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Research article

# A choreography of delay: The response of German auto incumbents to environmental policy

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ABSTRACT

Most serious environmental and health problems caused by the transport sector stem from the automobile. While other sectors have reduced emissions, transport emissions have increased and the sector's sustainability transformation seems stalled. Why is that? And what role do incumbent automobile industry actors play? Relatively few scholars have focused on the behavior of these incumbents. Our study contributes towards filling this gap by analyzing two case studies of how the German automobile industry has reacted to environmental policy initiatives. Our analysis allows us to make several contributions to the literature. First, we demonstrate how industry and policy makers attempted to outmaneuver each other. Second, we illuminate several tactics employed by incumbents to resist change. And third, our analysis reveals a pattern of behavior that we argue is linked to the degree of pressure placed on incumbents. Most other attempts to identify patterns have prioritized the temporal dimension.

## 1. Introduction

The automobile is responsible for most of the environmental and health problems in Germany caused by the transport sector, such as air pollution, $CO_2$ emissions, and soil sealing. This diagnosis is not new. In 1973, the German Advisory Council on the Environment stated that

> "*the automobile causes emissions of the most diverse kinds, it makes ever greater use of dwindling resources, and it causes social and political planning problems…*" (SRU, 1973: 1).

While all other sectors in Germany have made progress in reducing $CO_2$ emissions, transport emissions have increased in the past ten years despite more efficient vehicle drives (BMU, 2019). Ninety-six percent of these emissions are caused by road traffic (BMU, 2018: 38). The number of registered cars has continuously risen and currently exceeds 48 million vehicles (KBA, 2021). Moreover, cars have become heavier and larger with higher levels of motorization (KBA, 2020).

Policy makers and scholars have long been aware of the problems arising from fossil fuel-based transportation systems dominated by cars (Canzler and Knie, 2015; Dennis and Urry, 2009; Moriarty and Honnery, 2008; Sachs, 1992). However, change is only slowly happening. Why is that? What role does the automobile industry play in this process? And finally, what do incumbent actors' behavior and relations imply for policy attempts at tackling sustainability challenges?

Relatively few studies have specifically focused on the behavior of automobile industry incumbents. Some have examined how they

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hinder sustainability transitions (Geels et al., 2012; Wells and Nieuwenhuis, 2012), and others have spotlighted their lobbying strategies and the close interrelations between the industrial and political levels (Haas and Sander, 2019; Reh, 2018; Richter and Haas, 2020; Schwedes et al., 2015; Späth et al., 2016). Analyses of policy initiatives to address air pollution from automobiles in the United States (U.S.) have focused on how regulators elicited compliance (Gerard and Lave, 2005), and on the various strategies employed by industry actors in response to strict regulatory demands (Penna, 2014), including technological innovation efforts (Lee et al., 2010). A few scholars have approached the topic of incumbents with a somewhat optimistic tone, for example, by examining the greening of the automobile industry (Bergek et al., 2013; Bohnsack et al., 2020; Mikler, 2009; Penna and Geels, 2012).

The aim of our study is to understand the dynamics that have, for many decades, blocked change to the car-centered transport sector in Germany. To this end, we analyze two historical case studies of how German automobile manufacturers and their supporters reacted to environmental policy initiatives — the introduction of the catalytic converter in the 1980s and the particulate filter in the early 2000s — and make several interrelated contributions to the literature. First, we demonstrate how industry and policy makers attempted to outmaneuver each other. Second, we enumerate several case-specific resistance tactics employed by industry actors. And, third, we propose a new perspective for understanding the pattern of incumbent behavior. Our cases reveal that, in reaction to policy makers' initial vague proposals, industry actors deployed a strategy designed to delay the introduction of specific environmental measures. This delay response has been observed elsewhere in the literature, such as Gerard and Lave's (2005) analysis of the U.S. case. What our study adds to the literature is a systematic analysis of the various tactics and steps undertaken by industry incumbents as they attempted to thwart different degrees of policy maker pressure.

We find that when policy makers initially attributed an environmental problem to the transport sector, some or all industry actors resisted but then acknowledged that 'something should be done'. However, as policy makers began proposing specific technological adaptations, industry actors shifted back to a resistance mode and responded with a series of delay tactics. Our study illuminates several incumbent tactics that have not yet been fully explored in the literature. For example, incumbents asserted they "Need More Time" to bring new technologies to market, and they demanded that policy makers "Provide a Quid Pro-Quo", when industry finally accepted the government's proposals. The "Choreography of Delay" also included attempts by incumbent actors, as well as by policy makers, to influence European Union (EU) policy, in hopes of causing a boomerang effect on the Germany-level negotiations. Finally, one implication of our findings is that both technological adaptations, the converter and the filter (which would be termed 'environmental innovations' in the transition literature, see Penna and Geels, 2012), served to stabilize the status quo of the car-centered transport system rather than require a more radical restructuring.

Germany is particularly interesting for a study of automobile industry incumbent behavior because of the importance of the automobile in German economics, politics, and culture. The automobile was the vehicle of West Germany's post-WWII economic revival and is still considered the backbone of Germany's export-oriented economic model. The automotive industry currently employs more than 800,000 people (BMWi, 2021). Since the late 1960s, the automobile has been the dominant means of transport, and infrastructure has been tailored to the needs of car drivers (Klenke, 1995). Transport policy is — de facto — still an automobile and road construction policy (Haas and Richter, 2020). Hardly any other consumer good is as deeply anchored culturally as the car (Sachs, 1992).

This study focuses on the behavior of the German car makers, and the European/EU-wide industry, the German Government, and the EU decision level. However, the nexus of environmental policy and the auto industry is populated with many players (Bauner, 2007). Among these are suppliers such as Siemens and Bosch, unions, environmental organizations, and actors from other industries such as petroleum, electricity, and technology, as well as regulations on the international level, and even foreign countries (like China) that attempt to influence national transport policy. In the following case studies, we primarily focus on policy makers and auto firms as a start to investigating the interplay between political and industrial actors.

The article is structured as follows: we provide the theoretical underpinnings of incumbency in sustainability transitions in section two and our materials and methods in section three. Also in section three, we briefly review the link between EU and EU Member State policy. In section four, we present our two case studies and, in section five, interpret how policy makers and industry interacted, elaborate on the tactics employed by incumbents, and discuss the implications for further research. We close with our concluding remarks in section six.

