Whose Legitimacy? China’s Drive for Electric Vehicles

ABSTRACT Green technologies have become a field of competition between countries that are looking for new areas of economic growth and building low-carbon economies. This paper focuses on the case of electric vehicles (EVs) to look at the various actors embedded in the innovation network and explore the progress of and challenges to the diffusion of EVs in China. It complements a systems of innovation approach with the theory of institutional legitimacy, and discusses the regulative, normative, and cultural-cognitive types of legitimacy for different EV-related actors in China. We argue that the EV industry has gained a certain level of regulative legitimacy from the Chinese central state and some local states, but because of power struggles among stakeholders, it has not achieved much normative or cultural-cognitive legitimacy. In fact, it seems that what consumers want is different from what the central and local states have promoted. The discrepancy in different types of legitimacy is also because state investment in green technologies is more of an industrial policy than an environmental policy, seeking to leapfrog China into a technological powerhouse. We thus propose that when studying systems of innovation, it is important to take into account power dynamics across actors and the interactive process of establishing legitimacy, because institutions should not be taken as static, pre-given structures. The different layers of institutions are not always congruent, and when faced with conflicting institutional demands, actors may develop strategies to adapt and change the institutions.

KEYWORDS China, electric vehicles, institutional legitimacy, systems of innovation, power

INTRODUCTION
As a result of increasing concerns over global climate change and environmental degradation, green technologies have become a new field of competition between countries that are concurrently facing an economic downturn and seeking alternative models of development to the current high-carbon economy. This paper considers the case of electric vehicles (EVs) for three reasons. First, since the global recession in 2008, a number of countries—notably the United States, EU countries, China, and Japan—have started to see electric cars as providing new growth potential and have implemented various policies, from subsidies to tax credits, to incubate the industry. Second, it is a field where different technologies are still competing and evolving, with no definite leaders yet. Third, it has a strong and well-established competing interest—the gasoline auto industry—which makes formulating state policies challenging. The Chinese case is particularly illuminating because of China’s status as an emerging economy and the world’s factory, its lack of technological innovation in the conventional auto industry, and its sociopolitical context, which differs from Western
countries. As China seeks ways to move up the value chain, EV is perceived as an opportunity for technological leapfrogging (Pérez 2001), in which latecomers bypass previous technology pathways and catch up with advanced countries. Goldemberg (1998) and others specifically discuss the concept of energy technology leapfrogging and the possibility for industrializing countries to avoid the resource-intensive pattern of economic development by adopting the most advanced energy technologies available.

In 2017 China sold 579,000 EVs, 2.2% of its automobile market share and the most EV sales in the world, almost three times the number in the United States (McCarthy 2018). But before the rapid increase in sales after late 2015, for almost six years, beginning in 2009, China had struggled to promote EVs. In 2009 the central government set a goal of producing at least 500,000 hybrid and all-electric vehicles by the end of 2011, but by early 2013 only about 28,000 EVs had made it to the roads, of which about 80% were public buses (Ma and Hagiwara 2013). In response, in 2012 the government set new goals of producing 500,000 EVs by 2015 and five million by 2020, in the Plan on Energy Saving and the Development of the New Energy Vehicle Industry (2012-2020) (NEV Plan). A new round of incentive policies was launched in late 2013. However, even the revised goal was not met in 2015, despite a push from the state and inflated sales numbers due to subsidy fraud.

This paper intends to solve a puzzle in the development of EVs in China: why was there a disconnect between state policies and the industry’s actual development? We also hope to shed light on how China’s EV-related institutions work and how the actors involved protect and promote their interests in the process.

LITERATURE REVIEW

Although innovation can happen at the individual level and by chance, in most cases it is a “collective achievement” (Van de Ven et al. 1999). Thus, a systems of innovation (SI) approach has been applied to the study of innovation activities and the wider institutional framework in which these activities are embedded (Edquist 1997, 2005). One important approach in the SI literature focuses on the spatial level delimited by national or regional boundaries. For example, the “national innovation systems” concept, popularized through Freeman’s study in the 1980s of the success of the Japanese economy, has been used as a framework to address the processes of innovation that explain the differences in countries’ innovative performance and their international competitiveness (Freeman 1987, 1995; Freeman and Lundvall 1988; Lundvall 1992; Nelson 1993). Proponents argue that variation in national innovative performance depends on “institutional differences in the mode of importing, improving, developing and diffusing new technologies, products and processes” (Freeman 1995:20), and that innovation is an interactive process between firms and their environment (Lundvall 1988). While early literature mostly studied developed countries, interest has been increasing in applying the national innovation systems framework to developing countries, such as the Asian Newly Industrializing Economies (Kim and Nelson 2000; Lee and von Tunzelmann 2005; Lundvall et al. 2009). This approach has also been expanded to include subnational levels, such as regional and local innovation systems (Asheim and Gertler 2005; Fu et al. 2012; Iammarino 2005; Zhao et al. 2015). This is because innovation is
regarded as a socially and spatially embedded interactive learning process that cannot be understood independently of its region-specific institutional and cultural context.

Another SI approach analyzes innovation on the basis of technological, industrial, or sectoral characteristics regardless of geographic boundaries, as the knowledge base, actors, networks, and institutions involved can vary drastically across technologies, industries, and sectors, and the local, national, and global dimensions can coexist (Carlsson and Stankiewicz 1991; Freeman et al. 1982; Hughes 1983; Malerba 2005). This approach opens up better possibilities for tracing the coevolution of technology and institutions, rather than only considering entire national or regional systems (Geels 2004).

Both SI approaches point out the importance of studying innovation actors, their networks, and their embedded institutional context in producing and diffusing technology, and emphasize a holistic, interdisciplinary, and nonlinear perspective of innovation, even though they may disagree on where the boundaries of the system lie. Both also recognize the importance of government support in guiding, supervising, coordinating, and facilitating innovation through policymaking and institution-building. However, SI as a powerful heuristic tool is not without weaknesses. For example, Liu and White (2001:1094) suggest focusing on the “fundamental activities” of the innovation process to go beyond rigid structural analysis, as organizations and firms can have different meanings and play divergent roles that may not translate across national contexts; notably, the components of the system of innovation applicable to Western countries may not work in China or in former Soviet countries, which have a history of central planning. Similarly, Hekkert et al. (2007:415) address the need to study the dynamic processes rather than static structures of innovation through what they call “functions of innovation systems.” Huang and Whittington (2011) point out the lack of agency in national innovation systems studies and incorporate the concept of “institutional entrepreneurship” in their analysis. These efforts all aim to avoid the institutional determinism of earlier SI studies, which see institutions as resistant to change and successful innovations as dependent on their compatibility with specific institutional structures (Edquist 2005).

