

New Technologies and Mobility in Europe

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22nd REFORM Group Meeting, Salzburg
31 August, 2018

www.sustainablestrategies.eu

Acknowledgements

In my last year's Salzburg presentation "European Energy and Climate Policies Need a Strategic Industry Policy Approach" I had argued that the decline of the European PV industry had shown the lack of a strategic European industry policy and that this failure was about to be repeated in the case of European mobility technologies with much more serious consequences.

Following this presentation I was commissioned by Rebecca Harms MEP, to prepare a paper as input for a strategic discussion in Brussels. For that purpose I teamed up with Gerd Leipold, ex director of Greenpeace International.

What started as an attempt to summarise some thoughts and to collect some

expert views, ended up in an intensive research revealing challenges exceeding those of the energy transition.

This presentation first gives an overview on the results of this research. It then focuses on two particular aspects: 1) the challenge of developing a new governance framework for public transport and 2) the future of railways.

The full report and the executive summary can be downloaded here:

<https://sustainablestrategies.eu/shaping-the-impacts-of-new-technologies-a-call-for-new-european-mobility-policies/>

or here:

<http://rebecca-harms.de/post/a-call-for-new-european-mobility-policies-13759>

The scale of the challenge

posed by the mobility and transport transition

MOBILITY AND TRANSPORT

- **Directly touch everybody's daily life**
 - Professional and private time schedules & spatial patterns
 - Budgets & status symbols
 - Relations to other people
- **Have a huge impact on our environment**
 - air quality & noise
 - use of public space
 - CO2 emissions
- **Are central to European economies**
 - Many Europeans employed in the automobile industry (> 12 million)
 - High R&D investments by the car industry (> 50 billion € per year)
 - Important infrastructure investment (> 100 billion € per year)

MOBILITY AND TRANSPORT ISSUES ARE HIGHLY EMOTIONAL

The transformation of the power sector is easy in comparison

FEARS & HOPES

2015 - A SHOCKING ALIEN: Deep changes ahead

- Electric & driverless
- Small & smart
- The new lifestyle?
- Competitor with huge financial resources
- High speed innovation
- Radically new technologies
- Will Silicon Valley take over?
- Incumbent car manufacturers reduced to subcontractors?
- European Suppliers going out of business?
- Uncanny intelligence



Fears & hopes:

Ruggero Schleicher-Tappeser
Gerd Leipold

Triggers strong emotions: the dream of fast drivers

Tesla



luxurious, digital, unprecedented acceleration

Image: Tesla

Fears and hopes:

More cars, more congestion – only electric ?

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Gerd Leipold



Fears & hopes: Flexible, clean transport services for all?

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Gerd Leipold



Photo: Christophe Morin / Bloomberg

Fears & hopes: Driverless trucks

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Gerd Leipold

The nightmare of truck-drivers
The dream of logistics companies



Fears & hopes:

China leading: 16'000 electric buses in Shenzhen

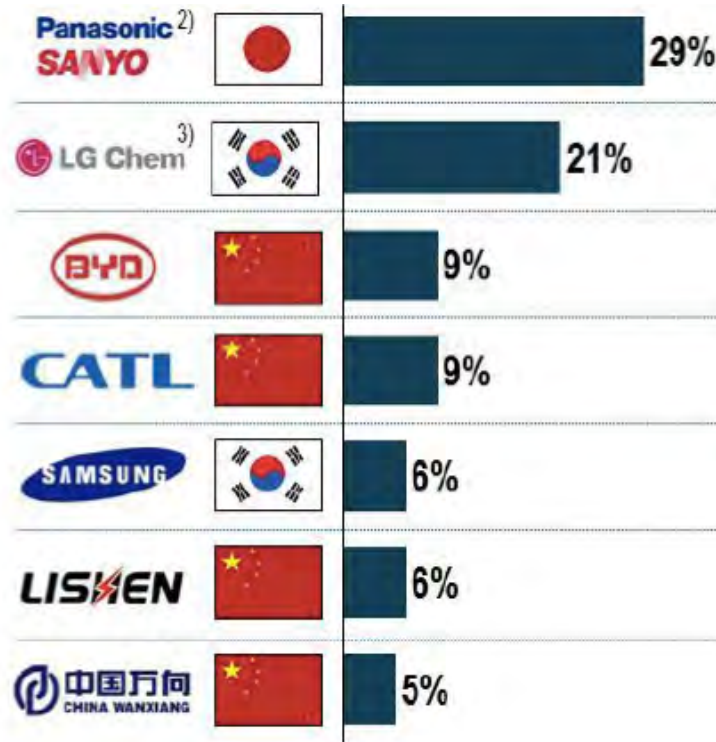
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Fears and hopes: Asian Companies dominate battery cell manufacturing

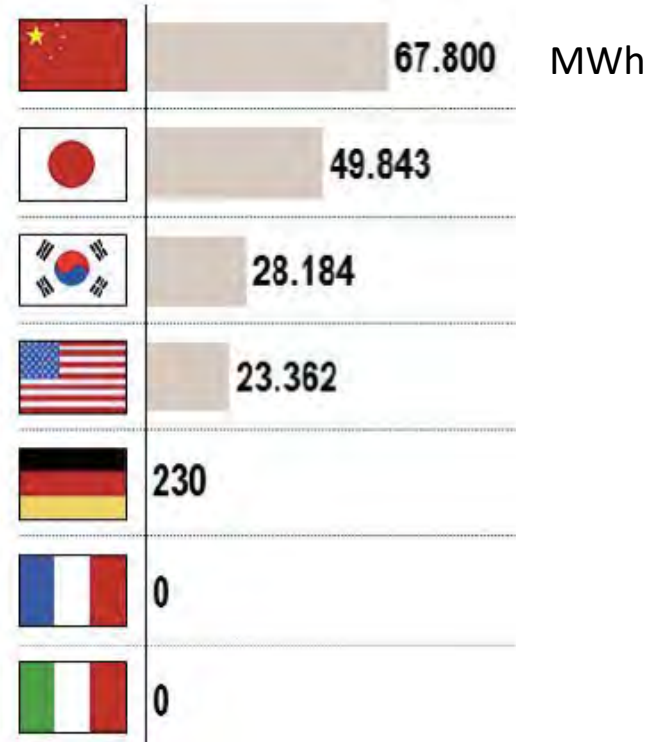
COMPANIES

Projected global market share in 2019



COUNTRIES

Projected domestic cell production 2015-2019



Fears & hopes:

Uber & Co: private monopolies taking over?

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Fears & hopes: A danger for traditional mass transit?

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Fears & hopes: Collapse of the European car industry?

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Fears & hopes: Gaining new space in the cities

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Fears & hopes: Rural Areas – Left behind?

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Fears & hopes: Growing dense agglomerations

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Gerd Leopold

No place for individual cars



Fears & hopes: Bikers and pedestrians in Copenhagen

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Unrivalled transport density



Fears & hopes: Air taxis

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Congestion above our heads?



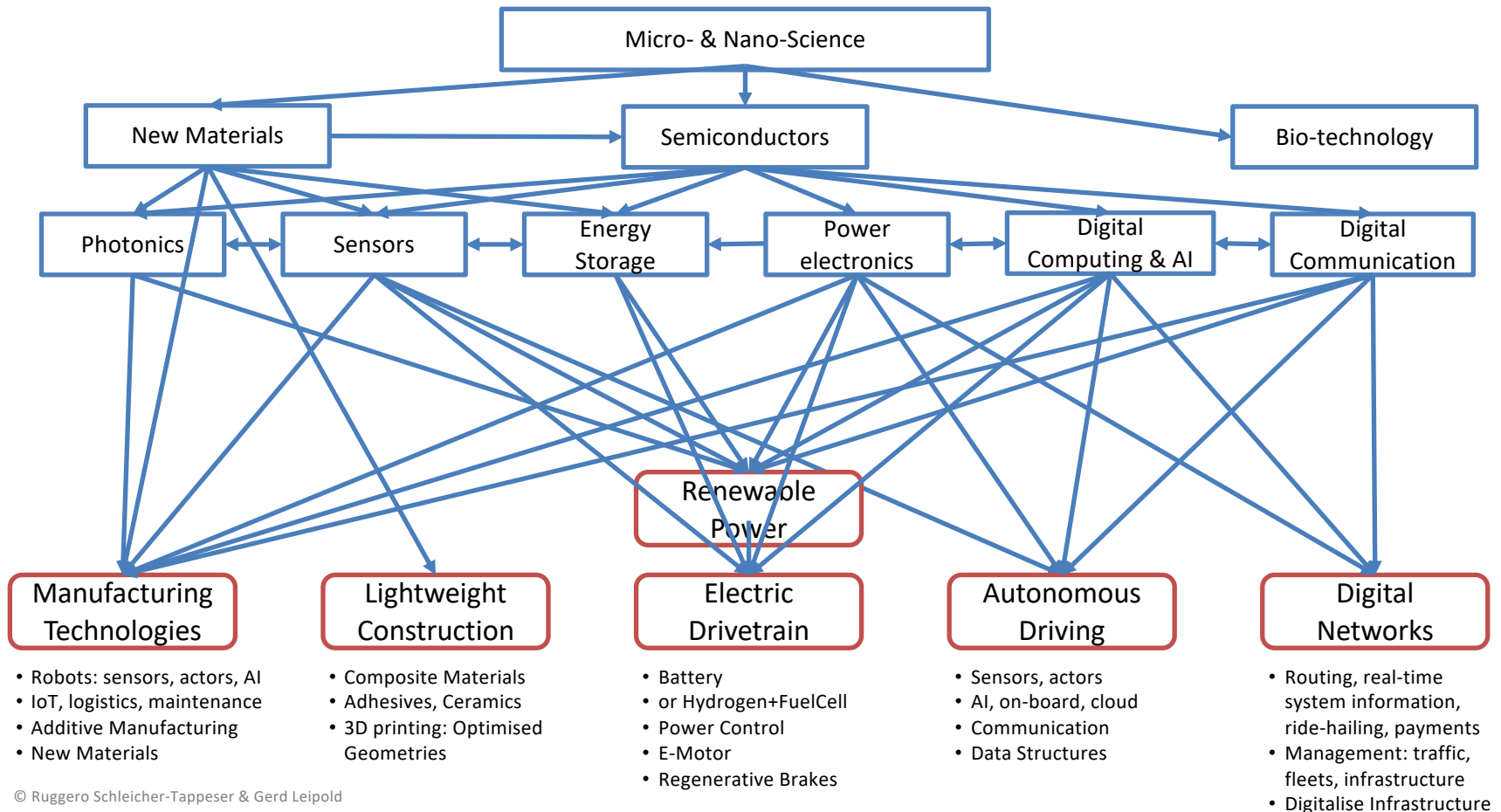
Fears & hopes: Robots for small-scale logistics

