

**Johannes Weyer, Sebastian Hoffmann, Jessica Longen**

## **ACHIEVING SUSTAINABLE MOBILITY**

**THE DISCONTINUATION OF THE SOCIO-TECHNICAL  
REGIME OF AUTOMOBILITY**

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**Herausgeber**  
**Prof. em. Dr. H. Hirsch-Kreinsen**  
**Prof. Dr. J. Weyer**  
**JProf. Dr. M. Wilkesmann**



# Achieving Sustainable Mobility

## The Discontinuation of the Socio-Technical Regime of Automobility

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## Editors

Prof. em. Dr. Hartmut Hirsch-Kreinsen  
vormals Lehrstuhl Wirtschafts- und Industriesoziologie  
Hartmut.Hirsch-Kreinsen@tu-dortmund.de  
www.wiso.tu-dortmund.de/wiso/de/fakultaet/ehemalige/hirsch-  
kreinsen/index.html

Prof. Dr. Johannes Weyer  
Fachgebiet Techniksoziologie  
johannes.weyer@tu-dortmund.de  
www.wiso.tu-dortmund.de/wiso/ts

JProf. Dr. Maximiliane Wilkesmann  
Vertretung Lehrstuhl Wirtschafts- und Industriesoziologie  
Maximiliane.Wilkesmann@tu-dortmund.de  
www.wiso.tu-dortmund.de/wiso/is

Technische Universität Dortmund  
Wirtschafts- und Sozialwissenschaftliche Fakultät  
D-44221 Dortmund

### *Ansprechpartnerin*

Britta Tusk, e-mail: [is.wiso@tu-dortmund.de](mailto:is.wiso@tu-dortmund.de)

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## Content

|  |           |
|--|-----------|
| <b>1. Introduction</b> .....   | <b>1</b>  |
| <b>2. Multi-level governance of socio-technical regimes</b> .....            | <b>2</b>  |
| 2.1 The multi-level perspective of socio-technical change .....              | 2         |
| 2.2 Actor-centred approaches .....   | 2         |
| 2.3 Multi-level governance .....   | 3         |
| 2.4 Towards an integrated conceptual framework.....                          | 3         |
| <b>3. Discontinuation policies to overcome the automobility regime</b> ..... | <b>6</b>  |
| 3.1 Methodology.....   | 6         |
| 3.2 Policy-making at EU-level.....   | 6         |
| 3.3 National and local policies.....   | 11        |
| <b>4. Examination of working assumptions</b> .....                           | <b>17</b> |
| 4.1 Multi-level perspective (MLP).....                                       | 17        |
| 4.2 Actor networks.....  | 19        |
| 4.3 Multi-level Governance.....  | 20        |
| <b>5. An integrated approach</b> .....                                       | <b>21</b> |
| <b>6. Limitations and further perspectives</b> .....                         | <b>23</b> |
| <b>7. Acknowledgement</b> .....  | <b>23</b> |
| <b>8. References</b> .....   | <b>24</b> |

## Abstract

So far, research on sustainable transitions has predominantly focussed on the management of innovation processes and mostly neglected that political decision-making has also to consider the discontinuation of the established socio-technical regime. We will present a case study on the automobility regime as an example of discontinuation governance “in the making”. Analysing policies and actor constellations on local, national, and supranational levels, we try to figure out strategies and measures that have been applied to (politically) challenge the automobility regime. Additionally, we propose combining three analytical models in order to grasp these developments, namely the multi-level perspective (MLP), the multi-level governance (MLG) and actor-centred approaches.

## *Highlights*

- This paper examines (political) attempts to discontinue the automobility regime.
- Different analytical frameworks (multi-level perspective, multi-level governance and actor-centred approaches) are used to investigate a neglected phenomenon: regime discontinuation.
- The case study shows that the European Union is an active actor in attempts to restrict automobility, especially exerting “landscape” pressure.
- In spite of many challenges, the automobility regime still remains remarkably stable.

## *Keywords*

Discontinuation, governance, automobility, socio-technical regimes, sustainability

## 1 Introduction

During the last decades, environmental issues (such as climate change, fossil fuel dependency and rising greenhouse gas emissions) have taken a pivotal place in political, societal and industrial debates. Since about a fourth of the EU's energy is used for transportation (of passengers and goods), measures to deal with environmental challenges are highly related to the organization of transportation (cf. Eurostat 2006). The private passenger car with internal combustion engine (ICE) is located at the centre of the automobility regime and represents the dominant way of how (personal) mobility is attained. Figures on modal share and motorization rates underline the dominance and stability of this system. With about 83%, the car represents the major share of total inland passenger kilometres travelled in the European Union in 2012 (cf. Eurostat 2014). Therefore, in order to achieve a more sustainable way of personal transportation, the current regime needs to be challenged. But how can we deviate from a strong and established technology such as the fossil-fuelled passenger car?

Research on socio-technical transitions has predominantly focussed on policy making fostering innovations (see e.g. Loorbach 2007): Technological breakthroughs, radical novelties, and innovation-networks have been regarded as key to success when creating new socio-technical systems, which may compete with the incumbent one and finally succeed in replacing it (cf. among others Geels and Schot 2007). However, socio-technical systems cannot be changed by merely developing innovative solutions or alternatives because of highly institutionalized actor constellations, infrastructures, and routines. Hence, we assume that the management of regime change also requires the (deliberate) discontinuation of well-established and powerful socio-technical regimes (such as the automobility regime with its core technology of the ICE-based car) – an issue that so far has been neglected in transition research (for exceptions see Stegmaier et al. 2014; Turnheim and Geels 2013).

Our case study (Section 3) investigates practices of discontinuation and strives to identify mechanisms and key factors of a governance of discontinuation. Unlike other cases of (enacted) discontinuation like the German energy transition, the ban of light bulbs in the European Union, or the worldwide ban of the insecticide DDT (cf. Stegmaier et al. 2014), the transformation of automobility is a case of 'discontinuation in the making' rather than a successful or concluded one. Comparing different actor constellations and policy measures in four different countries (UK, Germany, France and Netherlands) and on the EU level, we want to figure out strategies that challenge the regime of (ICE-based) automobility. We will analyse actors, strategies, governance-levels, and measures taken to overcome this dominant regime and achieve sustainable mobility. In doing so, we aim at contributing to a better understanding of the discontinuation of established socio-technical regimes. Our findings will show

that in spite of mostly ambivalent national politics, the interplay between national level(s) and the supranational level of the EU has produced a kind of dynamics that may open a window of opportunity to dismantle the ICE-regime.

The empirical case study at hand is guided by a theoretical concept of multi-level governance of socio-technical regimes (Sections 2 and 4). It takes the multi-level perspective (Geels and Schot 2007) as a starting point, but in an extended version, which is complemented by two other concepts: actors networks (cf. Weyer et al. 1997) and multi-level governance (cf. Bache and Flinders 2004).