We would like to follow those lines of research and further contribute to the theorizing of SI by incorporating institutional dynamics in the system, as the current framework falls short in explaining how actors make sense of existing institutions and how institutions adapt. Moreover, organizations can be faced with conflicting institutional demands and logics, making institutional alignment difficult to achieve (Currie and Guah 2007; Pache and Santos 2010). In the context of countries like China that are undergoing tremendous social and economic transformation, existing institutions are constantly being challenged, different layers of institutions can conflict or contradict each other, and new and informal institutions are being created alongside old and formal institutions (Tsai 2006), so what technology is adopted and diffused is often a result of power struggles among different actors at the local, regional, national, and global levels. For example, it has long been argued that the authoritarian regime in China is fragmented rather than monolithic: state agencies engage in bureaucratic entrepreneurship to vigorously protect and promote their own interests in the policymaking process (Lieberthal 1992). Political bargaining “sought to reconcile the conflicting organizational missions, ethos, structure, and resource allocations of the
ministries involved” (Lieberthal and Oksenberg 1988:4). Therefore, we argue that innovation is not necessarily a cooperative and synergistic process but may be full of conflicts and tensions within and across organizations—which are often overlooked in the SI literature. Institutions are not merely pre-given rules but should themselves be seen as dynamic.

The institutional approach in the sociology of organizations emphasizes how organizations obtain their legitimacy, or “taken-for-grantedness” (DiMaggio and Powell 1983). Unlike the market approach, which presumes market efficiency, or the cultural approach, which focuses on differences in values and meanings and may render any generalizations or comparisons obsolete, the institutional approach emphasizes the dialectic of structure and agency by studying how organizations and their practices gain domination (Biggart 1991). Organizational legitimacy is a generalized assumption that the actions of an entity are desirable or appropriate within some socially constructed system of norms, values, beliefs, and definitions (Suchman 1995:357). It is also used to explain how and why new practices are diffused in different fields of organizations (Dobbin and Dowd 2000; Fligstein 1987; Torbert and Zucker 1983) and has been applied at the level of a whole industry or technological field, such as solar cells, wind turbines (Jacobsson and Lauber 2006), or nuclear energy (Geels and Verhees 2011).

Although scholars use different taxonomies to discuss legitimacy, they generally agree that legitimacy may come from self-interest, moral evaluations, or public perceptions (Aldrich and Fiol 1994; Dowling and Pfeffer 1975; Jepperson 1991; Pfeffer 1981; Scott and Meyer 1991; Suchman 1995; Zucker 1986). Here we build on Scott’s (2001) typology of legitimacy to discuss the different layers of institutions: regulative, normative, and cultural-cognitive. Regulative legitimacy is conformity to regulatory standards, rules, and laws (Scott 2003:136; Zimmerman and Zeitz 2002). In general, regulatory bodies (governments, trade associations, professional organizations) set “explicit regulative processes,” which include rules, oversight, and sanctions in case of nonconformity (Scott 1995:35; see also Zimmerman and Zeitz, 2002). For normative legitimacy, organizations have to apply not only generalized social norms but also a variety of standards in different professional fields (DiMaggio and Powell 1983). Cultural-cognitive legitimacy, on the other hand, is conformity to widely held cultural beliefs and taken-for-granted practices underlying a social system (Aldrich and Fiol 1994; Scott 2001; Westfall, Gulati, and Shortell 1997); it is the most subtle and the most powerful, yet the most difficult to obtain and manipulate (Suchman 1995). Of course, not every organization in the field is faced with the same institutional environment or the same level of legitimacy; an organization’s ability to mobilize its resources and how reliant it is on a particular resource defines its power relations with other organizations and its environment (Pfeffer and Salancik 1978). For example, studies have shown that incumbents can engage in technological inertia because of path dependency or institutional lock-in and may block novel approaches (Christensen 1997; Guérard, Bode, and Gustafsson 2013; Unruh 2000), while newcomers may use different strategies to legitimize novel practices or technologies, such as associating them with more established concepts or actors (Etzion and Ferraro 2010; Gurses and Ozcan 2015; Hargadon and Douglas 2001; Zimmerman and Zeitz 2002). Similarly, marginal or peripheral members in an organizational field that has weak oversight mechanisms, multiple logics, or shifting constituents may
be able to claim legitimacy based on their niche status (Quirke 2013). And the three forms of legitimacy are by no means mutually exclusive. In fact, we can see from the Chinese EV case that the three pillars are intertwined in many ways—one of the reasons being the interconnectedness between the state and business organizations—but we hope to use this framework to investigate the complexity of institutions related to the emerging EV industry in China.

This paper thus complements the SI approach with the theory of institutional legitimacy, and looks at innovation not just as a technological breakthrough but as a process of actors gaining legitimacy. Unlike the SI approach, we do not see this process as merely technologies aligning with existing institutions. We propose that: (1) different layers of institutions do not necessarily match; (2) inconsistency in institutions leaves room for actors to strategically interpret, adopt, negotiate, or even change institutions, but their ability to do so is also constrained by existing institutions and power structures; and (3) technologies that are selected are results of the interaction between actors and institutions. The following sections analyze the development of the EV industry to explore how different actors in the Chinese EV innovation system navigate the regulative, normative, and cultural-cognitive institutions—state agencies at central and local levels, gasoline car producers (mainly state-owned), EV producers and suppliers, charging service providers, electric utility companies, users of EVs (including commercial users and individual consumers), and universities and other R&D institutions. We use the section on regulative legitimacy to focus on state actors in the formation of rules and policies; the section on normative legitimacy to discuss firms and organizations in the broad EV industry in their competition for resources and to become industry norms and standards; and the cultural-cognitive legitimacy section to analyze individual users and consumers and their knowledge and perception of EVs in relation to EV-related organizations’ views of user needs.

METHODOLOGY

The data used in this article are mostly based on our fieldwork in Shenzhen in 2013, updated with policy documents and media reports since 2013. We were interested in identifying, through a case-study approach, the institutional settings that facilitated or hindered the development of EVs, both locally and nationally. We did not form any hypotheses before we entered the field. Over the course of the interviews we started to notice different views on EVs and conflicts among various government agencies and organizations. The interviewees all seemed to make good arguments about whether EV is a viable alternative technology, based on their specific organizations’ goals and visions and their interpretations of what EV can bring to China. We were also surprised by the lack of involvement of environmental agencies and organizations, as well as consumer and user participation, in the policymaking process, and the dominant emphasis on economic rationality by our interviewees when talking about EVs. We then refined our interview questions and started to more directly ask questions based on the new institutionalist framework regarding the interviewees’ perception of their organizations’ legitimacy, their perceived allies and competitors, their views on EV policies and technologies, and why they thought consumers would or would not purchase EVs.
Over 20 semi-structured face-to-face interviews, lasting between an hour and three hours, were conducted with scientists and engineers at local universities who were working on EV-related research projects, employees of two EV producers, employees at charging service companies, managers of taxi and bus companies that have adopted EVs, and government officials in agencies that can affect the formation and implementation of local EV policies. Those agencies include the Shenzhen Municipal Commissions of Transport, Finance, and Development and Reform. Of the two EV producers (both are private companies), “Alpha” manufactures a wide range of electric and plug-in hybrid electric vehicles, including buses, passenger cars, and trucks, in addition to its lines of gasoline cars; “Beta” focuses on electric and hybrid buses and is expanding into the production of electric service vehicles.

We also held two group interviews with mid-level managers in the departments of EV marketing, financing, and public relations at Alpha, and informal interviews over meals with government officials and employees of Alpha, to get more background information that was not covered or to clarify points in the formal interviews. Those interviewees were selected by snowball sampling. When the new central policies on EV promotion were launched in September 2013, follow-up interviews were carried out with the officials and the mid-level managers of Alpha.