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Gerd Leipold



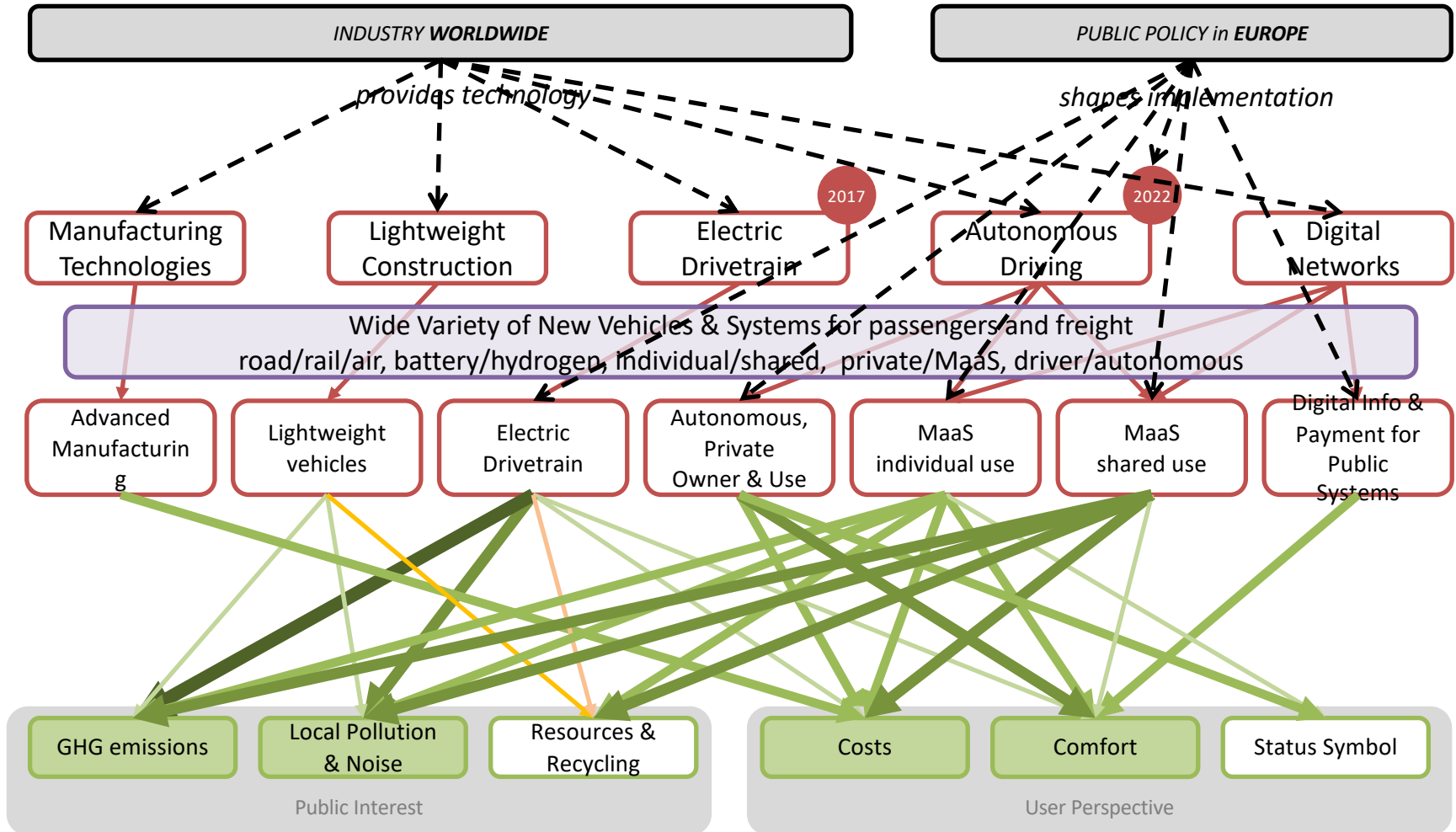
COMPLEXITY

Revolution in science brings a tsunami of new technological options for mobility

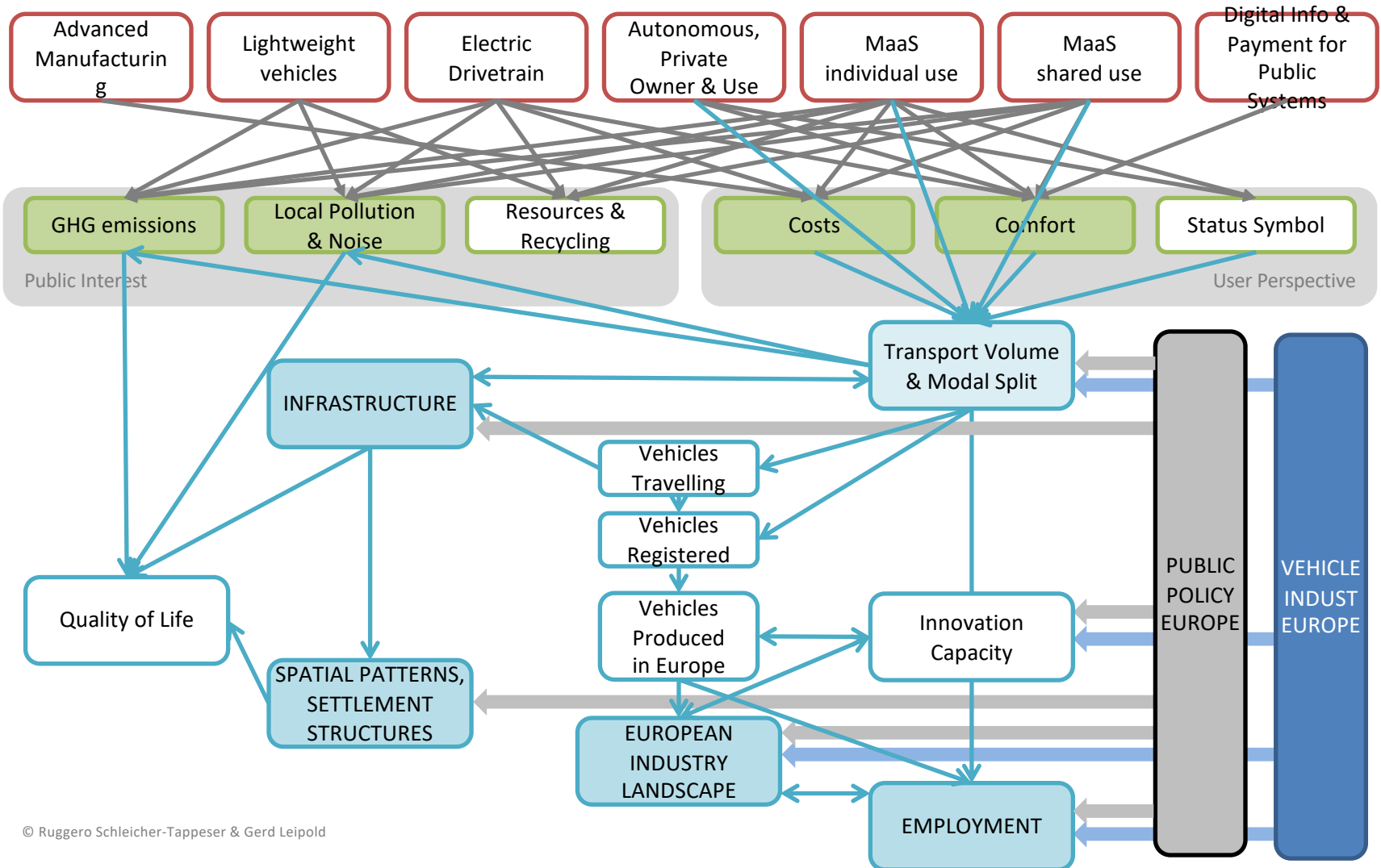


After a long period of merely incremental improvements in conventional mobility technology imposed by mature incumbent industries, hundreds of billions are being invested in a gold rush for new solutions

