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Abstract

This paper examines the development of the electric vehicle (EV) industry in China from the perspective of mission-oriented innovation policies. It explores how China's central and local governments interact to create and shape the industry, with a focus on state capacities and experimentation. Drawing on official policy documents, Chinese news outlets, EV industry data, and interviews, the paper analyzes two cases of local experimentation: one involving low-speed electric vehicles in Shandong province, and another featuring affordable, low-tech micro-EV models in Guangxi province. The paper argues that local governments, by establishing close ties with nontraditional companies and supporting experimentation, perform the *functions* of peripheral agencies in the context of innovation in new, emerging industries. The central government, in turn, monitors these local experiments, learns from them, and adjusts its national policies accordingly. The findings contribute to broader debates on how state bureaucracies can drive effective industrial transformation, particularly in middle-income countries.

Keywords: Mission-oriented innovation; Peripheral agencies; Experimentation; China; Electric vehicles.

Resumo

Inovação orientada por missões, capacidades do Estado, e experimentação local: o caso dos veículos elétricos na China

Este artigo examina o desenvolvimento da indústria de veículos elétricos (VE) na China sob a perspectiva das políticas de inovação orientadas por missões. Explora como os governos central e locais da China interagem para criar e moldar a indústria, salientando as capacidades do Estado chinês e suas políticas de experimentação. Com base em documentos oficiais chineses de políticas econômicas para o setor, artigos da mídia chinesa, dados da indústria de VE e entrevistas, o artigo analisa dois casos de experimentação local: um envolvendo veículos elétricos de baixa velocidade na província de Shandong e outro com modelos micro-VE de baixo custo e de baixa tecnologia na província de Guangxi. O artigo argumenta que os governos locais, ao estabelecer laços estreitos com empresas não tradicionais e apoiar a experimentação, desempenham as funções de agências periféricas no contexto da inovação em novas indústrias emergentes. O governo central, por sua vez, monitora esses experimentos locais, aprende com eles e ajusta suas políticas nacionais de acordo. Os achados da pesquisa contribuem para debates mais amplos sobre como as burocracias públicas podem impulsionar a transformação industrial, particularmente em países de renda média.

Palavras-chave: Inovação orientada por missões, Agências periféricas, Experimentação, China, Veículos elétricos.
Classificação JEL: B52; O14; O21; O38; P41.

1. Introduction

After a long period on the margins of the public debate, industrial policy has made a comeback. As part of this revival, sometimes referred to as "new industrial policy,"[1] there is an increasing agreement that 21st century industrial policies should be seen as indispensable components

(1) Yevgeny Kuznetsov, "Experimentalist Governance for Technology Upgrading: New Industrial Policy Process," in *The Challenges of Technology and Economic Catch-up in Emerging Economies*, eds. J.-D. Lee et al. (Oxford: Oxford University Press, 2021), 459–88.

of broader strategies to tackle pressing contemporary challenges, such as health, social issues, and especially climate change. This also implies that the discussion about state capacities—fundamental for the successful delivery of these broader strategies—should be reexamined. Yet, there is a lack of consensus on what are the most suitable institutional arrangements and public sector agencies to improve state capacities, and to lead an effective strategy for industrial transformation. Much of the recent literature on industrial and innovation policies seeks to contribute to this debate;[2] and despite undeniable advancements, some gaps remain.

First, although the literature has advanced in reconceptualizing how state bureaucracies and public sector agencies should be perceived—for example, by bringing in the concept of dynamic capabilities[3] and Schumpeterian developmental agency[4]—there is a lack of attention to the intricate relations between different governance levels within the state; in particular, the relationship between the central (or national) and local (or subnational) levels. Second, there is room for empirical, industry-level studies focusing on low- and middle-income countries, or on the Global South more generally. As will be shown, when countries with substantially lower income per capita levels than those in advanced countries engage in innovation in new, emerging industries, different challenges and opportunities arise. Empirical studies on China, in particular—a country where innovation and industrial policies have been widely adopted in the 21st century—have received insufficient attention from this new literature.

This paper aims to address these research gaps. It sets out to analyze the development of the electric vehicles (EV) industry in China from the perspective of the recent revival of industrial and innovation policies. The EV industry exemplifies how states can simultaneously tackle multiple contemporary challenges, including climate change, while driving domestic companies toward the global technological frontier.

To analyze the EV industry's development, this paper brings together the idea of mission-oriented innovation,[5] Schumpeterian developmental agency (SDA) and peripheral agencies,[6] and it highlights the role local states have played in this process. It argues that while the central state has primary responsibility for initiating mission-oriented goals—setting a long-term public agenda, the *direction* of technological change, and attenuating the uncertainties typical of the innovation

(2) Dan Breznitz, Darius Ornston, and Steven Samford, "Mission critical: the ends, means, and design of innovation agencies," *Industrial and Corporate Change* 27, no. 5 (2018): 883–96; Mariana Mazzucato, "Mission-Oriented Innovation Policies: Challenges and Opportunities," *Industrial and Corporate Change* 27 (2018): 803–15; Antonio Andreoni and Rainer Kattel, "States of Innovation: How the state shapes production transformation,", in *Handbook of Industrial Development*, eds. P. Bianchi, S. Labory, and P. Tomlinson (Cheltenham: Edward Elgar, 2023), 382–402; Andrea Laplane and Mariana Mazzucato, "Socializing the risks and rewards of public investments: Economic, policy, and legal issues," *Research Policy* 49S (2020), 100008; Kuznetsov, "Experimentalist Governance."

(3) Rainer Kattel, Wolfgang Drechsler, and Erkki Karo, *How to Make an Entrepreneurial State. Why Innovation needs Bureaucracy* (London and New Haven: Yale University Press, 2022).

(4) Yevgeny Kuznetsov, "Which Way from Rent-Seeking? Schumpeterian vs. Weberian Public Sector" (Washington, DC: The World Bank, 2009).

(5) Mariana Mazzucato, "From market fixing to market-creating: a new framework for innovation policy," *Industry and Innovation* 23, no. 2 (2016):140–56; Mazzucato, "Mission-Oriented Innovation Policies."

(6) Dan Breznitz and Darius Ornston, "The Revolutionary Power of Peripheral Agencies," *Comparative Political Studies* 46, no. 10 (2013): 1219–45; Kuznetsov, "Which Way from Rent-Seeking?"; Kuznetsov, "Experimentalist Governance."

process—local states in China are responsible for experimentation, and perform the *function* of peripheral agencies in innovation in new, emerging industries, such as EVs. Relying on official policy documents, both from the central and local levels, Chinese news outlets, official statistics from the EV industry, and expert interviews, the paper supports the argument by exploring two cases of local experimentation. Each case illustrates distinct local strategies to promote the EV industry, showcasing how they reveal new information to central policymakers, and how the latter can learn from this and adjust national policies accordingly.

The first case focuses on the emergence of low-speed electric vehicles (LSEVs) powered by lead-acid batteries, which experienced a surge in demand in the 2010s. Produced by companies in the province of Shandong, they were sold under the shadow of the national policy, in that they were largely unregulated and not officially classified as EVs. The second case focuses on the development of affordable, low-cost, less technologically sophisticated EV models, produced by a local company in the relatively small city of Liuzhou, Guangxi province. In an apparent deviation from the national goal of pursuing cutting-edge technologies, these EV models achieved commercial success, and one of them ultimately emerged as the bestselling model nationwide in 2021. While LSEVs suffered from the central state's increasing regulatory clout, the low-cost, low-tech models from Guangxi were eventually supported by new central policies. Through analyzing the central state's evolving monitoring and selection practices, the paper examines the types of experimentation that were inhibited, tolerated, or supported, during the industry's development.

The paper argues that the concept of peripheral agencies[7] can be used to make sense of the pivotal role local states have been playing in China's innovative rise. Rather than focusing on the *forms* assumed by certain institutions (in this case, public agencies), the paper concentrates on the *functions* they perform—i.e., the promotion of experimentation in emerging, innovative sectors. This approach enhances comparability between countries, which often differ radically in variables such as size and political systems. The paper concludes by discussing the analytical implications of its findings; it highlights the importance of policy learning by the central policymakers, and that state capacities can be enhanced, rather than weakened, by the autonomy that local states enjoy.

2. Literature Review

2.1. Mission-oriented innovation, state capacities, and experimentation

Alongside the re-emergence of the industrial policy[8] debate in recent years,[9] the notion of mission-oriented innovation has also come to the fore. Aiming to address contemporary grand challenges—be they economic, developmental, environmental, social, health-related, or a combination of all of them—mission-oriented innovation is characterized by the identification of concrete problems to be solved, the setting of a clear purpose and a public agenda, and consequently,

(7) Breznitz and Ornston, "The Revolutionary Power."

(8) This paper employs the terms "industrial policy" and "innovation policy" interchangeably, given the reduced boundaries between the two in this literature. See Slavo Radosevic, Despina Kanellou, and George Tsekouras, "The experimentation–accountability trade-off in innovation and industrial policy: are learning networks the solution?", *Science and Public Policy*, 50 (2023): 655–69, 656.

(9) Breznitz, Ornston, and Samford, "Mission critical"; Kuznetsov, "Experimentalist Governance"; Andreoni and Kattel, "States of Innovation"; Dani Rodrik and Joseph Stiglitz, "A New Growth Strategy for Developing Nations," available at: http://tinyurl.com/ymrg8qom.

the *direction* innovation should take.[10] The state consciously chooses the direction of technological change, actively favoring certain technological paths over others. As Mazzucato argues, it "requires that the playing field be *tilted* in the direction pursued, rather than *leveled*" (original emphasis).[11] This requires the state to tackle the uncertainties typical of the innovation process, by harnessing cross-sectorial investments and thereby creating and shaping new markets. Fundamentally, such mission-oriented innovation policies (MOIP) must count on political support to legitimize a long-term agenda for innovation in the chosen direction; this entails bringing in other agents to align with these missions, and a *crowd in* of private investment.[12]

However, to apply these MOIP in practice, the role of the state, in general, and of public policy, in particular, must be readdressed.[13] This relates back to the debate about state capacities.[14] The literature on state capacities is large, and an exhaustive review would be unfeasible. Different theoretical traditions have contributed, leading to different definitions of the concept. More recently, even the World Bank and mainstream economics have appropriated the concept.[15] In this paper, I employ Centeno et al.'s (2017) definition of state capacities as "the organizational and bureaucratic ability to implement governing projects."[16] This definition echoes the Weberian tradition of theories of the state, and the focus on the organizational features and capacities of bureaucracies. It also has the advantage of not confusing the concept either with its causes or with its consequences. In this sense, this definition is normatively neutral, and independent of its outcomes. However, the goals or projects to be achieved using state capacities can, and typically are, determined by normatively charged political processes.[17]

The notion of state capacities encountered in the developmental states literature an ideal place to thrive.[18] This literature emphasizes, to different degrees, the importance of an autonomous state—capable of fending off pressure from organized societal groups—and the role of skilled bureaucrats, recruited on the basis of their expertise and technical competence rather than on patron–client

(10) Reiner Kattel and Mariana Mazzucato, "Mission-oriented innovation policy and dynamic capabilities in the public sector," *Industrial and Corporate Change* 27, no. 5 (2018): 787–801.

(11) Mazzucato, "From market fixing to market-creating," 150.

(12) Mazzucato, "From market fixing to market-creating"; Mazzucato, "Mission-Oriented Innovation Policies."

(13) Kattel and Mazzucato, "Mission-oriented innovation policy."

(14) Theda Skocpol, "Bringing the State back in: Strategies of Analysis in Current Research," in *Bringing the State Back In*, eds. Peter Evans, Dietrich Rueschemeyer, and Theda Skocpol (Cambridge: Cambridge University Press, 1985), 3–37; Joel Migdal, Atul Kohli, and Vivienne Shue, eds., *State Power and Social Forces: Domination and Transformation in the Third World* (New York: Cambridge University Press, 1994); Miguel Centeno, Atul Kohli, and Deborah Yashar, "Unpacking States in the Developing World: Capacity, Performance, and Politics, in: Centeno," in *States in the Developing World*, eds., M. A. Centeno, A. Kohli, and D. J. Yashar (Cambridge: Cambridge University Press, 2017), 1–34.