To triangulate information and gain more perspective, we conducted less-structured interviews, using convenience sampling, with two workers and two e-taxi drivers at an EV repair shop owned and authorized by Alpha, four car-hunting consumers at an Alpha dealership that sells both conventional cars and EVs, five conventional and five e-taxi drivers, and four e-bus drivers, to get a sense of their attitudes to EVs and their major concerns. Besides the interviews, data are also drawn from observations at charging stations and EV companies, published and unpublished policy documents, media reports, and other scholarly works.

All the interviews were conducted in Mandarin, and they were transcribed and translated by one of the authors. The authors then independently coded the interview data and compared and combined their coding to minimize bias.

Shenzhen was selected as the main field site, because when we started our research project, Shenzhen was the most successful city in China in promoting EVs and creating industry leaders. It was among the first 10 cities designated by the central state to implement a demonstration program for EVs and among the first five cities to expand the demonstration program from public service vehicles to individual consumers. As one of the four top-tier cities in China (after Beijing, Shanghai, and Guangzhou), Shenzhen, which borders Hong Kong, was tapped by the State Council in 2008 to pilot its program of “national innovative cities” (Yang 2012), boasting top communications technology firms such as Huawei Technologies and the internet giant Tencent.

DATA AND ANALYSIS
Regulative Legitimacy
As mentioned in the introduction, the development of the EV industry is a deliberate industrial policy of the Chinese central state to leapfrog development and surpass industry leaders (wandao chaoche). Since 2006, China has been actively promoting indigenous innovation
(zizhu chuangxin), which aims at reducing technological dependency, creating its own intellectual property, and developing technologies that best fit China’s domestic economic and social conditions. Indigenous innovation is a massive plan to raise China to a technology powerhouse by 2020 and a global leader by 2050, and to transform China from low-end manufacturing to a major center of innovation.

The development of new energy vehicles (NEV)—primarily all-electric vehicles (AEV), plug-in hybrid-electric vehicles (PHEV), and fuel cell electric vehicles (FCEV)—is an important piece of China’s national strategy to promote indigenous innovation. In the 13th Five-Year Plan (2016-2020), “Made in China 2025” is proposed to upgrade manufacturing in China and develop strategic industrial sectors, including renewable energy and transportation. China’s previous policy for the auto industry, often dubbed “trading the market for technology,” led to the formation of joint ventures with leading foreign automobile companies, but failed in terms of technology transfer, and key technologies such as fuel injection, engines, and transmissions are still secrets held by foreign firms (Lu, 2006). China thus regards NEVs as an opportunity to bypass core patents and technologies related to conventional cars and catch up to industry leaders.

China has adopted a demonstration approach to promote NEVs. Major transnational events in Chinese cities became demonstration sites for NEVs. At the 2008 Olympic Games in Beijing, about 600 NEVs made their first appearance. The 2010 Shanghai Expo, the Asian Games in Guangzhou later that year, and the 26th Universiade in Shenzhen in 2011 all featured NEVs as the means of transportation. Although Shenzhen started to plan for its EV industry as early as 2005, it was not until after the Universiade that EV production volume scaled up to 2,000 vehicles.

The central state also offers financial incentives and sets quotas to promote NEVs in major cities. In January 2009 the Ministry of Finance (MOF), together with the Ministry of Science and Technology (MOST), launched NEV demonstration programs in 13 of China’s largest cities. This, along with the Plan on Shaping and Revitalizing the Auto Industry issued by the State Council, marked the central state’s support for the mass deployment of NEVs (General Office of the State Council 2009). The initial focus was on taxis, garbage trucks, postal service vehicles, buses, and other public service fleets, because their driving patterns are more predictable and easier to monitor. For passenger vehicles, each AEV was offered a subsidy of CNY 60,000 (roughly USD 9,000), and up to CNY 50,000 (USD 7,500) was offered for each PHEV; every qualified all-electric bus was offered a subsidy of CNY 500,000 (USD 75,000), and each plug-in hybrid bus, CNY 420,000 (USD 63,000) (MOF and MOST 2009). Also in 2009, the Ten Cities, Thousand Vehicles program challenged 10 cities, including Shenzhen, to each launch and monitor pilots of at least 1,000 NEVs. The program was later expanded twice, and by 2010, 25 cities had taken part. In June 2010, in addition to public service fleets, the program started to subsidize consumers in Shanghai, Shenzhen, Changchun, Hangzhou, and Hefei (World Bank and PRTM 2011). In 2012, the State Council issued the NEV Plan, which put NEVs on the list of vehicles officially approved for government procurement; qualified producers are exempted from business tax and enjoy reduced enterprise income tax (State Council 2012).
While the initial policies focused on subsidies, since 2014 other nonfinancial measures have been gradually introduced at local levels, exempting qualified NEVs from certain purchase and driving restrictions (General Office of the State Council 2014). Cities like Beijing and Shanghai attempt to curb traffic congestion and air pollution by allowing vehicle use only on certain days (depending on the license plate number) or restricting use during rush hour, but qualified NEVs are exempt from such restrictions. Many large cities also limit vehicle ownership through license plate lotteries or auctions, and this means a long waiting period and extra costs for consumers. In Shanghai qualified NEVs are exempt from such auctions (the successful rate of plate auctions was 4.5% in August 2015) and granted immediate access to free license plates, saving consumers about CNY 80,000 (USD 12,000) (Xiao, 2015). In Beijing and Shenzhen NEVs originally formed their own pool for license plate lotteries, but both have exempted qualified NEVs from lotteries since late 2015. Beijing, however, has a yearly limit of 60,000 NEV license plates.

The municipal government of Shenzhen, one of the pilot cities for NEVs, has issued multiple policy documents and regulations. Shenzhen’s 12th Five Year Plan designated NEVs as one of the strategic industries in the city’s development plan to move from low-value-added manufacturing to high-tech innovation and from light industry alone to a combination of light and heavy industry. In 2015 Shenzhen came up with a comprehensive incentive program that not only offered higher subsidies to NEV purchases than the central state but also provided subsidies for expenses incurred in the use of NEVs, such as charging and parking, construction of charging facilities, and battery recycling (Table 1).

As a national development strategy, it seems there is no question about the EV industry’s regulative legitimacy. However, promoting EVs in China is simultaneously an industrial policy (to catch up in science and technology and dominate the industry) and a way to manage risk (to reduce oil dependence and manage air pollution), and there are multiple approaches to those goals, which are not always compatible. For example, should priority be given to the most advanced technology available, or the technology that is achievable by domestic firms? Is it more important for firms to be able to design and produce whole cars, or to possess patents on key EV components? The goals of energy security and carbon emissions reduction could also be pursued through adopting a range of alternative fuels, or encouraging changes in driving behavior, or switching to public transportation or bikes, and discouraging private ownership of cars. The complexity of the goals leads to inconsistencies in policy and opens up room for bargaining across the various central agencies and between central and local governments.