Direct impacts of new technologies: Positive direct impacts will speed up adoption



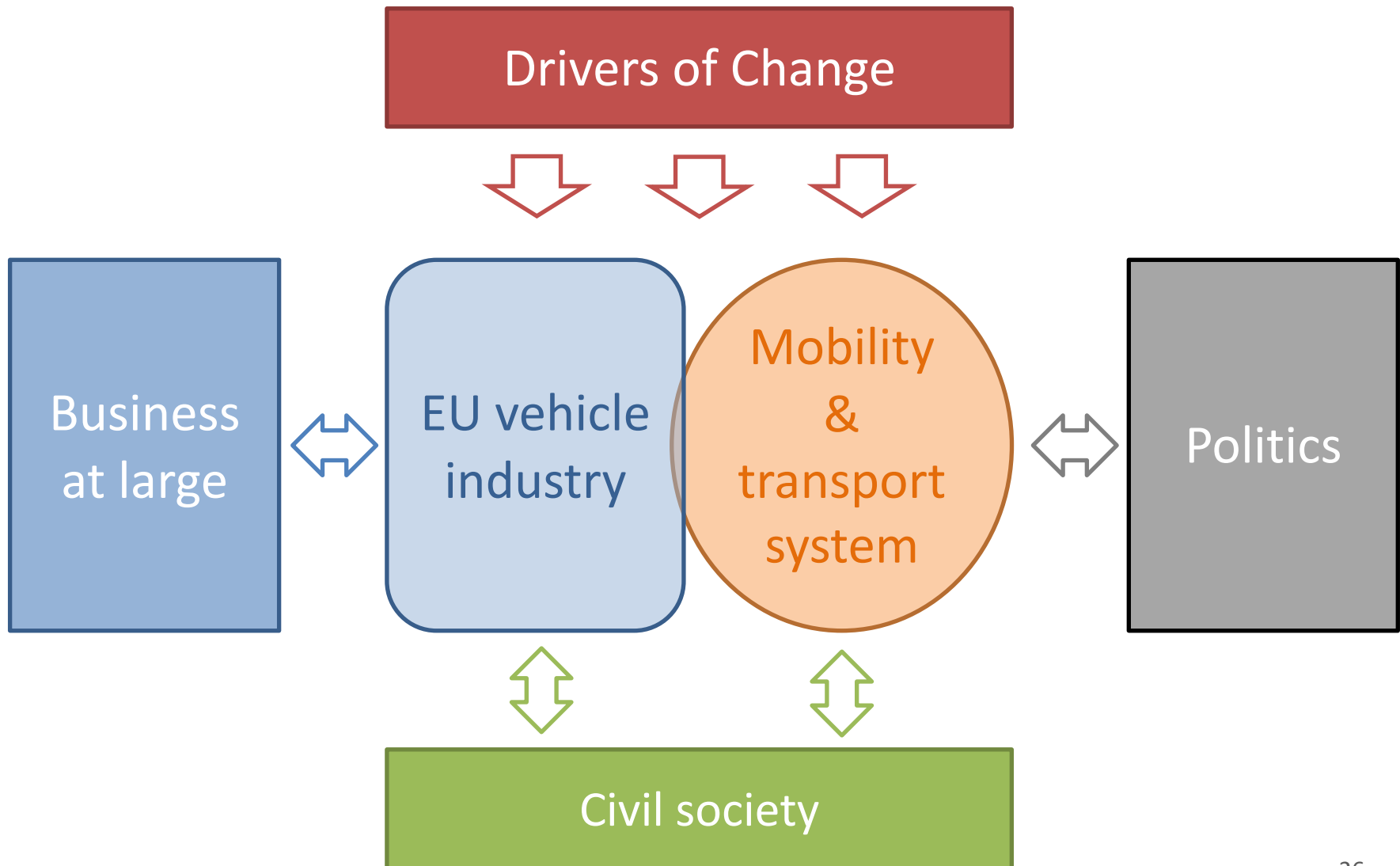
Systemic Impacts of new vehicles: bring difficult challenges, requiring political action



UNDERSTANDING THE FORCE FIELD

Trying to understand the force field: Exploring options for European politics

Ruggero Schleicher-Tappeser
Gerd Leipold



Three Drivers of Change

- **Technological innovation**

offers disruptive opportunities worldwide:

1. Electric drivetrain (*battery, power electronics*)
2. Driverless vehicles (*artificial intelligence, sensors, communication*)
3. Sharing platforms (*pervasive internet, cloud computing, artificial intelligence*)

- **Global competition**

- from emerging economies (*China*)
- from new players (*Silicon Valley*)
- challenging incumbent vehicle manufacturers

- **Urbanisation**

- Increasing share of population lives in cities
- Urban areas get more dense → increasing problems with individual cars
- Density & intensity of interaction increasingly important for economy
- Changing urban lifestyles (*dense interaction, sharing, from ownership to services*)

Be prepared for disruptions!

Contrasting forces – dynamics of change are hard to predict

Technical availability within two to five years

	<i>Competitive compared to</i>	<i>Technical availability</i>	<i>Commercial availability</i>
<i>Electric cars & trucks</i>	<i>conventional vehicles</i>	<i>2 years !</i>	<i>2 years !</i>
<i>Driverless vehicles</i>	<i>vehicles with prof. drivers</i>	<i>3-5 years ?</i>	<i>depends on politics</i>
<i>Air taxis</i>	<i>conventional taxis</i>	<i>5 years ?</i>	<i>depends on politics</i>

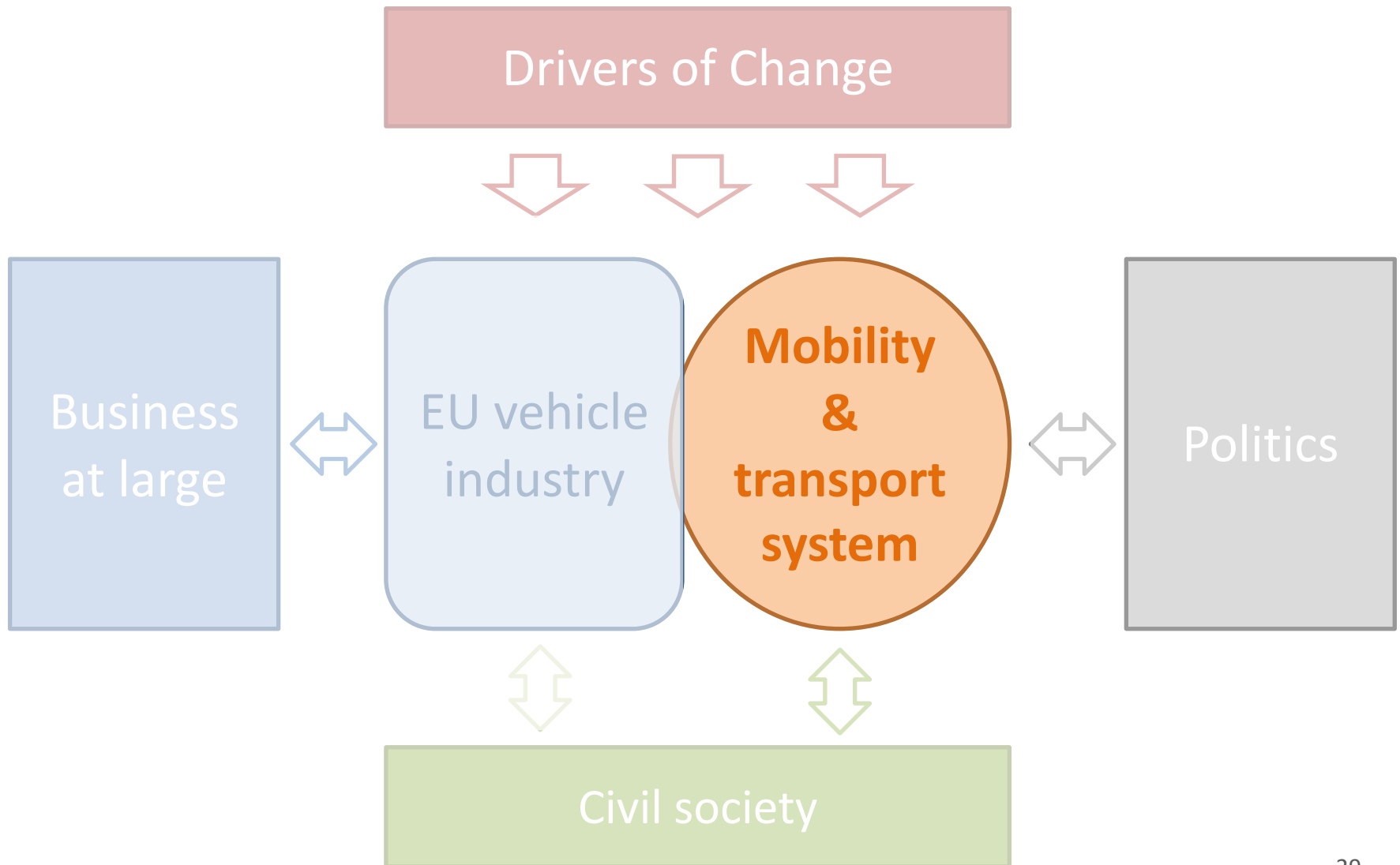
Enticing benefits may push for rapid adoption

