

Understanding structural barriers of innovations towards sustainable transportation

Dr.-Ing. Stephan Müller and Prof. Dr. Gernot Liedtke

German Aerospace Center (DLR)

A large, curved view of the Earth from space, showing the blue atmosphere, white clouds, and green and brown landmasses. The Earth is positioned in the lower right quadrant of the slide, curving from the bottom edge towards the right side.

Knowledge for Tomorrow

The need for sustainable transport

Current challenge in transportation:

- (1) Digitization: new socio-economic paradigm
- (2) Environmental issue: reduce or neglect external effects
- (3) Urbanization: the growth of population and agglomeration (rural exodus)
- (4) Individualization: collective expectations and behavior turns into individualism. The more developed a society is the more complex, flexible and variable demand becomes.

→ Sustainability?

Policy towards sustainability in transport:

→ Innovation, innovation, innovation

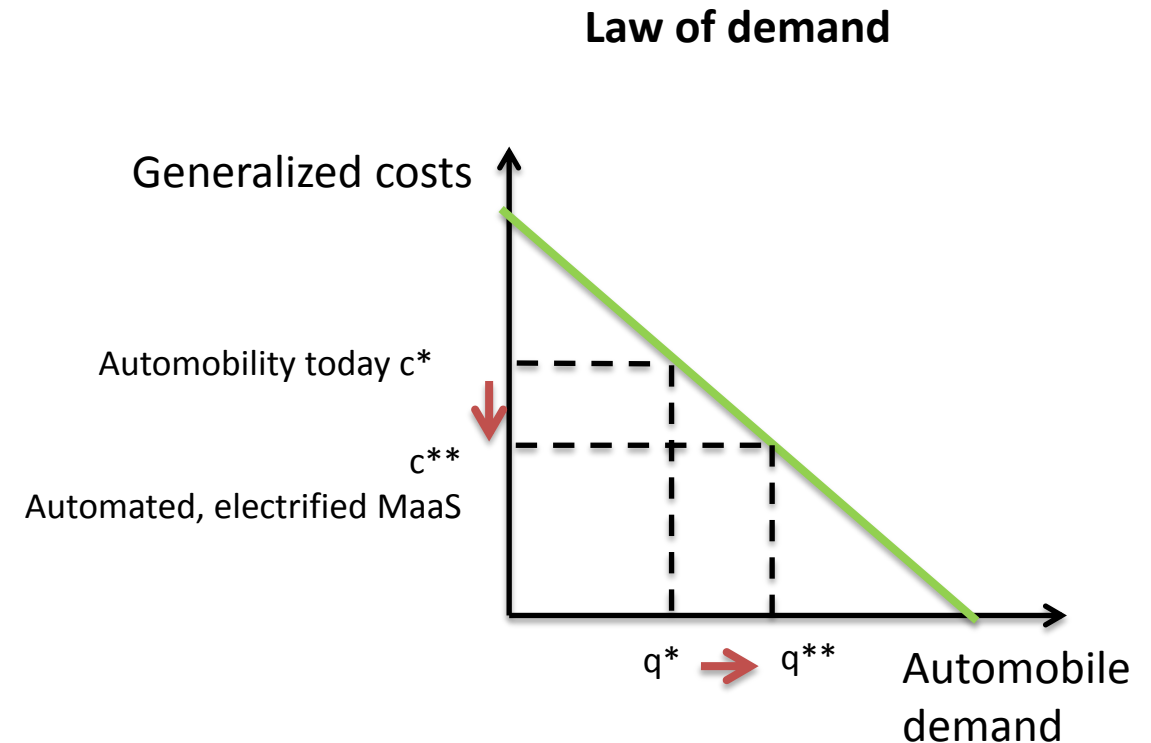
- Support of automotive transition
 - Automated transport
 - Electrified transport
 - Mobility as a Service (MaaS)
- Technological progress
- Input of money and knowledge
- (Shift of demand to alternatives)