## **2 Multi-level governance of socio-technical regimes**

In this Section, we will briefly discuss the theoretical concepts and identify their research gaps (2.1 to 2.3). Afterwards, we will propose an integrated framework of multi-level governance of socio-technical regimes (2.4).

### **2.1 The multi-level perspective of socio-technical change**

The multi-level perspective (MLP) has been developed in order to study regime shifts – mostly from an innovation-oriented viewpoint. It has proved to be a valuable tool for social studies of technology since it depicts regime change as the result of an interplay of three different levels: niche, landscape and regime (Geels and Schot 2007: 399f). While the regime is constituted by dominant structures, cultures, routines, and conventions (Geels 2012: 473), niches are crucial for transitions and serve as an incubation room for the development and testing of innovative alternatives. The socio-technical landscape constitutes the wider context, which influences developments on regime and niche level; these developments can either be of stabilizing or destabilizing nature. The MLP's main assumption is: A destabilization of the incumbent socio-technical regime may come about by mutual reinforcement of (1) growing landscape pressure, (2) increasing erosion of the incumbent regime, and (3) growing competition from niche innovations as they gain importance.

However, by taking a regime perspective, MLP tends to neglect the mechanisms of action and interaction on each single one of the three levels (and between them). These mechanisms sustain socio-technical regimes, but may also serve as important drivers of change. Furthermore, governance is not a focal interest of MLP.

### **2.2 Actor-centred approaches**

In order to better understand processes of regime stabilization and destabilization, it is necessary to zoom in on the three levels and to take into account the actors, their strategies, and negotiation processes in actor networks more detailed.

Actor-networks play a crucial role since they are promoters of a socio-technical system, which gains its momentum not only due to technical but also based on socio-political factors (Tushman and Rosenkopf 1992). This process of the social construction of technology has been studied frequently (Bijker et al. 2012; Pinch and Bijker 1987), putting emphasis on relevant social groups, their strategies, (inter-) actions, and negotiations as well as on the socio-political dynamics they produce.

In case of innovation processes, strategic actors from different fields negotiate and finally agree on one of the alternatives (“closure”), thus creating the starting point of a technological path. Although this path limits available options, it does not totally determine the regime’s course. At certain stages, new alternatives and new actors appear, creating opportunities for a new “closure”, which may either sustain the socio-technical regime or trigger change.

The actor-centred perspective has mostly been applied with the aim to investigate the social *construction* of socio-technical systems, but only seldom to analyse their social *de-construction* (Turnheim and Geels 2013).

### 2.3 Multi-level governance

Shifting socio-technical systems in order to achieve sustainability is a process that typically doesn’t come about by chance, but is a result of deliberate governance. Therefore, we have to add a third theoretical element to our model, being multi-level governance (MLG). In general, the concept of governance reaches beyond traditional government approaches, underlining the increasing relevance of non-state actors such as market and civil society actors, who participate in policy-making (Van Tulder and Van der Zwart 2005). Additionally, MLG is based on the idea of nested levels of governance. Each level has to govern itself, i.e. solve coordination processes within the level, but it also (deliberately) influences other levels by means of its actions and/or interventions (Weyer et al. 2015).<sup>1</sup> Policy making thus occurs at different scopes (international, national, regional, and local), which interact in a specific way (Bache and Flinders 2004) and shape the course of the socio-technical regime. Of course, the interplay between national strategies and policies must be taken into account as well as their interplay with European policies.

However, multi-level concepts of governance have never been applied to the issue of discontinuation before.

### 2.4 Towards an integrated conceptual framework

The idea of multi-level governance of socio-technical regimes refers to all of the three aforementioned concepts.

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<sup>1</sup> In Weyer et al. (2015), we propose an analytical model of multi-level governance, which defines governance as a combination of the basic mechanisms of control and coordination. This analytical perspective allows to depict different sample applications, e.g. a multi-level model of different levels of policy-making (transnational, national, regional, and local), as in the paper at hand.

From MLP, it adopts the idea that the socio-technical regime is the core subject to be investigated when studying social de-construction. Hence, our case represents the global automobility regime, to be defined by the following six items (cf. Urry 2004; Wells and Nieuwenhuis 2012):

- Cars that are individually owned and used for flexible, all-purpose and long-distance travels;
- decentralized on-board power stations (internal combustion engines, ICE) that rely on fossil fuels;
- vertically integrated industries that produce cars and develop new technologies along the existing path;
- on the part of consumers a strong societal hold of the car, which has a specific cultural status;
- political promotion and protection of the automobility regime by national governments (e.g. by means of regulation);
- a legal and technical infrastructure that favours the car and discriminates other technologies or systems.<sup>2</sup>

These six items help to evaluate the issue of regime stability more precisely, as formulated in our first working assumption:

(WA 1) A socio-technical regime may still persist, even if some of its elements have been challenged.

The actor network perspective aids to observe more details. In general, the main regime actors sustaining and promoting the socio-technical regime of automobility are the car industry itself, its suppliers, and supporting national policy makers. Therefore, our second working assumption reads as follows:

(WA 2) The stability of a socio-technical regime is based on a strong actor network.

However, the overall automobility regime is not homogenous but splits up in different national sub-regimes, which sustain the global regime, yet have dynamics of their own and interact with each other. Zooming in on these national policy networks helps discovering differences, e.g. between German, French, Dutch, or British constellations that are shaped – among others – by the strength of the national car manufacturers.

In order to grasp these sub-regimes, we propose the following working assumption:

(WA 3) The stability of a socio-technical regime may differ regarding various countries.

Furthermore, we are aware of the fact that actor networks may also appear at other levels of the MLP and actors' actions may not be restricted solely to one part of the MLP. Insofar, it seems reasonable to combine MLP and actor-

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<sup>2</sup> Admittedly, cultural status and infrastructure can also be regarded as part of the landscape, since both factors support the automobility regime (see Geels 2012: 477). However, they are also taken into account as major regime pillars.

centred approaches, since the latter may help to identify turning points on socio-technical paths that create an “openness” for change and thus may serve as starting points not only for social construction, but also for destabilization and social de-construction of a socio-technical regime. Thus, it makes sense to look out for actor networks at every level of the MLP: networks creating niches, stabilizing the regime, and finally shaping the landscape. For example, transnational organizations, such as the European Union, are candidates for actor networks on the landscape level, incorporating a variety of actors who have the power to put pressure on the regime.

Our fourth working assumption emphasises the role of actors in a multi-level framework:

- (WA 4) Actors may act at different levels of the MLP, but play different roles when acting either as landscape, as regime, or as niche players.

Finally, at the niche level, “actors work on radical innovations that deviate from existing regimes” (Geels 2012: 472). They are, for instance, amateur pioneers, innovative regime actors, or even actors from other sectors (e.g. electric utilities, internet companies). Pilot projects, e.g. in urban areas, partly promoted by regional, national, or supranational governments, are the place where these actors meet and interact. Even if those local or regional networks are rather small and initially unstable, they may gain momentum and challenge the current regime (Weyer et al. 1997: 402).