- Impressive cost reductions
(up to 50% for passenger and freight transport)
- Important comfort improvements
- Outstanding environmental benefits
(> 50% reduction in emissions)

Important vested interests at stake – retarding change a tempting option

- Industrial assets in the car and oil industry
(>> € 100 billion)
- High-skilled car industry jobs
(11% of European manufacturing employment)
- Jobs of professional drivers *(> 4 mio)*

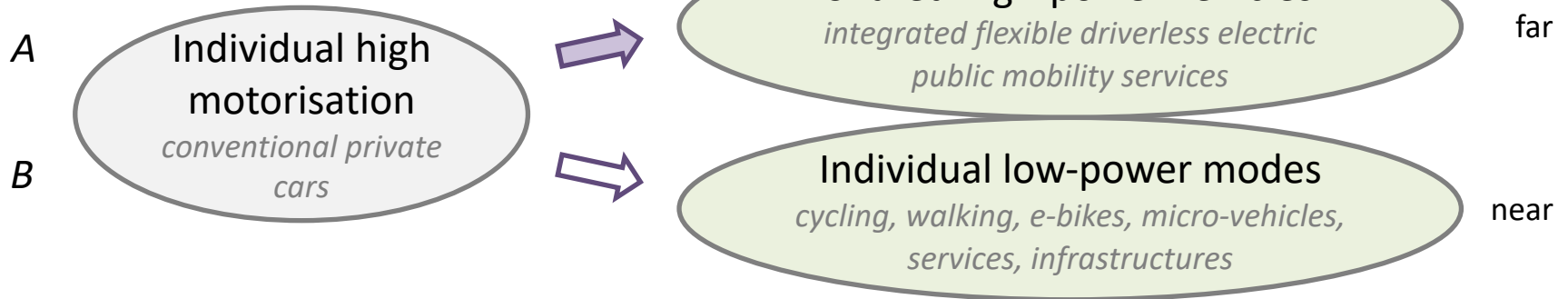
- **Delaying change** → high risk in a competitive environment
- **Delaying the debate and preparation of change**
 - loss of opportunities to shape conditions
 - risk of growing fear and populist reactions



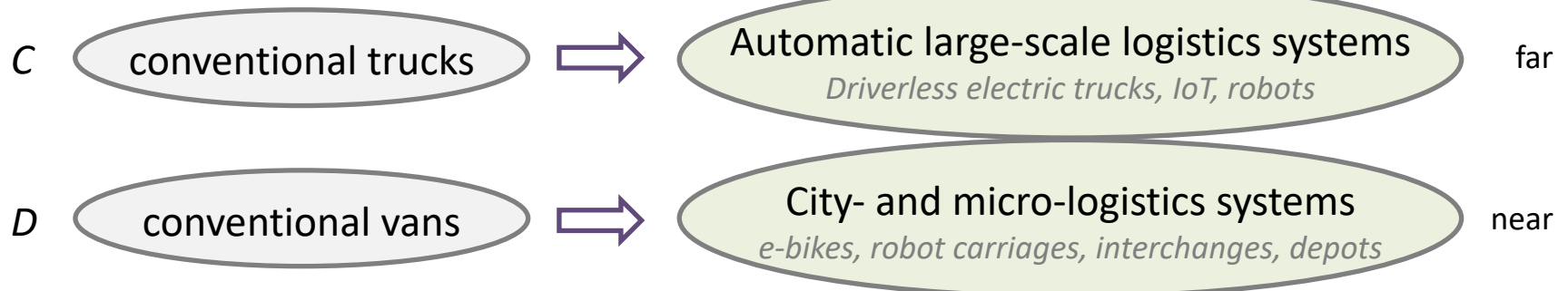
Key transformation paths

All	low tech	→	high tech	Tech innovation Global competition Urbanisation	Drivers
	products	→	services		
	low density	→	high density		







PASSENGERS



FREIGHT



Key transformation path A: conventional private car → advanced shared mobility services

		COMFORT	ENVIRONMENT	COSTS	SOCIAL
	0 Conventional private car				
	↓	↓	↓	↓	↓
	1 <u>Electric</u> vehicle		Drastic reduction of emissions		Better health Fewer jobs
	↓	↓	↓	↓	↓
	2 <u>Autonomous</u> electric vehicle		Optimised driving		Less accidents Less jobs in operation
	↓	↓	↓	↓	↓
	3 <u>Public</u> mobility service with AEV		Less vehicles, less parking space	Drastic capital cost reduction → widespread adoption	No need for own car, better accessibility Fewer jobs
	↓	↓	↓	↓	↓
	4 <u>Shared</u> ride driverless mobility service	Slightly longer trips	Less vehicles circulating, less infrastructure needed	Less operational costs, less infrastructure	Affordable transport for all challenge: urban/rural, modal split
	↓	↓	↓	↓	↓
	5 <u>Integrated</u> flexible inter-modal mobility service	Seamless comfort		Optimised tariffs across system	

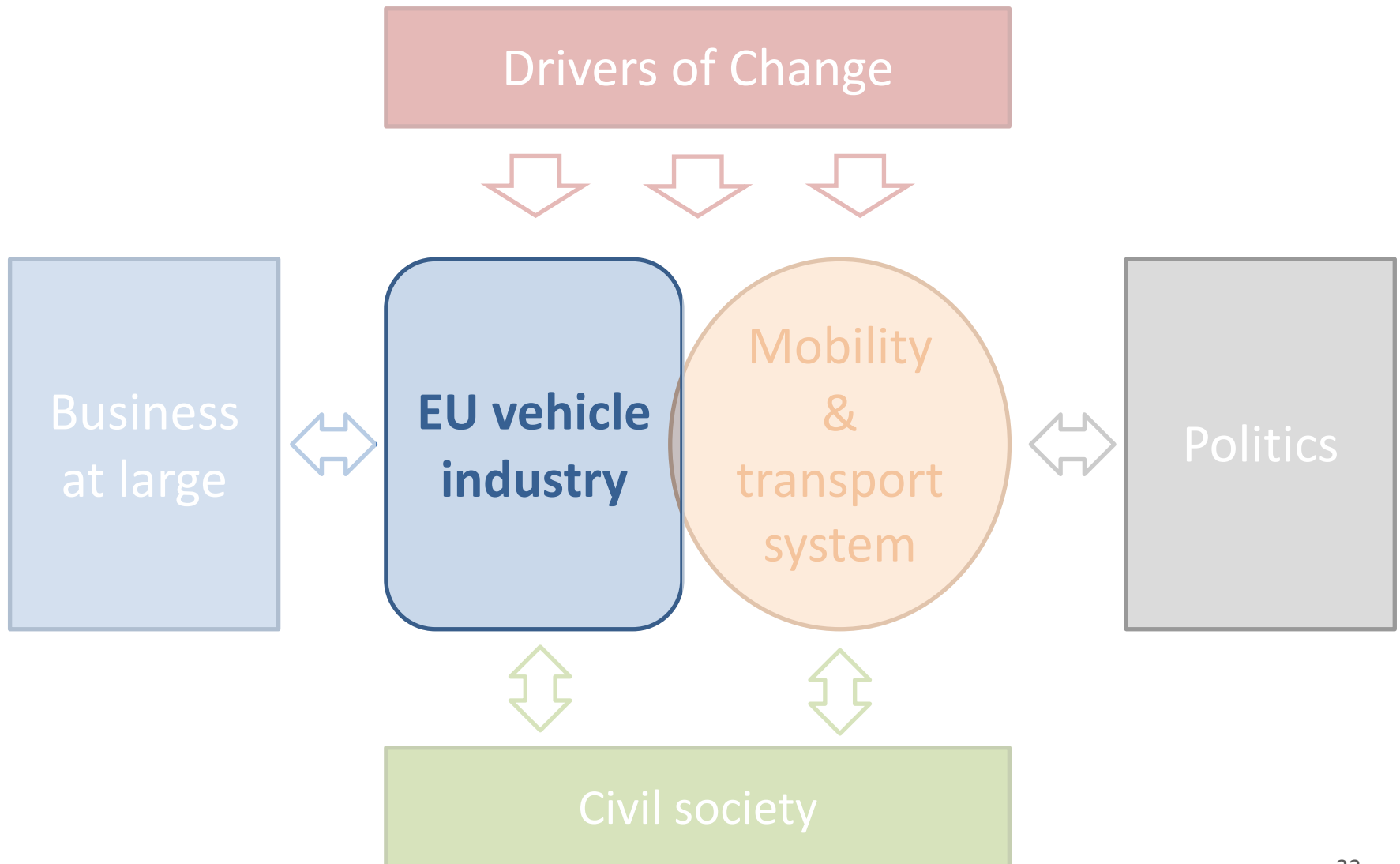
worse better

Mobility & Transport System

Key transformation path A: Rough estimate of some impacts

		Capital cost	Parking space	Road space
		per person-km ¹		
0	Conventional private car	100%	100%	100%
	↓			
1	<u>Electric</u> vehicle	110%	100%	100%
	↓			
2	<u>Autonomous</u> (driverless) electric vehicle	150%	100%	100%
	↓			
3	<u>Public</u> mobility service with AEV	23%	53%	100%
	↓			
4	<u>Shared</u> ride driverless mobility service	14%	27%	52%
	↓			
5	<u>Integrated</u> flexible inter-modal mobility service			

¹ Assumptions: Vehicle usage time in public mobility service: 50%. Vehicle occupancy in shared ride: 2,5 persons. Capital cost shared AEV: 180% of conventional car.