Policies on NEV subsidies come from four central government agencies: the MOF, the MOST, the National Development and Reform Commission (NDRC), and the Ministry of Industry and Information Technology (MIIT). The MOF controls the budget and is responsible for reimbursing EV producers for the number of qualified vehicles sold, but some of our interviewees revealed that the MOF and its local branches had doubts about EVs and were reluctant to offer financial incentives other than sales subsidies. The central state also expected local states to match central subsidies, but not every municipal government has the budget to match central subsidies or is willing to prioritize EV subsidies over other expenditures. Therefore, the extent to which central policies get implemented varies, and it is
often cities that have the financial capacity and see EVs as an opportunity to transform their industrial structure that are more likely to have matching policies for subsidizing and promoting EVs. Also, the MOF does not issue subsidies directly to EV buyers; EV producers have to apply based on their sales volume. Reimbursement takes time and has to follow set procedures, and EV producers thus risk not being reimbursed in time for production planning and fear that changes in policy will affect pricing and sales. As a result, local states not only serve as the first gatekeepers in scrutinizing EV producers’ qualifications for subsidies, but also play a significant role in advocating and providing incentives to EV producers; and the disparities in local states’ abilities to promote EVs often lead to local protectionism that favors local producers over nonlocal ones.

Shenzhen has been active in promoting EVs, because it is not traditionally a car-producing city. China’s conventional auto industry has been dominated by state-owned companies that have established joint ventures with major global automakers. Changchun, Shanghai, Wuhan, Chongqing, and Guangzhou are the leading auto cities. Therefore, developing EVs provides a way for Shenzhen to get a share of the well-entrenched auto industry and to upgrade its economy from an export-oriented, labor-intensive manufacturing center to an innovation hub. As Shenzhen already has a vibrant electronics and battery industry, switching to produce key EV components seems to be a logical transition.

The MIIT is responsible for the regulation and development of strategic industries and technologies, and the auto industry, including conventional cars, is within its jurisdiction.

### Table 1. Purchase subsidies provided by Shenzhen in 2015 per the Plan on Energy Saving and the Development of the New Energy Vehicle Industry (2012–2020)

<table>
<thead>
<tr>
<th>Subsidy category</th>
<th>Type of NEV</th>
<th>Amount of subsidy (CNY per vehicle)</th>
</tr>
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<tbody>
<tr>
<td>Purchase</td>
<td>All-electric buses</td>
<td>Length ≥ 10 meters, 500,000</td>
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<tr>
<td></td>
<td></td>
<td>8 ≤ L &lt; 10 m, 400,000</td>
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<tr>
<td></td>
<td></td>
<td>6 ≤ L &lt; 8 m, 300,000</td>
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<tr>
<td></td>
<td>All-electric specialty vehicles</td>
<td>2,000/kwh, no more than 150,000 per vehicle</td>
</tr>
<tr>
<td></td>
<td>All-electric passenger vehicles</td>
<td>Range ≥ 250 kW, 60,000</td>
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<tr>
<td></td>
<td></td>
<td>150 ≤ R &lt; 250 kW, 50,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R &lt; 150 kW, 35,000</td>
</tr>
<tr>
<td></td>
<td>Plug-in hybrid-electric passenger vehicles</td>
<td>R &gt; 50 kW, 35,000</td>
</tr>
<tr>
<td></td>
<td>Fuel cell commercial vehicles</td>
<td>500,000</td>
</tr>
<tr>
<td></td>
<td>Fuel cell passenger vehicles</td>
<td>200,000</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>Plug-in hybrid-electric passenger vehicles</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R &gt; 250 kW, 20,000</td>
</tr>
<tr>
<td></td>
<td>All-electric passenger vehicles</td>
<td>150 &lt; R &lt; 250 kW, 15,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R &lt; 150 kW, 10,000</td>
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<tr>
<td>Charging facilities</td>
<td>30% of investment cost</td>
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</table>
Companies need production permits from the MIIT before they can start producing whole cars. Although the MIIT generally agrees with the development of EVs, it also has a close relationship with the state-owned automakers that have benefited from producing and selling gasoline cars. As a result, our interviews indicated that the MIIT supported HEVs more than AEVs.

The NDRC is the major remnant of central planning in reform-era China and is responsible for approving important and strategic projects. It often sees EVs as an opportunity to strengthen its power as the planner, so the NDRC and its local branches are often pro-EV. The minister of science and technology, Wan Gang, a former engineer at Audi, is one of the firm advocates for the development of NEVs, and according to our interviews, he was the major figure behind the Ten Cities, Thousand Vehicles program. For the first 13 pilot cities, nine were led by MOST’s local branches (Zheng et al. 2012:19). But there have been debates within MOST and among experts over whether China’s car revolution should focus on FCEVs or battery electric vehicles (Gallagher 2014:55).

Several government agencies are surprisingly missing from the EV initiatives. Other than setting limits on vehicle emissions, the Ministry of Environmental Protection has not participated in the promotion of NEVs. The Ministry of Transport, which manages the daily operation of vehicles, including bus route planning, is also absent from the promotion of EVs. In our interviews, proponents of EVs frequently accused the Ministry of Transport and its local branches of blocking the promotion of EVs, because the latter agencies regard EVs as dangerous on the road, difficult to manage, and increasing their workload, as they need to plan new bus routes specifically for NEVs based on the availability of charging facilities and the amount of traffic. EVs also disrupt the ministry’s embedded interests. For example, the ministry’s local Transport Commissions charge license fees for taxis, a source of fixed revenue for them, but for e-taxis, the license is free as part of the incentive program. Rather than EVs, the Ministry of Transport is more interested in upgrading the existing gasoline vehicles into natural gas vehicles.

The Ministry of Land and Resources is also not involved, which affects the allocation of land for recharging facilities and designated parking spaces for EVs. Right now land allocation for charging stations has to rely on either municipal governments allocating certain plots of government-controlled land (e.g. bus terminals) or leasing from rural collectives, as land is still publicly owned in China. If local governments are more interested in real estate development than in building charging stations, or if villages decide to use the land for some other purpose and revoke the lease, then charging stations—the essential infrastructure for EVs—cannot be built or maintained. The spatial limitation is particularly salient for cities like Shenzhen that have high population density. Our interviewees who are EV proponents repeatedly commented that for true growth momentum, the policies should come directly from the State Council rather than the four ministries and should require cooperation from all relevant government agencies.

AEVs and PHEVs have eventually won central-state support over other alternative fuel vehicles that can also reduce carbon emissions, such as LNG vehicles, HEVs, and FCEVs, because facing the dual goals of creating an industrial policy and managing environmental and energy risks, the state has adopted technological pragmatism. AEVs can achieve zero
emissions, so they are preferred over hybrids, whose emissions reduction depends on the habits of the driver and how often electricity is charged and used. However, because promoting EVs is fundamentally an industrial policy that aims to strengthen domestic firms, battery electric vehicles are encouraged over FCEVs, whose prices are presently too high to commercialize (and a technical breakthrough is more difficult to achieve domestically), and over HEVs, whose core technologies are controlled by Japan. In sum, the EV industry—particularly EV producers—has gained some regulative legitimacy in the form of the central state elevating it to a strategically important industry and offering policy and financial support, but this is a result of bargaining among various actors at the central and local levels and is met with different degrees of commitment at the local level.