(15) See Stuti Khemani, "What Is State Capacity?", World Bank Policy Research Working Paper 8734 (2019). For the World Bank's Worldwide Governance Indicators (WGI), see Daniel Kaufmann and Aart Kraay, "Worldwide Governance Indicators," 2023. For a view closely associated with new institutional economics, see Mark Dincecco, *State Capacity and Economic Development: Present and Past*. *Elements in Political Economy* (Cambridge: Cambridge University Press, 2017).

(16) Centeno, Kohli, and Yashar, "Unpacking States in the Developing World," 3.

(17) Centeno, Kohli, and Yashar, 6.

(18) Alice Amsden, *Asia's Next Giant: South Korea and Late Industrialisation* (Oxford: Oxford University Press, 1989); Chalmers Johnson, *MITI and the Japanese Miracle: The growth of Industrial Policy, 1925–1975* (Stanford, CA: Stanford University Press, 1982); Robert Wade, *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization* (Princeton, NJ: Princeton University Press, 1990).

relations. While Peter Evans' concept of "embedded autonomy"[19] amends an excessive emphasis on state insulation by highlighting the bureaucracy's engagement with other social forces (especially industrial capital), the importance of state autonomy is preserved—that is, the state's ability to draw on its own vision of economic transformation, and to withdraw support to private capitalists when they fail to meet targets set by the state.[20] These characteristics provided East Asian countries with strong state capacities; particularly in the implementation of industrial policies.

The success of these early-developmental states was predicated on their bureaucracies' organizational features, characterized by centralized, supra-ministerial agencies, such as the Economic Planning Board in South Korea, which was capable of mobilizing resources for targeted industries. As argued by Wade, "the Korean government has a more centralized management structure… [t]op officials of these agencies can exercise broad control from a single position, acting through command hierarchies."[21] From this perspective, bureaucratic fragmentation is problematic, because it leads to policy misalignment and may thus undermine policy and bureaucratic coherence.[22]

The importance of centralized agencies has been recently challenged by scholars focusing on the promotion of new, innovative sectors, which are operating at, or pushing, the global technological frontier.[23] While centralized agencies were pivotal to the promotion of traditional and mature sectors, such as steel and shipbuilding, they are unfit to promote investments at the technological frontier, such as biotech. Because of the inherent uncertainty of innovation, which leads to *new* technologies and *new* markets, a different form of bureaucratic organization is required: one that encourages experimentation. The state should stimulate different implementation strategies to flourish, promote a continual selection of experiments, and be amenable to occasional failures. Kuznetsov calls this ideal-typical state agency a Schumpeterian Developmental Agency (SDA): one with "a mandate to experiment," and that "carefully monitor[s] the portfolio [of experiments] yet remain[s] accountable for the results of the experimentation."[24]

The concept of SDA is employed by Breznitz and Ornston (2013) in their study of innovation in Finland and Israel. Agencies situated at the periphery of the public sector, lacking financial resources and political prestige, ended up needing to search for new solutions, experimenting and forging alliances with the private sector; especially with nontraditional actors. Eventually, these

(19) Peter Evans, *Embedded Autonomy: States and Industrial Transformation* (Princeton: Princeton University Press, 1995).

(20) For the closely related concept of "discipline," see Amsden, *Asia's Next Giant*.

(21) Wade, *Governing the Market*, 323–24.

(22) Antonio Andreoni and Ha-Joon Chang, "The political economy of industrial policy: structural interdependencies, policy alignment and conflict management," *Structural Change and Economic Dynamics* 48 (2019), 136–50.

(23) Joseph Wong, *Betting on Biotech: Innovation and the Limits of Asia's Developmental State* (Ithaca, NY: Cornell University Press, 2011); Breznitz and Ornston, "The Revolutionary Power"; Sung-Young Kim, "East Asia's developmental states in evolution: the challenge of sustaining national competitiveness at the technological frontier," in *The Routledge Handbook to Global Political Economy: Conversations and Inquiries*, ed. Ernesto Vivares (London: Routledge), 511–27.

(24) Kuznetsov, "Experimentalist Governance," 479.

peripheral agencies managed to pioneer "radically new science, technology, and innovation policies."[25]

The debate about SDAs and peripheral agencies can inform the need for state capacities to serve contemporary MOIP. The grand societal challenges that MOIP aims to address often require the combination of multiple partial solutions, each of them unknown at the time of launching a mission—that is, there are no well-established blueprints to follow.[26] Missions only set the direction of technical change, but do not assume preconceived solutions. They thus encourage the emergence of an array of possible partial solutions, which can only appear if agents have the leeway to experiment, and even to fail. This possibility means that the state must also pursue continuous evaluation of policy alternatives, selecting some and discarding others. As Kattel and Mazzucato ask, "In the context of firms, market success provides the selection environment. How can we conceptualize similar dynamics in the public sector?"[27] If distinct state institutions could simultaneously devise an array of alternative policy solutions, the central leadership in charge of directing MOIPs would be well-suited to monitor, learn, select, and scale-up the most appropriate alternative(s). As I aim to show below, China's bureaucratic organization in the post-1978 era is a good fit for this endeavor.

2.2. China: state capacities, experimentation, and industrial policies

China can be considered one of the most successful cases of economic development in the past half-century. The "reform and opening up" strategy initiated in the late 1970s emphasized economic growth and technological modernization. This required significant modifications in China's bureaucratic organization. Although the core of the political system—headed by the Chinese Communist Party (CCP)—remained unchanged, continuous reforms in China's bureaucracy and governance systems were hallmarks of the post-1978 period.[28]

A key element of the reforms was local officials' increased leeway in implementing central policies. Although the system remained politically centralized, economic governance—including the administrative and fiscal domains—was decentralized.[29] This generated scope for policy experimentation at the local level. On the one hand, experimentation allowed local officials to tailor central policies to their local realities; this made policy implementation more effective, and thus potentially increased state capacities. For example, the massive growth of township and village enterprises (TVEs) in the 1980s, responsible for a significant portion of that period's economic growth, had not been carefully planned by an enlightened social engineer. As Deng Xiaoping himself would admit: "In the rural reform our greatest success—and it is one we had by no means

(25) Breznitz and Ornston, "The Revolutionary Power," 1223.

(26) Mazzucato, "Mission-Oriented Innovation Policies."

(27) Kattel and Mazzucato, "Mission-oriented innovation policy," 20.

(28) Anthony Saich, *Governance and Politics of China* (London: Palgrave Macmillan, 2015); Dali Yang, *Remaking the Chinese Leviathan: Market Transition and the Politics of Governance in China* (Stanford, CA: Stanford University Press, 2004); Author.

(29) Jae Ho Chung, *Central Control and Local Discretion in China: Leadership and Implementation during Post-Mao Decollectivization* (Oxford: Oxford University Press, 2000); Chenggang Xu, "The fundamental institutions of China's reforms and development," *Journal of Economic Literature* 49 (2011): 1076–1151. For the origins of fiscal and administrative decentralization in China still under Mao, see Audrey Donnithorne, "China's cellular economy: some economic trends since the Cultural Revolution," *The China Quarterly* 52 (1972): 605–19; Vivienne Shue, *The Reach of the State: sketches of the Chinese body politic* (Stanford: Stanford University Press, 1988).

anticipated—has been the emergence of a large number of enterprises run by villages and townships. They were like a new force that just came into being spontaneously … The Central Committee takes no credit for this."[30] Indeed, local policy experimentation has often been elevated to a key factor in explaining China's rise by China scholars.[31] On the other hand, the same local leeway allowed local officials to deviate from central directives, and to implement policies selectively,[32] thereby in practice undermining state capacities.

As Zhou Xueguang has recently argued, the combination of these two features engenders a "fundamental tension" in China's governance system, "between the centralization of authority and effective governance."[33] Local flexibility in policy implementation can be positive, leading to experimentation and assuaging the need for the central government to provide specific and technical information in detailed policy blueprints. However, local implementation may at times follow narrow local agendas, and can be captured by the interests of local elites. Ultimately, as Zhou concluded, "flexibility and deviation in policy implementation are often the same phenomenon with different labels."[34]

This tension between central authority and local discretion also manifests itself in the domain of industrial and innovation policies. On the one hand, multiple local states end up hurriedly investing in whatever priority industry is assigned by the central government, but without necessarily having the required technological capabilities to do so.[35] This also generates duplication of assets across the country, and consequently a potentially fragmented and poorly coordinated industry, which undermines the full exploitation of scale economies nationally. Even when the central government tries to intervene to reduce fragmentation and to consolidate a given industry, local officials tend to resist such policies.[36] On the other hand, this system has the advantage of generating high levels of productive investments across the country—a key variable in spurring economic growth, technical progress, and employment. Indeed, lack of investment is a key concern in other comparable, middle-

(30) Deng Xiaoping, "We Shall Speed Up Reform," June 12, 1987. Available at: https://www.marxists.org/reference/archive/deng-xiaoping/1987/90.htm. Last accessed: August 5, 2024.

(31) Sebastian Heilmann, "Policy Experimentation in China's Economic Rise," *Studies on Comparative International Development* 43 (2008): 1–26; Chung, *Central Control and Local Discretion in China*.

(32) Kevin O'Brien and Lianjinag Li, "Selective Policy Implementation in Rural China," *Comparative Politics* 31, no. 2 (1999): 167–86; Ling Chen, "Globalization: Foreign Capital and Local Bureaucrats in China's Economic Transformation," *World Development* 98 (2017): 381–99.

(33) Xueguang Zhou, "The Institutional Logics of Governance in China," in *Civilization and Governance: The Western and non-Western World,* ed. Boy Luthje (Singapore: World Scientific), 241–74, 243. See also Xueguang Zhou, "Chinese Bureaucracy Through Three Lenses: Weberian, Confucian, and Marchian", *Management and Organization Review* 17, no. 4 (October 2021): 655–82.

(34) Zhou, "The Institutional Logics of Governance in China," 265.

(35) For a recent case in the semiconductor industry, see Kathrin Hille and Sun Yu, "Chinese Groups Go from Fish to Chips in new 'Great Leap Forward'," *Financial Times*, October 13, 2020. Available at: www.ft.com/content/46edd2b2-1734-47da-8e77-21854ca5b212. Last accessed: August 6, 2024.

(36) Yasheng Huang, "Between Two Coordination Failures: Automotive Industrial Policy in China with a Comparison to Korea," *Review of International Political Economy* 9, no. 3 (2002): 538–73; Pei Sun, "Is the state-led industrial restructuring effective in transition China: evidence from the steel industry," *Cambridge Journal of Economics* 31, no. 4 (2007): 601–24.

income countries.[37] In addition, local states trigger experimentation in the industrial realm, which often leads to positive, even if unexpected, outcomes.[38]

This is of particular importance, because since the early 2000s a paradigm placing industrial and innovation policies at the center of economic development has emerged. While arguably China had been promoting industrial and innovation policies for a long time, either through imperative planning or through its numerous state-owned enterprises,[39] this paradigm gained much more importance in the past two decades, and has been strengthened under Xi Jinping.[40] As part of this general strategy, China boosted funding for innovation, increased R&D expenditure, and launched several sectorial industrial policies. Ministries directly related to innovation, such as the Ministry of Science and Technology (MOST), and the Ministry of Industry and Information Technology (MIIT), established in 2008, gained prominence in this period.[41]

Thus, the question arises of whether China has the necessary state capacities to implement those policies, especially as the country moves toward the global technological frontier. The study of electric vehicles—one of China's most heavily supported industries since the late 2000s—can shed light on this question. Moreover, one of the major controversies to have emerged with the rise of Xi Jinping is whether his concentration of power has led to the end of local experimentation. While some authors have suggested that local experimentation has been severely curtailed under Xi,[42] others have taken a more nuanced and cautious view.[43] This research also seeks to contribute to this debate.