The European car industry is falling behind

		Europe	USA	China	Other Asia
Engineering & Production	Mechanical Engineering	High	Low	Medium	High
	Vehicle Production	High	Medium	High	High
	Battery Production	Low	Medium	High	High
Technology	Electric drive	Low	Medium	Medium	Medium
	Autonomous drive	Medium	High	Low	Low
	Software	Low	High	Low	Medium
Economics	Ability to invest	Medium	High	High	Medium
	Home market	Low	Medium	High	Medium
	Sharing platform	Medium	High	Medium	Low
Politics	Overall strategy	Low	Low	High	Low
	Government support	Low	Medium	High	Medium
	Regulation autonomous driving	Medium	High	Low	Medium



Important role for European economies

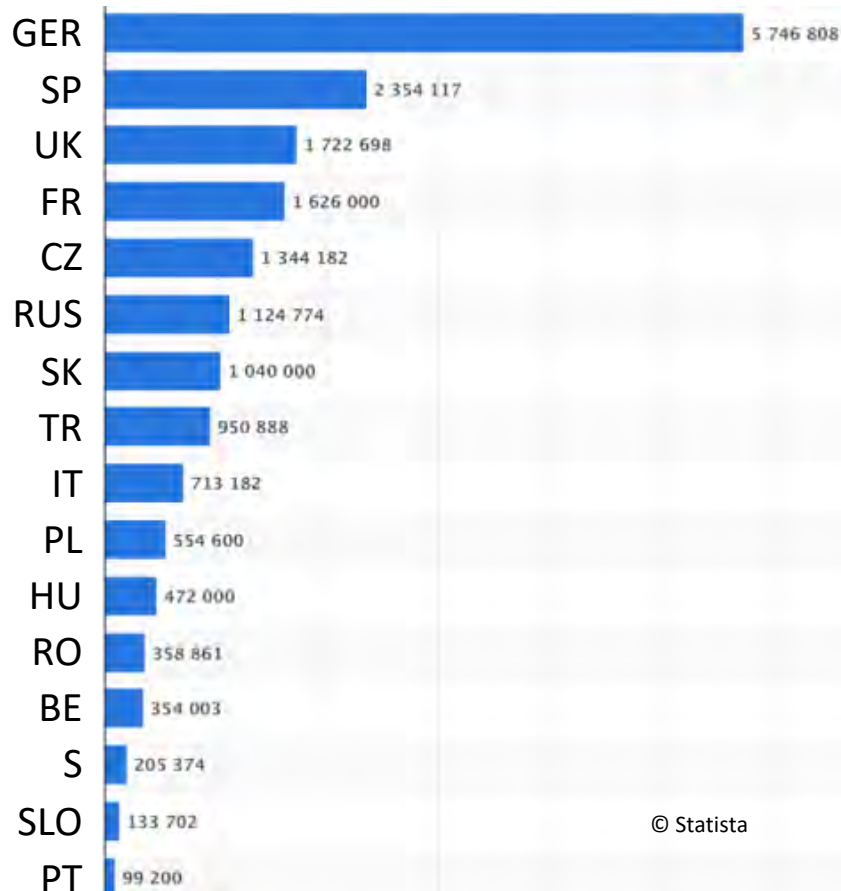
Car production in Europe 2016

EU motor vehicle manufacturing employment: 2,5 mio

EU: 8,5% of manufacturing employment

Investment of EU car industry: €50bn / a

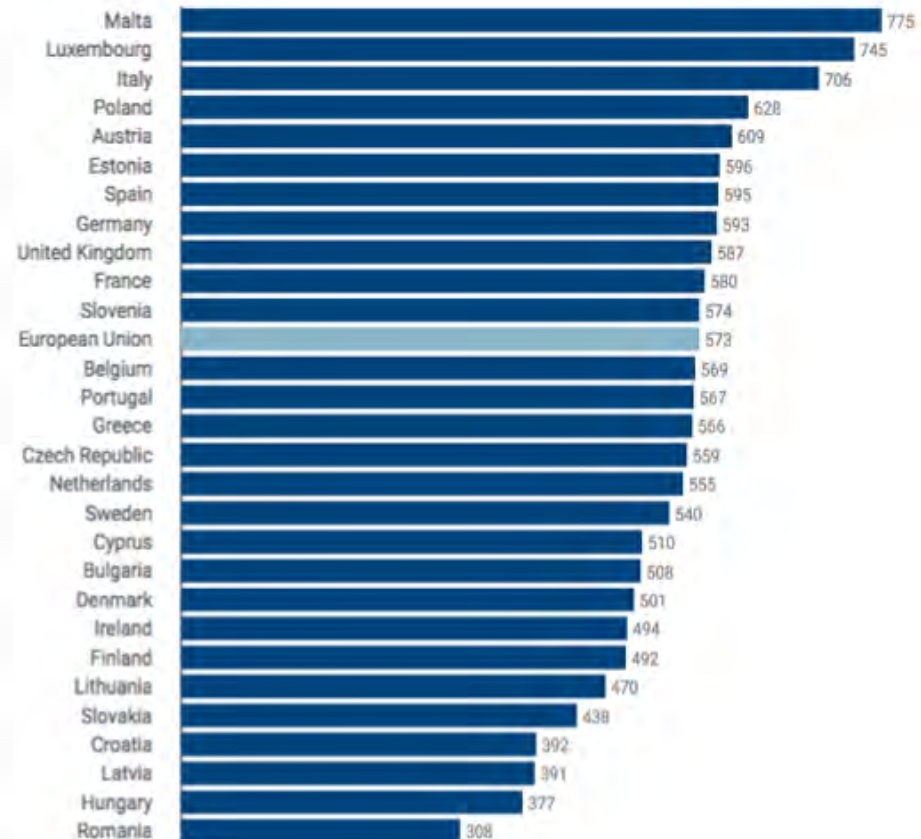
Germany: 35% of all R&D investments

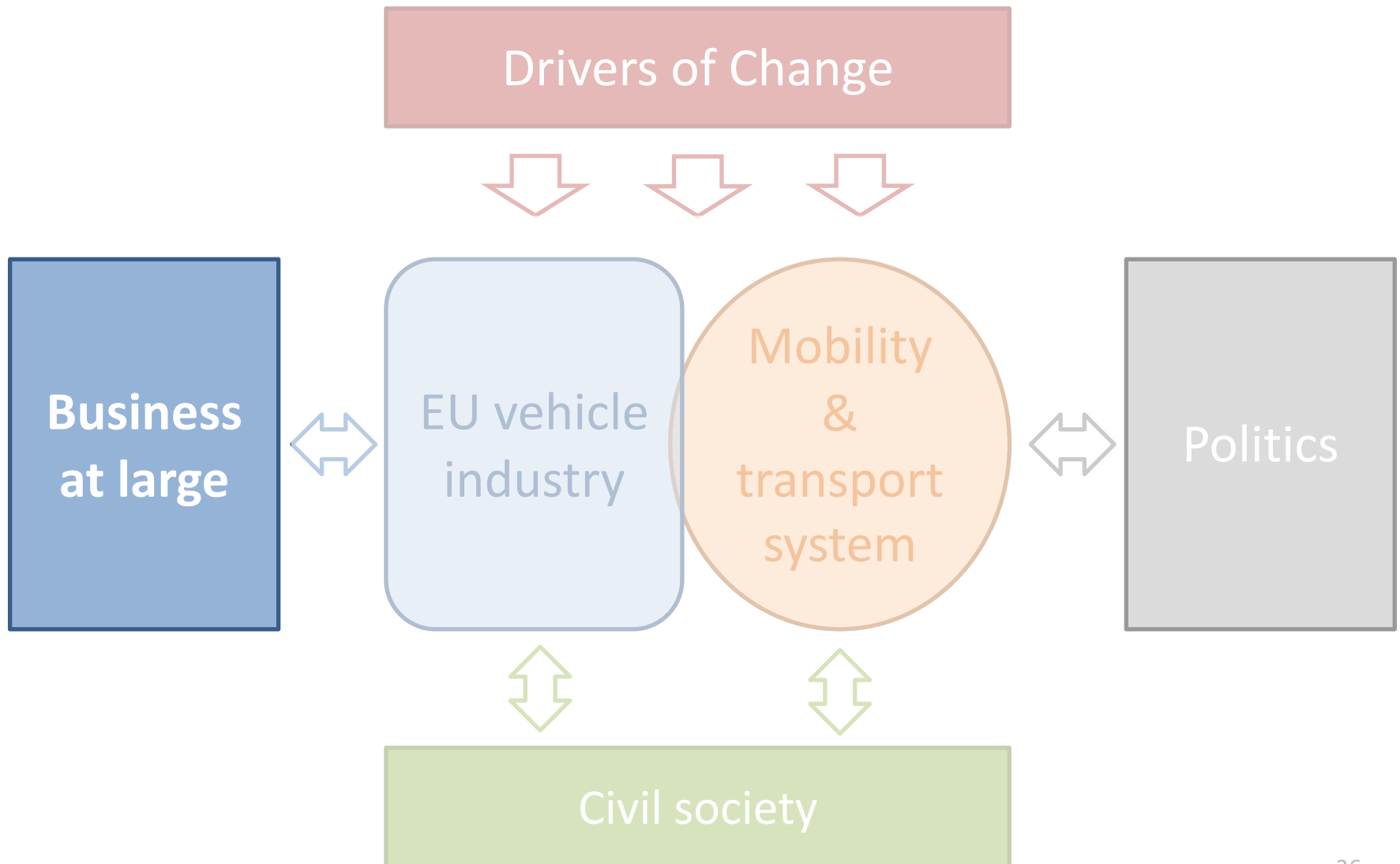


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Car density 2015

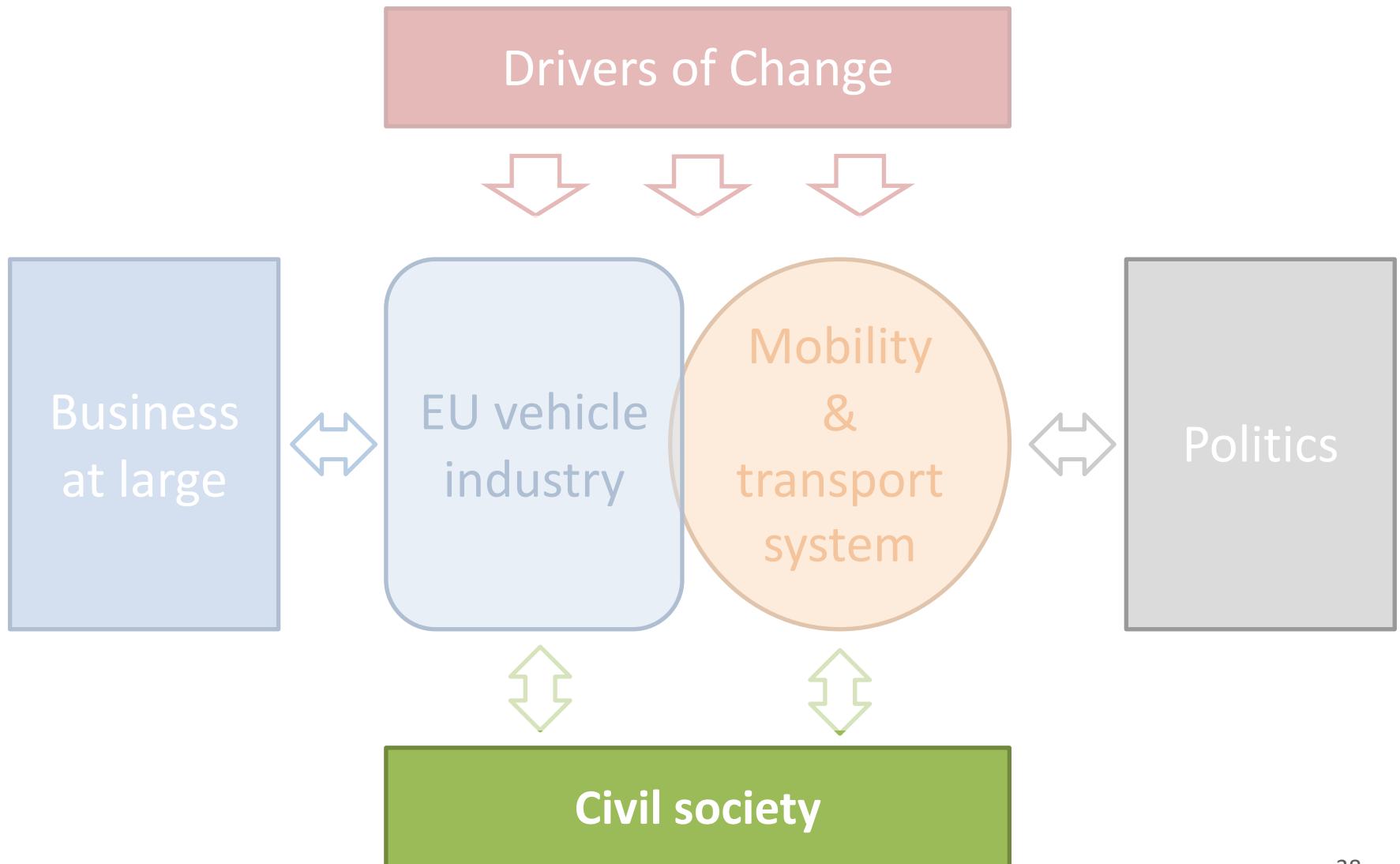
USA	821 cars/1000 inhabitants
EU	573
Russia	358
Brasil	206
China	118
India	22





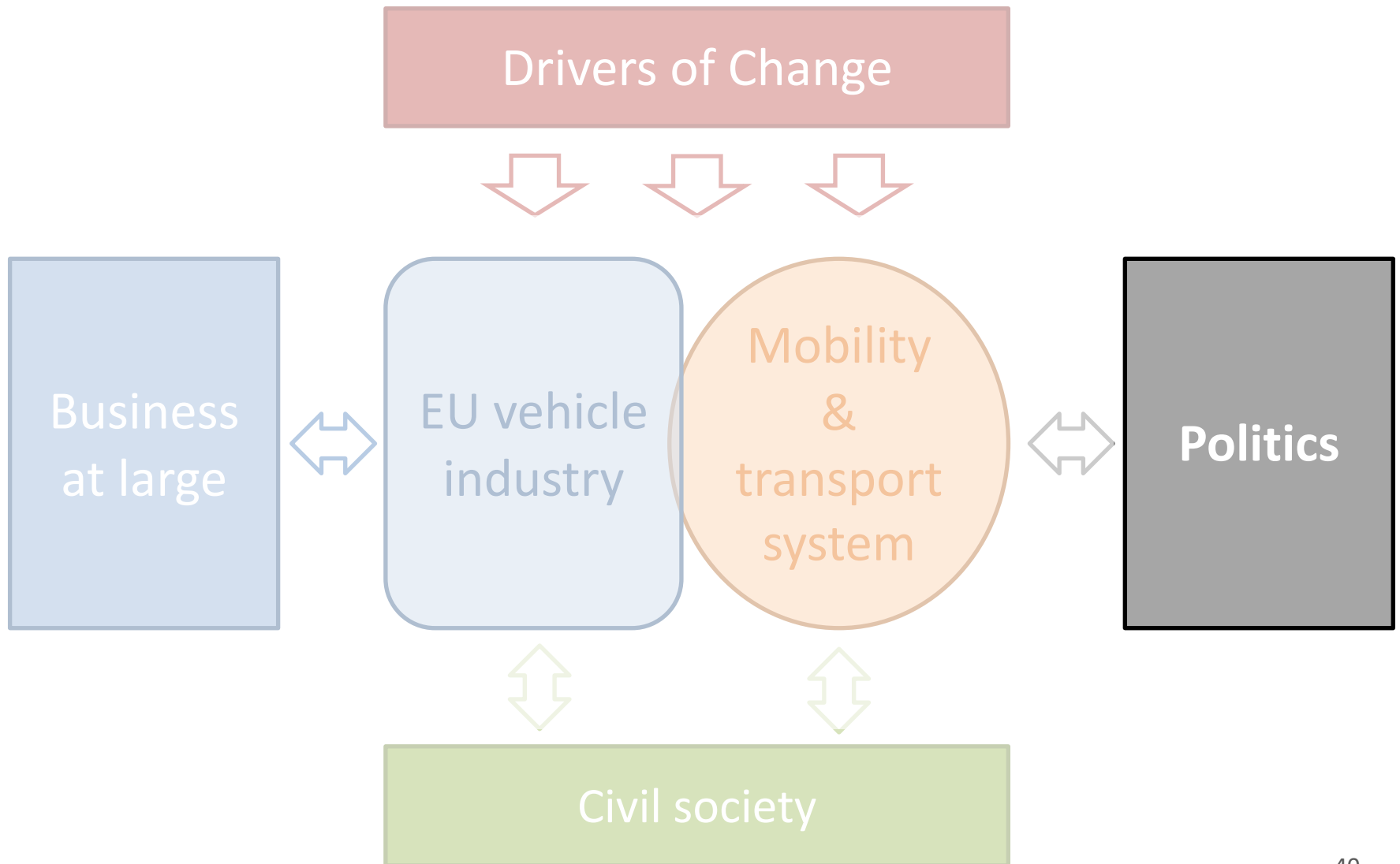
Business at large may gain in transformation that avoids deindustrialisation

