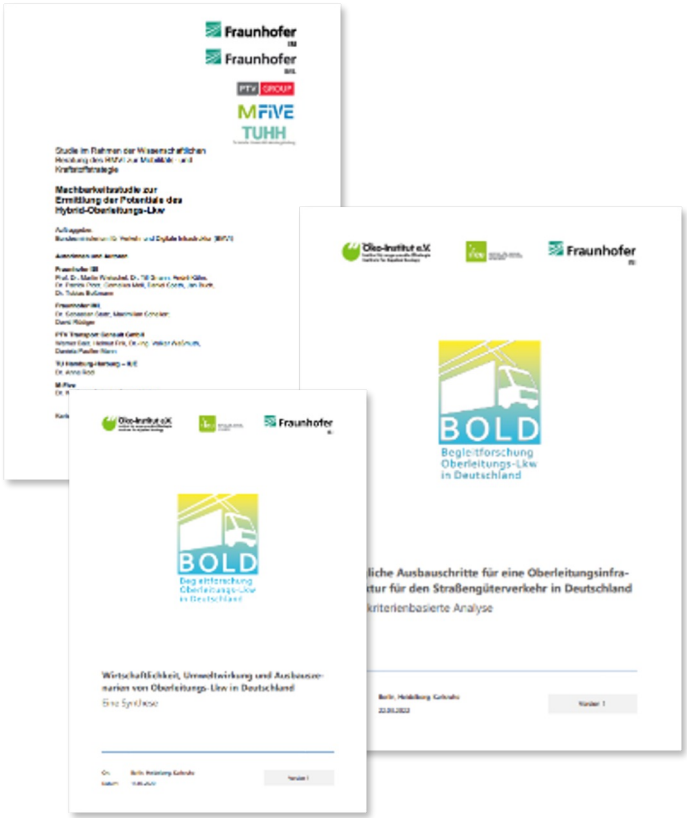
- **Electric road systems (ERS)**:
  - Dynamic charging while driving
  - On paper: efficient usage of resources: smaller batteries; avoiding energy loss from fuel conversion
  - **Catenary systems**: charging infrastructure above the road (overhead lines); trucks with pantograph

- **From niche to mainstream?**
  - Niche(s) established with demonstration projects in Sweden and Germany
  - Multiple governments interested but only small number of producers and users engaged in demonstrations

Identifying factors for the (lack of) support of ERS: not just a techno-economic question

Assumption I: rational choice of organisations assessing technology characteristics

- Most common in field of heavy-duty transport
  - Involves economic assessments + modeling
  - Focus: technological feasibility, costs, CO_2 reduction potential
- Criteria are met on paper but still: only small supporting actor coalition
  - Potential reasons: incomplete information of actors, actors' power asymmetries, and uncertainties inherent in sustainability transitions