EV policies have been largely dominated by four agencies—MOF, NDRC, MIIT, and MOST—with the MOF leading. EV promotion has thus focused mostly on financial subsidies and is framed more as an industrial policy to revitalize China’s auto industry than as an environmental policy. The incentive schemes have become more comprehensive since our fieldwork in 2013 to include exemption of EVs from purchase and driving restrictions and from purchase taxes and to reduce the amount of and raise the technological requirements (e.g. miles per charge and battery capacity) for subsidies, indicating a gradual change from subsidizing producers to incentivizing users and the state’s increasing efforts to expand consumer demand for EVs. But EV policies have been inconsistent. For example, although subsidies incentivize EV producers, no policies have been formed to punish conventional automakers or to make conventional cars more costly. Alpha is committed to investing in R&D for EVs and owns many EV patents, including for power batteries, but its profits come from making conventional cars, not EVs. To achieve the current fuel-efficiency standard of 42.2 miles per gallon, automakers do not necessarily have to electrify (Gallagher 2014:60). In addition, subsidies have leaned toward production, rather than the whole range of suppliers and infrastructure providers that would be important to the development of the industry, and basing subsidies on sales also does not encourage technological innovation and advancement, as shown in the cases of subsidy fraud. To further understand the disconnect between state support and the growth of the EV industry, especially in the consumer market, requires an analysis of the normative and cultural-cognitive pillars of legitimacy.

Normative Legitimacy

The smog that has been plaguing China has raised public awareness of air quality and its related public health issues, driving the central state to declare a war on pollution (Greenstone 2018). Our pro-EV interviewees often argued that carbon emissions is one of the biggest contributors to air pollution in large cities, where population and building density is extremely high. A notice issued by the Shenzhen Municipal Government in 2014 reinforced this view, stating that about 41% of the city’s PM2.5 could be attributed to emissions from its 3.14 million motor vehicles. Developing NEVs seems to match the emerging norm of sustainable development and the rising middle classes’ call for a cleaner environment and a low-carbon lifestyle (ditan shenghuo). But the EV industry has a clear competitor: the conventional auto industry, which, along with the petrochemical industry, is deemed strategically important for the Chinese central state. The process of establishing normative
legitimacy for the former is therefore also a process of challenging the normative legitimacy of the latter. This section will focus on the tensions among the nonstate actors faced with institutional uncertainties and their competition for normative legitimacy in the EV industry. It is important to note that nonstate actors can have close ties to the state, such as in the case of state-owned enterprises, and normative legitimacy interacts with regulative legitimacy—the state has control over public perceptions and industry norms, and nonstate actors can influence policy.

As the technology is still evolving, not many standards have been formed, and EV producers are going in different directions, betting on state policies. For example, there are still debates over whether AEV or PHEV should be the focus, whether any restrictions should be put on low-speed EVs, and what kind of power batteries should be pursued—lithium iron phosphate (more stable and cheaper, used by Alpha and Beta), ternary lithium (of higher energy density and lighter, but more expensive and less stable; used by Tesla and more and more Chinese domestic electric passenger car producers), or fuel cell. Battles over technological routes result not only from technological capacities but also the conflicting institutional demands: should the ultimate goal of the industry be technological innovation, mass commercialization, environmental sustainability, profitability, or some combination of these? Are EVs complementing, challenging, or replacing conventional cars? For how long should the state protect EV businesses from market competition, and how much should EV businesses rely on government subsidies? As a result, conflicts in business interests often take the form of divergent normative justifications, such as safety, fairness, market robustness, and contribution to social welfare. We will consider three areas of contention to discuss how EV producers, utility and charging service providers, and EV operating companies frame their interests and compete for institutional support.

**Battery charging versus battery swapping.** Battery swapping requires standardization of batteries made by different producers and more investment, as swapping stations often take up more space for battery storage and multiple sets of batteries are needed for each vehicle. In our interviews, EV producers expressed reservations about having to share key technical data with grid companies to build battery swapping stations. They also shared concerns over safety when batteries are frequently put in and taken out, and the problem of managing and monitoring batteries in their different years of life or at different charging statuses. For battery charging, on the other hand, besides standardizing the charging interface, companies can keep their own vehicle designs and types of batteries, and charging facilities of varying sizes can be built, allowing more flexibility. Battery charging is therefore preferred by EV producers like Alpha. The State Grid, however, initially supported battery swapping, which gives more power to charging service providers than to EV producers and might limit the number of competitors because of the large upfront capital investment, while the Southern Grid—the State Grid’s main competitor—stood behind battery charging. The latter has so far gained more state support, mainly because given the current status of EV technologies in China charging is more viable and safer than swapping. It was also pointed out by our interviewees that shrinking charging times will eventually make swapping unnecessary and that the battery standardization required for swapping could result in technological lock-in that prematurely constrains innovation. At a time when normative legitimacy is uncertain
and various routes of technological innovation coexist, the path that offers higher safety and requires less standardization has been chosen. However, the State Grid has not completely given up on the swapping model and has invested in swapping stations in cities like Hangzhou and Qingdao.

Charging standards and local protectionism. The controversy over battery swapping and charging also reveals the conflicting interests between EV producers and the state-owned grid companies that control electric power distribution.

In Shenzhen, in addition to the Southern Grid, which monopolizes the residential charging market and provides charging services to e-taxis, Potevio (a state-owned oil company) has established a subsidiary, Lineng Charging Station Co., to build and operate charging facilities for e-buses and e-taxis. Interviewees at Alpha, for example, proposed that charging facilities should be smaller and more dispersed for the EV industry to grow and that electricity for EV recharging should be billed at a subsidized price, because EVs reduce air pollution and improve social well-being. Interviewees at both Alpha and Beta complained that charging companies care more about “enclosing the land” (paoma quandi), meaning grabbing market share, than about optimizing charging networks or serving the EV industry. But they also recognized their lack of power and financial ability to provide the charging infrastructure on their own.

Interviewees at Lineng, on the other hand, questioned the lack of standards for building charging facilities in terms of their location, maintenance, and safety. They particularly mentioned the charging piles installed by Alpha in a public underground parking garage, which saved costs but posed safety hazards during flooding or a fire emergency when a sprinkler system is used. They also complained that EV producers were the only ones subsidized by the state, while service providers had to run at a loss, as the charging fee for EVs was set (at the time) as the commercial price of electricity and did not reflect charging service providers’ labor cost, equipment depreciation, and monitoring cost. Interviewees at Lineng proposed that a service fee be added to make the charging business profitable and sustainable in the long run; otherwise, they argued, it would be too risky for private capital to enter the industry. In 2015 Shenzhen started to allow companies to charge service fees at a rate no higher than CNY 0.45 (USD 0.067) per kWh, a policy change that reflected charging service providers’ interests.