Referring to these alternatives, our fifth working assumption is:

- (WA 5) Challenging the incumbent regime requires a competing actor network (with the vision of a new socio-technical regime).

Finally, the multi-level governance perspective helps to understand the interrelatedness of governance activities at different levels, be it either transnational – national – regional – local, or landscape – regime – niche. We assume that some actors (e.g. politicians) perform actions in order to steer an external system (e.g. transportation) into a desired direction (e.g. sustainability). They do so by shaping the boundary conditions of other actors acting either at the same or at another level and thus create incentives making desired outcomes more feasible (c.f. Weyer et al. 2015).

Our final working assumption aims at these theoretical implications:

- (WA 6) Actors at each level try to influence and to control each other and thus intentionally shape other parts of the multi-level structure in order to promote the continuation or discontinuation of a socio-technical regime.

In the following, we will apply the concept of multi-level governance of socio-technical regimes – at least partially – to the case of discontinuation of the automobility regime. Additionally, the case study shall help finding a way to streamline our model. We assume that at least parts of the three concepts can be integrated in a way that facilitates the multi-level model’s use.

### 3 Discontinuation policies to overcome the automobility regime

The following Section describes and analyses the transport and environment policies in the four aforementioned countries and on the EU-level – especially regarding political attempts to foster a sustainable mobility by displacing the dominant automobility regime. In principle, the following three starting points to promote change can be identified:

1. Restrictions of use, e.g. by means of road pricing, car tolls, or spatial planning (mostly national or local), or by means of regulation, e.g. of CO<sub>2</sub> emissions (mostly supranational), i.e. measures that aim at stimulating sustainable mobility and thus challenge the incumbent regime;
2. Promotion of alternative mobility patterns like modal shift, public transport, or car sharing (mostly national or local), i.e. measures that mainly promote niche innovations, but also indirectly affect the regime;
3. Promotion of alternative drive technologies, e.g. the electric vehicle by means of financing R&D, pilot projects, or investing in infrastructure (at different levels), i.e. measures heading for niche innovations yet also indirectly affecting the regime.

In the following, we will focus on the first type of measures, which is directly and purposefully restricting the use of cars, while neglecting the other two types, which challenge the incumbent regime only indirectly by promoting alternative options.

#### 3.1 Methodology

The case study at hand draws primarily on document analysis: Data was collected from publications by scientists, interest groups, municipalities, and (supra-)national governments. Additionally, we conducted interviews with academic, political, industrial, and societal actors to gain a better understanding of prevalent actor strategies and constellations. To cover a wide range of actors, interview partners who act outside the dominant automobility regime were selected as well, for instance representatives of the civil society or social movements.

#### 3.2 Policy-making at EU-level

During the last two decades, actors on the EU level increasingly started to challenge the socio-technical regime of automobility.<sup>3</sup> Subsequently, we will analyse EU regulation on CO<sub>2</sub> emissions (Section 3.2.1) and its strategic roadmaps towards sustainable mobility (Section 3.2.2).

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<sup>3</sup> For a detailed description of the development and regulation activities including the regulation on noxious vehicle emissions by the so-called EURO norms, see Wagner (2011: 58f).

### 3.2.1 EU regulation on CO<sub>2</sub> emissions

The 1990s mark the beginning of the EU's regulation on environmental issues, partly triggered by the Kyoto Protocol (United Nations 1998), which had, among others, also raised the public awareness of ecological consequences of transport. Afterwards, the Kyoto protocol became a major reference point for EU activities in climate policy, and in other sectors as well. Prior to this, most measures, e.g. on fuel consumption of cars, had primarily been initiated by national governments for economic reasons (Wells et al. 2013: 32).

The European Union's explicit attempts to influence the use of cars with combustion engines started in 1995 with the European "Community Strategy to Reduce CO<sub>2</sub> Emissions from Passenger Cars and Improve Fuel Economy", which demanded measures for "reducing the use of motor vehicles, influencing driving behaviour (e.g. speed) and achieving a higher vehicle fuel efficiency by a combination of technical and non-technical measures" (European Commission 1995: 3). Additionally, it called for "an encompassing strategy [including] the improvement of public transport within an *overall plan for inter-modality* and the promotion of a modal *shift towards public and non-motorised means of transportation* [...]" (European Commission 1995: 3; emphasis added).

The next step was a voluntary agreement (VA) between the European Car Manufacturer Association (ACEA) and the EU, through which the automobile industry committed to an average emission target of 140g CO<sub>2</sub>/km until 2008; furthermore, the EU demanded an intermediate target of 165-170g by 2003 and held out the prospect of 120g by 2012. The VA had been negotiated since 1997 and was finally acknowledged by the European Commission in 1999.

Due to different product portfolios and hence different positions on the subject of emission reduction, the ACEA was basically divided into two "camps": the manufacturers of big, premium vehicles (headed by Germany) and the manufacturers of small vehicles (headed by France and Italy), either of which were supported by their respective national governments (Wagner 2011: 176, 177). Since the fulfilment of strict CO<sub>2</sub> limits was especially challenging to the former, they resisted the most. However, during the negotiation process of the VA, the members of the ACEA managed to act in a unified way (in spite of their internal differences) – mainly by taking a "lowest common denominator position" in order to avoid binding legislations by the EU (ibid.).

For the purpose of transparency, the progress of the ACEA's commitment was monitored annually by the European Commission (European Commission 2004: 4). Although the automobile industry was initially able to make substantial progress regarding the realisation of the targets (and thus fulfilling their commitment for 2003), further developments came to a halt between 2004 and 2006, when average exhausts levelled off at around 160g CO<sub>2</sub>/km. Hence, the European Commission's perception of ACEA's progress shifted considerably from 2004 to 2007: While the 2004 report stated that the industry made "good progress" (European Commission 2004: 20), reports after 2006 stressed

“growing concerns” and the Commission’s “readiness to consider all measures, including legislative ones” (European Commission 2006a: 3; 2007c: 5). Consequently – and even though the ACEA “delivered a sizeable contribution to the EU strategy for reducing greenhouse gas emissions and to its Kyoto reduction objectives” (European Commission 2006a: 8) – the VA had “not worked as well as had been hoped”, and the European Commission declared it as a failure (European Commission 2007b: 6).

Although the emission targets within the VA lack ambition and represent a setback in comparison to the initial EU target (120g CO<sub>2</sub>/km by 2005), for the first time the car industry agreed on voluntary emission reductions, preparing the industry for a binding legislation. Nevertheless, neither the European Parliament nor the European Council nor civil society actors (e.g. environmental NGOs) have been involved in the negotiation process of the agreement (Dalkmann et al. 2005: 25).