3. China's promotion of electric vehicles: a case of mission-oriented innovation policy

The electric vehicles (EVs) industry—or, as they are known in China, new energy vehicles (NEV)—exemplifies China's renewed emphasis on industrial and innovation policies. Thus, the promotion of NEVs in China is part of a larger strategy to spur innovation in the country and promote high-tech industries. NEV is the general label used in China for pure battery electric, plug-in hybrid

(37) Antonio Andreoni and Fiona Tregenna, "Escaping the middle-income technology trap: A comparative analysis of industrial policies in China, Brazil and South Africa," *Structural Change and Economic Dynamics* 54 (2020): 324–40.

(38) Sebastian Heilmann, Lea Shih, and Andreas Hofem, "National Planning and Local Technology Zones: Experimental Governance in China's Torch Programme," *The China Quarterly* 216 (2013): 896–919; Jonas Nahm, "Exploiting the Implementation Gap: Policy Divergence and Industrial Upgrading in China's Wind and Solar Sectors," *The China Quarterly* 231 (2017): 705–27.

(39) Chen Li and Muyang Chen, "National Champions, Reforms, and Industrial Policy in China", in *The Oxford Handbook of Industrial Policy*, eds. A. Oqubay et al. (Oxford: Oxford University Press), Chapter 25.

(40) State Council, "Outline of the National Innovation-Driven Development Strategy" [国家创新驱动发展战略纲要], May 19, 2016. Available at: https://www.gov.cn/zhengce/2016-05/19/content_5074812.htm. Last accessed: August 5, 2024; Barry Naughton, "Grand Steerage," in *Fateful Decisions: Choices That Will Shape China's Future*, eds. T. Fingar and J. Oi (Stanford, CA: Stanford University Press, 2020): 51–81.

(41) Yutao Sun and Cong Cao, "Planning for Science: China's 'Grand Experiment' and Global Implications," *Humanities and Social Sciences Communications* 8, no. 1 (2021): 1–9; Author.

(42) Anna Ahlers and Gunter Schubert, "Nothing new under 'top-level design'? A review of the conceptual literature on local policymaking in China," *Issue and Studies* 58, no. 1 (2022): 1–34.

(43) Abbey Heffer and Gunter Schubert, "Policy Experimentation under Pressure in Contemporary China," *The China Quarterly* 253 (2023): 35–56; Yuen Yuen Ang, "Ambiguity and Clarity in China's Adaptive Policy Communication," *The China Quarterly* 257 (2024): 20–37.

electric, and fuel-cell vehicles. It also refers to private electric passenger cars, buses, taxis, officials' vehicles, garbage and sanitation trucks, and logistics vehicles.[44]

China's NEV industry started to be promoted, with little fanfare, in the 1990s; but it received a significant boost in the late 2000s.[45] By the end of the 2010s the country became the world's largest market for EVs, and home-grown domestic brands, until then unheard of in the West, became familiar names—such as Shenzhen-based BYD, and CATL, the largest electric battery manufacturer in the world. Moreover, China also rose to dominate other pivotal segments in the EV supply chain, such as the processing and refining of critical minerals used in electric batteries. Ganfeng Lithium, for example, became one of the largest lithium compounds producers in the world.[46]

China's promotion of NEVs can be perceived as a case of MOIP, as it seeks to address grand challenges that China is currently facing. The rationale for promoting EVs is broad and seeks to tackle three interrelated challenges. The first is economic and technological: taking advantage of the slow resolve of incumbent leaders in the global internal combustion engine (ICE) industry to move towards electrification, China seeks to leverage on lower barriers to entry and promote domestic companies to the status of global leaders while the EV industry is still developing—in essence, promoting a leapfrogging strategy. Second, there is an environmental challenge: EVs bring the promise to reduce greenhouse gas emissions and air pollution in major Chinese cities. These can trigger health problems in urban residents, and may thus undermine the party-state legitimacy.[47] Third, there is a geoeconomic and geopolitical challenge: the transition from ICE to electrification will reduce the country's dependence on oil, a major item in its imports bill. Beyond the pure economic costs of imports in foreign exchange, reliance on fossil fuels implies higher dependency on oil-producing countries, which exacerbates geopolitical risks and undermines China's energy and resource security.[48]

Moreover, the NEV agenda gained political support, especially from the late 2000s onwards, and eventually it became an undisputed top priority for China's leadership—as attested in several official documents of the period. NEVs were elevated to the status of a "strategic emerging industry" in 2010, and increasingly occupied a primary place in the leadership's public agenda;[49] they were

(44) Hereafter, the paper employs NEV when referring to China's national policies and national strategy of promoting electric vehicles, including all segments and types; and EV when referring solely to electric private passenger cars.

(45) Huiming Gong, Michael Wang and Hewu Wang, "New energy vehicles in China: policies, demonstration, and progress," *Mitigation and Adaptation Strategies for Global Change* 18, no. 2 (2013): 207–28; Sabrina Howell, Henry Lee, and Adam Heal, "Leapfrogging or stalling out? Electric vehicles in China," Regulatory Policy Program Working Paper, no. RPP-2015-07 (Cambridge, MA: Mossavar-Rahmani Center for Business and Government, Harvard Kennedy School, Harvard University, 2014).

(46) Henry Sanderson, *Volt Rush: The Winners and Losers in the Race to Go Green* (London: Oneworld, 2022).

(47) Elizabeth Thurbon et al., *Developmental Environmentalism: State Ambition and Creative Destruction in East Asia's Green Energy Transition* (Oxford: Oxford University Press, 2023).

(48) John Mathews, "Leapfrogging on Steroids: China's Green Growth Strategies," in *The Challenges of Technology and Economic Catch-up in Emerging Economies*, eds. J.-D. Lee et al. (Oxford: Oxford University Press), 331–48.

(49) State Council, "Decision of the State Council on accelerating the cultivation and development of strategic emerging industries" [国务院关于加快培育和发展战略性新兴产业的决定], [国发[2010]32号], October 18, 2010. Available at: http://www.gov.cn/zwgk/2010-10/18/content_1724848.htm. Last accessed: August 5, 2024; State Council, "State Council's notice on energy-saving and New Energy Vehicles industry development plan (2012–2020)" [国务院关

recently labelled, alongside electric batteries and solar panels, as one of the "new three" industries (*xin san yang*) to become the country's new growth drivers.[50] It is also highlighted in broader efforts to promote the "green transformation."[51] As such, electrification represents a clear *direction* for technological change, consciously chosen by China's top leadership to address economic, technological, geopolitical, and environmental problems.

A key figure in amassing political support for NEVs within China's top leadership was the then MOST minister Wan Gang, previously described as "perhaps China's most aggressive advocate of EVs."[52] His role could be perceived as a "policy entrepreneur," someone "who takes a risk by organizing new collaborative alliances" in the context of putting forward new industrial policies.[53]

With Wan Gang at the helm of MOST from 2007 to 2018, NEVs received a more significant boost. In 2009, the pilot program "Ten cities, a thousand vehicles" was launched. The program did not meet all its targets,[54] but rather than terminating the NEV agenda altogether, the central leadership built on its achievements; after all, it had kick-started the commercialization of EVs, and fostered technological improvements and public awareness.[55] Thus, the central leadership launched a national policy in 2012,[56] demonstrating consistent political support for the NEV agenda. The 2020 target of

于印发节能与新能源汽车产业发展规划（2012—2020年）的通]知], [国发[2012]22号], July 9, 2012. Available at: http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm. Last accessed: August 5, 2024; State Council, "New energy vehicle industry development plan (2021–2035)" [新能源汽车产业发展规划 (2021—2035年)], [国办发 [2020] 39号]. 20 October, 2020. Available at: http://www.gov.cn/zhengce/content/2020-11/02/content_5556716.htm. Last accessed: August 5, 2024.

(50) MERICS, "China Essentials," March 14, 2024.

(51) Central Committee of the Communist Party of China, "Opinions of the State Council on Accelerating the Comprehensive Green Transformation of Economic and Social Development" [国务院关于加快经济社会发展全面绿色转型的意见], July 31, 2024. Available at: http://politics.people.com.cn/n1/2024/0811/c1001-40296672.html. Last accessed: August 13, 2024.

(52) Howell, Lee, and Heal, "Leapfrogging or stalling out?," 8; see also Qiang Zhi and Margaret Pearson, "China's Hybrid Adaptive Bureaucracy: The Case of the 863 Program for Science and Technology," *Governance* 30, no. 3 (2017), 407–24.

(53) For the policy entrepreneur concept and its relationship with the "new industrial policy" literature, see Kuznetsov, "Experimentalist Governance," 471. Understanding that China had to move decisively towards electrification, and that other countries (especially Japan, South Korea, and the US) traditionally dominated basic and applied research in the field of electric batteries, Wan Gang was determined to push China ahead of its potential competitors while they were still hesitant to commit to mass manufacturing and commercialization of EVs. Steve LeVine vividly recounts Wan Gang's 2010 visit to Argonne National Laboratory (the US federal laboratory at the center of fundamental advancements in lithium-ion battery technology): "He had a mission … a war was on … a battery war." See Steve LeVine, *The Powerhouse: America, China, and the Great Battery War* (New York: Penguin Books), 3.

(54) Gong, Wang, and Wang, "New energy vehicles in China."

(55) Yanchao Li, Luke Georghiou, and John Rigby, "Public procurement for innovation elements in the Chinese new energy vehicles program," in *Public Procurement for Innovation*, eds. C. Edquist et al. (Edward Elgar Publishing, 2015): 179–208.

(56) State Council, "State Council's notice on energy-saving and New Energy Vehicles industry development plan (2012–2020)."

five million NEVs on the road was virtually met, and China became the largest market for EVs in the world.[57]

This result was achieved thanks to a series of supportive policies launched during the 2010s, of which I highlight four: purchase subsidies, the exemption of the sales tax for NEVs, the dual-credit policy, and the green plate license policy.[58] The first provided generous purchase subsidies, and especially after 2016 became more closely tied to EVs' level of technological sophistication. After being gradually phased out by the end of the decade, it was terminated in 2022. With the end of the purchase subsidies, the sales tax exemption became more important to support the industry.[59] Next, the dual-credit policy gained traction as the purchase subsidies policy started to wane. This policy awards credits to automotive companies which produce NEVs above a minimum level, and/or produce more fuel-efficient ICEs. Companies with negative net credits must purchase credits from surplus companies, or face penalties. Essentially, this incentivizes manufacturers to migrate their production from ICEs to NEVs. Finally, the green plate license policy exempts EV buyers from the otherwise mandatory and expensive lottery and/or auction system to obtain a new license plate for a new passenger vehicle. This policy essentially tilts consumer purchase decisions towards EVs.

Concurrently with these policies, a series of environmental plans were put forward, which in practice also spurred the adoption of NEVs—especially public buses and logistics vehicles. Following growing concerns over national air quality, the State Council enacted the Air Pollution Prevention and Control Action Plan in 2013,[60] which for the first time set clear goals for fine particulate matter 2.5 ($PM_{2.5}$)[61] reductions in the 2013–2017 period. In 2018, China strengthened this strategy by launching the National Plan of Blue-Sky Defense.[62] This similarly aimed to reduce air pollution in urban centers by, among other measures, encouraging the deployment of NEVs. In addition, as the 2010s advanced, a series of measures to curb air pollution were implemented, many of which included the promotion of NEVs, either directly or indirectly, by discouraging ICE sales or strengthening their

(57) China achieved 4.92 million NEVs by 2020, and most industry experts consider the target has been met. See Hui He and Lingzhi Jin, "How China put Nearly 5 Million New Energy Vehicles on the Road in One Decade," The International Council on Clean Transportation (ICCT). January 28, 2021.

(58) For a detailed description of the main policies used in China and in other countries, see International Energy Agency (IEA), *Global EV Outlook 2019: Scaling-Up the Transition to Electric Mobility*, May 2019; Hui He et al., "Assessment of Electric Car Promotion Policies in Chinese Cities," The International Council on Clean Transportation (ICCT), October 2018; Godfrey Yeung, "'Made in China 2025': The Development of a New Energy Vehicle Industry in China," *Area Development and Policy* 4, no. 1 (2019): 39–59.