## 2. Theorizing the role of incumbents and their resistance tactics

### *2.1. The transition field's new focus on incumbents*

The field of sustainability transition studies has rapidly developed in recent years and four frameworks have become prominent: transition management, strategic niche management, the multi-level perspective on socio-technical transitions, and technological innovation systems (Köhler et al., 2019; Markard et al., 2012). These frameworks each offer a different perspective, but share certain commonalities, such as a socio-technical approach. Another commonality was an initial understanding that new technologies, developed at the "niche" level, could potentially build up sufficient momentum to break through and gain acceptance at the "regime" level, which "captures 'how things are done now' and includes soft factors (e.g. rules, norms, culture, and habits) and hard factors (e.g. extant infrastructure, factories and tools)" (Smith Stegen, 2018: 79–80).

However, the slow pace of a fundamental transition towards sustainability indicated two weaknesses in the key frameworks: first, the momentum-breakthrough concept was too simple. Second, although there has been some work conducted on power relations (e.g. Avelino, 2017), a full appreciation of power dynamics was lacking (Moss and Gailing, 2016; Haas, 2019). These gaps led transition scholars to shift more attention to factors blocking change, such as lock-in effects (Seto et al., 2016; Unruh, 2002, 2000), the role of

incumbents in socio-technical transitions, in general (Berggren et al., 2015; Stirling, 2019; Turnheim and Geels, 2012; Turnheim and Sovacool, 2020); and the active resistance of incumbent actors to pressure for change (Geels, 2014; Sovacool and Brisbois, 2019).

### 2.2. Role of incumbents

Recent studies have grappled with the role of incumbents in sustainability transitions. Some of these studies reveal the historical entanglement of the industrial/economic and political realms (Baker et al., 2014), which can result in 'deep incumbency' (Cox et al., 2016; Stirling, 2019) and the perpetuation of the status quo. In the United Kingdom (U.K.), for example, incumbent utilities used their relations with policy makers to resist change (Geels, 2014). In Australia, a 'greenhouse mafia' comprising political and industry actors shaped climate change policy (Pearse, 2007). Other studies indicate that, even when political and industry actors do not work closely together, incumbents can still influence policy making and their institutional environments (Geels, 2014; Lawrence and Suddaby, 2006; Penna and Geels, 2012; Smink et al., 2015). But do incumbents always resist change? Some studies suggest that firms can assist in cross-sectoral change (Turnheim and Geels, 2019) and reorient towards change by investing in niche development (Berggren et al., 2015; Penna and Geels, 2015). Two scholars recently argued that incumbents should not be automatically perceived as 'villains' opposed to sustainability transitions (Turnheim and Sovacool, 2020).

Most studies, however, find that incumbents usually assess the demands for change as threats and engage in defensive behaviors (Lawrence and Suddaby, 2006; Maguire and Hardy, 2009). Their overarching aims are to protect themselves and their business interests. Thus, the dominant perception in the transition and transformation literature is that incumbents primarily attempt to resist or delay efforts to change the status quo (Johnstone et al., 2017; Penna and Geels, 2015; Smink 2015; Stirling 2014), typically by influencing policy makers and public opinion. To achieve their aims, incumbents use a variety of tactics that may be deployed through myriad channels and venues. Here we rely on the distinction between tactics ("particular, well-chosen actions") and strategies ("ideas that orchestrate these actions") as formulated by Cels et al. (2012: 16).

### 2.3. Tactics, agents, and venues commonly employed by incumbents in transition challenges

In the literature focusing on transition and/or transformation challenges we have identified at least eight categories of tactics employed by incumbents (not in order of importance; see Smink et al., 2015 for an overview).

1 *Warn of Economic Consequences*: emphasize the potential economic disadvantages of change, particularly job losses (Denniss, 2012) and consumer costs (Lee and Hess, 2019).
2 *Doubt the Scientific Data*: cast doubt on the environmental science or data (Maguire and Hardy, 2009; Oreskes and Conway, 2011).
3 *Challenge Government Standards*: attempt to change government standards, for example, $CO_2$ targets (Haas and Sander, 2019; Schwedes et al., 2015).
4 *Criticize the New Technologies*: assail the purported advantages or marketability of new competing sustainable technologies (Smink et al., 2015), including wind and solar (Kungl, 2015), and electric mobility (Richter and Haas, 2020; Schwedes et al., 2015).
5 *Generate Countervailing Data*: attempt to counter policy makers by conducting or commissioning research, for example, opinion research showing public support for the industry's position (Haas and Sander, 2019; Hess, 2020).
6 *Minimize Costs of Status Quo*: attempt to obscure the full social or economic costs of the status quo (Johnstone et al., 2017).
7 *Reframe Polluting Technologies*: attempt to reframe old or polluting technologies as new or innovative (Johnstone et al., 2017).
8 *Criticize Government Interference in R&D*: accuse the government of interfering in technological development and undermining the natural selection process of identifying the best technologies to address environmental problems (Smink et al., 2015).

These tactics can be used individually or in combination and are deployed by myriad agents, such as single firms, coalitions of firms, lobbyists, grassroots and other supportive groups, and institutions established by incumbent firms (Hess, 2014; Hockerts and Wüstenhagen, 2010; Newell and Paterson, 1998; Wesseling et al., 2015). The venues in which the tactics appear are diverse, and can include the media, courts, and conferences (Hess, 2020 Lauber and Sarasini, 2014). To generate and diffuse information, incumbents use a wide variety of means. They may, for example, commission research and reports; supply position papers, technical reports and testimony; establish journals; and engage in educational efforts (Hillmann and Hitt, 1999; Smink et al., 2015).

### 2.4. Patterns of behavior

Extant scholarship primarily focuses on the individual tactics that incumbent actors employ to defend their interests. An approach that identifies patterns or dynamics of political behavior is lacking, aside from two notable attempts. Johnstone et al. (2017), for example, propose a typology based on how powerful U.K. energy utilities promoted their interests. The authors identify four mechanisms: "recasting their goals in terms of national security ('*securitization*'), obscuring the full social or economic costs of a regime ('*masking*'), reframing an old or polluting technology as new or innovative ('*reinvention*'), or placing incumbent stakeholders in positions of political or regulatory power ('*capture*')" (Johnstone et al., 2017: 11). This approach emphasizes categorization, but lacks an explanation of how the tactics are connected to each other.