After the failed VA, the European Commission began to work on a draft for a legally binding CO<sub>2</sub> limit. This time, conflicts *within* European Commission emerged, when two Directorates General, namely DG Environment and DG Enterprise & Industry, worked in parallel on draft regulations, and both introduced them in February 2007 (European Commission 2007a, 2007c). Although DG Environment was officially responsible, DG Enterprise and Industry managed to include an “integrated approach”, which had been developed by stakeholders from the European automotive sector, into the final proposal (European Commission 2007a: 9-12).

This was heavily disputed by the DG Environment and environmental NGOs for watering down binding targets (Deters 2010: 25).

Difficulties in finding uniform standards were not only sharpened by the discord within the European Commission, but also by the disunity between the EU member states, especially between Germany, France and Italy – basically representing the interests of the two industry camps within the ACEA. They had fierce debates, the main issue of which was the appropriate slope of the emission value curve: A high one would force manufacturers of small vehicles to enhance efficiency (mainly Italy and France), while a low slope would require improving large premium vehicles (mainly in Germany) (Deters 2010: 26). Each national government demanded slopes that favoured their national automotive industry, forming two opposing actor coalitions of national governments and national industries. In contrast, environmental NGOs acted in unison, demanding a 95g/km-target.<sup>4</sup>

For some time, the bargaining processes remained deadlocked, until the stalemate was overpassed by a bilateral agreement between France and Germany, which mostly corresponded to German interests (ibid.: 23) and thus demonstrated the role of Germany as an agenda setting force. This arrangement was

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<sup>4</sup> Interviews with environmental NGOs (NGO1, 1:11:46 - 1:15:48 and NGO2, 00:16:05 - 00:16:41).

pushed through the approval processes at the EU Council and finally adopted by the EU Parliament as Regulation 443/2009.

In sum, compared to the Community Strategy of 1995, this regulation represents a setback (regarding dedicated discontinuation governance), since it relies more on innovation policies (European Union 2009: 1f) than on restricting the use of fossil-fuelled cars.

Recent negotiations about the revision of Regulation 443/2009 underline the important role of Germany. In 2013, Germany resisted to a tightening of limits and thus delayed progress again, but then started bilateral discussions with other member states and enforced an informal agreement within the European Parliament (European Council 2013). This encompassed a major concession for the automotive industry (in form of a limited one-year phase-in period for the new target of 95g CO<sub>2</sub>/km), which again provoked severe negative reactions, especially on the part of environmental associations (like the German DUH and VCD) and the German Green Party.

### *3.2.2 Strategic roadmaps towards sustainable mobility*

Besides regulating the automotive industry and the use of cars, the EU has also been proposing roadmaps to achieve an eco-friendly and sustainable mobility for about 20 years.

In 1992, the “Green Paper” of the DG Transport and DG Environment (c.f. European Commission 1992: 28, 36, 55) promoted a modal shift to cope with environmental issues of the transport sector on the one hand and the expected impact of European market integration<sup>5</sup> on the other hand. In 2001, the White Paper “European Transport Policy for 2010” demanded to counter the “unequal growth in the different modes of transport” and to draw on an integrated transport policy guided by “a new imperative – sustainable development” (European Commission 2001: 7, 9). However, compared to the preceding “Green Paper”, it was less restrictive regarding road transport, but focussed on the promotion of other modes of transport instead (European Commission 2001: 11). The “White Paper” mainly proposed pricing measures and infrastructure investments, wherefore it received negative feedback from environmental as well as from industrial associations (EurActiv 2001).

Its 2006 revision put stronger emphasis on solutions for urban transportation and suggested to shift responsibility for the development of sustainable measures to urban administrative authorities (European Commission 2006b: 14). Furthermore, the EU committed itself to promote various low-carbon propulsion technologies. The approach again resembled innovation policy rather than deliberate discontinuation policy.

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<sup>5</sup> The presumed increase in economic activity (e.g. due to the creation of the European Economic Area) was expected to lead to a boost in transport demand (European Commission 1992: 36). Hence, a shift towards sustainable transport sectors with excess capacities was promoted (e.g. from private car to public transport).

Early in 2011, the “Roadmap to a Single European Transport Area” (European Commission 2011b)<sup>6</sup> was put into place. Again, its objective was a sustainable transformation of the transportation system, gained by reducing dependency on oil, decreasing greenhouse-gases, and creating a modern infrastructure and multimodal mobility (ibid.: 3f). In contrast to its predecessors, targets for the phase-out of cars with conventional ICE were set: The use of fossil-fuelled passenger cars in cities was ought to be halved by 2030 and phased out entirely by 2050. So far, this had been the first (and sole) document of EU regulation dedicatedly demanding for a discontinuation of automobility.

Concerning measures, the roadmap states, “curbing mobility is not an option”, and proposes to accompany the phase-out of ICE-based cars via the fostering of new drive technologies (ibid.: 5) instead. In addition, it suggests to charge users and polluters for external costs (environmental and social ones) and to terminate “harmful subsidies” in order to generate revenues and ensure financing for future investments in transportation (ibid.: 14).

The 2011 edition of the White Paper triggered mixed responses across different states and organisations: Although many principally appreciated it for pointing in the right direction (e.g. the European Cyclists’ Federation, the Association of European Metropolitan Transport Authorities, and the German Green Party), the document was predominantly criticised for its lack of precision, ambition, and feasibility<sup>7</sup> (e.g. by the international NGO association “Transport and Environment”, Greenpeace, and the British Independence Party), the neglect of co-modality (e.g. by ACEA and the International Road Transport Union), and the absence of specific financial schemes (e.g. by the German Federal Assembly).

### *3.2.3 Interim conclusion: Discontinuation policy on the EU level*

In recent years, the EU has become a powerful actor in regard to sustainable transport policies, being the first one to demand a phase-out of conventionally fuelled cars on the urban level. In doing so, the EU has increasingly put pressure on national regime actors and hence forced them to act.

However, the analysis of policy processes and relevant actor constellations reveals a strong opposition by industrial actors who were able to influence decision processes despite sector-internal discord. They drew on the support of national governments that bypassed formal regulation procedures by informal agreements. Thus, the industry was able to cope with required limits by drawing on incremental solutions, such as optimizing the ICE-based car, e.g. by means of “hybridization” (Wells and Nieuwenhuis 2012: 1686). The EU’s regulative measures did not end up in shifting the automobility regime (Dijk and Kemp 2012: 54). However, its actions have opened a window of opportunity that may weaken the incumbent regime in the long run.

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<sup>6</sup> It was complemented by an “Impact Assessment” (European Commission 2011a), suggesting concrete targets, scenarios, and policy measures.

<sup>7</sup> Interview environmental NGO (NGO1, 00:12:16 - 00:17:17).

Analysing these developments from the perspective of MLP, we can observe a dual role of politics: *Supranational* institutions exert landscape pressure on the regime (e.g. by setting up CO<sub>2</sub> regulation), what forces regime actors to take action, or – as one of our interviewees puts it – “gets the member states to move on”.<sup>8</sup> *National* politics can be regarded as a mean pillar of different national sub-regimes of automobility, being influenced by this kind of landscape pressure. However, national politics is also part of the negotiation processes and decision-making at EU level, even when acting as lobbyists from national industries. This way, it is also able to shape the landscape, thus taking a dual role as regime and landscape actor simultaneously.