(59) Scott Kennedy, "The Chinese EV Dilemma: Subsidized Yet Striking," Center for Strategic and International Studies (CSIS), June 20, 2024. Available at: https://www.csis.org/blogs/trustee-china-hand/chinese-ev-dilemma-subsidized-yet-striking. Last accessed: August 10, 2024.

(60) State Council, "Notice of the State Council on Issuing the Air Pollution Prevention and Control Action Plan" [国务院关于印发大气污染防治行动计划的通知], [国发(2013) 37号], September 10, 2013. Available at: https://www.gov.cn/zwgk/2013-09/12/content_2486773.htm. Last accessed August 5, 2024.

(61) The term PM2.5 refers to tiny particles in the air that are two-and-a-half microns or less in width. These are considered extremely dangerous as they can enter deep parts of the lungs or even into the bloodstream. Coarse particles (PM10-2.5), although obviously unhealthy, are less threatening.

(62) State Council, "Notice of the State Council on Printing and Distributing the Three-Year Action Plan for Winning the Blue-Sky Defense War" [国务院关于印发打赢蓝天保卫战三年行动计划的通知], [国发 (2018) 22号], June 27, 2018. Available at: https://www.gov.cn/zhengce/content/2018-07/03/content_5303158.htm. Last accessed: August 5, 2024.

emission standards.[63] China also pledged to achieve peak emissions of carbon dioxide (CO_2) in 2030, and carbon neutrality by 2060—goals that are unlikely to be achieved without the promotion of NEVs.[64]

In summary, the Chinese state has consistently provided a long-term public agenda to tackle grand economic, technological, environmental, and geopolitical challenges related to the automotive industry and society at large, and promoted the industry's transformation to electrification. In doing so, the Chinese state has given the industry a clear *direction*. As these transformations also affect adjacent sectors and realms—such as the processing and refining of minerals, the manufacturing and recycling of electric batteries, and urban planning to establish a dense network of recharging stations—these are essentially cross-sectorial transformations. Such an ambitious strategy calls for formidable state capacities. As EVs can be considered a case of innovation at the global technological frontier, fraught with uncertainties and with no policy blueprint to follow, one may expect to observe cases of local experimentation regarding the promotion of electrification in the automotive industry. This paper concentrates on this issue next.

4. Local experimentation in China's push toward electrification

In reality, the *implementation* of the aforementioned policies is a task for local states. For one example, on top of the central-level purchase subsidies, local governments were allowed to choose how much to add from their own coffers.[65] For another, they had the discretion to decide whether to adopt the green plate license policy. In fact, only a few metropolises have implemented this policy.[66] Moreover, they have the autonomy to design their own charging network infrastructure, and to integrate newly built charging stations within their own urban planning policies.[67] NEV-related environmental policies also have a local component, as cities suffering the most from air quality problems typically set up their own local versions of the environmental plans discussed above.[68] Thus, the behavior of local governments and their leeway in implementing policies leads to different, regionally based, models.

4.1. Method and case selection

The research turns now to a comparison between two cases of very active industry promotion by two peripheral local states. The first case focuses on the emergence of low-speed electric vehicles (LSEVs) powered by lead-acid batteries, produced primarily by companies in the province of

(63) Yana Jin, Henrik Andersson, and Shiqiu Zhang, "Air Pollution Control Policies in China: A Retrospective and Prospects", *International Journal of Environmental Research and Public Health* 13, no. 12 (2016): 1219; Qiang Zhang et al., "Drivers of improved PM 2.5 air quality in China from 2013 to 2017," *Environmental Sciences* 116, no. 49 (2019): 24463–69; Yidan Chu et al., "Assessment of leading new energy vehicle city markets in China and policy lessons," International Council on Clean Transportation (ICCT), September 2022.

(64) Yuntian Zhang, Hui He, and Zhinan Chen, "Trends of new passenger cars in China: air pollutant and CO2 Emissions and Technologies, 2012–2021," International Council for Clean Transportation (ICCT). January 2023.

(65) Yeung, "Made in China 2025."

(66) Lingzhi Jin et al., "Driving a Green Future: a retrospective review of China's electric vehicle development and outlook for the future", International Council for Clean Transportation (ICCT), January 2021.

(67) Johannes Lauer and Ingo Liefner, "State-Led Innovation at the City Level: Policy Measures to Promote New Energy Vehicles in Shenzhen, China," *Geographical Review* 109, no. 3 (2019): 436–56; Author.

(68) Chu et al., "Assessment of leading new energy vehicle city markets," 45.

Shandong.[69] The second case concentrates on Guangxi province; specifically on Liuzhou, a relatively small city that has supported the development of affordable, low-cost, less technologically sophisticated EV models produced by a local company.

The research follows the tradition of small-N comparisons, in which both cases are similar—in this case, peripheral local states in China's innovative efforts, and promoting low-cost innovations—yet they differ in the responses they triggered from the central government. This strategy allows the research to draw contrasts and similarities between the cases, and to gain insights that would be harder to detect in a larger, quantitative study.[70]

Both provinces, Shandong and Guangxi, can be considered peripheral in relation to the central state. Moreover, in contrast to major provincial economic powerhouses such as Jiangsu and Guangdong, they lack well-established high-tech industrial bases and do not perform well in innovation indicators, such as R&D expenditure and patent applications. As Table 1 indicates, in 2022 the share of Guangxi's R&D expenditure was a meagre 0.78% of the national total. While Shandong performed better, with 8.93%, Jiangsu and Guangdong's figures were almost twice as high (15.46% and 16.62%, respectively). Similarly, for invention patents, Guangxi's share was only 0.83% of the national total, and Shandong's was 6.66%. Jiangsu's figure was roughly double (13.26%) Shandong's, and Guangdong amassed more than a quarter (26.88%) of all invention patents in China in 2022. Unequivocally, Guangxi and Shandong can be considered peripheral players in China's innovative efforts.

Table 1
Selected innovation indicators (2022)

	R&D expenditure (10,000 RMB)	R&D expenditure per capita (RMB per person)	R&D expenditure as share of the national total (%)	Patents (inventions only) (units)	Patents (inventions only) per capita (units per 10,000 persons)	Patents (inventions only) as share of the national total (%)
National	193,617,617.00	1,370.65	100.00	554,615.00	3.93	100.00
Jiangsu	29,936,774.00	3,519.90	15.46	73,525.00	8.64	13.26
Guangdong	32,177,548.00	2,536.86	16.62	149,075.00	11.75	26.88
Shandong	17,287,025.00	1,699.81	8.93	36,935.00	3.63	6.66
Guangxi	1,505,736.00	298.94	0.78	4,615.00	0.92	0.83

Source: Own elaboration based on data from National Bureau of Statistics (NBS), "China Statistical Yearbook" (Beijing: China Statistics Press, 2023).

Despite their similarities, the two cases triggered contrasting behaviours from the central government. In the second case, emerging from Guangxi province, a new central-level policy further

(69) Although LSEVs are, in a more mundane understanding of the expression, electric vehicles—that is, a vehicle powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source—they were not officially considered NEVs by the central government. For a definition of electric vehicles from outside China, see US Department of Energy, "Alternative Fuels Data Center," available at: https://afdc.energy.gov/laws/12660. Last accessed: August 12, 2024.

(70) Dimiter Toshkov, *Research Design in Political Science* (London: Palgrave MacMillan, 2016), 258–84; Robert Yin, *Case Study Research and Applications: Design and Methods* (London: SAGE, Sixth Edition, 2018).

legitimized the model and boosted sales nationwide; moreover, its success led even mainstream companies, such as BYD, to adapt their business models. In the first case, however, LSEVs pioneered by Shandong province suffered from the central state's increasing regulatory clout. The comparison of these two cases of local experimentalism—and their different responses from the central government—draws on official policy documents, both from the central and local levels, Chinese news outlets, official statistics from the EV industry, and online expert interviews. The comparison sheds light on three aspects: first, the importance of local experimentation for the success of China's electrification goal. Second, through analysing the central state's evolving monitoring and selection practices, it clarifies the types of experimentation supported, tolerated, or inhibited, and showcases how they complement, operationalize, or challenge priorities set by the central state. Third, and in contrast with innovation in advanced economies, the comparison highlights the importance of advancing "bottom of the pyramid" innovation, and thereby exploiting large markets for low-cost innovative products.

4.2. Local experimentation under the shadow of the national policy: the rise of low-speed electric vehicles (LSEVs)

With clear signals from the central government toward electrification since the late 2000s, an EV manufacturing spree started in China, and even localities without previous relevant industrial experience started to invest in the field, although sometimes in a manner unforeseen by the central state. Some local governments started to heavily support a different type of electric vehicle: a new, low-cost, low-tech alternative, which, due to its different technical characteristics, was not even officially classified as a NEV. Dubbed low-speed electric vehicles, LSEVs experienced strong growth already by the early 2010s, when policy-backed NEVs were still struggling to make initial inroads into the domestic market.

Due to their unregulated nature, there is no uncontested definition of LSEVs. In fact, the establishment of technical standards to better define them would be at the core of central authorities' efforts to regulate them more strictly by the end of the 2010s, as will be discussed below. It is commonly accepted, however, that they are typically four-wheeled battery-powered electric vehicles, with a maximum speed of 40–70km/h. Their size varies, from a small passenger vehicle to golf-cart size vehicles.[71] Importantly, they are often powered by lead-acid batteries, which are cheaper than lithium-ion ones. Besides these technical characteristics, LSEVs are known for their distinctive consumer base: typically, low-income people from rural areas or small cities.

Shandong, a province lacking any major automotive passenger car company and more associated with agricultural production, was at the heart of the development of a LSEV industry. By the 2000s, the province could boast a local industry for agricultural tractors, three-wheeled small vehicles, and electric-bikes, powered by lead-acid batteries. Building on these existing technological capabilities, instead of developing pure electric or plug-in hybrid passenger EVs comparable to

(71) Jinpeng Gao et al., "Low-speed Electric Vehicle Market Boom in China," December 2017, Institute of Transportation Studies, University of California, Davis; Yu Zou et al., "Agile Business Development, Chinese Style: An Exploration of the Low-Speed Electric Vehicle Industry in Shandong Province, China," *The China Review* 22, no. 1 (February 2022): 107–33.

traditional ICEs (as national leaders expected), local firms quickly recombined their productive capabilities to create LSEVs.

In the early 2010s, when central policymakers were still struggling to kick-start the NEV market in China's large metropolises,[72] LSEV sales started to boom in Shandong's countryside, with an estimated almost 80,000 units in 2011.[73] In 2017, 756,000 LSEV were produced in Shandong alone.[74] The success of this strategy quickly spread to other provinces, and in 2018, national LSEV sales reached an impressive 1.4 million units; whereas pure electric and hybrid electric private passenger cars combined totaled only 1.1 million units that year.[75]

Despite their poorer technical standards, which make them unappealing to well-off consumers in wealthy cities, LSEVs have lower prices and maintenance costs. Moreover, their lead-acid batteries can be easily recharged from 220-volt sockets present in most households, rather than requiring a large and well-distributed network of charging stations—a key bottleneck in the initial phase of China's EV promotion.[76] Marketed in rural areas and small cities, LSEVs' low maximum speed and low range autonomy were not a source of concern for its consumer base. In addition, as LSEVs were not officially classified as automotive vehicles, a driver's license was not required, which boosted demand.[77]

Under this model, many companies thrived, such as Shifeng, Byvin, and Baoya; at least until the central government started to exert more regulatory pressure on the industry in the second half of the 2010s (discussed further below). What all these companies had in common was the fact that they were all nontraditional companies in the automotive sector, and all forged close ties with Shandong provincial government and other local actors. Moreover, due to their lower technological capabilities than other leading EV automakers, they placed less importance on developing lithium-ion batteries or other core automotive technologies.