Going beyond techno-economic assumptions with an expectations-focused approach

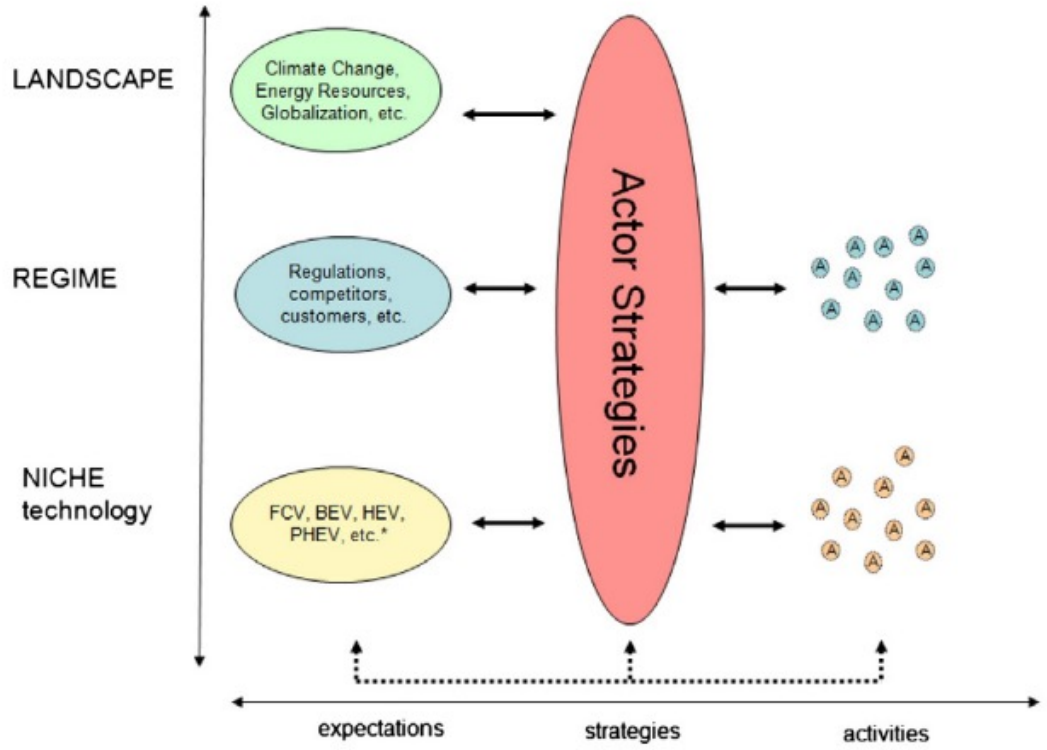
Assumption II: expectations determine strategic involvement with a technology

- More common in the fields of innovation studies and strategic management
  - "Will the support pay off in the long run?"
  - Less measurable; different potential scenarios
- Power struggle between individual and collective expectations