In contrast, Penna and Geels' (2012) dialectic issue lifecycle model (DILM) depicts incumbents' behavior as following a temporal pattern. The DILM's five sequential phases are: (1) problem definition and framing struggles, (2) rising public concern and defensive industry responses, (3) political debates and defensive hedging, (4) political regulations and diversification, and (5) spillovers to task

environment and strategic reorientation. The DILM gained some traction in the transition field, however, as its creators themselves concede, it is an "ideal-type pattern from which real-world cases may deviate (ibid.: 1015)."

Our study combines the aspirations of both these approaches: identify and categorize incumbent tactics and demonstrate how they are connected.

## 3. Materials, methods, and contextual background

### 3.1. Case selection

This study focusses on the behavior of German auto industry incumbents when faced with regulatory efforts to address environmental problems. We understand that the actions of incumbents are embedded in larger contexts involving policy makers, regulatory bodies, trade unions, other industries, consumers, and others. We take this broader dimension into account while we focus on the behavior, strategies and tactics of the automobile industry incumbents and in the interactions — the movements and counter movements — undertaken by the industry and political levels. When referring to strategies and tactics, we mean those employed by the automobile industry to defend their interests in the policy-making process, as opposed to the technological strategies that car makers pursue to comply with environmental regulations. Thereby, we seek to understand how the incumbents respond and their choice of strategy.

Some scholars have suggested that automobile industry incumbents in Germany appear to use resisting and delaying tactics to slow down the introduction of environmental innovations as well as deeper fundamental changes to the transport system (e. g. Richter and Haas, 2020; Späth et al., 2016; Bauner, 2007). However, these studies do not provide detailed analyses of how the political strategies play out in practice. Our study seeks to deepen the understanding of this type of behavior by closely exploring two historical cases of how German automobile incumbents responded to environmental initiatives. We thus examine two critical junctures in German transport and environmental policy: the introduction of the catalytic converter in the 1980s and the introduction of the particulate filter in the early 2000s.

Three criteria were used to select these cases. Together, they needed to (1) span a sufficiently large time period; (2) be "unique cases […] as members of a class or type of phenomenon", that is, instances of industry reaction to environmental policy; and 3) provide robust data material (George and Bennett, 2005: 113). We use a "structured" case study approach (George and Bennett, 2005: 67). In each case study, we present the environmental issue, the policy proposals, the industry's reactions, any counterproposals, and conclude with the outcome.

### 3.2. Data sources and analysis

The analysis of the automotive industry's strategies draws on desk research and interviews. The desk research includes official reports (such as of public authorities, environmental and industrial lobby groups, the automobile manufacturers), press releases, newspaper articles, gray literature, and academic publications. Using structured content analysis, the material was combed to reveal issue development and context and to acquire original statements of key actors. In 2020, interviews were conducted with ten stakeholders who have been working on environmental topics (particularly related to transport) for decades in diverse sectors and organizations, such as environmental NGOs, the European Parliament, politics (e.g., former state secretary), labor unions, media, think tanks and science. The interview partners were selected because of their insights into the processes of transport policy making and their background knowledge regarding the role played by various actors in these processes. The interviews thus served to fill gaps in the empirical material that is available via desktop research. The qualitative interviews followed a semi-structured approach. They lasted on average one hour and were conducted in person, via skype, or over the phone. Process tracing was used to connect data on the actions of the industry with insights into contextual factors such as competitors' behavior and political actions.

This research approach has its limitations. The analysis relies heavily on statements made by key actors in media material. The extent to which the media themselves are the subject of the industry's strategy cannot be answered here. Nor does this approach allow any conclusions about the coordination processes that took place within the respective firms or in political backrooms. In addition, the interviews were conducted with stakeholders who are proponents of environmentally friendly developments in the automotive industry.

### 3.3. EU policy and the German car industry

As we suggest above, the strategies and tactics of auto incumbents in Germany cannot be analysed without considering the larger context, including the policy processes in which, for instance, binding standards and regulations are set. For German automakers, the EU level is particularly significant in this regard.

To ensure that Member States cannot gain competitive advantages by tinkering with certain environmental regulations, motor vehicle emission standards (e.g., Euro 1–6 norm) — for example, for nitrogen oxide (NOx), particulate matters, and $CO_2$ emissions — are decided at the EU level. These negotiations are highly political with Member State governments and lobby groups jockeying to defend their interests.

The lines of conflict primarily run between countries that have domestic car production and those that do not; and between manufacturers of premium and large models (German) and smaller cars (French and Italian). In the 1980s and 1990s, when environmental policy was still new, the German auto lobby pursued a "flexible variant of direct lobbying" (Petersen and Schallaböck, 1995:

178) by being open to stricter limit values in Germany, but opposing such regulations within the European Automobile Manufacturers' Association (ACEA), which is the main European lobbying organization for automobile manufacturers. Such actions reveal the multi-scalar dimensions of the German automotive industry.

The main actors on the national level include some of the world's most well-known automobile manufacturers, such as BMW, Daimler, Opel and Volkswagen, and powerful interest groups that often act as the industry's spokesperson. The General German Automobile Club (ADAC) is the largest association of motorists in Europe and the German Association of the Automotive Industry (VDA) is the main industry lobbyist. The VDA is a powerful organization in Germany as well as at the EU level (Bandelow et al., 2013; Haas and Sander, 2019), and there have been close personal ties between the VDA and politicians for decades.

Many of these actors appear in the following case studies, in which we focus on the behavior of policy makers and incumbent industry actors as they negotiate solutions to two environmental problems.

## 4. The cases

### *4.1. The debate over the catalytic converter (1983–1984)*

#### *4.1.1. The environmental issue: Waldsterben*

The link between air pollution and automobiles has been publicly known in Germany since the 1960s (Petersen and Schallaböck, 1995: 88). As the number of vehicles rapidly increased and environmental problems intensified, the German government began to push for emissions reductions, which it had to do in coordination with the European Commission (EC) and other Member States. Against this backdrop, a new environmental problem emerged in the mid-1970s that prompted the German government to urge the German automobile manufacturers to act.