Shifeng, for example, started as a manufacturer of agricultural vehicles and agricultural machinery in Shandong.[78] Byvin had a strong presence in the local market for e-bikes since the early 2000s.[79] With the national push towards electrification, both companies shifted their production to EVs. However, they evaded the increasingly fierce competition with major automakers such as

(72) Gong, Wang, and Wang, "New energy vehicles in China."

(73) Chris Kimble and Hua Wang, "China's new energy vehicles: value and innovation," *Journal of Business Strategy* 34, no. 2 (2013): 13–20, 17.

(74) Zou et al., "Agile Business Development, Chinese Style," 122.

(75) Nathaniel Bullard and Colin McKerracher, "Dispelling the Myths of China's EV Market," *Bloomberg UK*, February 18, 2019. Available at: https://about.bnef.com/blog/bullard-dispelling-myths-chinas-ev-market/. Last accessed: August 5, 2024.

(76) Anders Hove and David Sandalow, "Electric Vehicle Charging in China and the United States," Columbia School of International and Public Affairs, Center of Global Energy Policy. February 5, 2019; Kimble and Wang, "China's new energy vehicles."

(77) Author's interview #1, August 2024; see also Gao et al., "Low-speed Electric Vehicle Market Boom in China".

(78) Qunhong Shen, Kaidong Feng, and Xiaobin Zhang, "Divergent technological strategies among leading electric vehicle firms in China: Multiplicity of institutional logics and responses of firms," *Science and Public Policy* 43, no. 4 (2016): 492–504.

(79) Zou et al., "Agile Business Development, Chinese Style."

traditional state-owned SAIC, or emerging private players such as BYD, and focused on China's large market for low-cost innovation—in practice betting on a "bottom of the pyramid"[80] innovation strategy. This approach centered on satisfying the demand of large swathes of China's massive rural and semi-rural population, who were typically ignored by mainstream EV manufacturers.[81]

The support from, and close ties with, Shandong provincial government proved pivotal. First, differentiated traffic laws formed a fundamental incentive for the spread of LSEVs in Shandong. The central government prohibits driving LSEVs on public roads in urban areas, which limits their appeal to consumers. The Shandong provincial government, however, allowed LSEVs in small cities, thus boosting demand.[82] Some sources also suggest that local traffic enforcers had a more lenient attitude toward LSEVs.[83] Second, a coalition spearheaded by local officials and local companies led to the establishment of an LSEV industry alliance, which stimulated firms' exchange of information and promotion of the industry.[84] Third, other local actors were also important. Local companies, such as Baoya, established partnerships with Shandong University to foster technological upgrading of the company's powertrain system.[85] By supporting local firms in multiple ways, Shandong provincial government in practice enabled these non-traditional companies' experimentation in the industry.

This local support was especially critical because LSEVs were not favored by the central government; they were tolerated to some extent, but never supported. First, LSEVs are essentially a low-end, low-tech EV, unlikely to gain popularity with consumers from advanced economies. As such, one of the key objectives of the NEV strategy—helping China to leapfrog incumbent competitors worldwide—would not be achieved if the country's EV industry were dominated by LSEVs. Worse still, to keep costs down, LSEVs often used lead-acid batteries. This depresses domestic demand for products of Chinese companies such as CATL (the world's largest lithium-ion electric battery producer), and can also harm the environment, due to countless incidents of lead leakage. No wonder, then, some would refer to LSEVs as "industrial garbage" (*gongye lese*).[86] Finally, due to their unregulated nature and the non-requirement of a drivers' license, LSEVs were involved in many traffic accidents throughout the 2010s. Central government authorities, reflecting their close

(80) Raphael Kaplinsky, "'Bottom of the Pyramid' innovation and pro-poor growth," in *Making innovation policy work: learning from Experimentation*, eds. Mark A. Dutz et al. (Paris: OECD Publishing, 2014), 49–70.

(81) China's rural population is estimated at 491 million people in 2022; see NBS, *China Statistical Yearbook* (Beijing: China Statistics Press, 2023), Table 2-1.

(82) Zou et al., "Agile Business Development, Chinese Style."

(83) Shen, Feng, and Zhang, "Divergent technological strategies."

(84) The alliance organized the establishment of standards for the testing, environmental impact, and safety for LSEVs, and organized annual exhibitions (Author's interview #2, July 2024). See also Ke Rong et al., "Organizing business ecosystems in emerging electric vehicle industry: Structure, mechanism, and integrated configuration," *Energy Policy* 107 (2017): 234–47; Zou et al., "Agile Business Development, Chinese Style"; Kimble and Wang, "China's new energy vehicles."

(85) Rong et al., "Organizing business ecosystems."

(86) D1EV, "'Mobility scooters' require a revitalization: how can China's low-speed electric vehicles restore their reputation?" ["老头乐"也要有春天：如何为中国低速电动汽车正名?], April 19, 2024. Available at: https://www.d1ev.com/kol/227132. Last accessed: August 21, 2024.

monitoring of this booming market, reported LSEVs' involvement in around 830,000 traffic accidents between 2013 and 2018—some of them fatal.[87]

Indeed, LSEVs' commercial success was increasingly monitored by the central government, and hostilities towards LSEVs would only increase. Starting in 2016, the central government tried to set specific technical standards to regulate LSEVs and tackle their disorderly expansion.[88] In 2018, a notice jointly issued by the MIIT, MOST, the National Development and Reform Commission (NDRC), the Ministry of Public Security, the Ministry of Transport, and the State Administration for Market Regulation, urged local governments to identify and close LSEV manufacturers without appropriate passengers vehicle's production licenses; to stop issuing policies to encourage the development of LSEVs; and to stop approving new LSEV investment projects.[89] In 2021, MIIT issued a public document soliciting opinions on a new *recommended* national technical standard for LSEVs. The recommendations included clearer size, power, performance and battery standards. Importantly, stricter safety requirements (e.g., crash testing) should be consistent with those of regular passenger EVs.[90] This increasing stringency from Beijing has indeed placed pressure on LSEV companies and local governments, and many underqualified companies were driven out of the market, while others resorted to gaining appropriated production licenses through acquiring existing automotive

(87) Xinhua News, "Will the mobility scooter sales keep growing?" [老年代步车"刹"得住车吗], June 22, 2021. Available at http://www.xinhuanet.com/politics/2021-06/22/c_1127585082.htm. Last accessed: August 7, 2024; Zhu Junxi, "Citing Safety, Beijing Bans Unregistered Electric Scooters," *Sixth Tone*, January 2, 2024. Available at: https://www.sixthtone.com/news/1014388. Last accessed: August 7, 2024; Sohu News, "Mobility scooters are further 'slowed down', and have been 'banned' in many cities; it once sold millions of units a year with its cool appearance" [老头乐没法"乐"了，多地遭"封杀"，外观拉风曾年销百万辆], May 19, 2023. Available at: https://www.sohu.com/a/677031900_507074. Last accessed: August 7, 2024.

(88) Author's interview #2, July 2024; see also MIIT, "The preparation and first meeting of the standard working group for 'Technical Conditions for Four-wheel Low-speed Electric Vehicles' was held in Beijing" [《四轮低速电动车技术条件》标准工作组筹建及第一次会议在北京召开], November 18, 2016. Available at: https://www.miit.gov.cn/jgsj/zbys/qcgy/art/2020/art_3809d2e645044b8eadaf54581bfc446e.html. Last accessed: August 7, 2024. Initially, the China Micro Electric Vehicle Industry Technology Innovation Alliance and other industry associations jointly drafted the "Technical specifications for Micro Low-speed Electric Vehicles," which detailed the terms and definitions, models, technical requirements, test methods, and other aspects of LSEVs. However, since this standard was made by a non-governmental association, it was not legally binding. Still in 2016, the National Standardization Administration announced the draft of the "Technical conditions for four-wheel low-speed electric passenger vehicles."

(89) NDRC, "Notice on Strengthening the Management of Low-Speed Electric Vehicles" [关于加强低速电动车管理的通知], [工信部联装〔2018〕227号], November 2, 2018. Available at: https://www.ndrc.gov.cn/fgsj/tjsj/cyfz/zzyfz/201811/t20181108_1150001_ext.html. Last accessed: August 7, 2024.

(90) China Association of Automobile Manufacturers (CAAM), "Public solicitation of opinions on the recommended national standard 'Technical requirements for pure electric passenger vehicles'" [公开征求对推荐性国家标准《纯电动乘用车 技术条件》的意见], June 21, 2021. Available at: 公开征求对推荐性国家标准《纯电动乘用车技术条件》的意见 (caam.org.cn). Last accessed: August 7, 2024.

companies to keep operating.[91] Hence, from being at least tolerated by the central government, LSEVs became increasingly inhibited.

Despite its undeniable hostility, the central government has never fully banned LSEVs. The aforementioned MIIT regulations, for example, have never been officially implemented; rather, they were recommended standards. There are two reasons for that: first, it would be very costly to enforce these regulations throughout China's vast countryside, demanding great human and financial resources from the central government. Second, the net benefits would be small. The strict enforcement of these regulations would in effect push too many firms out of the market, with negative consequences for output growth and employment.[92]

The central government's position regarding LSEVs has thus been ambiguous. On the one hand, it has been increasingly hostile. LSEVs certainly were not the type of product envisaged by MOST's former minister Wan Gang, nor as the visible face of China's "innovation-driven strategy."[93] Their dependence on lead-acid batteries also undermined any claim to environmental friendliness. On the other hand, LSEVs revealed to central authorities there was a hitherto untapped demand for a particular low-cost, low-tech type of EV. Importantly, LSEV consumers typically had never owned *any* proper passenger car before.[94] As such, there was a hope that, after initially purchasing a LSEV, these consumers could eventually move to a proper EV. Moreover, given that LSEV consumers were not using alternative forms of ICE-powered transportation, such as motorcycles or tricycle minitrucks (which are common in rural areas), they were contributing to China's lower dependency on imported oil—another rationale for promoting NEVs (see Section 3). From this specific viewpoint, as an expert on energy commodities claimed, as long as China's dependency on imported oil diminishes, "central leaders concerned with this goal are agnostic about how that happens."[95] Consequently, the multiplicity of the central authorities' justifications for promoting NEVs in general could be exploited by local actors to legitimize LSEVs.

Hence, although inhibited by Beijing's increasing regulatory clout, LSEVs have never been officially banned. Indeed, as Zou et al. argued, "central government appears to have purposefully provided maneuvering space for Shandong and other local provinces."[96] This sort of "strategic

(91) Byvin, for example, entered financial dire straits, and according to a local expert had to be financially supported by Shandong's government (Author's interview #2, July 2024). Baoya, on the other hand, acquired part of FAW-Jilin's shares, and became qualified to produce EVs; see Sohu News, "'Mobility scooter' brand upgrade: Shandong Baoya pure electric vehicle equipped with solid-state battery, and the driving range is worth paying attention to" [老头乐品牌升级 山东宝雅纯电车搭载固态电池 续航里程值得期待], July 5, 2021. Available at: https://www.sohu.com/a/475546320_151980. Last accessed: August 21, 2024.

(92) Author's interview #2, July 2024.

(93) State Council, "Outline of the National Innovation-Driven Development Strategy" [国家创新驱动发展战略纲要], May 19, 2016.

(94) Gabriel Collins, "Low-Speed Electric Vehicles: An Underappreciated Threat to Gasoline Demand in China and Global Oil Prices?", May 2019, Issue brief no. 05.15.19. *Rice University's Baker Institute for Public Policy*, Houston, Texas.

(95) Author's interview #3, July 2024.

(96) Zou et al., "Agile Business Development, Chinese Style," 117.

ambiguity"[97] led by the central government weakens the LSEV experiment, but nonetheless does not terminate it. A recent document from Laizhou, a county-level city in Shandong, illustrates this ambiguity: although it claims that the city has carried out several on-site inspections and investigations since 2019, even cancelling one manufacturer's production license, it also admits that since a policy-binding national standard for LSEVs has not been issued thus far, "it is impossible to entrust inspection agencies to determine the product quality of low-speed four-wheel electric vehicles […] which has caused some difficulties in supervision."[98] In recent times, some LSEV companies have continued operating, and some even upgraded their capabilities, but kept out of the spotlight.[99]

The undeniable commercial success of LSEVs, combined with their clearly sub-standard technological and environmental features, prompted other local governments to experiment, by harnessing the models' strengths but avoiding their drawbacks. Similarly, central government—demonstrating its capacity to monitor and learn from experiments—adjusted its national NEV policy framework to better take advantage of the untapped demand in China's countryside.