- **Industry and trade in general** are very interested in lowering transport costs and ensuring smooth traffic
 - As far as electric and driverless vehicles, traffic control systems and more efficient use of infrastructure can help in this, industry will support their introduction
- The **oil industry** was a heavy supporter of the individual fossil fuel car in national and international politics – their focus may have shifted to strongly growing economies
 - The transport sector makes up for more than half of the oil consumption
 - The revenues of European oil companies and car companies are comparable
2017: 5 largest Oil (Shell, Total, BP, ENI, OMV): \$ 627 bn, 5 largest Car (VW, Daimler, BMW, Peugeot, Renault): \$ 631 bn
 - Employment in the oil industry is much smaller than in the car industry
 - The oil industry is slow in shifting towards other energy sources
- Electric **power companies** are interested in the electrification of the transport sector. They understand that this must be associated with a shift towards renewable energy.
- The **construction industry** may profit from more sophisticated infrastructure requirements but needs to adapt (*infrastructure ~ 10% of turnover*)
- Most industries benefit from **innovation impulses and R&D spending** of the car industry → innovative transformation is welcome, decline is feared
- **Tourism and other personal services** may profit from easier and cheaper transport
 - However, equilibrated development is essential for destinations in peripheral areas
- **ICT industries** would clearly be winners of a rapid transformation of the mobility sector



Attitudes are changing

- **Car ownership and driving** have become **less attractive** in industrialised countries
USA: drivers license in the 16 to 44 age group: 1983: 91,8%, 2014: 76,7%
- **Bicycles**, electric bicycles and shared bicycles have become **very popular**
China sales 2017: Passenger vehicles 24.72 mio, electric bikes 15.72 mio.
- **Metropolitan cities** rethink the **role of car**
London will introduce a ultra low emissions zone on April 8
Paris has banned cars from the Seine river, pioneered bicycle plans
- **“Active traffic”**: **Health aspects of transport increasingly recognised**
Habitual walking and biking as daily exercise
- **New actors** in the mobility debate
Trade unions, regions with car manufacturers, small and medium scale cities



Politics can shape the future of mobility in Europe

Disruptive new technologies, global competition and urbanisation will cause a rapid and thorough change of mobility and transport in Europe. Politics can influence how.

potential problems	direct consequences	potential benefits
<ul style="list-style-type: none"> • High job losses in manufacturing and traditional mobility jobs • Diverging interests between European countries • Deindustrialisation of now strong regions • Widening the gap between rich and poor and between metropolitan and rural areas • Loss of European innovation capacity and competitiveness 	<ul style="list-style-type: none"> • European car manufacturers face new competitors • Fast shift to electric drive • Lower cost of mobility and transport • Value chain will shift from vehicles to mobility services • Increased use of autonomous vehicles 	<ul style="list-style-type: none"> • Reduction of noise and air pollution • Reduction of Greenhouse gas emissions • Reduced number of vehicles, freeing up inner city space • Increased mobility for people with limited mobility • Comfortable integrated transport system requiring less infrastructure

European politics cannot stop the change.

Delaying change, could jeopardise the competitiveness of European economies.

Only politics can tip the balance in favour of the common good.

Politics has to deal with many ACTORS: A wide range of strong interests

Industry at large

EU vehicle industry

Mobility & Transport System

Politics

Energy supply industry

Oil companies, gas stations, electric power companies, distribution grids

Transport infrastructure industry

Construction industry, cement and steel industry

Users of mobility & transport services

Industry, trade

Road vehicle manufacturers

Premium brands, mass market brands, trade organisations

Component supply chain

Large and multinational suppliers, SMEs

Rail and aircraft industry

Rolling stock industry, rail system providers, aerospace industry

Trade Unions in manufacturing

Vehicle service industry

Car sales, repair shops, parking industry,

Mobility and transport services

Railways, logistics companies, airlines, airports, local and regional public transport, taxi companies

Trade unions in services

Cities

Metropolitan cities, medium-size cities

Regions

Peripheral and rural areas, mixed regions

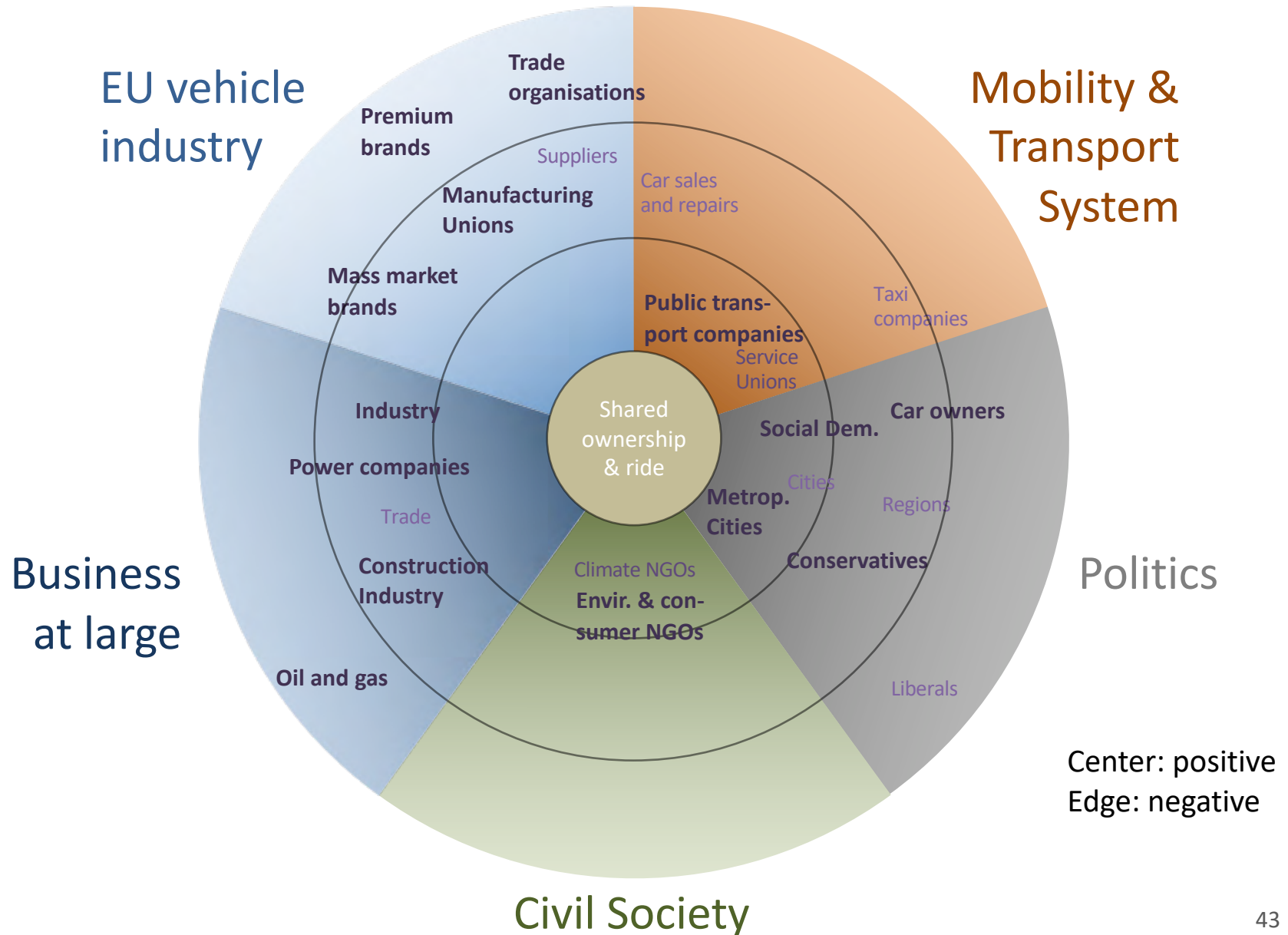
National and European politics

governments, regulation agencies, advisory structures, intergovernmental bodies, EU institutions

Civil society

Climate organisations, environmental organisations, consumer groups, ad hoc citizen groups, research

Actors' positioning: Shared ownership & ride



DEVELOPING NEW EUROPEAN MOBILITY POLICIES

Developing New European Mobility Policies

The starting point: European Assets

Europe has globally leading vehicle industries

- Premium brand & mass market car manufacturers (No. 1,2,3 & 1)
- Truck and commercial vehicle manufacturers (1, 2, 4)
- Rail industries: rolling stock and infrastructure (2, 4, 6, 7)
- Aerospace industries (1)
- Premium Two-Wheel-Industries

Europe has globally leading logistics industries

- World leaders in Integrated logistics (1, 2, 4)
- World leaders in maritime logistics (1, 2, 3)

Europe has unique flexible industrial skills

- Globally leading highly specialised SMEs in B2B markets
- Long tradition in flexible specialisation in B2C and B2B markets

Europe has a long tradition of dense civic urban life

- A culture of dense and varied cities with high intensity of interchanges
- A tradition of striving for high living standards and accessibility on the countryside
- A tradition of high environmental and social awareness

Developing New European Mobility Policies

Objectives and conditions for success

European societies have dual objectives

in view of the deep changes in the mobility sector:

- To realise the potential environmental and social benefits of new technologies
- To maintain the strength of the industrial mobility sector in Europe

Success depends on the following conditions:

- A rapid shift towards space-efficient flexible mobility services
 - shared use of high-tech high-power vehicles (“passive mobility”)
 - a framework for public transport systems
 - more attention for individual low-power mobility (“active mobility”)
- A forward looking industrial policy for Europe based on this orientation

All these conditions have to be fulfilled to meet the objectives.
However, many constituencies do not support them all yet.