The problem was a new type of large-scale forest damage that appeared throughout Central Europe. The German term created to describe this phenomenon was *Waldsterben* (the dying of the forests), which connoted a powerful image and encapsulated the concern of the German public (Holzinger, 1994; Radkau, 2011). Most scientific studies stated that the cause of forest die off was related to air pollution, especially to NOx levels (Holzinger, 1994: 152). NOx is harmful to humans and the environment and causes acid rain.

In the public debate, passenger cars emitting NOx were discussed as a significant accelerator of *Waldsterben* and politicians were called on to act (Schmuck, 1996: 151). In principle, there were three options to reduce NOx emissions: reduce the total mileage of passenger car traffic; reduce driving speeds by introducing speed limits; or require catalytic converter filters be added to cars. Political consensus coalesced around the third option, with the newly formed Green Party also arguing for speed limits. One catch of mandating catalytic converters, however, was that they require lead-free gasoline. As Germany was still using leaded fuel at that time, policy makers would also have to phase out leaded fuels.

#### *4.1.2. Automotive industry initial reactions*

When the issue of *Waldsterben* appeared on the political agenda, some members of the automotive industry were somewhat cooperative while others played down the effects of automobiles on forests. There were varied positions within individual firms and also between automobile manufacturers (WZB, 1996 14). The introduction of unleaded gasoline and catalytic converters to the German market would have been acceptable for upper-end automobile manufacturers like BMW, Daimler, and Porsche. These firms were already exporting converter technologies to the U.S. and Japan (Gaul, 1983; Spiegel, 1983a, 1983d). For instance, BMW's CEO argued that BMW-cars with converters and fueled by unleaded gasoline would not suffer the performance and consumption disadvantages portrayed by other manufacturers (Gaul, 1983). The lower-end manufacturers, VW, Ford and Opel, balked. Unlike the other firms, they would have been unable to quickly produce any models that could use unleaded gasoline and catalytic converters. VW's CEO responded by publicly opposing the new political initiatives and questioning the scientific basis for linking automobile emissions to *Waldsterben*: "The exact causes have … not yet been clearly analyzed" (cit. after Spiegel, 1983c). VW's development chief also called for more impact research on *Waldsterben*, before car companies and consumers squander billions on new environmental protections (Spiegel, 1983b).

The VDA lobby organization followed an ambiguous almost self-contradictory approach. In its annual report of 1982/1983, it acknowledged the environmental impact of automobiles. Yet, it downplayed the link to acid rain and *Waldsterben* from car's exhaust emissions by emphasizing the lack of decisive scientific evidence (VDA, 1983: 48). Further, the VDA asserted that the extent of environmental harm caused by the transport sector was unclear and that the connection between the two was motivated by political agendas. However, it also conceded that lead-free catalytic converter technology would be the best option for quickly achieving exhaust gas improvements in new vehicles (VDA, 1983: 50). However, it would not be possible to simply transfer the U.S. experience with converter technology to Germany. "Adaptations" would be needed on the German and European levels (VDA, 1983: 52).

#### *4.1.3. Proposed policy remedies – and a timeline*

In 1983, public pressure over *Waldsterben* led the Federal Minister of the Interior, Friedrich Zimmermann, to take action. In April 1983, Zimmermann invited the state secretaries of the Economics and Transportation Ministries as well as representatives of the automotive and petroleum industries for talks. The government emphasized the need to reduce exhaust emissions. Zimmermann argued for the catalytic converter and unleaded fuel, and it was agreed that the manufacturers would present proposals within six months. For its part, the industry requested that the German government work towards achieving a consensus on the introduction of the catalytic converter and unleaded gasoline on the European level and eschew a German stand-alone approach (Spiegel, 1985a). As we outline below, chances to achieve such a consensus were slim ab initio.

However, shortly after this meeting, the government made more concrete policy announcements and specified that unleaded gasoline would be introduced on January 1, 1986. Concomitantly, the catalytic converter would become mandatory for all petrol automobiles (Federal Government, 1983). On October 26, the Cabinet also passed a resolution that, as of January 1, 1986, automobiles using unleaded gasoline would have to comply with the much higher U.S. emission standards — which could only be met with the catalytic converter. The requirement of the U.S. emission standards would make German standards higher than the EU's. It was exactly the type of stand-alone initiative the automobile manufacturers feared.

#### *4.1.4. Automobile industry coalition and counterproposal*

The automobile industry was caught by surprise (Spiegel, 1983g), and VW, Ford and Opel successfully exerted pressure on the other manufacturers to form a united front. Top executives at BMW, for example, "swung fully to the industry line and pleaded for a postponement of the planned changeover" (Gaul, 1983: 25).

The main line of argument was that the policy makers' deadlines could not be met (Gaul, 1983), and the auto industry countered with its own "introduction concept" - a "realistic timetable for the realization of further steps to improve air quality in European cadence" (VDA, 1984: 50). This timetable shifted the introduction of all new cars meeting the ambitious U.S. emission limits to the end of 1989, four years after the German government's proposal. In the run-up period, the automobile manufacturers offered to bring out new environmentally friendly models, albeit on a voluntary basis.

Working together, the industry actors unleashed an array of tactics to delay the introduction of unleaded gasoline and catalytic converter technology. For its part, the VDA argued that the changeover would require an extreme technical effort that could not be achieved within three years (VDA, 1984: 51). Furthermore, the manufacturers argued they would need more information about the regulations for exhaust emissions before fully switching to the converter technology.

Economic concerns were also raised. Automobile executives argued that a sudden introduction of the catalytic converter would drive up unemployment rates within the industry. Supplier industries would also suffer considerable job losses (Spiegel, 1983f). Executives from Ford and Opel were even more explicit. If the German government insisted on the January 1, 1986 launch, then engines from the group's parent companies would have to be imported from abroad, to the detriment of domestic production. The automotive industry also argued that the price of conversion would be costly for consumers and the national economy (Spiegel, 1983f). Finally, the VDA argued that the continuous debate about the introduction of the catalytic converter would unsettle buyers and lead to a decline in sales (Hoffmann, 1984).

One other argument concerned the choice of technology. The VDA argued for engine optimization and opined that catalytic converter technology was by no means the best option, partly because it would require higher fuel consumption (VDA, 1984: 53) – a stance that contradicted its position in 1983 when the organization favored the converter. Last but not least, the VDA asserted that policy makers could set emission targets, but they should let the manufacturers devise the technological means to reach them. The main problem with this assertion was that, left to their own devices, the manufacturers were too slow.