  - "Which developments are most important to consider?"
  - "Will the developments be positive or negative for the technology?"

Research questions

- Which expectations are put forward by different actors to justify their positions on ERS?
- How do expectations spread between actors?

Conceptualizing and structuring expectations



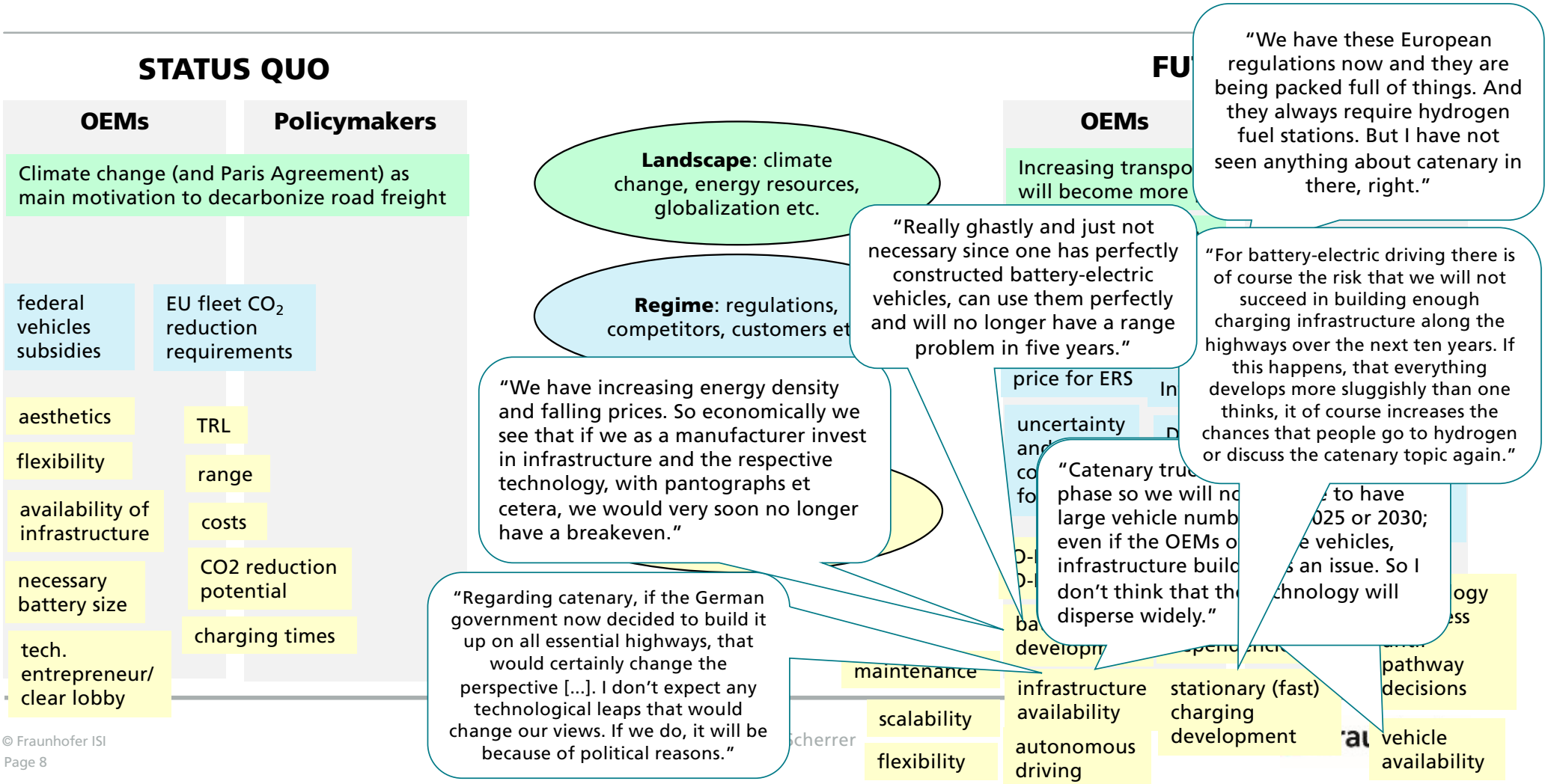
- Original focus: companies
- Here: OEMs, infrastructure providers, and policymakers