4.3. Local experimentation in the spotlight of the national policy: the rise of "microcars" and central government's policy adjustment

If something similar to a LSEV could be manufactured with lithium-ion batteries, and with improved technical standards, such as better safety, higher maximum speed and range autonomy, it could officially be marketed as an EV. Automakers quickly realized this opportunity. Avoiding the higher costs and technological challenges involved in producing high-end EVs (a segment where Tesla, with its gigafactory in Shanghai, has gained prominence), some companies decided to exploit the demand for low-cost, low-tech EVs. For the central government, too, having cheap EV models that meet basic technical standards could only be positive, as it would expand China's EV market.

(97) For the notion of "strategic ambiguity" in the context of policy experimentation with multiple policy goals in China, see Ang, "Ambiguity and Clarity in China's Adaptive Policy Communication." For the related notion of "creative ambiguity" in China's central-local relations, see Yongnian Zheng, "Explaining the Sources of de facto Federalism in Reform China: Intergovernmental Decentralization, Globalization, and Central–Local Relations," *Japanese Journal of Political Science* 7, no. 2 (2006): 101–26.

(98) Laizhou Municipal Market Supervision Administration, "Reply to the proposal on strengthening the standardized management of low-speed electric vehicles No.074-2" [第074-2号：关于加强低速电动车规范管理提案的答复], June 8, 2024. Available at: https://www.laizhou.gov.cn/art/2024/6/8/art_62833_18083.html. Last accessed: August 8, 2024. A central government official's message to industry stakeholders in Shandong, still in the early days of LSEV development, perhaps sums up the ambiguity of Beijing's approach: "Go ahead if there is market demand, but don't call them 'green' vehicles". See Fang Yan and Ken Wills, "Mini electric cars fill gap in China as official EVs sputter, *Reuters*, April 19, 2012. Available at: https://www.reuters.com/article/us-china-mini-ev-idUSBRE83I0CZ20120419/. Last accessed: August 5, 2024.

(99) Author's interview #3, July 2024. Due to its contested nature, it has become more difficult to acquire reliable data about LSEV sales after 2018. That said, one source points out that in 2021 only 330,000 units were sold. See D1EV, "'Mobility scooters' require a revitalization: how can China's low-speed electric vehicles restore their reputation?" ["老头乐"也要有春天：如何为中国低速电动汽车正名?], April 19, 2024. Available at: https://www.d1ev.com/kol/227132. Last accessed: August 21, 2024.

SAIC-GM-Wuling, a joint venture between state-owned SAIC, foreign-owned General Motors (GM), and Liuzhou-based Wuling motors, is a case in point. Before the central government decided to push the NEV agenda, Liuzhou Wuling Motors, located in Liuzhou city, Guangxi province, was manufacturing simple and cheap ICE minivans, which became popular among farmers and China's rural population. In 2002, SAIC and GM invested in the company, establishing the three-part joint venture. The company's bare-bones approach to production, its knowledge of the needs of China's rural customers, and its extensive network of dealerships, especially in poorer areas, was at the heart of its success.[100]

The central government's push for electrification compelled SAIC-GM-Wuling (hereafter SGMW) to start producing EVs. The company was already producing small ICE passenger cars targeted at short commutes, and saw the NEV national policy as an opportunity to reframe its strategy. SGMW's first inroad into the EV industry was with the Baojun E100, launched in 2017, followed by the Baojun E200 in 2018. Both can be officially classified as "microcars" (*weixing che*; also classified as A00-class segment EVs).[101] They were both two-seater EVs, with the former having a driving range of 155km, while the E200 version achieved 210km with a single charge. Both models were developed leveraging SGMW's knowledge of its customer base. The company's R&D team studied traffic characteristics in Liuzhou and concluded that the vast majority of vehicles only carried two passengers. Baojun sold well in its home Guangxi province, and later in Shandong province, especially in Qingdao city.[102]

Although the Baojun models performed well, SGMW faced obstacles when marketing them to other provinces and in wealthier urban areas; the Baojun was a two-seater, and SGMW was a peripheral player in China's automotive industry, based in a peripheral location. Liuzhou is not even the capital of Guangxi, which itself is one of China's poorest provinces.[103] SGMW would have to innovate to become a relevant national player.

Keeping its traditional customer-centered approach, the company learned that almost 90% of Baojun users did not drive more than 30km daily. It thus concluded that it could produce a cheap four-seater model—more likely to be accepted than a two-seater—by reducing its driving range. This resulted in another microcar, the Wuling Hongguang Mini EV (hereafter, WHME), launched in July

(100) Steve Schifferes, "Cracking China's car market," BBC, May 17, 2007. Available at: http://news.bbc.co.uk/1/hi/business/6658583.stm. Last accessed: August 5, 2024; Eric Thun, "Innovation at the Middle of the Pyramid: State Policy, Market Segmentation, and the Chinese Automotive Sector," *Technovation* 70–71 (2018): 7–19; Gao Wang and Qiong Zhu, "Wuling Hongguang MINIEV: A New Breed of Chinese Automaker," May 2022, China Europe International Business School.

(101) The classification of passenger cars in China can follow different criteria, such as length, wheelbase, and engine displacement. Unfortunately, there is no perfect correspondence among these criteria, and some models may fall under different classifications depending on the criteria adopted. Data from the China Passenger Car Association (CPCA) is typically presented based on segmentation (e.g., A00, A0, A, B, C, D). In this research, "microcars" (*weixing che*) are considered A00.

(102) Wade Malone, "SAIC-GM Boosts Electric Range Of Baojun E100," *InsideEVs*, June 19, 2018. Available at: https://insideevs.com/news/338622/saic-gm-boosts-electric-range-of-baojun-e100/. Last accessed: August 5, 2024.

(103) With a GDP per capita of 52,164 RMB in 2022, it was only above Gansu and Heilongjiang in the list of China's 31 provincial-level units; see NBS, *China Statistical Yearbook* (Beijing: China Statistics Press, 2023), Table 3-9.

2020. According to Sam Fiorani, an automotive industry expert, this was the first time an automotive company had produced "a simple EV that targets buyers looking for a real car."[104] The model quickly became a commercial success, outselling other well-established models such as Tesla's Model 3 and the BYD's Qin. In 2021 it became the best-selling model nationwide.

The success of the WHME was predicated not only on SGMW's shrewd business strategy, but especially on close ties with, and supportive policies from, Liuzhou's municipal government; as well as the company's understanding and careful leverage of central-level NEV policies. When the Baojun E100 was launched in 2017, it qualified for purchase subsidies of 36,000RMB per vehicle. With the gradual phasing out of the subsidy policy, however, the company would have to produce vehicles with a higher driving range. One year later, the same E100 would qualify for a subsidy of only 15,000RMB; while the upgraded version, the E200, could qualify for a subsidy of 24,000RMB, thanks to its higher driving range.[105] However, after 2020, when the WHME was launched, only vehicles with a driving range above 300km were eligible for purchase subsidies. Although it was possible to produce such vehicles, this would imply higher costs, and thus undermine the company's core strategy of producing affordable vehicles mainly intended for daily commuting.[106]

However, as the purchase subsidy policy was waning, the dual-credit policy (see Section 3), came to the fore. SGMW still produced ICE vehicles, so the company urgently needed to produce more EVs to obtain credits, and thus counterbalance its negative score stemming from its ICE production in other segments. In 2020, one credit was estimated to be worth 3,000RMB, with the WHME worth two credits. In this scenario, for each WHME produced, SGMW would receive the equivalent of 6,000RMB—approximately 20% of the model's final tag price.[107]

Local supportive policies from Liuzhou, and later from Guangxi province, were also pivotal for the viability of SGMW's strategies. First, before the Baojun E100 was officially launched, the Liuzhou municipal government promoted a city-wide test drive campaign, which boosted awareness of this EV model.[108] Second, when the Baojun E100 was launched, some public institutions in

(104) Justin Harper, "Chinese £3,200 budget electric car takes on Tesla," *BBC*, February 25, 2021. Available at: https://www.bbc.co.uk/news/business-56178802. Last accessed: August 5, 2024.

(105) With an official driving range of 205km, it just surpassed the 200km threshold to qualify for higher subsidies.

(106) SGMW would still launch the Baojun E300 (two-seater) and the Baojun E300 Plus (four-seater), in May 2020. With a 305km range, they met the 300km threshold. However, it was considerably more expensive than the E200 and the WHME, and did not perform as well in sales.

(107) James Chen, "Wuling makes a mere 89 RMB (14 USD) profit on Mini EV," *CarsNewsChina*, July 6, 2021. Available at https://carnewschina.com/2021/07/06/wuling-makes-a-mere-89-rmb-14-usd-profit-on-mini-ev/. Last accessed: August 5, 2024. Other EV-only manufacturers such as NiO and Tesla also benefit tremendously from this policy. In 2020, NiO reportedly received 200,000 credits, the equivalent of roughly RMB 600 million, considering the estimate of RMB 3,000 per credit. Tesla, thanks to its credits revenues, reported net profits for the first time since its establishment. See Tom Kang, "China's 'dual credit' policy, what you need to know," *CnEVPost*, July 25, 2021. Available at https://cnevpost.com/2021/07/25/chinas-dual-credit-policy-what-you-need-to-know/. Last accessed: August 5, 2024.

(108) Around 70% of the participants chose to purchase a Baojun E100 afterward; see Hongyang Cui and Hui He, "Liuzhou: A New Model for the Transition to Electric Vehicles?", International Council on Clean Transportation, December 18, 2019. Available at: https://theicct.org/liuzhou-a-new-model-for-the-transition-to-electric-vehicles/. Last accessed: August 5, 2024.

Liuzhou bought the vehicles in bulk for their staff.[109] Third, at this initial phase of promotion, the Liuzhou government once transferred more than 20 cadres to work together with enterprise experts, reinforcing industry-government cooperation.[110] Fourth, the Baojun and other EVs of similar size were allowed to drive in bus lanes, unlike ICEs; they also were entitled to free parking and a simplified registration process.[111] Fifth, the city established parking spots just large enough to fit these microcars throughout the city (although too small for other regular vehicles to fit in) and equipped them with chargers.[112] This was done after local policymakers financially rewarded residents who found suitable new parking spaces for microcars.[113] Similar to Shandong, then, Liuzhou provided support for a non-traditional automobile company to thrive.

The results were impressive. In 2018, Liuzhou had achieved a 20% market share of EVs, placing the city second nationally, after Shenzhen.[114] Liuzhou became widely known for its successful model of promoting microcars. For example, in 2021, 83% of Liuzhou's EVs were microcars, while the same segment corresponded to only 2% in Shanghai.[115]

Eventually, this model spread to the provincial capital Nanning and other cities in the province, such as Hechi, Laibin, and Chingzuo, and also became known as "Guangxi model". Local officials from Liuzhou visited different cities in the province to expand the model.[116] A provincial-level policy document from 2019 urged all localities in the province to "promote the 'Liuzhou model',"[117] and Guangxi has set NEV promotion targets for all its 14 prefecture-level cities.[118] Moreover, in 2022 the Guangxi New Energy Vehicle Laboratory was established in the province. The laboratory, led by SGMW and other local research institutions such as the Guangxi University of

(109) Wang and Zhu, "Wuling Hongguang MINIEV."

(110) Sohu News, "Liuzhou model leads the promotion and development of NEVs in the post-subsidy era" [柳州模式引领"后补贴时代"新能源推广发展], July 24, 2019. Available at: https://www.sohu.com/a/329058497_157536. Last accessed: August 31, 2024.

(111) Cui and He, "Liuzhou: A New Model."

(112) Wang and Zhu, "Wuling Hongguang MINIEV."