#### *4.1.5. German government's attempt to be a vanguard for Europe weakens its bargaining position*

The German auto industry's delaying strategy gains significance when set against a larger context. At that time, it was already apparent that the German government's stand-alone approach within Europe — to stipulate stricter U.S. emission standards for all cars registered in Germany — would have little chance of success. Yet the VDA still argued for a European consensus before moving ahead (VDA, 1984: 51), which can be interpreted as part of the delaying strategy.

But why were chances of success so slim? Unleaded gasoline could only be introduced with the EC's blessing, because the EC at that time still allowed leaded gasoline. If Germany was to require its citizens to fill up only with unleaded gasoline, then the other European automobile manufacturers would have disadvantages in selling their models on the German market. The same applies for the converter technology. Germany's stand-alone shift to unleaded gasoline would lead to action by the European Court of Justice. And, as the VDA reasoned, it could cause a tangible economic backlash (Hoffmann, 1984) if other European countries retaliated by shutting their markets to imports of German automobiles. This would mean that the export surplus of 15.5 billion Marks generated by the German automotive industry would be at stake (VDA, 1984: 51). The risks of the stand-alone approach were exceedingly high.

France, Italy, and Great Britain — the other EU Member States with strong auto industries — did not agree with Germany's plans (Holzinger, 1994: 175). Their domestic auto industries would be disadvantaged and trade conflicts would have ensued. French and Italian firms would have been particularly affected as they produced smaller cars for which the converter was more price intensive. In an October 1983 article, *Der Spiegel* surmised that if Italy and France said no, the German government could only rely on voluntary agreements with the auto industry, which it would have to incentivize with tax breaks (Spiegel, 1983e).

The auto industry already had an idea about this. In its introductory concept, it proposed that the German government compensate "at least in part" for the increased acquisition costs of catalytic converter vehicles by waiving the motor vehicle tax for these cars (Spiegel, 1983e: 138). In other words, the German government's insistence on surpassing the EU's emissions standards gave the automobile industry a negotiating advantage.

#### *4.1.6. The outcome*

The resistance of the automobile industry was ultimately crowned with success. Zimmermann eventually buckled and, in summer 1984, even adopted the industry's step-by-step introductory plan with a transition period of four years (Spiegel, 1984c). This move also took the mandatory introduction of the catalytic converter off the table. Catalytic converter technology would only be mandatory for all new cars from 1990 onwards, at the earliest. Unleaded gasoline, however, would be introduced in 1986. The main argument of the automobile industry was that the EC would not agree to Germany's stand-alone actions (VDA, 1984).

Indeed, Zimmermann was not able to push through his ideas on the European level. At a meeting of EC environmental ministers in early 1985 - in the so-called Lisbon Compromise - it was decided that the deadline for the registration of environmentally friendly cars would be pushed until the early 1990s. This affected about 85 percent of vehicles. Only cars with an engine capacity of two liters or more would be subject to limits from 1988/89 onwards. Reaching these limits would require a catalytic converter (Schmuck, 1996: 147).

#### *4.1.7. The speed limit debate and the final push for the converter*

The lengthened timeline, however, did not stop the forests from dying. German policy makers began looking for other mitigation measures and returned to one of the earlier options: introducing speed limits. Many stretches of the German highway system had no speed limits, so a 1984 proposal to limit speeds to 100 km/hour (ca. 62 miles/hour) was highly controversial. The entire German automobile industry was opposed. It had gained its global prominence by building powerful engines that can perform at high speeds: if high speeds were taken away, so would the raison d'être for high-performance German engines.

To prevent speed limits, the industry and its supporters trotted out many of the same tactics employed against catalytic converters. For example, doubt was cast on whether speed limits would reduce NOx levels and calls were made for more research on the environmental impacts (VDA, 1984: 59). Daimler issued a study that downplayed the positive environmental effects of speed limits (Mayer-List, 1984; Spiegel, 1984a). Also, dire economic prognoses were issued. The VDA, for example, warned that the entire industry could decline and raised the specter of job losses (Spiegel, 1984b). Concerns were also raised that the speed limit issue was coming too soon after the catalytic converter debate: buyers were deeply unsettled by all the proposed changes and sales were dropping (Spiegel, 1984d). The effect of the government's focus on speed limits was that the automobile manufacturers suddenly found catalytic converters to be palatable. In 1985 a quid-pro-quo compromise was reached: the industry accepted catalytic converters and, in exchange, the speed limit proposal was dropped (Spiegel, 1985b). In addition, the federal government agreed to subsidize automobiles newly registered between 1986 and 1988 with a reduction in the motor vehicle tax for up to seven years.

The time that policy makers and industry actors spent wrangling over the catalytic converter, unleaded gasoline and speed limits allowed more damage to be done to the environment. By 1989, less than 50% of new cars from German manufacturers were equipped with exhaust gas purification. Between 1970 and 1990, traffic increased by two-thirds. In 1979, 27% of NOx emissions came from traffic; a mere 11 years later, this number had increased to 55% (cit. after Haefeli, 1999).

### *4.2. Struggles over the diesel particulate filter (1999–2006)*

#### *4.2.1. The environmental issue: particulate emissions and human health*

Diesel engines have generally been considered less climate destructive than petrol engines, primarily because they require less fuel to cover the same distances and thereby emit comparatively less $CO_2$. Between 1975 and 2002, the percentage of diesel cars in Germany rose steeply, from 5% to 38% (Haum and Petschow, 2003). However, diesel engines produce other types of pollution, such as fine particulates like soot ('Carbon Black'), which are linked with respiratory illnesses and cancers. In the early 2000s, mounting scientific evidence indicated they also contribute to the greenhouse effect (Gerlach, 2008; Haum and Petschow, 2003). At that time, German manufacturers did not have an in-engine solution nor did they provide filters to reduce the emission of soot particulates.