In the absence of a national charging standard, Shenzhen, under the leadership of the Commission of Development and Reform, came up with its own in 2010, and Alpha and Beta both participated in drafting it, along with other stakeholders. Shenzhen’s standard on charging connectors (with minor revisions) was adopted in 2013 as the national standard, but the national standard was only recommended, not mandatory, creating charging compatibility problems among EVs produced by different manufacturers. This has resulted in a localized EV market, as charging facilities are often built to suit locally available vehicle models. More detailed national charging protocols became effective in 2016, which could solve the problem of charging incompatibility, but they are not enough to deal with the issues resulting from the lack of coordination and consistent policies, such as the underuse and lack of maintenance of existing facilities (which were built not necessarily out of need or demand but in response to state-set targets and based on charging providers’ abilities to
secure land), the lack of available land to build public charging stations (especially when the best locations have already been occupied), and the inability of existing electric infrastructure to support a sufficient number of fast-charging facilities (Beijing Youth Daily 2016).

Standards are also used by local governments to favor local companies. For example, interviewees at Alpha complained that Shanghai set up its local standards based on Roewe, a brand of the Shanghai Automotive Industry Corporation (a state-owned enterprise), making it difficult for nonlocal brands to enter Shanghai’s market. In response, the central state announced in 2013 that nonlocal vehicles should account for at least 30% of all promoted NEVs (MOF and MOST 2013), but it is hard to monitor how effective this policy is and what constitutes being "local." Others indicated that to qualify for local subsidies EV producers were forced to use local parts.

To gain support from local governments, Alpha has developed two strategies: “investment for market” (yi touzi huan shichang), in which they build e-bus factories locally to gain entry into a particular market; and extending into the operating and charging ends of the industry, such as building charging facilities and investing in e-taxi companies, to demonstrate for local governments.

The battles over standards indicate conflicts between local states, EV producers, and utility and charging service providers regarding who sets the standards, who leads the industry, and how open a local market should be.

Vested interests and proprietary rights. Bus and taxi companies are also stakeholders in the Chinese EV industry, because they have been mandated to buy EVs by state-enforced demonstration programs. But they have also been entrenched in the conventional auto industry and have strong bargaining power vis-à-vis local state public service companies. They thus have a complicated relationship with EV producers. For example, bus companies have their own preferred vendors for things from seats to air conditioning and bus stop announcers, but with e-buses they have to let companies like Alpha and Beta enter their supply chain and look for new vendors to provide equipment, parts, and services specific to e-buses. Adopting e-buses also requires bus companies to design routes based on the available charging facilities and to take on extra work to monitor and maintain the performance of the vehicles. To reduce resistance from bus companies, Alpha and Beta both let them designate suppliers for non-electric parts. For taxi companies, on the other hand, to attract drivers for e-taxis they have to offer a higher base salary, provide training, cover a fixed amount of charging and repair expenses, and take into account hours spent on repairs and charging. Because of EV producers’ monopoly on repairs and protection of their intellectual property and technical know-how, companies can only send drivers to EV producers’ repair shops and do not know what exactly is repaired. In that sense, adopting EVs breaks those companies’ set routines and displaces existing interests and their established industry norms.

As e-buses are more expensive than conventional buses, and have a shorter driving range and fluctuating performance, to make adoption of e-buses commercially viable, Alpha, bus companies, and Lineng have reached an agreement on a financing model, called “financial leasing, separating vehicle and battery, combining charging and maintenance” (rongzi zulin, chedian fenli, chongwei jiehe). This means that bus companies pay the same amount for
e-buses as for conventional buses, and they own the body of the bus and lease the battery. Power charging franchisee Lineng covers the rest of the cost, keeps ownership of the power battery, and provides an eight-year warranty on the battery to the bus company. Power charging franchisee Lineng covers the rest of the cost, keeps ownership of the power battery, and provides an eight-year warranty on the battery to the bus company.

The bus company also pays Lineng the amount they would normally spend on gasoline as charging fees. This model addresses the problem of the different life cycles of the body of the bus and the power battery and reduces the cost of adopting EVs, but it also has its flaws. Electricity is supposed to be cheaper than gasoline—that is why EV producers argue that although their vehicles may be more expensive to purchase, in the long run the lower fuel and maintenance costs will offset the upfront expenditure. In this model, however, bus companies spend the same amount of money on electricity as they do on gasoline. And although Lineng owns the power battery, it will require coordination with EV producers to provide repairs and maintenance to the battery. Interviewees at Lineng said that their long-term plan was to have their own repair and maintenance crew and to be able to provide independent battery testing but will EV producers be willing to share data related to the power battery, a nonstandardized, key component of the EV?

Clearly, no norm has been established regarding what constitutes ownership in the EV industry. How much information should EV producers share with users, especially institutional buyers, and other organizations, like repair shops and charging service providers? How should EV producers collect data to improve their technologies? Who owns those data?

In sum, EV producers have gained some level of normative legitimacy, which varies depending on their technological strength and their ability to negotiate with the state. In fact, most EV producers are private enterprises that are otherwise marginalized in the conventional auto industry or are new to the industry. State-owned oil companies and utility companies have also started to realize that EVs might be the future trend and want to take advantage of the state’s favorable policies, and they enter the industry by building charging facilities. But the industry standards and norms are still full of uncertainties, which prevents more actors from committing to the EV industry. It is also not clear how subsidies, interests, and costs should be divided among EV producers, charging service providers, grid companies, and operating businesses to best develop the industry.

As a result of these conflicting institutional demands, EV businesses respond differently to the normative uncertainties. Alpha, for example, takes the do-it-all approach, which includes, internally, vertical integration to produce almost all of the key parts in-house, and externally, investment in charging facilities and operating businesses to expand its market and gain local governments’ support. State-owned charging service providers and electric utility companies mobilize their economic and political resources and compete with EV producers over the standards for building charging facilities and control over technical data and power batteries. For taxi and bus companies, adopting EV means breaking away from the existing industry norms and vested interests, even though the regulative legitimacy does offer some financial incentives and mandates for companies to switch.

Consumers’ voices are not present in all these debates. Perhaps not surprisingly, for consumers, buying EVs is far from the norm, despite the EV industry’s regulative legitimacy.
Cultural-Cognitive Legitimacy

Although EVs as we know them today are new to China, vehicles run on electricity are not that strange for many Chinese. For a country that has long been a nation on two wheels rather than four, e-bikes have a natural appeal, and in just a decade, they went “from near zero to more than 150 million by 2015” (Cherry 2013). The popularity of e-bikes and low-speed EVs, which are cheaper and used for short-range transportation, can be contrasted with Chinese consumers’ initial lukewarm reactions to EVs, even though the latter have gained more state support and resource allocations. E-bikes and low-speed EVs are technologically less sophisticated than EVs, and perhaps not any safer. Therefore, it probably cannot be argued that the organizations involved in electricity-powered transportation in general lack cultural-cognitive legitimacy in China. However, concerns about EVs’ safety, learning curves related to adopting a new technology, and the immaturity of the technology and the industry have affected the public discourse around EVs.

The first EV users in China were mostly taxi and bus drivers, since consumer demand was negligible, and the state concentrated on electrifying the public service fleets. For them, driving EVs means adopting a new routine, as they have to take into account charging time and fit it into their daily schedules. Although most e-bus and e-taxi drivers we interviewed enjoyed EVs’ ease of driving compared to gasoline vehicles, which have less acceleration, are noisier, and require manual shifting, they were concerned about possible battery combustion and electromagnetic radiation from recharging and everyday operation. In Shenzhen the widely covered “s26 accident” of May 2012, in which a BYD e6 taxi burned after colliding with a GTR sports car and two passengers and the driver died, has made the public even more suspicious of EVs’ safety, even though later investigation revealed no defects or design problems with the vehicle.