### 3.3 National and local policies

Supranational transport policies typically are adjusted to specific national contexts by means of national and local policy measures. In the following, we will take a closer look at transport policy on these two levels, especially programmes for sustainable mobility (3.3.1), spatial restrictions, and road charging (3.3.2). By this means we will try to identify attempts that challenge the incumbent automobility regime.

#### 3.3.1 National and urban transport plans for sustainable mobility

National programmes fostering sustainable mobility and modal share came up in the 1990s, at the same time as supranational environmental policymaking did (see also Figure 1).

The Dutch “Second Traffic and Transport Structure Scheme” (SVV2) from 1990 (to 2001) sought to combine environmental and spatial planning objectives with transport sector development goals and promoted the proliferation of clean, safe, and efficient vehicles (TKdSG 1990). In the UK, “A New Deal for Transport” (DTR 1998) launched strategies for sustainable mobility in 1997 and therewith ended the government’s large-scale road building strategy. Furthermore, both national traffic development plans fostered the idea of modal shift via improving alternatives to the private car, like public transport and cycling facilities for instance. The necessary investments were to be funded by a newly created infrastructure fund, filled out of revenues such as the motor vehicle tax or the motor fuel tax. But in contrast to the “New Deal”, the SVV2 also pushed the idea of restricting mobility by reducing the number of kilometres travelled and by promoting a selective accessibility to roads (e.g. through limiting vehicle access). Hence, since the 1990s, Dutch traffic policies have not been taking car use for granted anymore (Schot et al. 1994: 1071).

Tendencies to impede individual car use can be found in Dutch policymaking regarding mobility to date. For example, the Dutch national research institute for mobility suggests to curb the demand for mobility (e.g. by improving conditions for home working) and to support a modal shift (Moorman and Kansen 2011: 5). The institute also opts for the introduction and subsidisation

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<sup>8</sup> Interview with Member of German Federal Parliament (MDB1, 00:17:48).

of a variety of low carbon technologies, which should be made more competitive by the promotion of an emission reduction policy.

In the UK as well as in the Netherlands, the introduction of traffic development plans was accompanied by tendencies of decentralization. In the Netherlands, the VERDI accord (“Traffic and transport: regional, decentralized and integral”) was established in 1996 to foster the scope for local initiatives and to transfer responsibility for transport aspects, spatial planning, etc. to local authorities (MVW 1996). In the UK, the so-called “devolution transition” did the same by urging local authorities to produce five-year plans for transportation and to describe strategies to achieve an integrated transport system. In 2000, the decentralization process received a legal basis by through the Transport Act (HMG 2000), which permitted local authorities to introduce ‘road user charging’ or ‘workplace parking charge’ schemes as part of an integrated transport system.

However, especially in the UK, the economic and political resources to promote sustainable mobility were lacking at the local level, and a consensus about strategies and proceedings was missing. Additionally, public acceptance for sustainable mobility plans was lacking: The fuel protests in 2000, for instance, illustrated the public’s strong dependency on fossil-fuelled automobility. Altogether, the decentralization process did not work as a lever for sustainable mobility.

In 2008, the UK’s government issued the first (and only) legal obligation in a European member state to meet CO<sub>2</sub> reduction targets of the Kyoto Protocol: The Climate Change Act (CCA) demanded an 80% reduction of net carbon account for all greenhouse gases in 2050 in comparison to 1990. However, the strategies to accomplish these emission goals were ambivalent regarding the reduction of car-usage. The British Department for Transport argued that energy efficiency “will primarily be delivered through advances in the efficiency of the internal combustion engine. Alongside this, new ultra-low emission vehicles will be available on the mass-market.” (DfT 2009: 38) On the other hand, the department advises local authorities to „use parking policies alongside other planning and transport measures to promote sustainable transport choices and reduce reliance on the car“ (ibid.: 11) – thus partly promoting (improved) cars, partly trying to restrict their use.

Since the early 1980s, France has been pursuing a similar strategy to foster sustainable transport via urban mobility plans (“Plan de déplacements urbains”, PDU). The French Air Quality and Rational Use of Energy Act (“Loi sur l’air et l’utilisation rationnelle de l’énergie”, LAURE) from 1996 made those plans compulsory for urban areas with over 100.000 inhabitants (Assemblée Nationale 1996), in 2005 even for medium-sized towns. A few years later, they became legally binding. Urban mobility plans should support the reduction of car traffic (Art. 28-1) and promote the development of public transport, less pollutant vehicles, and of active transport modes (Art. 28-2). As in 2013, 80 PDUs had been established (CERTU 2013: 1). This was partly due to recent

EU regulations on CO<sub>2</sub> emissions that encouraged and legitimized national transportation policy referring to climate change.

The French 2010 environment protection law „Grenelle II“ (Assemblée Nationale 2010) provided the legal foundation for “public transport on separate lanes” (“Transport en commun en site propre” - TCSP), which sought to enhance the quality of public transport and simultaneously reduce the space for cars (e.g. by building railway lines on former roads). This represented a new quality of political regulation, since the TCSP plan contained the deliberate purpose to restrict and discontinue passenger car use through strong measures.

In sum, we could find several activities in the area of transport and environment policy during the past two decades that enhance sustainable mobility and (at least partly) challenge the dominant regime, e.g. by changing infrastructural conditions, which may affect deeply entrenched car-user behaviour. In all three countries, transportation policy heading for sustainable mobility was accompanied by a process of decentralisation, shifting responsibilities to local (resp. urban) levels.

Germany was lagging behind in terms of eco-friendly transport policies (or even shifting the automobility regime) and initiatives fostering the reduction of car use were mainly absent (exceptions being low-emission zones, see following chapter). Due to the strong support of the car (by consumers), the restriction of car usage is deemed as “political suicide”<sup>9</sup> and a “topic of outrage”.<sup>10</sup> In contrary, as a reaction to the global financial crisis in 2008, the German (and the British) government subsidized the purchase of new cars – be it a low or a high polluting car – by environmental bonuses such as the scrappage scheme. “Carefully constructed narratives about the need to reduce dependence on the car were sacrificed at the altar of short-term economic stability and *increasing* car production and sales.” (Docherty and Shaw 2012: 111).

### 3.3.2 Spatial restrictions and road charging

Spatial restrictions and road charging represent the second type of policy measures constraining automobility to be investigated here. One well-known example is the urban congestion charging in London, which was legally enabled by the afore-mentioned Transportation Act and a corresponding EU legislation in 2003. This road toll had been introduced to overcome the gridlock in London City by promoting a modal shift from individual cars to public transport. Although electric vehicles were not affected by the charge, it had not been conceived of as a means of deliberately facilitating sustainable mobility, but primarily as a tool to avoid traffic jams and raise new funds to finance the road infrastructure (Erdmenger 2010: 16f).