#### *4.2.2. Proposed policy remedies*

The regulation of diesel automobiles started through a 'back door'. Shortly after the Green Party and the Social Democratic Party (SPD) won the German federal elections in Fall 1998 and formed a Red-Green coalition government, an unusual grouping emerged with the aim of promoting low-sulfur and sulfur-free fuels (BMU, 1999; VDA, 2001). These fuels are a prerequisite to exploiting the potential of new engine technologies for reducing fuel consumption and emissions, such as particulates. The new alliance consisted of the Ministry of the Environment (BMU), the Federal Environmental Agency (UBA), the VDA lobbying organization, the ADAC motorist association, and a well-known environmental NGO (DUH). It was agreed that the political level would promote the 'clean' fuel against the interest of the mineral oil industry, while the auto industry would introduce 'cleaner' diesel technologies (Interview, DUH). At a press conference in Fall 1999, it was publicly announced that sulfur-free fuels would be introduced and subsidized (BMU, 1999).

#### *4.2.3. Initial industry reaction*

With these actions, Germany took a leading role in Europe. One part of the alliance—the political actors—had thus fulfilled their part of the agreement to make diesel cleaner. Now it was up to the automotive industry to bring new technologies to market in order to reduce the fine particulates emitted by diesel automobiles (Interview DUH, 2020). BMU promised to promote them financially. However, there were different positions regarding whether a filter would be needed to lower the emission of fine particulates and comply with the Euro 4 emission standard (to be introduced in 2005). In its 2000 Yearbook, the VDA took the position that emissions should be prevented from the start by engine modifications rather than retroactively filtered out (VDA, 2000). The VDA further denied that filter systems were already in the state of mass production (VDA, 2000: 15). Regarding this line of argument, some scholars assume that the automobile industry had silently agreed not to introduce filter systems prematurely onto the market (cit. after Haum and Petschow, 2003: 21). In contrast, the BMU pursued the position that filters would be a suitable solution. Long-term tests by the ADAC and UBA showed that filters would "drastically reduce particulate emissions (especially ultra-fine particles)" (Haum and Petschow, 2003: 23); even below the ceiling of the Euro 4 standard. However, during the following few years, the industry introduced neither in-engine modifications nor a filter solution.

#### 4.2.4. Government and civil society steps

In the early 2000s, several events occurred that increased pressure on the automobile industry to adopt particulate filters. In September 2001 Greenpeace initiated legal action against the automotive industry and the Federal Motor Transport Authority, thereby raising public awareness. In September 2002, Greenpeace proved the particulate filter's effectiveness by conducting road tests with a retrofitted used Mercedes. A few months later, a broad alliance of environmental and consumer protection organizations initiated the 'No Diesel without Filter' campaign, which called for all diesel vehicles sold after July 1, 2003 to have particulate filters and for tax incentives to be introduced that would accelerate the process.

In October 2002 the recently re-elected Red-Green coalition called for higher European-wide emission standards and for tax incentives for the filters, which would increase demand by making it more attractive for buyers to request them (Coalition Agreement, 2002; see also VCD, 2003). In November 2003, the Conference of Environmental Ministers of the German federal and state governments spoke out in favor of comprehensive tax incentives for soot filters – to such an extent that, if possible, the voluntary purchase of diesel vehicles with filters would be encouraged even before the new EU-emission limits (Euro 4 standard) for 2005 came into force (VCD, 2003).

In Spring 2003, the BMU and its French counterpart called for more ambitious European emission standards, the Euro 5 standard, to be implemented in 2010, with levels that could only be met through the use of particulate filters (in June 2004, the German Minister repeated this call). In this case, Paris was an interesting ally, as the French automobile group Peugeot Citroen was the first manufacturer to introduce a filter system in 1999 (Haum and Petschow, 2003: 21).

#### 4.2.5. Industry reactions

Around 2002, the automobile manufacturers and the VDA started a two-pronged approach, which they followed for a while. On the one hand, they criticized filters as both causing higher fuel consumption (VDA, 2004) and being a half-measure that only filtered out some pollutants. As before, the auto industry still held on to its preference of more comprehensive in-engine solutions (VDA, 2003: 162; Gerlach, 2008: 163). VW even claimed it was in the midst of developing engines that would be able to meet the next level, the Euro 4 standard.

On the other hand, the industry resorted to the same kind of defensive tactics as seen in the other case. In 2003, for example, the VDA cast doubt on the environmental data with the statement that "to date, no quantitative risk assessment of the effects of automotive diesel soot emissions is possible from epidemiological data, as would be necessary for a calculation of a possible environmental risk" (VDA, 2003: 160).

Economic concerns were also raised. The automotive industry was against tax incentives for filters, because they were concerned this would lead to a mandatory, across-the-board introduction of filters and would obviate the need for an in-engine solution, thus hindering technological advancement. As the VDA stated: "Diesel technology is too important for our industry and for our jobs in Germany…". VW's CEO also raised concerns about "serious economic consequences for customers and manufacturers" (Reitz, 2004). In the following months, he tried to directly influence German Chancellor Schroeder to delay the introduction of tax incentives until 2007 and to raise limits for particulates as discussed on the EU level (DUH, 2004).

The German industry was unhappy about the prospect of tighter EC standards—and with the German government's activities to secure these. The VDA warned that such standards would "weaken the competitive position of our industry in a crucial area" (Hamann, 2005, 6), presumably because higher standards would be to the advantage of foreign competitors, who could already meet them with filters.

Additionally, the VDA argued that incentivizing one particular technology would prevent innovation, and that policy makers should aim for achieving impact rather than specifying technologies (VDA, 2004: 136). VW also argued that it should be up to the manufacturers to determine the best technical solutions (Gerlach, 2008: 163).

For several years the automotive industry was fairly unified in its preference for developing an in-engine solution over a filter fix, but the technology was taking too long to develop, especially when filters were already available. Pressure on the manufacturers continued and, by spring 2003, cracks had started to appear in their united front (Köhn, 2003). Ford already had a partnership for diesel engines and particulate filters with the French manufacturer, Peugeot, and indicated its willingness to accept a filter solution (Handelsblatt, 2003). Shortly afterwards, Daimler, BMW, and Opel started to offer cars with a filter, for a surcharge—but still preferred a more comprehensive in-engine solution.