Discussing the s26 accident, one conventional-taxi driver doubted the reliability of the investigation and said he would never consider driving an e-taxi. “For only 800 EVs, there has already been more than one explosion. The rate is pretty high. Even though gasoline cars may also explode, the rate is not as high.” A pro-EV official, on the other hand, commented that EVs should not be evaluated on conventional cars’ terms. “For example, Tesla. They have a thousand cars in use and have already had two incidents of spontaneous combustion . . . isn’t that a pretty high rate? But does it mean anything?” He didn’t think the state should stop promoting EVs just because of a couple of accidents.

Taxi drivers in particular also talked about the need for good planning on their part, as they are more affected by charging time and driving range than bus drivers, who drive a fixed and predictable route. Some experienced drivers said that they could use the recharging time to rest, eat, or even exercise, which would make their otherwise sedentary job healthier, but newer drivers often found it difficult to make the same amount of money as their conventional counterparts. There is thus a learning curve for e-taxi drivers to figure out the best time for charging in consideration of demand, rush hour, peak charging time, and the locations of fast and slow charging facilities. Drivers also complained of more frequent repairs compared to conventional cars and miles per charge not always meeting the advertised range, which complicated their planning.
Aside from the concerns over safety, charging, and range, consumers who buy e-bikes or low-speed EVs and people who can afford EVs are perhaps looking for different values in their purchases. As a more expensive investment, cars are often status symbols in addition to their functionality. For CNY $200,000 to $300,000 (about USD $30,000 to $40,000; the retail price of Alpha’s AEV model is about CNY $360,000, USD $53,700, and after subsidies it still costs around CNY $240,000, USD $35,800), there is a wide range of choices for consumers. EVs are thus competing with domestic and foreign gasoline cars. Our interviewees who have a pessimistic outlook on EVs repeatedly argued that those who can buy a CNY $200,000 car do not care about saving a few dollars on gasoline, and those who are cost-conscious cannot afford an EV. Clearly, cost is still seen as a major barrier to the mass commercialization of EVs, but behind that is probably also EVs’ lack of symbolic value. Both the Chinese state and EV producers focus on the economic value of EVs when preaching to consumers by emphasizing, for example, savings on fuel cost (the extent of which, nonetheless, depends on mileage, the cost of electricity—peak and valley prices are different—the cost of fossil fuel, and other added costs to charging, like parking fees and service fees) and subsidized purchase prices (which still do not necessarily make EVs cheaper than their conventional counterparts, and government subsidies are shrinking\(^\text{3}\)). Little effort has been made to boost the symbolic value of EVs. In that sense, Tesla may have adopted the right strategy, targeting the upper-class consumers who are looking to buy a second or third car that can display their unique identity—once the symbolic value of the brand is established and the price is reduced, it can diffuse into middle-class families.

Still, China’s strategy of pushing EVs into the public service sectors aligns with its state-centered innovation system and its vision of EVs as an area for China’s national technological upgrading, not just personal consumption. Neither producing low-tech e-bikes and low-speed EVs, nor creating “toys” for wealthy people, can meet the demand of China’s industrial policy. Public service sectors are also the area over which the state has the most control.

It is important to point out that in big cities like Beijing, Shanghai, and Shenzhen the immediate access to license plates does make EVs appealing to some consumers, driving up demand. A six-city consumer survey indicated that consumers in Beijing and Shanghai are more likely to buy an EV as their first vehicle, whereas in cities without purchase restrictions consumers are more likely to purchase an EV as their secondary vehicle. Most consumers in Beijing and Shanghai buy EVs for their license plates, not for energy or environmental reasons, and will switch to conventional cars if EVs are not exempt from purchase restrictions. And most consumers prefer having their own charging piles and will otherwise not buy EVs (Meng 2017). But many Chinese families do not own parking spaces in which to build private charging piles, or their apartment complex’s existing electrical capacity cannot accommodate EV charging, and even if they meet all the requirements to build their own pile, the property management office may not approve it, so charging at home can be a problem. Some consumers have developed their own coping strategies, such as buying a PHEV and relying mostly on gasoline, or creating user groups on social media to locate and borrow other EV owners’ charging piles, or taking a safety risk by connecting charging equipment to a home outlet through extension cords (Tian 2018; Yao 2016). Some of these informal
institutions may counteract the initial purposes of promoting EVs, and they are far from making consumers convinced of their choices.

CONCLUSIONS AND IMPLICATIONS

China’s past strategy of developing the auto industry through joint ventures with major foreign automakers has been largely deemed a failure, as the market has been ceded, yet the expected technological transfer has hardly occurred, and domestic producers remain dependent on their foreign partners for patented technologies and designs. EVs are thus seen as an opportunity for China to revitalize its auto industry and bypass the leaders of the conventional auto industry. The Chinese central state’s commitment to the EV industry is a result of EVs’ potential to leapfrog China into a technological powerhouse, reducing China’s energy dependency and greenhouse gas emissions. The multiple goals, however, have created room for bargaining and power struggles among different state agencies and local states and resulted in China’s technological pragmatism in choosing to focus on battery electric vehicles over other alternative technologies.

And the EV industry is faced with a number of challenges. Different government agencies have discrepant views on the future of EV and vehicle technologies, and their local agents have different levels of commitment to the promotion of EVs. State subsidies focus more on producers than other stakeholders, such as charging service providers and public service companies that are end users of EVs. Sales-based subsidies do not offer incentives for investment in technological innovation—some producers are just recycling conventional auto technologies and designs or trying to meet the minimum technical requirements to qualify for subsidies. Local protectionism prevents EV producers from expanding into more markets. The lack of standardization and coordination among stakeholders, as in the case of charging infrastructure, makes it difficult for more companies to enter the EV industry and for EV producers to scale up demand, especially when multiple norms coexist in the industry. And the current promotion strategy focuses more on economic than on normative incentives, and therefore the central state’s blueprint for indigenous innovation and auto industry revitalization arouses little enthusiasm in consumers.

China’s EV industry has developed from its regulative legitimacy. However, for the EV industry, along with China’s strategy of indigenous innovation, to gain normative and cultural-cognitive legitimacy, it will need to take further measures to change social and industry norms to make conventional vehicles less desirable than EVs and domestic brands more attractive than foreign brands. To achieve that will require not only improved technologies that are both reliable and cost-effective but also more comprehensive state support, providing incentives and coordination to all stakeholders in the industry and stricter sanctions against nonconformity. However, if that happens, state-owned automakers’ interests may be hurt, and foreign companies and governments may protest China’s protectionism. This poses a dilemma for the Chinese state. See Table 2 for a summary of the different types of legitimacy of the Chinese EV industry.