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<sup>9</sup> Interview with Mobility Researcher MR1, 01:04:16.

<sup>10</sup> Interview with Member of German Federal Parliament MDB1, 00:35:28.

The London example is considered to be a success. However, almost no other city in the UK introduced congestion charging. In Edinburgh and Manchester, introduction proposals were even rejected.

In France, car tolls on motorways have already been implemented in 1955 as a means to finance road maintenance and thus support the automobility regime. In Germany, attempts to introduce road charging have been pushed likewise by strategies to raise money for maintaining the road network. The introduction of a car toll is currently part of the bargaining process between different political parties, because it has been – despite severe differences – registered in the coalition agreement in 2013. Concepts for road fees issued by the Minister of Transport are heavily criticised by automobile associations.<sup>11</sup> In the Netherlands, the long debate on road pricing (especially in terms of congestion charging) was even discontinued by the coalition agreement of the actual government (Geels et al. 2012: 359).

Another approach to restrict the car use is to ban them from cities via „low-emission zones“. As the term already indicates, this measure has been legitimised by environmental motives, i.e. reducing particular emissions in cities, as in the case of Germany in 2008. Hence, the environmental zones were strongly supported by German NGOs.<sup>12</sup> However, most cars attain the entry allowance and pollution monitoring is insufficient, with lacking consequences of exceeding limits.<sup>13</sup> Therefore, NGOs now prompt for stronger standards.<sup>14</sup>

In France, the introduction of “Zones d’Actions Prioritaires pour l’Air” (ZAPA) started with a (heavily discussed) three-years test in 2012, implementing seven ZAPAs in Paris, Grenoble, Lyon, Aix-en-Provence, Bordeaux, and two other cities. With this measure, the French ministry of environment reacted to EU legislation of 2008, since the country had been unable to meet the limits of particular matters (PM10). Once more, this emphasises the influence of EU regulation on national politics when it comes to restraining automobility.

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<sup>11</sup> Interviews at Ecologic Automobile Association (EAA1, 00:19:54 - 00:21:58) and at Automobile Association (AA1, 00:04:12 - 00:05:11).

<sup>12</sup> Interview environmental NGO (NGO1, 01:16:27 - 1:27:27).

<sup>13</sup> Interview with Member of German Federal Parliament (MDB1, 00:46:20- 00:47:28).

<sup>14</sup> Interview environmental NGO (NGO2, 00:49:27 - 00:51:20).

### 3.3.3 Interim conclusion: Discontinuation on national and local levels

In sum, we were able to find various national and local policies regarding sustainable transport, resulting in a patchwork that does only allow for identifying some tentative patterns (see Figure 1):

- (a) The early 1990s were the starting point for supranational activities in the EU and the UN aiming at reducing greenhouse gas emissions. International agreements, such as the Kyoto Protocol, triggered national programs, which supported sustainable mobility for the first time, but did not challenge the incumbent regime at all.
- (b) Those countries that fostered sustainable mobility in the late 1990s also encouraged decentralization, and shifted responsibilities to the local level. However, with some exceptions (such as the Dutch SVV2 or the French TSCP), we could hardly find any deliberate attempt to challenge the dominant automobility regime. National policies rather continued to support it (especially the UK and Germany).
- (c) National and local policies in the late 1990s and early 2000s have increasingly been influenced by EU regulations, which served as a source of legitimacy for measures concerning transportation.
- (d) Despite various local programs for spatial restrictions or road charging in this phase, an integrated approach has neither emerged on the nation state nor on the EU level. All measures mentioned above remained isolated policy instruments and did not “add up” to seriously challenge the automobility regime. On the contrary: Road charging is usually not used to impede automobility but as an instrument to finance the road infrastructure and thus support the regime.
- (e) Since the mid-2000s, the EU has started a “new wave” of activities, such as the CO<sub>2</sub> regulation and the “Roadmap Towards a Single European Transport Area”, which put increasing pressure on national governments and automobile manufacturers to comply with climate policy objectives. This has created a window of opportunity for challenging the regime, but no compelling force that might trigger regime change in due course.