The peril of automated and electrified mobility as a Service

The decrease in generalized costs of automobility

- Automated mobility
 - Access for non-drivers
 - New value of driving time
 - Automated parking (time)
 - „Call a Robo-taxi“
- Electrified mobility
 - allowed/prohibited in cities
 - Lower distance costs
- Mobily as a service
 - Individual mobility instead of collective
 - Easy access (time-space availability)
 - The car for every



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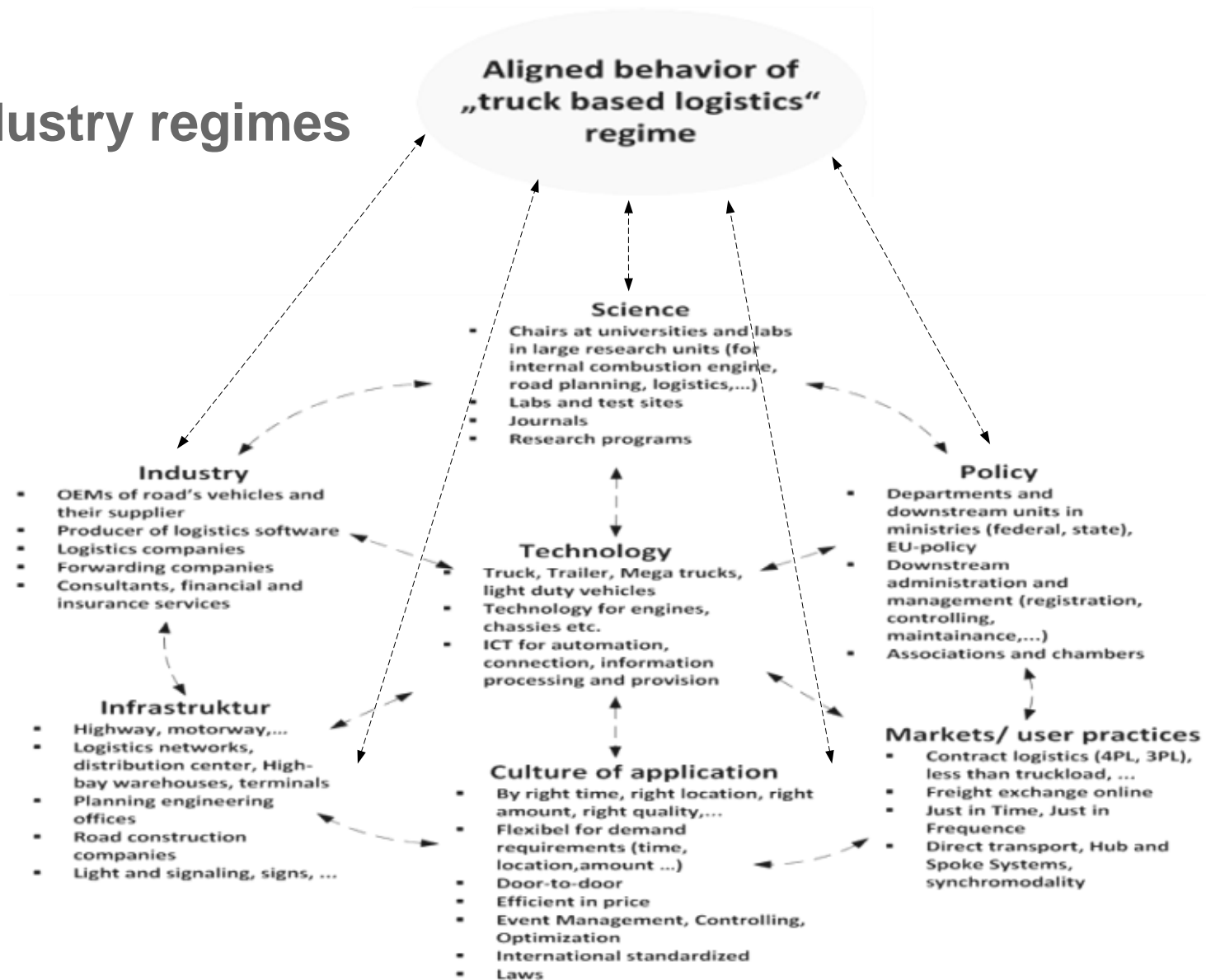
Sustainability challenge in transportation at growing demand:

- (1) Digitization: new socio-economic paradigm intensifies
- (2) Environmental issue: external effects increased
- (3) Urbanization: agglomeration, density, space conflicts increase
- (4) Individualization: individualism intensified



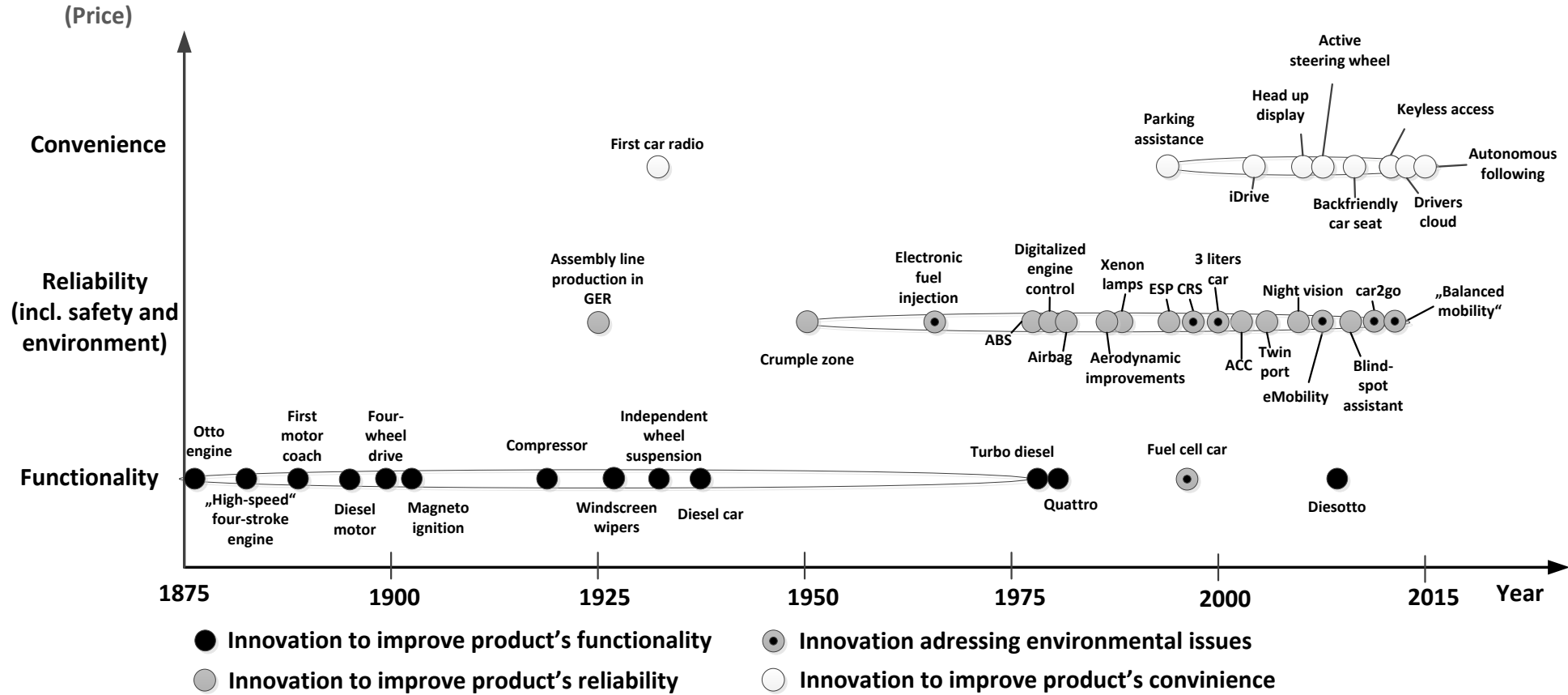
The path-interdependency of industry regimes