(113) Chu et al., "Assessment of leading new energy vehicle city markets."

(114) Cui and He, "Liuzhou: A New Model."

(115) Yidan Chu and Hui He, "Leading new energy vehicle city markets in China: A 2021 update," International Council on Clean Transportation (ICCT), November 2022.

(116) Guangxi Daily, "Liuzhou and Guilin join hands to accelerate the promotion of new energy vehicles" [柳州桂林携手加快新能源汽车推广], March 6, 2019. Available at: http://m.gxcounty.com/show-7-147304-0.html. Last accessed: August 9, 2024; Chu et al., "Assessment of leading new energy vehicle city markets."

(117) Guangxi Development and Reform Commission, "Action plan for promotion and application of new energy vehicles in Guangxi Zhuang Autonomous Region" [广西壮族自治区新能源汽车推广应用攻坚行动方案], [桂发改电力〔2019〕1034号]. October 31, 2019; see also Science & Technology Daily, "Guangxi launches a battle to promote new energy vehicles" [广西打响新能源汽车推广应用攻坚战], October 1, 2020. Available at: https://auto.china.com.cn/view/qcq/20200110/702293.shtml. Last accessed: August 31, 2024.

(118) Guangxi Development and Reform Commission, "The 24th issue on the promotion work of new energy vehicles in the whole region" [全区新能源汽车推广应用 工作动态第二十四期（总第二十四期], December 16, 2024. Available at: http://fgw.gxzf.gov.cn/fzgggz/dlhd/t7337965.shtml. Last accessed August 13, 2024.

Science and Technology, has established partnerships with national level institutions and received an investment of over 10 billion yuan, further strengthening the importance of the model.[119]

National-level figures also praised the model, such as a former vice-president of the China Association of Automobile Manufacturers (CAAM).[120] Most importantly, Wan Gang, shortly after stepping down as MOST minister, visited Liuzhou and SGMW, not only praising the model but also proposing to "promote it nationwide" (*zai quanguo tuiguang*).[121] Other central-level institutions, including the powerful NDRC, also advertised the advantages of the Liuzhou/Guangxi model.[122]

Hence, when SGMW launched the WHME in July 2020, it benefitted from previous supportive policies from Liuzhou and Guangxi, legitimacy from the national level, and a more receptive customer base. With WHME's success, even mainstream EV manufacturers entered the microcar segment and launched similar low-cost, low-tech models. For example, BYD, the leading domestic company in China, first launched the BYD Dolphin, a small car (*xiaoxing che*; also classified as A0-class segment) in 2021, and in 2023 the BYD Seagull, a microcar.[123] The importance of microcars for China's EV market can be seen in Figure 1 below:

(119) Guangxi Daily, "Guangxi's new energy vehicles are gaining popularity overseas" [广西新能源汽车驰骋海外], August 22, 2023. Available at: http://wsb.gxzf.gov.cn/yhjw_48207/gxydm_48209/t17001930.shtml. Last accessed: August 31, 2024.

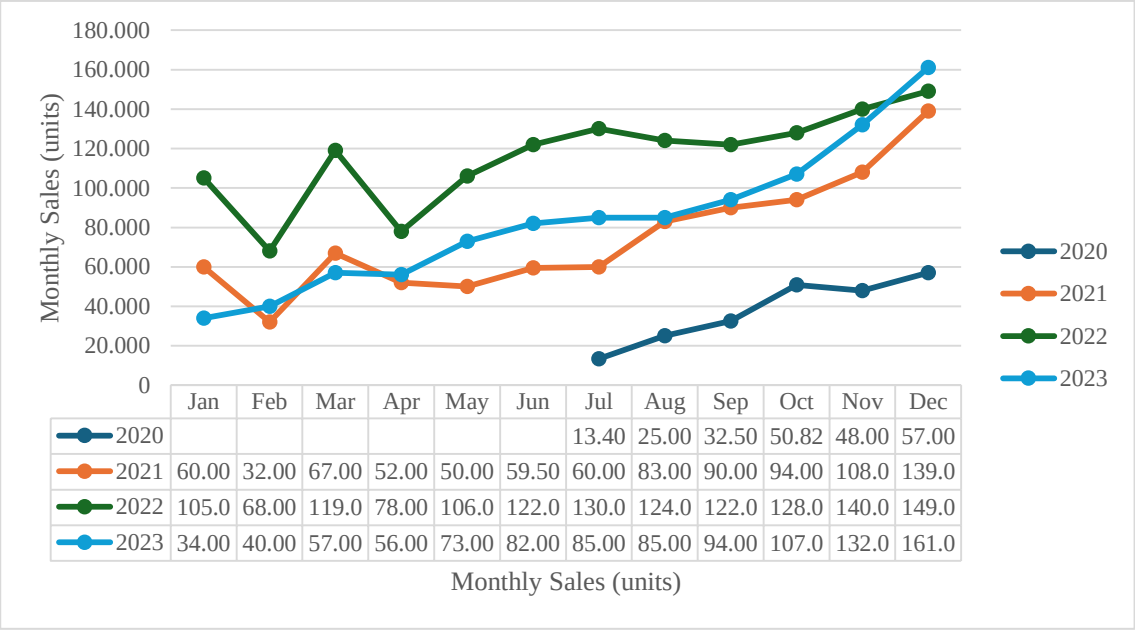
(120) Xin He, "'Liuzhou Model' upgrades to 'Guangxi Model' to lead the development of NEVs in the post-subsidy era" ["柳州模式"升级"广西模式" 后补贴时代引领新能源发展], *Chejiahao*, July 24, 2019. Available at: https://chejiahao.autohome.com.cn/info/4309746. Last Accessed: August 31, 2024.

(121) Danting Xu, and Yonghui Xie, "Wan Gang, Vice Chairman of the National Committee of the Chinese People's Political Consultative Conference, visited Guangxi for research and guidance [全国政协副主席万钢来桂调研], December 14, 2019. Available at: http://www.gxzx.gov.cn/index.php?m=content&c=index&a=show&catid=14&id=30765. Last accessed: August 31, 2024. After leaving his position at MOST, Wan Gang held positions as the Chairman of the Zhi Gong party (one of the eight minor parties in China), and also as Vice Chairman of the National Committee of the Chinese People's Political Consultative Conference.

(122) Lan Yongqian, "The Guangxi model is being fully implemented to improve the new energy infrastructure" [广西模式"全面推行，为百姓倾力完善新能源基础设施], November 15, 2019. Available online at: https://www.gov.cn/xinwen/2019-11/15/content_5452345.htm. Last accessed: August 9, 2024; NDRC, "Liuzhou promotes the application of new energy vehicles to help the transformation and upgrading of the automobile industry" [广西柳州新能源汽车推广应用助力汽车产业转型升级], August 29, 2019. Available at: https://www.ndrc.gov.cn/fggz/dqzx/lzydfzxfz/201908/t20190829_1085408_ext.html. Last accessed: August 31, 2024; National Government Offices Administration, "Problems and countermeasures in the promotion of new energy vehicles—Taking Liuzhou as an example" [新能源汽车推广过程中的问题与对策—以柳州为例], May 27, 2022. Available at: https://www.ggj.gov.cn/zgjghq/2022/2205/202205/t20220527_38439.htm. Last accessed: August 31, 2024.

(123) Microcars are normally classified as A00, while small cars as A0. Please note that some sources may consider the Seagull a small car (A0), depending on the criteria adopted. To the best of the author's knowledge, most sources classify it as belonging to the A00 segment. See, for example, Sohu News, "BYD Seagull is the 'dark horse' in the pure electric car industry" [比亚迪海鸥就是纯电动小车界的"黑马"], September 5, 2023. Available at: https://www.sohu.com/a/717915938_120016526. Last accessed: August 31, 2024.

Figure 1
Monthly sales of pure electric microcars (A00 segment)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020							13.40	25.00	32.50	50.82	48.00	57.00
2021	60.00	32.00	67.00	52.00	50.00	59.50	60.00	83.00	90.00	94.00	108.0	139.0
2022	105.0	68.00	119.0	78.00	106.0	122.0	130.0	124.0	122.0	128.0	140.0	149.0
2023	34.00	40.00	57.00	56.00	73.00	82.00	85.00	85.00	94.00	107.0	132.0	161.0

Note: Data for microcars are based on A00 data.
Source: Own elaboration, based on data from the China Passenger Car Association.

Figure 1 depicts the steady increase in sales of microcars in China, starting in July 2020, when the WHME was launched, up until the end of 2023. This performance has certainly been supported by a central-level policy led by the MIIT since July 2020, entitled "NEVs to the Countryside" (*xin nengyuan qiche xia xiang*). Essentially, the policy aims at marketing EVs to rural areas and small cities. It includes a series of events held at various locations across China's countryside; local governments are expected to announce supportive policies, and eligible manufacturers to present their EV models and available discounts.[124] The MIIT has organized five rounds of the policy so far, one each year from 2020 to 2024.[125] The launching event of the policy's first round, tellingly, was held in

(124) Lingzhi Jin and Yidan Chu, "Accelerating new energy vehicle uptake in Chinese cities: assessment of new energy commercial vehicles policies," International Council for Clean Transportation (ICCT), July 2023.

(125) MIIT, "Notice from three departments on launching the NEVs to the countryside promotion activities" [三部门关于开展新能源汽车下乡活动的通知], [工信厅联通装函〔2020〕167号], July 14, 2020. Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/zbgy/art/2020/art_79e301a67f5842c08fc032cf609db8ee.html. Last accessed: August 8, 2024; MIIT, "Notice of four departments on launching the 2021 NEVs to the countryside promotion activities" [四部门关于开展2021年新能源汽车下乡活动的通知], [工信厅联通装函〔2021〕57号], March 26, 2021. Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/zbgy/art/2021/art_4d96a5cfd3db41ee86dd917071563562.html. Last accessed: August 8, 2024; MIIT, "Notice of four departments on launching the 2022 NEVs to the countryside promotion activities" [四部门关于开展2022新能源汽车下乡活动的通知], [工信厅联通装函〔2022〕107号], May 16, 2022. Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2022/art_d89398fdd8a141ab92d70058fa7a7012.html. Last accessed: August 8, 2024; MIIT, "Notice of five departments on launching the 2023 NEVs to the countryside promotion activities" [五部门关于开展2023年新能源汽车下乡活动的通知], [工信厅联通装函〔2023〕149号], June 12, 2023. Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2023/art_6dbc82a29e604abb99a42cd4cf4924ca.html. Last accessed: August 8, 2024; MIIT, "Notice of five departments on launching the 2024 NEVs to the countryside promotion activities"

Shandong province. Table 2 below summarizes the most relevant information from the five rounds so far.

Table 2
NEVs to the Countryside (2020-2024): Main indicators

	2020	2021	2022	2023	2024
Number of automotive companies	10	18	16	31	33
Total number of models	16	52	70	69	99
Number of microcar models	8	15	15	13	14
Share of microcars to total	50.00%	28.85%	21.43%	18.84%	14.14%
Ministries	MIIT, MAO, MOC	MIIT, MAO, MOC, NEA	MIIT, MAO, MOC, NEA	MIIT, MAO, MOC, NEA, NDRC	MIIT, MAO, MOC, NEA, NDRC

Note: MIIT = Ministry of Industry and Information Technology; MAO = Ministry of Agriculture and Rural Affairs; MOC = Ministry of Commerce; NEA = National Energy Administration; NDRC = National Development and Reform Commission.
Source: MIIT (various years), see Endnote 125.

As shown in Table 2, the NEVs to the Countryside policy became larger, more comprehensive, and resourceful over time. First, the number of automotive companies participating more than tripled, from 10 in 2020 to 33 in 2024. Second, the number of models offered by these companies also increased substantially, from 16 in the first round to almost a hundred in 2024. The number of ministries organizing the policy also rose, from three to five. This suggests an increasingly more comprehensive approach, with stronger cross-ministerial engagement, and indicates broader efforts to achieve the goal of electrification and stronger policy legitimacy.