Developing New European Mobility Policies

Shared use of motorised vehicles is key

1. Shared ownership / mobility services

- Private cars are standing idle 95% of the time
- Shared cars (maintaining individual use): up to 10 times more intense use
 - Reduce capital costs
 - Avoid degradation without use
 - Require less parking space, less public space

2. Shared rides

- Individual car use: vehicle occupancy in Berlin: 1,3 passengers
- Shared rides (ride pooling in normal cars, shuttles, buses, mass transit):
 - More intense use
 - Reduce capital costs
 - Require less (road) infrastructure, less public space

New technologies facilitate shared ownership and shared rides:

- Driverless vehicles
- User-friendly on-demand systems
- Intelligent flexible routing

Developing New European Mobility Policies

A new framework for public transport

1. Publicly accessible mobility services are public transport
2. The shift from ownership to services is a shift from private to public transport
3. Mass transit and shared ride allow for high density, individual cabs do not
4. Natural monopolies – such as the use of public space, roads, rails, traffic management and traffic communication – must remain subject to public decisions
5. We need an appropriate “market design” for an integrated public transport system

Developing New European Mobility Policies

Low power mobility (“active mobility”)

- Short distances do not require high speeds, heavy vehicles and high-power motorisation
- Short distances are much better served by
 - **low speeds**
 - **no or very light vehicles**
 - **no or low-power motorisation**
 - **low space requirements**
 - **high flexibility**
 - **direct personal control – active mobility**
 - **increasingly combined with highly efficient tools requiring low efforts**
 - **interoperability with high-power modes for longer distances**
- Low power mobility includes
 - **Passenger transport:** Walking, biking, e-bikes, wheelchairs, low-speed vehicles...
 - **Freight transport:** bikes, small freight vehicles, delivery robots...
- Health benefits from physical movement are increasingly appreciated



Developing New European Mobility Policies

European industry policy: new activities & jobs

- **Enhanced transport infrastructure:** electric, communication, management
 - Charging infrastructure, wireless charging, integrating photovoltaics in transport structures
 - Communication for autonomous driving, navigation systems, data management
 - Flexible traffic management on road, rail and air corridors: combining peer-to-peer and central control
- **Broader approach to public transport:** new concepts, tools and vehicles
 - Concepts and management tools for flexible, integrated, multi-modal public transport systems
 - Driverless electric vehicles of all sizes including maintenance and charging infrastructure, fleet management
 - Comfortable interchange points, stations, luggage handling...
 - Navigation, micro-navigation, reservation & payment systems
 - Special vehicles: Intermodal pod systems, indoor vehicles, funiculars
- **Freight & logistics:** boom with IoT and e-commerce
 - The largest logistics and trade companies are based in Europe
 - Advanced trucks and special purpose vehicles, drones of all sizes
 - Concepts, software, sensors & communication equipment for integrated logistics systems
 - Intermodal concepts, automatic interchanges, small container systems
 - Micro-logistics & distribution: storage, commissioning & distribution robots, city logistics, box systems
 - New service concepts, local service and distribution centres
- **Personal micro-vehicles and services:** new high-tech comfort
 - Bicycles, e-bikes, skates, scooters, rollators, personal robot carriage...
 - Personal mobility services, device maintenance, sharing services, links to freight distribution

New European Mobility Policies

European industry policy: tools

- **Ensuring monitoring and setting up strategy capacities**
 - *Need for stronger EU capacities for integrated strategic thinking*
- **Developing a shared vision**
 - *A shared vision developed in a broad debate can help to align actions across Europe*
- **Ensuring appropriate frame conditions for realising the vision**
 - *All policies must be analysed regarding their support for realising the vision*
- **Defending European global players**
 - *Confronted with determined Chinese and other strategies, key European players have to be identified and defended against take-overs*
- **Facilitating the transition of incumbent industries**
 - *Key incumbent industries may need support in the transition. A competent and transparent agency must ensure that change according to the vision is embraced.*
- **Taking care of those affected by change**
 - *Early orientation and requalification of workforce needed to reduce fears. In a larger context: do we need new social security approaches? Most affected is the unemployed youth.*
- **Facilitating the development of new champions**
 - *A start-up hype for digital business is not sufficient for covering the whole range of needs*

Developing New European Mobility Policies:

Start immediately: Organise a broad learning process

- **Enable cities and regions to experiment with new opportunities and rules**
 - European and national governments need to open strict rules and support experimenting
 - New alliances have to learn how to cooperate
 - Cities are strong and motivated actors, make use of the Pact of Amsterdam
- **Start a broad European discussion process**
 - Identifying challenges and opportunities
 - Developing a European vision
 - Defining objectives
 - Forging alliances

Europe has a chance to play a key role on the way to a sustainable, flexible, comfortable and at the same time cheaper transport system – but only if we actively discuss and seize the opportunities

Digging deeper I

GOVERNANCE OF MOBILITY SYSTEMS

Developing New European Mobility Policies

A new framework for public transport

- **Publicly accessible mobility services are public transport**
 - The shift from ownership to services is a shift from private to public transport
 - Mass transit and shared ride allow for high density, individual cabs do not
- **The success of Uber has shown that neither laissez-faire nor a simple ban are solutions to the challenge of new privately operated mobility services**
 - Sharing platforms bring important economic benefits to users and vehicle operators even before the introduction of driverless vehicles
 - Platforms having strong network effects (see [Google](#), [Facebook](#)) tend to form monopolies
 - Such private monopolies may strive for vertical integration of functions giving them a huge influence on whole sectors of public life and the economy
- **We can learn from previous experiences in telecommunication, rail and power sector regulation**
 - Also there, a combination of new technologies and ideologically driven “liberalisation” had led to the threat of dominating private monopolies
 - Gradually, national and European regulation agencies are learning how to define different roles in a sophisticated “market design”, ensuring the ongoing functioning of market mechanisms and the pursuit of public goals
- **We need an appropriate “market design” for an integrated public transport system including competing private operators for specific roles**
 - Natural monopolies such as the use of public space, roads, rails, traffic management and traffic communication structures must remain subject to public decisions

Developing New European Mobility Policies Ideological preferences in regulation

LEFT

RIGHT

direct control

market design

minimal regulation

**state
monopolies**

slow innovation
bureaucracy risks to
beat public interests

contained markets

specific rules
market roles

**competing companies
in several roles
&**

**temporary concessions
for natural monopolies**

competition
innovation
public interests
respected through rules

free market

unhindered use
of
network effects

private monopolies

bureaucracy
slowing innovation
profit beats public interests

destroys

*competent & independent
regulation agency must
set and continually adapt
rules (e.g. central banks,
Bundesnetzagentur...)*

Developing New European Mobility Policies

Data governance

Data will play a key role for a variety of functions

- Planning and managing infrastructure
- Developing, producing and managing vehicles
- Managing traffic flows
- Managing vehicle fleets
- Independent driverless navigation
- Connected driverless navigation
- Matching mobility offers and demand
- Managing Payments
- Marketing at all levels

Large companies try to control, monopolise, and connect data from these different functions – potential network effects and profits are huge

Appropriate design of markets and data governance should distinguish and connect these functions so as to

- Ensure user privacy
- Avoid uncontrolled monopolisation of infrastructure functions
- Ensure public access to data relevant for infrastructure, spatial planning and further development of regulatory framework
- Ensure competition and diversity in all markets
- Provide opportunities for small companies and innovation

Digging deeper II

THE FUTURE OF RAIL

European Rail Freight – towards a small niche market



- Freight transport costs dropping due to autonomous trucks
- Online trading → decreasing size of transport units, also in B2B
- Automatic handling, smaller hubs
- Already today rail freight is increasingly concentrating on bulk loads and point to point services

→ → →

- Freight transport costs may drop up to 40% due to autonomous trucks
- Change will be faster than expected – intermediate steps:
 - Platooning
 - Automated hub to hub relations
 - One teledriver for 10 trucks

- Rail freight will probably only survive on long distance, point to point, heavy load and time-insensitive markets
- We need to consider the possibility of a drastic shrinking within ten years → transitions strategies??

Midrange passenger rail: New airborne competitors



Electric midrange aircraft aircraft may be technically available in ten years

- Less noise → smaller airports nearer to city centres
- Environmental impact lower than trains?
- Autonomous aircraft → cheaper operation of small aircraft
- Direct intercity flight connections → more rapid, cheaper, less polluting than trains on midrange(500km) connections

- Speed of implementation strongly depending on regulation & construction of appropriated airports
- Serious competition for high-speed rail on distances > 3h
- Serious challenge before end of lifetime of trains and rail infrastructure commissioned today
- Threat to the present cash-cows of national railway companies
- Decline of high-speed procurement programmes ?
- Importance of aircraft industry & new propulsion tech
- **STRATEGIC DECISIONS NEEDED SOON**

For metropolitan transport rail remains essential

- Competitive modern metropolitan areas depend on comfortable rapid transport connecting millions of people
- **Mass transit on rail** remains **unrivalled** as **backbone** for passenger transport in densely populated areas
- Comfortable interconnections with more flexible short-distance and low-density mobility service systems are essential for maintaining role

POLICY CONSEQUENCES

- **Heavy investment in metropolitan mass transit is necessary**
- **Smart regulation must strengthen role of high-density rapid transit**
- **Evolution of European inter-city transport has important consequences for infrastructure policies and real estate patterns in cities**

- The mobility transformation will be more demanding than the energy transition
- Mobility systems and patterns deeply shape our everyday lives
- Data and mobility are intrinsically linked
- European competitiveness and ability to self-determination will largely depend on a coherent strategy discussed in time
- No time to lose!