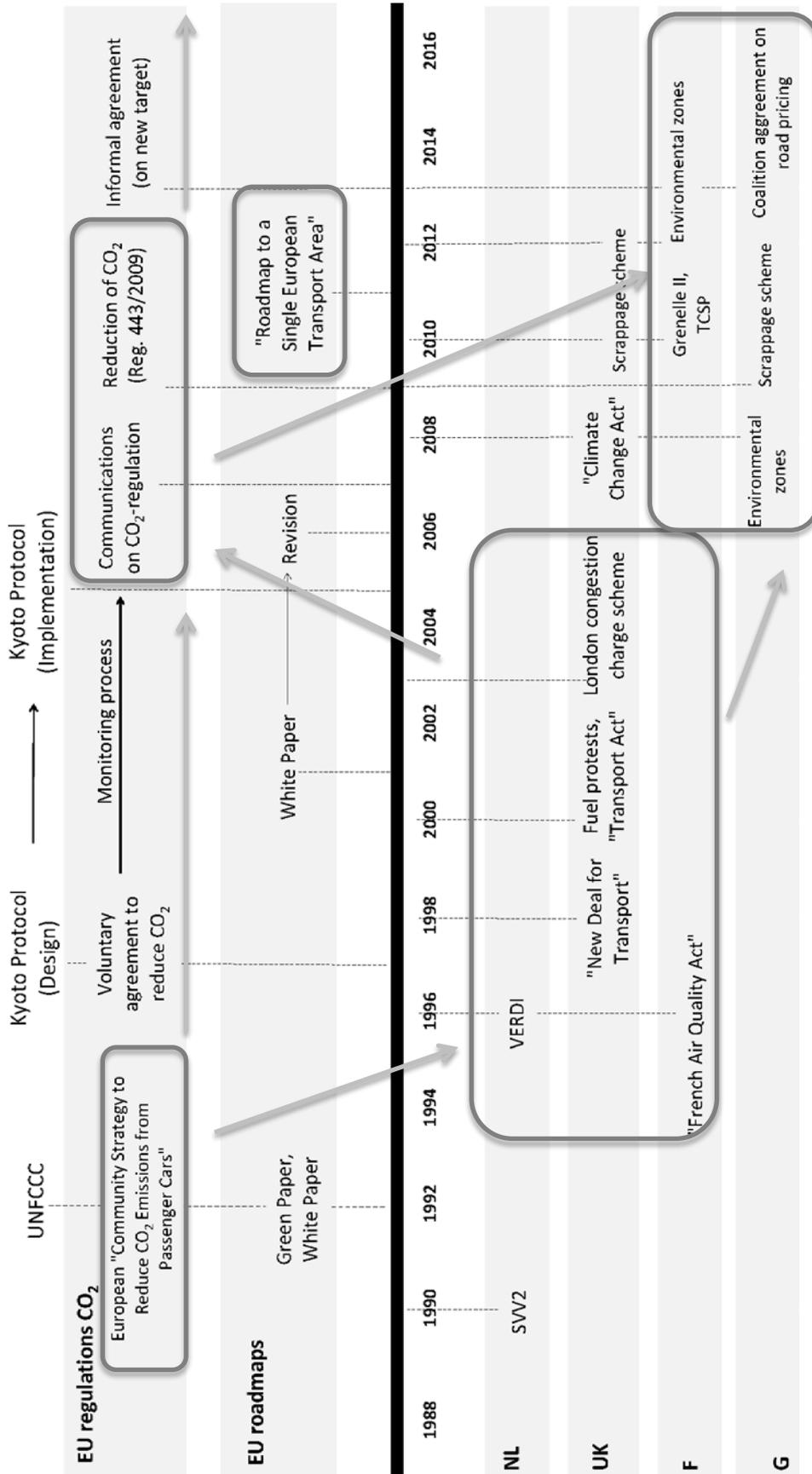


Figure 1: Timeline of discontinuation policies at local, national and supranational levels

## 4 Examination of working assumptions

Empirically, we found strong indicators that the perception of the automobile shifted during the last decades from being a solution for economic problems to a policy problem. Hence, evidences point to some changes in the landscape of the socio-technical automobility regime. However, although generally promoting sustainable mobility, most political initiatives have not challenged the incumbent regime of conventionally fuelled cars by forcing its discontinuation.

In the following, we will review the three theoretical concepts, and check if they helped confirming our working assumptions. Furthermore, we will discuss our findings in the broader context of research on (auto-) mobility transitions (which will partially exceed our policy-focussed study).

### 4.1 Multi-level perspective (MLP)

#### 4.1.1 Regime

Our analysis of attempts to deliberately destabilize the automobility-regime has shown that the regime's stability is constituted by several components – basically confirming other authors' studies (see Geels 2012; Urry 2004; Wells and Nieuwenhuis 2012). Especially the analysis of the CO<sub>2</sub> regulation illustrates the automotive industry's crucial role in many national economies. Due to this critical economical and social embedding, it enjoys a privileged status in terms of political agendas and represents a powerful lobby (Wells and Nieuwenhuis 2012: 1686).

The automobility regime is furthermore based on a powerful business model, which encompasses high sunk costs and allows mass production due to economies of scale – both substantial boosters of path-dependency. This constitutes significant barriers for new market entrants and technological alternatives. Additionally, the concept of the car has a strong societal hold. “Public's love affair with the motor car” (Financial Times, 2000, 29<sup>th</sup> September) is based on consumption routines that rely on flexible (auto-) mobility.

As indicated, the socio-technical regime of the automobile is based on a strong actor network of the automobile industry (and associated sectors), transportation policy, and customer behaviour, which mutually reinforce each other and create path dependency. Hence, the automobility regime is able to generate and reproduce a “specific character of domination” (Urry 2004: 25). These stabilising and continuous features may even lead to a “transition failure” (Wells and Nieuwenhuis 2012).

(WA 2) Our working assumption: “The stability of a socio-technical regime is based on a strong actor network” can thus be confirmed.

#### 4.1.2 Contested elements of the regime

Nevertheless, when also taking the broader context of research on mobility-transitions into account, at least some regime elements have been contested in the past:<sup>15</sup>

- Several patterns of modal share or alternative mobility seem to threaten – at least in some parts of society, e.g. in urban districts – the concept of the individually owned and used car for flexible, all-purpose, and long-distance travels;
- Alternative propulsion technologies, such as the electric vehicle\* challenge the dominant internal combustion engine due to climate noxious effects;
- New players\* from other business sectors (dotcom firms or energy companies) have entered the market and challenged the incumbent business model of the automotive industry;
- At least some fractions of consumers (especially in urban areas\*) do no longer attribute the car a privileged cultural status to;
- The dominant pattern of political protection of the automobility regime has been challenged by climate policy measures, especially on part of the EU, which call for a fundamental transformation of transportation;
- Finally, the traditional strategy of extensive infrastructural growth (building roads) has come to an end and has been replaced by a strategy of intensive growth, relying on smart devices and a smart network management\* – they principally can also be used to promote multi-modal services that do not solely rely on the car.

However, these six separate trends do not “add up” to a regime change yet.

(WA 1) Hence, our working assumption: “A socio-technical regime may still persist even if some of its elements have been challenged”, can also be confirmed.

The next subsections will show that neither landscape pressure nor niche developments are strong enough to put pressure on the regime to possibly trigger change.

#### 4.1.3 Landscape

Various stabilizing and destabilizing landscape developments can be distinguished regarding the transition of automobility. The existing road infrastructure as well as the increasing demand for mobility both represent landscape influences that tend to stabilize the socio-technical regime of automobility with its core component of the fossil-fuelled car (Geels 2012: 478). On the other hand, as depicted in our case study, the growing public awareness and political

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<sup>15</sup> The asterisks mark those elements, which have not been investigated in our case study in detail.

discourses concerning environmental issues such as climate change (partly at supranational levels, e.g. the European Union) can be regarded as destabilizing landscape pressures. This also applies to economic developments and pressures like scarcity of fossil fuels or the necessity to obtain national competitiveness regarding new technologies and markets.

#### 4.1.4 Niches

Although not investigated in detail in this paper, we were able to find a large variety of niche innovations like alternative drive-technologies (e.g. electric vehicles) and new mobility patterns in the (automotive) transport system (Geels 2012: 457 ff; Nilsson et al. 2012). These innovations are promoted partly by amateur outsiders who, for instance, construct their own solar vehicle and partly by regime actors who conduct large demonstration projects with car sharing for instance (like Daimler's Car2Go). Additionally, new actors from other industrial sectors, such as Tesla or Google, step in and create new visions concerning the future automobile. In some cases, public authorities have funded showcase projects as "protected spaces", where the niche innovation can prove its performance. Other examples underline the relevance of EU funds as being important means of promoting new options and encouraging experiments with alternative mobility patterns.

## 4.2 Actor networks

As already discussed in Section 4.1, the (international) actor network of automobility is still strong enough to sustain the regime and to cope with any kind of disturbances, even with current challenges through climate policy (WA 2). Zooming in on the interaction processes within these networks reveals interest conflicts not only between different parties but also within them, e.g. within the group of industrial actors or between different governments. These interest conflicts have fundamentally influenced the governance processes fundamentally. Especially the EU's increasing influence can be related to the disaccord of the European automotive companies who weakened the negotiation power of industrial actors.

However, national actor constellations differ remarkably, as our comparison of four countries revealed. The existence of a national automobile industry, as in France and Germany) obviously matters, compared to the Netherlands and Great Britain, which both lack big national companies and thus do not have relevant stakeholders in this sector.