Budde, Alkemade & Weber (2012)

Methods

- Qualitative approach
  - Case: catenary systems as one type of ERS; Germany as starting point
- Data sources
  - 11 expert interviews (07-2021 to 04-2022) with manufacturers (n = 9), manufacturer association (n = 1), and government agency (n = 1)
  - 4 international workshops with researchers, industry, and government representatives (01-2022 to 05-2022)
- Data analysis
  - Qualitative content analysis (Mayring, 2014) in MaxQDA
  - Theory-led but allowing for inductive categories as well

Results RQ1 – current technology assessments vs. expectations

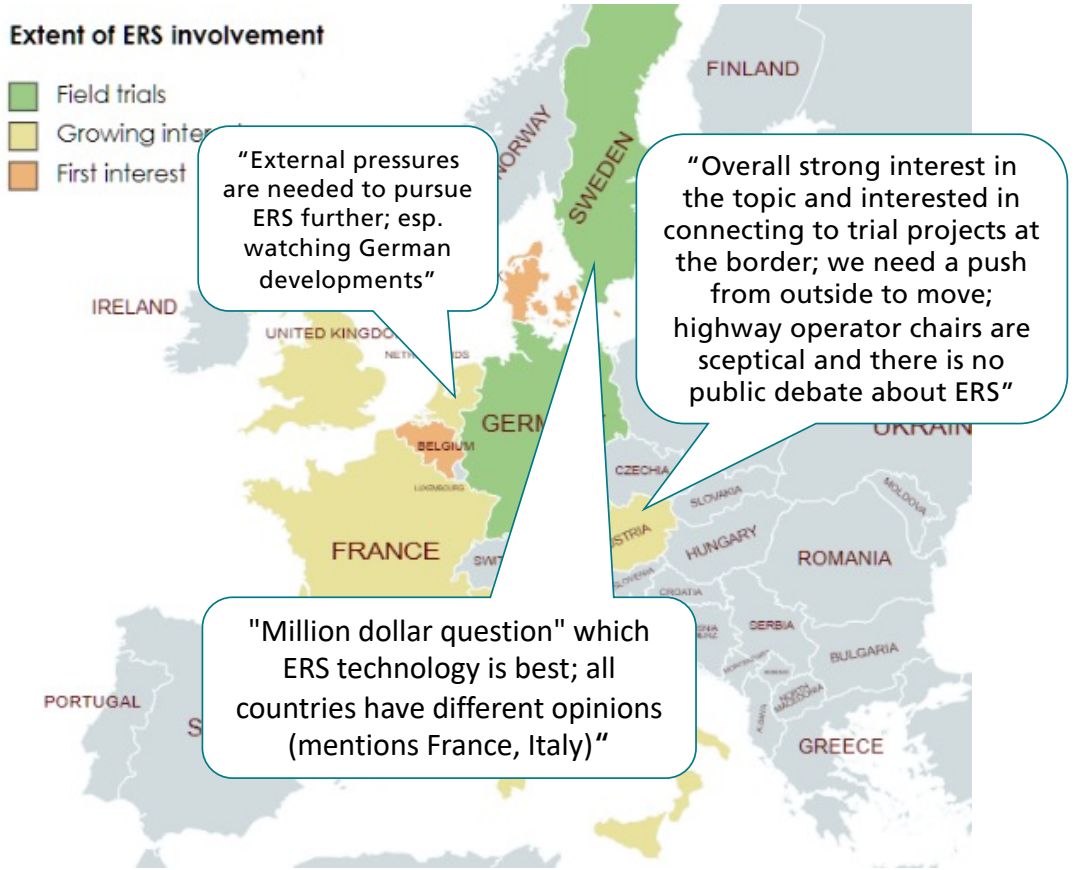


Results RQ2 – influential expectations; who dominates?

- Trial projects and involved actors coordinate and thereby influence information exchange
  - Research projects as crucial initiator for collaboration
  - Siemens and Scania as main industry actors
  - Variable government involvement
    - Sweden: Swedish Transport Administration active in planning a large ERS track
    - Germany: dynamic between two federal relevant Ministries; additional involvement at the state level; R&D so far: Env./Climate Ministry; longer innovation routes planned now: Econ./Climate Ministry

Results RQ2 – influential expectations; who dominates?

- Additional developments in other EU countries
  - Both self-initiated and through invitation for exchange
  - Italy, France, Netherlands, Austria, UK
  - Belgium, Denmark
- EU level: moderate engagement; very restrained lobbying of ERS proponents because of remaining uncertainties, negative lobbying by some OEMs (AFIR)



Discussion and further research

Drivers and barriers

- Commitment of government and EU as crucial; policies as a central motivator
  - Timeline as critical: synergies or competition with other charging options; remaining USP if stationary charging is built up quicker and battery technology keeps improving
- Perceptions and emotions around technology also important, even though topic appears to be purely techno-economic → aesthetics, history of the technology, associations with rail

Reflections

- Own involvement in the process
- Role of research for initiating collaboration → include in future research?

Policy recommendations

- Keep track of individual agendas to avoid lock-in
- Differentiate between individual company perspectives and system view on efficient usage of renewable energy to leverage potential technology synergies
- Pathway decisions: balance fear of lock-ins and technology openness with risk of being too late
  - Openness for ERS solutions in other countries is fragile and requires first mover
- If decision for the technology is made, create clear narratives:
  - Attach the USP of the technology to different future scenarios / trends and a specific timeline
    - e.g. battery developments; other (charging) infrastructure; developments in bordering countries; automated driving

References

- Budde, B., Alkemade, F., & Weber, K. M. (2012). Expectations as a key to understanding actor strategies in the field of fuel cell and hydrogen vehicles. *Technological Forecasting and Social Change*, *79-540*(6-7), 1072–1083. https://doi.org/10.1016/j.techfore.2011.12.012
- Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. Klagenfurt. https://www.ssoar.info/ssoar/bitstream/handle/document/39517/ssoar-2014-mayring-Qualitative_content_analysis_theoretical_foundation.pdf?sequence=1&isAllowed=y&lnkname=ssoar-2014-mayring-Qualitative_content_analysis_theoretical_foundation.pdf

Appendix

Catenary trucks: demonstration projects

Schöpp et al. (2021)

Field trials

- Sweden: E16 (2016 – 2020)
- Germany:
  - ELISA, A5 (2018 – 2022);
  - FESH, A2 (2018 – 2022);
  - eWayBW, B462 (2017 – 2024)