#### 4.2.6. The outcome

In November 2003, the Conference of Environmental Ministers of the German federal and state governments spoke out in favor of comprehensive tax incentives for soot filters—to such an extent that the voluntary purchase of diesel vehicles with filters would be encouraged before the new emission limits came into force. In July 2004, Chancellor Schroeder announced that tax incentives for the filters would become law on January 1, 2005. This marked a "turning point" in the filter debate (Gerlach, 2008: 176). At a summit meeting in the Chancellor's Office in July 2004, the German auto industry relented and promised to voluntarily — without surcharges — equip all domestically registered diesel cars with particulate filters by 2009. In return, an agreement was struck that a tax subsidy would be provided for limit values of 8.5 mg of soot particles per kilometer. But the struggle over the filter was not yet finished. At the end of 2005, a number of manufacturers, including BMW and Daimler, tried to block the retrofitting of diesel vehicles with filters. VW spearheaded this effort to hinder filter development and was criticized for equipping only its upper-end vehicles with filters (BMU, 2005; DUH, 2005).

It was months before a corresponding decision on tax incentives for retrofits was made. In March 2006, a compromise was reached: the automobile manufacturers would get a one-off tax subsidy of 330 Euros for each diesel car they retrofitted with a particulate filter

between January 1, 2006 and December 31, 2009. In exchange, diesel cars without filters would be subject to a surcharge of 1.20 Euros per 100 cubic centimeters of engine capacity until March 31, 2011.

## 5. Findings and discussion

This study started from the assessment that the transformation of the car-centered transport system in Germany is not progressing, and the analysis was driven by a desire to understand why this is so. Regarding the crucial role played by industry actors in shaping the path of transport and environmental policies, the research literature suggests that they hinder rather than promote fundamental changes. However, how industry reacts to environmental problems and exerts its influence on policy makers has received scant in-depth attention. Our analysis of the two historical cases supports earlier findings about industry incumbents, but provides a more fine-grained picture.

Our analysis shows that the industry's strategy was to delay the introduction of policies that would reduce pollutant emissions, and this unfolds in a specific behavioral pattern. First, industry actors responded with 'symbolic' promises when confronted with policy maker requests to solve the problem of *Waldsterben* and the high concentrations of particulate matter in the air. The really interesting point is how — from this point on — policy makers and industry incumbents tried to outmaneuver each other. Once policy makers' proposals became more specific (technological innovations and timeline of introduction), some or all industry actors resisted.

Where differences in positioning existed within the industry, the VDA worked to 'harmonize' the competing voices into a united front (Penna, 2014: 311), which was more apparent in the converter case. The united front position accepted that 'something needs to be done', but according to the industry's terms. This seemingly cooperative 'wait-and-see approach' changed, however, when pressure for action continued to increase from the political and public realms. Both cases illustrate that once the industry's 'we will think about what to do' approach lost viability, various other delaying tactics were implemented, including some case-specific ones that we discuss below. Finally, when pressure on the industry became very high, the unified position of the industry crumbled, with some manufacturers using the technological innovations earlier than others.

Some scholarship has described incumbent behavior when confronted with demands for change as following a temporal pattern, for example, the five sequential phases depicted in the DILC model (Penna and Geels, 2015). We posit that the incumbent actors' steps are not following a set sequence, but are instead a response to the degree of external pressure placed on them and their available options for reducing the pressure. It is a subtle but important difference. We surmise that this pressure-response pattern occurs because the industry adjusts its "choreography of delay" according to the context as it unfolds.

Our cases also demonstrate some new and unexpected dynamics, such as how the industry and government both used the European level, either to push or slow down the actions of the other side. In the case of the catalytic converter, industry actors agitated for a European solution and against a German stand-alone approach. At that time, a number of European countries rejected not only the converter but also the harsher emission limits. This meant there was a counterforce to the German approach that was in line with the industry's interests. However, the situation in the filter case played out differently. The German government was able to ally with France — home to Peugeot, which already offered the filter — to push for the quick introduction of the filter at the EU level. In this case, the EU level was beneficial for the German policy makers. These findings suggest that the EC has the potential to create a 'level playing field' when industry and government interests collide.

Our analysis further demonstrates that the automobile industry used several resistance tactics we identified in the literature, primarily *Warn of Economic Consequences*, particularly potential job losses (which is still used today to fend off climate and environmental standardization), *Criticize the New Technologies, Criticize Government Interference in R&D*, as well as *Doubt the Scientific Data*, and *Generate Countervailing Data*. Our findings contribute to systematizing various tactics that are otherwise sporadically described in the transition literature. We also add case-specific variations of known tactics and demonstrate their significance to the 'choreography of delay':

- *Need More Time*: A core tactic used by the industry in both cases was to argue that it was not possible to bring the new technology within the timeframe proposed by policy makers. This argument is surprising in view of the fact that the manufacturers had been exporting cars with catalytic converters to the U.S. since the 1970s. In the case of the filter, ADAC and BMU had made a recommendation at an early stage. And, by retrofitting an old Mercedes, Greenpeace made the entire auto industry look insincere—because clearly the converter worked.
- *Criticize Efficacy of Government's Solution*: The industry argued that there were better solutions than those proposed by policy makers, and that they would work on them. However, none of the auto manufacturers were able to present an alternative. In the case of the catalytic converter, it is also surprising that the VDA changed its opinion within a short amount of time from being the best option for quickly achieving exhaust gas improvements in new vehicles to just another alternative.
- *Scare Customers Away*: This is a sub-tactic of the *Warn of Economic Consequences* tactic. Automobile manufacturers argued that the policy changes would be price intensive and scare away customers. Also, the continuous debates about proposed changes to the market would unsettle buyers and lead to market decline. It should be noted, however, that the sales figures for the auto industry since the 1980s have been steadily increasing, with the exception of 'crisis year' 2009. Hardly any other industry has recorded such continuous sales growth.
- *Compensate Us/Provide Quid Pro-Quo*: Compensation for the introduction of 'solutions' was the turning point in both cases. However, they differed. Whereas in the converter case it was the promise of policy makers to drop the unpopular speed limit proposal, in the case of the filter it was primarily a matter of financial gifts in the form of tax breaks. Tax breaks, in particular, only seem desirable once domestic industry has the technology in series production, so as to not cheat foreign industries.

Some of these tactics are a refinement of ones already established in the literature (see Section 2.3.); for example, the tactic *Scare Customers* Away adds a nuance to the *Warn of Economic Consequence* tactic. Similarly, the tactic *Criticize Efficacy of Government's Solution* reinforces the *Criticize Government Interference in R&D* tactic.