The analysis of actor constellations provided an explanation of why the four countries reacted differently vis-à-vis climate change challenges and promoted various kinds of alternatives (cf. Section 3.3). We could observe different national pathways of continuation and/or transformation of the automobility regime – even if somehow ambivalent.

(WA 3) There is some evidence that our third working assumption: “The stability of a socio-technical regime may differ regarding various countries”, can be confirmed.

However, alternative visions of mobility that really might challenge the incumbent regime are rather rare. There is a huge number of initiatives in different fields (e.g. electric mobility). But, surprisingly, we did not find any hint to a new actor network that could emerge as a rival in near future – neither in the niches nor in the visions of the environmental NGOs.

(WA 5) Our fifth working assumption: “Challenging the incumbent regime requires a competing actor network” can thus be confirmed, too.

### 4.3 Multi-level Governance

In the case of the socio-technical regime of automobility, governance activities occur at different levels: in national policy making, at the European Union level, which has become an important actor during the last decades, and, finally, in regions and cities that experiment with different approaches of regulating the automobile or promoting alternative modes of transport. Hence, the interactions between different levels of the multi-level governance system are relevant, e.g. when European regulation affects national transportation policy or when European funding promotes local experiments with alternatives. Actors mutually influence each other, since actions at one level change the boundary conditions of the actors at another level and vice versa, thus producing a hardly controllable dynamic.

(WA 6) There is at least some evidence for the validity of the working assumption: “Actors at each level try to influence and to control one another and thus intentionally shape other parts of the multi-level structure in order to promote the continuation or discontinuation of a socio-technical regime.”

The case study provides ample evidence on the assumption that policy making occurs within a nested set of governance layers: international, national, regional and local. Actors aiming at discontinuing the automobility regime act at different levels, ranging from negotiations and regulations on the supranational level to national policies, urban spatial planning, and regional pilot schemes. By means of scarcely coordinated measures they created a vast and widespread patchwork of discontinuation policy in Europe (cf. Figure 1).

Furthermore, network memberships are partly overlapping with actors playing different roles at different levels. Regarding policy makers, for example actors sustaining the national regime, may also be part of the transnational governance processes that are pursuing the objective of sustainable mobility much more fiercely than national politics (see for instance Germany’s dual role in CO<sub>2</sub> regulation).

(WA 4) Our fourth working assumption: “Actors may act at different levels of the MLP, but play different roles when acting either as landscape, as regime, or as niche players” can thus be confirmed as well.

European policy makers are much more active concerning sustainable transport policies than their national and local colleagues (Geels 2012: 478). We could only find weak indicators that the discontinuation of the ICE-based car is being promoted by national governments (remarkable exceptions are the TSCP in France and the SVV2 in the Netherlands).

## 5 An integrated approach

One objective of this paper was to demonstrate the value of an integrated approach, combining the multi-level perspective (MLP) of socio-technical change, the actor network approach, and the concept of multi-level governance (MLG). We can conclude that these three concepts obviously work well together and do not produce any inconsistencies, e.g. in terminology.

### 5.1.1 Combining MLP and actor-centred approaches

The actor network approach rather enriches the multi-level perspective and helps to better understand the negotiation processes at all of the three levels, as well as the interactions between them. Indeed, we conceptualized levels more concrete and actor-specific as originally intended by the founders of MLP.

### 5.1.2 Combining MLP and MLG

But the question remains whether we need two multi-level frameworks and - if so - whether they can be smoothly integrated. MLG leads to a deeper insight into the interaction between landscape, regime and niches. MLP conceptualizes at least landscape and regime as rather anaemic entities: They emerge, develop, and influence each other, but seem to have a life of their own, since internal dynamics are mostly disregarded. MLG is able to fill this gap through emphasising actors and actor networks, which deliberately try to control each other by affecting the boundary conditions of one another (at different levels).

Combining MLP and MLG therefore leads to the most surprising result of our analysis: It is mainly actors at the supranational level who exert landscape pressure on the automobility regime. As our case study shows, the influence of the EU has remarkably increased over the last years: It has become the most important player prompting towards the discontinuation of the socio-technical regime of automobility. Windows of opportunity have mainly been opened by policymaking at the supranational level, like in the case of CO<sub>2</sub> regulation. Furthermore, this landscape pressure is not a vague and diffuse occurrence, but has been constructed rather deliberately.

In order to grasp how this landscape pressure emerged, actor network approaches reveal further details of the decision-making processes at the EU level and provide an explanation for the emergence and specific shape of landscape pressure. The case of CO<sub>2</sub> regulation illustrates how regime actors have influenced the landscape (e.g. via lobbying) and have also tried to absorb landscape pressure (e.g. by incremental changes of the incumbent technology, which did not endanger the regime).

### 5.1.3 One single framework?

Complementing MLP with the concept of actor networks leads to a more substantial notion of levels, conceptualising them no longer as amorphous entities, but as places or spaces where actors (inter-)act and thus create and shape reality, instead. In doing so, MLP and MLG levels converge to an extent that allows to integrate these two frameworks at least partly. Our case study demonstrates:

- Destabilizing landscape pressure is mainly constructed (and exerted) by international players such as the UN or the EU (even if national actors are part of the game).
- The regime has a strong national hold, especially within politics and industry (even if manufacturers operate globally).
- Niches typically are regional or local spaces where a variety of players act and interact, ranging from cities reorganising urban transport (e.g. London) over local activists, outsiders and tinkerers, to regime players (e.g. Daimler) and landscape players as well (e.g. the EU, funding alternative mobility experiments).

Even if this may not apply to other cases, at least in ours, the two multi-level frameworks can be integrated to a single concept of an actor-centred multi-level governance of socio-technical systems.

### 5.1.4 Governance of complex systems

This actor-centred, multi-level approach also allows considering the discontinuation of the socio-technical regime of automobility as a sample of governance of complex systems. In contrast to other cases such as DDT or the electric light bulb, which both have been banned by multinational institutions (Stegmaier et al. 2014), there is neither a common vision nor concerted actions nor coordinated control which would endanger the automobility regime.

We rather see multiple actors pursuing a variety of strategies while playing different games at various levels, mutually influencing each other in a way that impedes predicting the outcome. However, the integrated actor-centred, multi-level approach helps to analyse these complex processes better than one of the three approaches on its own.

## **6 Limitations and further perspectives**

Until now, our integrated approach combining different analytical concepts has so far only been tested through one explorative case study. Hence, the question of its transferability to other cases remains unresolved. Furthermore, the paper at hand puts emphasis on only some elements of the regime and does not further investigate e.g. cultural change or smart infrastructures as factors challenging the regime.

Further research should also analyse actor constellations and developments within the niche(s) more in-depth. This might help answering questions of whether new actors (from civil society, NGOs, dotcoms and/or the energy sector) are entering the stage and whether new actor networks are emerging, which might altogether challenge the incumbent regime.

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