There have been some policy adjustments that may reduce the disconnect between the EV industry’s regulative legitimacy and its normative and cultural-cognitive legitimacy. First, the central state is working on national standards for battery recycling, recharging, maintenance,
| Table 2: Institutional legitimacy in the Chinese electric vehicle (EV) innovation system |
|---|---|---|
| **Regulative legitimacy** | **Normative legitimacy** | **Cultural-cognitive legitimacy** |
| **Actors** | Ministry of Finance and its local branches; Ministry of Industry and Information Technology and its local branches; Ministry of Science and Technology and its local branches; National Development and Reform Commission and its local branches; provincial and municipal governments | EV producers; EV parts suppliers; electric utility companies (SOEs); power charging providers (mostly SOEs); EV operating companies; university and research institutes; conventional auto industry | Consumers and other potential EV users |
| **Sources of legitimacy** | Rules and regulations; incentive programs | Established industry norms and standards; environmental and social welfare contribution; state recognition; market competitiveness | Positive public perception and “taken-for-grantedness” |
| **Major fields of contention** | Goals for developing EVs; types of alternative vehicle technologies; extent and types of incentive programs | Technological routes; who gets subsidies; who leads the industry standards; how open the market should be; criteria for measuring organizations’ performance | In competition with the public perception of the conventional auto industry (e.g. cost, technological maturity, convenience, status symbol) |
| **Possible solutions** | Include all the relevant government agencies; sanctions against non-conformity; reconcile or prioritize conflicting goals | More comprehensive incentive programs; coordination between EV producers and other industry actors | Delegitimize the conventional auto industry; promote new social norms and values; create EVs’ symbolic value; restore consumers’ agency |
and repair. This should create more stability and rules for other players to enter the field, but it may also prematurely lock in a set of technological configurations and prevent further innovation. Moreover, as in the case of charging facilities, standards alone cannot solve the problems with lack of coordination. Second, mini-EVs, which are small and more affordable yet technologically more sophisticated than low-speed EVs, have gained some policy support. Cars like the Zotye Zhidou E20 have become qualified for government subsidies. Third, the central state is determined to invest more in R&D for key EV technologies and to offer more comprehensive incentives for the development of the EV industry.

Companies like Tesla have entered the Chinese market, and EV models developed by major global automakers, such as the BMW i3, have become available to Chinese consumers, which means increasing consumer recognition of EVs but also more competition for domestic producers. Some new joint ventures have already been established between domestic EV producers and foreign automakers. Indigenous innovation is, after all, not separable from the global players.

Whether or not China can become a world leader in the auto industry through EVs, it seems that this time the central state wants domestic firms to retain both the market and the technology. The challenge remains to balance the multiple, often conflicting, goals of indigenous innovation, industrial upgrading, and environmental and energy risk management, and how costs, interests, and responsibilities should be divided among the various stakeholders—different government agencies and local states, state-owned and private auto companies, electricity and charging service providers, EV operating companies, EV parts suppliers, and consumers. The future of EV diffusion and commercialization in China will likely depend on the continuous power struggles among those stakeholders and the level of congruity between the regulative, normative, and cultural-cognitive forms of legitimacy.

One of the implications of our study, therefore, is that when studying systems of innovation, it is important to pay attention to the different dimensions of legitimacy, how congruent they are, and how power dynamics and conflicts of interests between actors affect each dimension of legitimacy. As can be seen in the Chinese EV case, institutions are dynamic, not stable. While regulative legitimacy affects EV businesses’ choice of technologies, investment, and commitment to the industry, as well as EV adoption by public service companies and consumers, normative and cultural-cognitive legitimacy also influences regulations and rules in the industry to reflect the interests and power of different stakeholders.

For the theory of institutional legitimacy, our case indicates the interactive process of establishing the EV industry’s legitimacy, on which the different EV organizations depend to varying extents. While EV producers’ legitimacy relies heavily on the legitimacy of the industry, utility and public service companies are already well established in their own fields but are incentivized or mandated to enter the EV industry. As a result, their commitment to the industry and their available resources vary. Nevertheless, different actors may interpret, selectively attend to, or manipulate the existing institutions differently, or create new or informal institutions when faced with conflicting institutional demands and fighting to protect and promote their interests. Further studies are needed to compare different green technologies and their respective process of gaining legitimacy and to include the interaction between domestic and global actors.
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**NOTES**

1. According to the Ministry of Industry and Information Technology, 398,000 "new energy vehicles" were produced in 2015, of which 172,100 (more than 43%) were produced in the last two months, and in which commercial vehicles, such as buses and trucks, accounted for over 45% (http://miit.gov.cn/n11446212/n1146904/n1648362/n1648363/c4588273/content.html). Although this was much more than in previous years, it was still short of the half-million-vehicle target. It was also reported in January 2016 that some EV producers—mainly bus and coach makers—had invented ways to exaggerate their sales figures to cheat the state subsidy scheme; these producers were fined and punished after a nationwide investigation into subsidy fraud (http://www.miit.gov.cn/n1146290/n4588791/c54128955/content.html). Clearly, the thriving EV market in 2015 did not reflect the actual consumer demand for EVs.
2. There are five administrative levels in China: central, provincial, municipal/prefectural, county, and township. For each level, there are corresponding Communist Party and state agencies. The village level is not regarded as a formal administrative division but as a self-governing unit whose leadership is selected through direct elections; nonetheless, the Communist Party and the formal state do penetrate into villages.

3. Although new energy vehicles can include any alternative-fuel vehicles, the Chinese central state has set vehicles powered by electric motors as the primary type. There is controversy over whether the focus should be on all-electric vehicles or hybrid-electric vehicles, which we will discuss later in the article. Though FCEVs are included in the policy documents, they are far from commercialization, and the subsidies and other nonfinancial incentives thus apply more to battery electric vehicles than to FCEVs. In this article, EV includes both all-electric and plug-in electric vehicles.

4. The phrase “trading the market for technology” (yì shíchǎng huànxíshū) means opening the Chinese automobile market to foreign investment in the hope that foreign automakers will transfer technologies to China. It was repeatedly used by our interviewees, especially government officials, in reference to the status quo of the auto industry.

5. Interview with an official of Shenzhen’s Commission of Development and Reform, November 2013.

6. Vehicle purchase taxes belong to the central state. Before the policy change in 2014, while the central state subsidized each all-electric passenger car by CNY 60,000, it took away a 10% purchase tax.

7. Low-speed electric vehicles have sold extremely well in Shandong Province. They can only run for a short range at a slower speed, and are thus suitable for daily commutes and errands in urban areas. Because they have small batteries, charging time is short, and any outlet can be used. They are also cheap, and owners do not need a driver’s license. However, because of safety and quality concerns, companies that make them cannot get production permits from the MIIT, and their cars can only run locally, on a special license issued by the province.

8. An e-bus costs about CNY 1 million (USD 150,000), after government subsidies—half a million from the central state and another half a million from the Shenzhen municipal government—while a conventional bus only costs around CNY 650,000 (USD 97,000).

9. Conventional buses are replaced every eight years.


12. Subsidies for NEV shrank by 20% in 2017 from their 2016 level, and will fall by another 40% in 2019.

13. The E20 is a mini all-electric model with a top speed of 80 km/h and a range of 120 km per charge. It costs only a little over CNY 100,000 before subsidies and below CNY 50,000 after subsidies.