Our findings also raise several issues and leave gaps for other scholars to fill. First, how does the strategy of delay and the tactics identified in the German catalytic converter and particulate filter cases manifest in other cases? Recent studies suggest that automobile incumbents are still using these tactics to resist other policy initiatives, such as stricter $CO_2$ emission targets and the push for battery electric drives. And, there are indications that incumbents are pursuing "a double-strategy", that is, agreeing to innovate when political delaying tactics falter, while concomitantly pursuing other avenues to derail regulations supporting innovations (Richter and Haas, 2020, 14; see also Späth et al., 2016). Further studies could investigate such 'subversive' actions and explore how incumbent actors' strategies and tactics play out depending on the context (e. g. according to the type of environmental problem/regulation, political actor constellations, etc.).

A second fruitful area of research could be cross-country comparisons of how industries react to environmental policies. For example, the case of air pollution regulation in the U.S. in the 1970s suggests that industry fought against strict regulation by adopting delaying efforts. Thereby, incumbents used tactics beyond those described in our study, such as mobilizing support within Congress to delay hearings and mobilizing pressure on members of Congress (Penna, 2014). Other accounts relate how industry incumbents in the U.S. accommodated to regulations and innovated technologies while lowering the costs of production (Lee et al., 2010). Comparative studies could also explore the concept of 'diverging innovation strategies', which are sensitive to local barriers and drivers for change (Bauner, 2007).

Third, the mounting problems associated with environmental and climate crises will require progressive actions from companies. However, as our study shows, the German auto incumbents have been a regressive force and have successfully deployed, for many decades, delay strategies and tactics. They have pursued such strategies despite branding themselves as forward-thinking companies, as emblemized by slogans such as "Vorsprung durch Technik" (advancement through technology). This image is problematic — and perhaps even misleading — because, as seen in the 2015 diesel scandal, German carmakers did not rely on "Vorsprung durch Technik" to comply with emission values, but expended great effort to cheat. Some experts posit that the diesel scandal shook public confidence in the automotive industry as a whole (e. g. Bratzel, 2018; Rammer et al., 2017). Future studies could explore whether this crisis provided an impetus for the industry to change course or if the incumbents have continued their preference for regressive tactics — and, whether crises, in general, prompt progressive change.

## 6 Concluding remarks

The automobile-centered transportation system has caused serious environmental problems, some of which could have been quickly solved. As our cases illustrate, the converter and filter were available technological solutions to air pollution. However, the automobile industry resisted these solutions and had ample resources to cause significant delays and ultimately gain concessions. Our study thus exemplifies that power and asymmetrical power relations "across multiple sites of visible and invisible struggle, in all shapes and sizes, from the intimate to the infrastructural, and across micro and macro scales" (Sovacool and Brisbois, 2019: 26) play a critical role in processes of transformation. However, as mentioned in section two, power relations have hitherto been understudied (Moss and Gailing, 2016; Haas, 2019), aside from a few exceptions (e.g. Avelino, 2017; Goerg et al., 2017). Our analysis contributes to this body of research by presenting empirical data and illuminating the strategy of the incumbent car industry to discursively exercise its power and influence policy making to its benefit.

We also hope that the data from our two historical cases strengthens the transition field's body of research on the factors blocking progress, such as incumbent behavior. Our work contributes empirical insights that illuminate the political strategies deployed by incumbents to defend their interests when confronted with environmental initiatives and transformational demands. We believe that if such regressive behavior is to be curbed, one must first understand the underlying dynamics, such as the 'choreography of delay' we identified.

This choreography illustrates that the tactics of incumbents are not chosen at random but rather deliberately. Incumbents follow a basic pattern of delaying and - when action becomes inevitable - imposing their own solutions to supplant those of policy makers. The final step in the choreography, in both our cases, was a financial concession from the political realm. Our cases also indicate that the selection of particular tactics by incumbents does not follow a temporal sequence but is largely contingent on the context and the degree of public and political pressure.

When it comes to effecting urgent changes to the transportation system, it is not easy to steer incumbents in a particular direction. To foment change, the political and public arenas must place substantial pressure on incumbents. Therefore, it is key for advocates of change to be aware of and thus one step ahead of incumbents and their tactical maneuvers. The industry's warning of economic losses, for instance, is still a prominent argument in today's debates and feeds off the narrative of the German automobile industry as the backbone of the German socioeconomic model (see also Späth et al., 2016). This industry tactic raises the specter of economic disaster; however, over the past decades, hardly any other industry has experienced such continuous economic growth as the automotive industry. The fact that these tactics continue to be effective can be seen, for example, in the development of electromobility. Despite many years of political debate and demands, which became more vehement after the financial crisis of 2007–2008, electromobility has only recently gained traction in Germany. Here, too, industry, together with other actors such as the trade unions, has delayed developments (e.g. Richter and Haas, 2020). Whether these delay tactics will continue to be successful, in the face of mobility market realignments, the looming environmental crisis, rising energy prices, and pressures from packed urban centers, is yet to be seen.

Against this background, the 'choreography of delay' that we revealed can also be understood as an analytical framework against

which companies' actions can be identified and actively addressed. Moreover, studying incumbents' tactics can unveil what incumbents consider to be the 'weak spots' that shield them from transformational interventions. Finally, our case studies illustrate that the political debates and policy measures to address air pollution were primarily focused on solutions that were technical adjustments. Because they were incremental adaptations, they contributed to stabilizing the status quo of the car-centric transport system (Zijlstra and Avelino, 2012). Policy options that would have entailed more radical changes to 'deep structures' (Geels, 2004) and 'incumbent structures' (Stirling, 2015: 62) were not even up for debate. The speed limit proposal could have presented a substantial challenge to the status quo, but it served at best as leverage to get car companies to implement the converter. While it is hardly surprising that incumbents are interested in sustaining a well-functioning business model, advocates for change should pay more attention to proposing alternative policies and not allowing incumbents' preferred solutions to define the transition path.

The lack of real transformation in the transport sector is evident in the increase in individualized mobility and by the rising number of larger and more powerful cars on German roads. Our analysis implies that technological innovations can be an important component of a transformation towards sustainability (Stirling, 2015: 62). However, they are not the silver bullet. If the primary focus of policy makers and industry actors is on technical optimization — without accompanying deeper structural changes — then the automobile industry's path might get greener, while the overall transport system continues in the same direction.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data from interview material are confidential; list of analyzed media material is available on request.

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