- Regime elements can only develop incrementally – in co-evolution and alignment
- Disruptive innovation steps destabilize a regime, because disrupting one or two elements disconnects the others to this development.
- Regime develop thus quasi-stability and evolve incrementally “forward”



Example of the regime „Truck-based logistics“

The level of product innovation competition

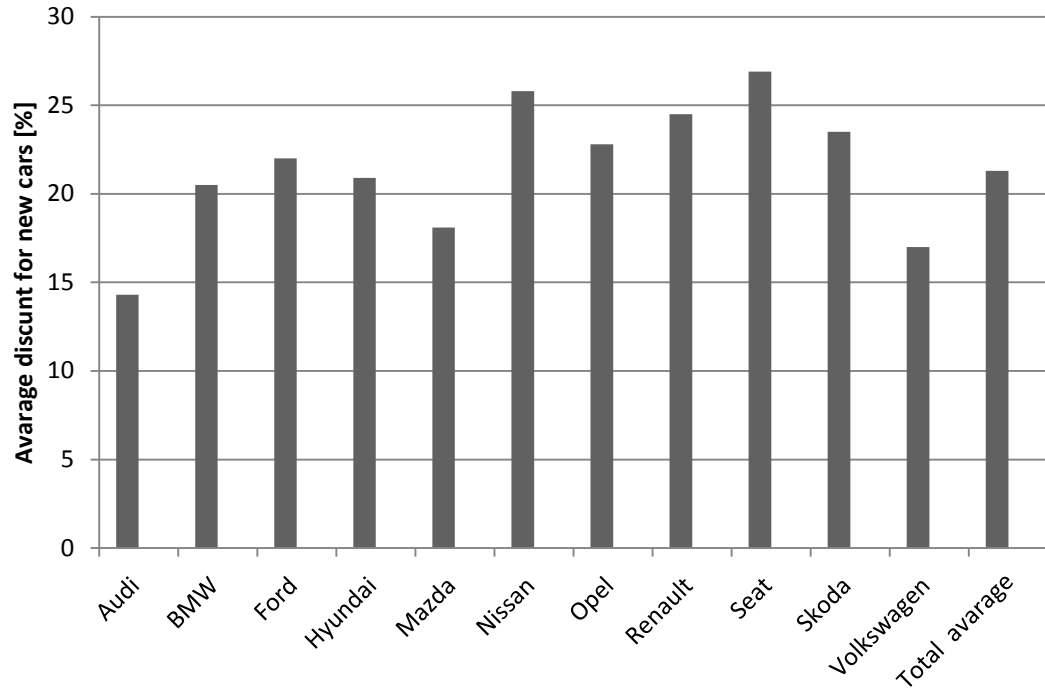


Product innovation pattern of the German Automotive Industry

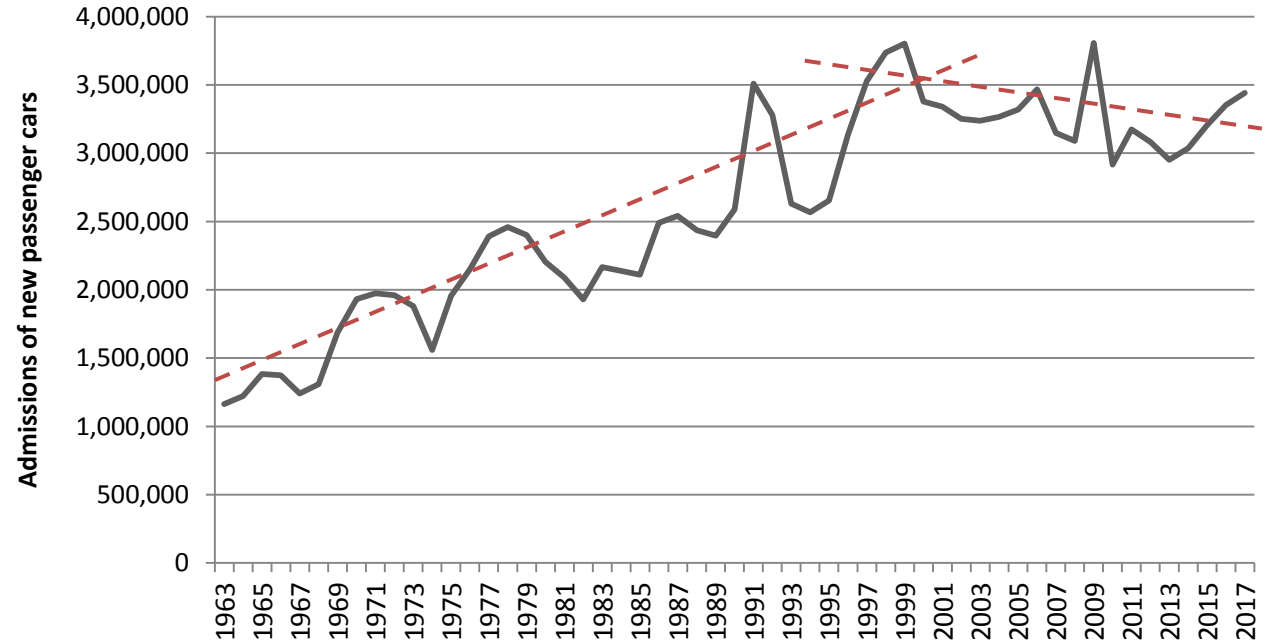
Müller 2019 (supported by Labuzinski (2018) and B. Fester), Innovations and Innovation times upon VDA (2017)



The level of product innovation competition



Discount rates for new cars in Germany by OEM
Müller 2019 (data source CAR 2017)



Passenger car market development in Germany
Müller 2019 (data from Kraftfahrt-Bundesamt 2019)



The level of product innovation competition

Implications:

- During the product innovation competition the complexity of the regime elements increase
 - At increasing optimization level marginal improvements of innovations become smaller, but investments for these improvements increase (“law of diminishing marginal gains”)
- In price competition the market becomes saturated because it lacks in genuine innovations
 - Replacement purchases are the only driver to buy a new product
 - Efficiency innovation are promising for KPIs
- In a prize driven market no or very low margins can be achieved (Bertrand competition)
 - Lack of profitability of investments and thus, no incentive for investments
 - Lack in capital for reinvestments in innovations.

→The Stalemate in technology:

No market dynamic implies no innovation investment

No innovation investments imply no market dynamic.



The dilemma of the internalization of social benefits into individual strategies

- The source of external costs lays in the regime's core technology and its innovation pathway.
 - It needs disruptive technologies!
- To include disruptive innovations changing the core technology and core functionality of an industry regime
 - linked to high risks, sunk costs and new, uncertain investments
 - Destabilizing mass market for niche market demand
- First strategic moves towards incorporating social benefits are the most risky, most expensive and most uncertain
 - A suited alternative is in the beginning of being explored.
 - Free rider problem (or wait and see strategy): following a first successful pathway and speed up is cheaper than being the pioneer.

Mobility pattern
„learned in the past“



Mobility pattern
„Electric Car“



Policy implications towards sustainable transport

→ Sustainable transport needs disruption (technology transition)

→ Sustainable transport is unlikely by the regime efforts

- Acceptance of the transition (disruption)
- The state as investor
- Growth from niches
- New actors are more relevant than incumbents
- Adapted framework conditions for disruptive innovations
- The state does not seek the winner but the winner seeks the state

