



*Car Firms and Low-Emission Vehicles: The Evolution of Incumbents' Strategies  
in Relation to Policy Developments*

R. Bohnsack

# CAR FIRMS AND LOW-EMISSION VEHICLES

The evolution of incumbents' strategies  
in relation to policy developments



René Bohnsack

## English summary

Global challenges such as climate change, resource depletion and energy security, as well as local challenges including air pollution and congestion, have led governments around the world to require the car industry to become more sustainable and to invest in more environmentally-friendly products, especially low-emission vehicles (LEVs). While cars with an internal combustion engine have been made more efficient by incumbents to defend its dominance, car firms have also increasingly engaged in various low-emission vehicle technologies, namely hybrid, electric and fuel-cell vehicles. This dissertation studied the car industry and the evolution of low-emission vehicles under the influence of policy interventions. It explored how the interplay between policy interventions and car firms' strategies has evolved over time and how firms have adapted their innovation strategies and business practices.

To shed light on the interplay between firm innovation and policy interventions, this dissertation studied international LEV developments from 1997 until 2010. It sought to answer four research questions: 1) How have low-emission vehicles evolved internationally over the years, and in what way have government policies influenced firm innovation?, 2) in the trajectory of low-emission vehicles, what has been the influence of protection mechanisms of governments and incumbents, respectively?, 3) in designing business models, how have incumbents dealt with the tension of the disruptive character of electric vehicles and the influence of government intervention?, and 4) considering the disruptiveness of low-emission vehicles, what have been the strategic motivations of car firms to engage in electric vehicles?

Four empirical chapters shed light on the factors central to this development. The empirical chapters were based on a large dataset of multiple industry and newspaper sources from 1997 until 2010. Performing a keyword search of the most important LEV technologies a dataset was compiled that included 9,908 articles from two trade magazines (Automotive News and WardsAuto World), a car magazine (Autoweek) and a daily newspaper (Financial Times). The dataset was carefully analyzed using the qualitative data analysis software Atlas.ti 6.2.

The first empirical chapter (Chapter 4) gave an overview of developments throughout the whole period. It enabled an understanding of the major international players in the industry over several years in light of technological, market and policy developments. Based

on the empirical analysis of the international LEV development, the chapter proposed mechanisms which explain why and how technological trajectories occur internationally.

Next, in describing how LEVs emerged, explanations commonly refer to government regulation, incentives or public-private projects. The analysis in Chapter 5 showed that in addition to such ‘protected spaces’ provided by governments, incumbents also ‘protected’ the development and commercialization of green cars themselves by supporting ‘unprofitable’ activities. Chapter 5 puts forward a framework that allows us to distinguish the type of protection and for whom it is most suitable, depending on the type of innovation—disruptive, systemic, or socially embedded. The analysis of the LEV trajectory shows that both governments and incumbents protected the LEVs. The interplay was illustrated in two trajectories, and this study found that although private protection was more effective, government support was necessary to trigger the trajectory.

The third empirical chapter (Chapter 6) studied business models for the commercialization of electric vehicles (EVs) in more detail. The commercialization of EVs has been a struggle for car manufacturers, as EVs are expensive, require a new recharging infrastructure, and have a shorter driving range than ‘current’ cars (with customers thus having to change their driving and recharging patterns). Besides barriers inherent to the technology, the empirical results implied that, in addition to the ‘incumbents’ curse due to a firm’s history—i.e., path dependence—surprisingly, government support also impeded the successful diffusion of EVs through what is, for now, coined the ‘incentive curse.’ Firms face the incentive curse when government incentives foster counter-economic choices.

The last empirical chapter (Chapter 7) subsequently explored incumbents’ motivations to engage in sustainable innovations such as EVs and contributed to the sustainable innovation debate. The chapter revealed that one of the benefits of engaging in sustainable innovations—in addition to first-mover advantages, CSR activities and policy pre-emption—is the possibility to facilitate strategic turnarounds. These motivations provide insights as to why and when firms invest in sustainable innovation which is valuable for analyzing and differentiating reasons for firms’ engagement in, for example, environmentally-friendly technologies.