→ Transition is a long term goal and undertaking



Thank you

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

German Aerospace Center

Institute of Transport Research | Rutherfordstrasse 2 | 12489

Berlin | Germany

Dr.-Ing. **Stephan Müller** | Prof. Dr. Gernot Liedtke

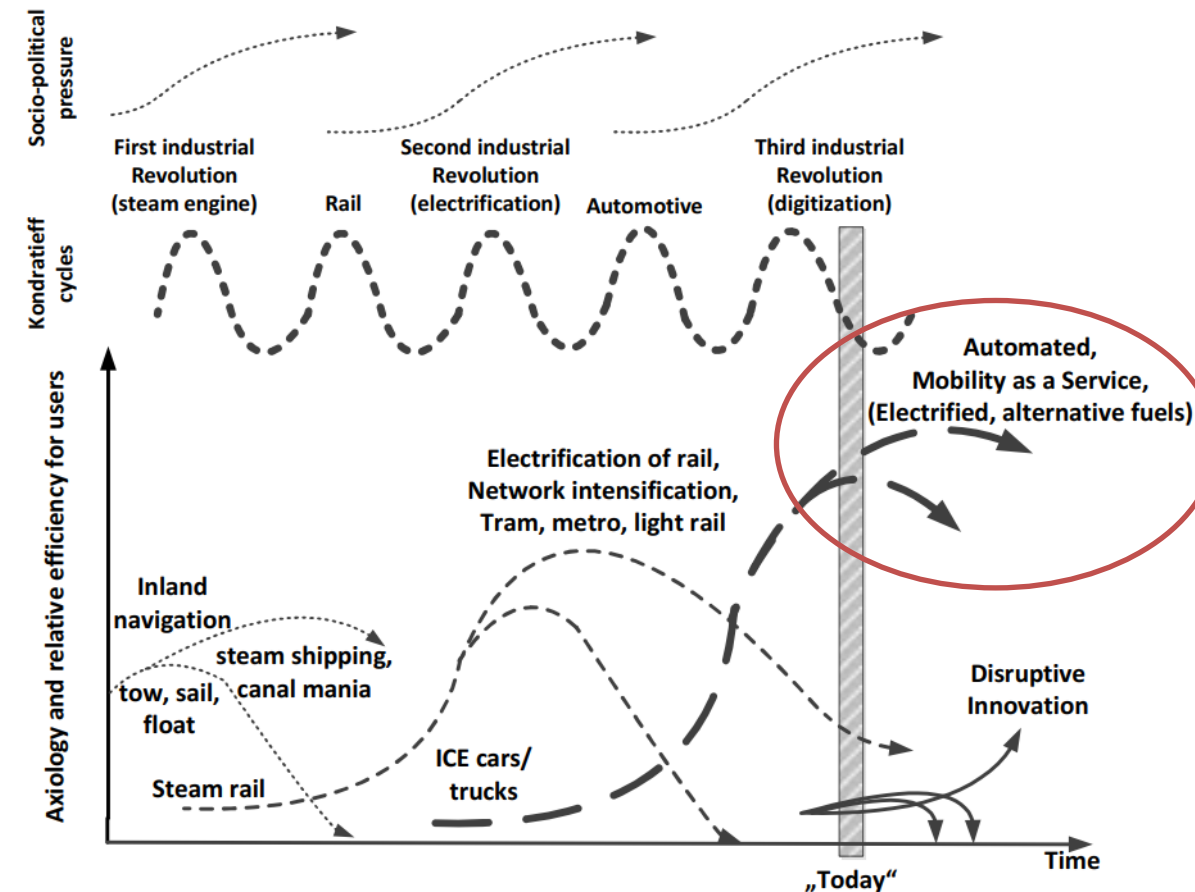
stephan.mueller@dlr.de | gernot.liedtke@dlr.de

www.DLR.de/vf



Methodology of the analysis: Concept of Transport System's Evolution

- Micro-foundation of the multi-level perspective (Geels 2002) by models/findings from:
 - Evolutionary economics (e.g. Mensch 1975, Freeman and Perez 1988, Perez 1983)
 - Innovation economics (e.g. Utterback and Abernathy 1975, Christensen 1997, Christensen and Rosenbloom 1995, Barras 1986)
 - Socio-technical systems (e.g. Geels 2002, 2014, Lundvall 1988, Hughes 1987)
- Explain general steps for the evolution of transport systems (found by Heinze and Kill 1990)



Transport system's evolution in the long run
(Müller 2019)



Development steps of transport systems

Heinze and Kill 1990