The policy appears to have produced exceptional results. Although it is difficult to disentangle the sales of EVs directly attributable to this policy from non-policy related sales, news outlets indicate that the sales of EV models participating in the policy skyrocketed: they leaped from slightly less than 400,000 units in 2020 to over 3 million units in 2023.[126]

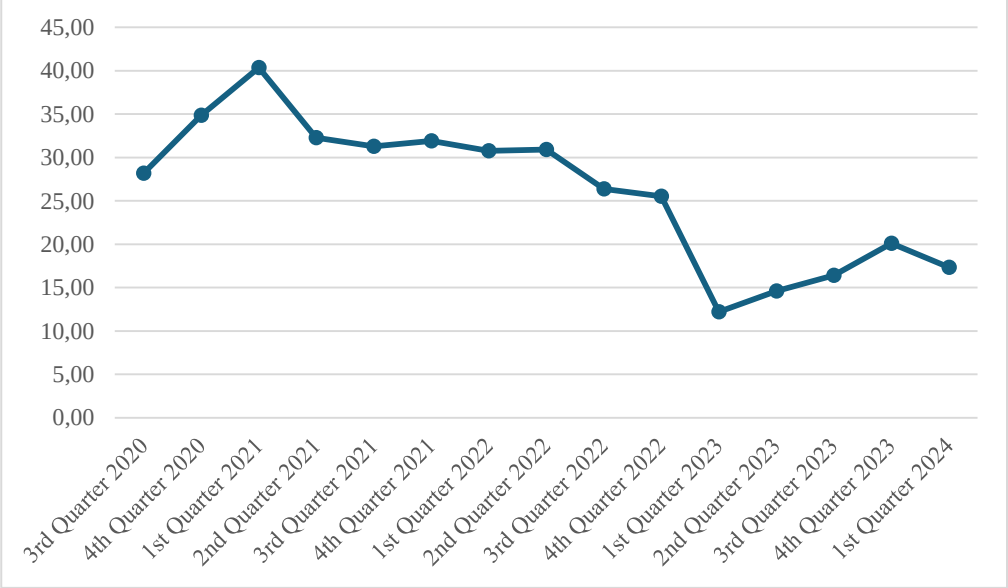
[五部门关于开展2024年新能源汽车下乡活动的通知], [工信厅联通装函〔2024〕158号], May 15, 2024. Available at: https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2024/art_5812a3d3b04e4372b2b4a1453c9e2d4c.html. Last accessed: August 8, 2024.

(126) See Sohu News, "The cumulative sales of new energy vehicles in rural areas have exceeded 4.1 million in the past three years" [新能源下乡车型3年累销410多万辆，各地如何续写下乡故事？], March 28, 2023. Available at 新能源下乡车型3年累销410多万辆，各地如何续写下乡故事？_搜狐汽车_搜狐网 (sohu.com). Last accessed: August 8, 2024; China News, "99 new energy vehicle models are launched in rural areas, with a market potential of over 3 million vehicles" [99款新能源车型下乡 市场潜力或超300万辆], May 16, 2024. Available at: https://www.chinanews.com.cn/cj/2024/05-16/10218148.shtml. Last accessed: August 8, 2024.

Despite the importance attached to the microcars segment, especially due to its affordability, the NEV to the Countryside policy did not neglect other more sophisticated models. According to Table 2, while the number of microcar models participating in the policy increased from eight to 15 in 2022 (and eventually 14 in 2024), in reality their proportion to the total steadily diminished, from 50% in the inaugural round to less than 15% in 2024.[127] This is because in addition to boosting general EV sales, the central government also aims to promote technological upgrading of the industry and to foster high-end models; this is more closely aligned with the goal of promoting leapfrogging development and outcompeting automakers from advanced countries, which is unlikely with microcars alone.

The declining importance of microcars in the NEVs to the Countryside policy mirrors developments in the national market. Although sales of microcars in absolute numbers have increased in the past few years, as seen in Figure 1, their relative importance has declined. Figure 2 depicts this trend since the WHME was launched. After achieving roughly 40% of the national market in the first quarter of 2021, microcars' share halved to roughly 20% in Q4 of 2023.[128]

Figure 2
Share of pure electric microcars sales (A00 segment) in total national sales (%)



Note: Data for microcars are based on A00 data.
Source: Own elaboration, based on data from the China Passenger Car Association.

(127) Note that the "NEVs to the Countryside" policy documents only display the names of the models offered. The classification of microcars was done manually. Because different criteria can be used to classify passenger cars in China, the number of microcars may vary slightly depending on the criteria adopted. The paper's qualitative conclusions, however, remain unaffected.

(128) Microcars' share in total sales was even higher before 2020 (when the national market was smaller), but the China Passenger Car Association does not disclose consistent data by segmentation. See Chu et al., "Assessment of leading new energy vehicle city markets in China and policy lessons," 4.

This trend is related to other central-level efforts to promote technological upgrading. First, the purchase subsidies policy, operating until 2022, rewarded EVs characterized by higher technological sophistication (e.g., longer driving range) with higher subsidies. After its demise, the sales tax exemption became relatively more important. Extended until 2027, a new policy adjustment determines that the exemption can only be granted if EV models meet certain technical standards, such as for maximum speed, driving range, and battery mass energy density.[129] Although most models can meet these requirements, and mid- and high-end models are largely unaffected, microcars are more strongly impacted. The central government has thus reduced the tax incentives for micro EVs, aiming to foster advanced EV technology. Rather than clamping down on micro EVs due to their lack of technological sophistication, the central government has built on their strengths to expand the national EV market, and at the same time adjusted national policies to promote mid- and high-end models.

5. Discussion and conclusions

This study has assessed the growth and development of the EV industry in China from the perspective of MOIP and state capacities. It highlighted how a clear *direction* for technical change was defined by the central authorities, which tilted the playing field, while at the same time giving scope for strong experimentalism to emerge. With the existence of multiple experiments, each providing different policy solutions to meet the same goal of electrifying China's automotive industry, the central government could monitor them, learn from their strengths and weaknesses, and adjust its national policies accordingly. Thus, in contrast to neoclassical arguments that also favor decentralization of governance and local experimentalism—such as fiscal federalism[130] and market-preserving federalism[131]—here it is the central state, guided by its *missions* and policy goals, that is chiefly responsible for the selection of experiments, not the market.

Therefore, this research suggests that local government autonomy should not be seen as detrimental to state capacities. Deviations from central goals, such as lead-acid powered LSEVs, can still reveal relevant information for central authorities. Provided that the long-term goals and the *direction* of technical change are upheld—a function of mission-oriented innovation policies—then these deviations can enable policy learning and adaptation to unforeseen scenarios. Instead of perceiving central–local relations as a sort of zero-sum game or a tug-of-war between central planning and local interests, they should be perceived as a continuous iterative and dynamic process, which allows for the discovery of new information.

(129) State Taxation Administration, "Announcement on the adjustment of the technical requirements for new energy vehicle products for sales tax exemption" [中华人民共和国工业和信息化部 财政部 税务总局关于调整减免车辆购置税新能源汽车产品技术要求的公告], December 7, 2023. Available at: https://fgk.chinatax.gov.cn/zcfgk/c100013/c5217984/content.html. Last accessed: August 8, 2024.

(130) Wallace Oates, "An Essay on Fiscal Federalism," *Journal of Economic Literature* 37, no.3 (September 1999): 1120–49.

(131) Barry Weingast, "The Role of Political Institutions: Market-Preserving Federalism and Economic Development," *The Journal of Law, Economics, and Organization* 11, no. 1 (1995): 1–31; Gabriella Montinola, Yingyi Qian, and Barry Weingast, "Federalism, Chinese Style: The Political Basis for Economic Success in China," *World Politics* 48, no. 1 (1995): 50–81.

More specifically, the research highlighted two experiments led by two distinct, peripheral local states in China's innovative efforts: Shandong and Guangxi. In both cases, local officials collaborated closely with nontraditional local businesses, and succeeded commercially thanks to a series of local supportive policies. However, while the Shandong model based on LSEVs attracted increased hostility from the central government (due to environmental and safety problems, and poor technological sophistication), the microcars model from Guangxi did not suffer from Beijing's regulatory clout. SGMW, the key company behind this model, was free to exploit existing central policies, such as the purchase subsidies and dual-credit policies. Moreover, the local information revealed by both experiments led the central government to adjust its national policy, and in 2020 it launched the "NEVs to the Countryside" policy, which still continues and has helped to expand China's EV market. This has further legitimized and supported the importance of affordable, low-tech microcars. In sum, it has helped in the implementation of national goals, thus increasing China's state capacities.

In addition, the central government's behavior shows its capacity to monitor and learn from these local experiments, and to selectively adapt central policies. The central government has never fully banned LSEVs – it rather let the model exist under increased scrutiny and stronger regulatory pressure. With this strategic ambiguity, local LSEV companies were left in a "gray zone." At the same time, the central government heavily promoted microcars and other more advanced EVs to the same areas and segments of China's society that were the main consumers of LSEVs.

The existence of local experimentalism, even under Xi, is an important finding. In a recent overview of the topic, Ahlers and Schubert stated that "[t]here is a unanimous agreement in the literature that policy experimentation in the Chinese local state has declined under the influence of re-centralization efforts after 2013."[132] This research's findings cast doubt on this assertion, while it concurs with other recent empirical studies that also suggest the existence of local experimentation.[133]

In his analysis of China's bureaucratic organization, Zhou Xueguang argues that the central state always retains the ability "to redraw the boundaries" of local officials' policy discretion.[134] This does not imply the termination of local experimentation; it simply "redefine[s] the boundaries of flexibility."[135] The central state's increasing regulatory pressure and tightening of the policy space for LSEVs, without banning them, exemplifies the dynamics described by Zhou. There was no indiscriminate assault on local experimentalism *per se*, but rather a redefinition of what would be encouraged or inhibited. When industrial policymaking is permeated by strong experimentation, this continual "redefinition of boundaries" – in other words, evaluation and selection – is critical for its success.

(132) Ahlers and Schubert, "Nothing new under 'top-level design'," 22.

(133) Shuanping Dai et al., "Innovation Network Formation and the Catalyzing State: A Study of Two Innovative Industry Clusters in China," *Journal of Contemporary China* 33, no. 147 (2023): 373–91; for a recent empirical study emphasizing experimentation and policy learning at the central level, see Ziying Jiang and Kaidong Feng, "Policy Learning in Governing Complex Technologies: The Pendulum Swing of China's Central Government," *The China Quarterly* (2024): 1–17.

(134) Zhou, "The Institutional Logics of Governance in China," 264.

(135) Zhou, 264.

The MOIP and "new industrial policy" literatures emphasize that innovation at the global technological frontier requires experimentation, often to be led by peripheral agencies. Essentially, these agencies, establishing close ties with nontraditional business, and enjoying little political prestige, promote experimentation in emerging, innovative sectors. This research has shown that the *functions* of peripheral agencies studied by Breznitz and Ornston[136] can be performed by other institutions, such as local governments in the case of China. In fact, there are multiple institutions that can serve the same function, and the same function can be served by different institutions, especially when considering cross-country comparisons.[137] A staunch adherence to certain institutional *forms*—in this case, agencies—could lead to a reiteration of "one-size-fits-all" arguments.

This finding has important implications, especially for large middle-income countries, such as India or Brazil, which may rely on the myriad of local governments to promote experimentation. Rather than seeking to import institutional forms—the peripheral agencies as found in the paradigmatic cases of Israel or Finland—they may be better served by building on their own indigenous institutional settings. The argument here is not to import "Chinese-style" decentralization either, but rather to highlight that, due to tacit knowledge in the industrial policy *process*, the institutional forms that best perform the function of promoting experimentation in innovative sectors are an outcome of domestic, endogenous policy processes—in which self-discovery, rather than importation of "best practices," plays a key role.

Considering the type of innovation analyzed here, the findings of this study are particularly relevant for other low- and middle-income countries. These countries are normally far from the technological frontier, making it daunting to compete with advanced economies in innovation. However, the case of microcars reveals that these countries can leverage existing technological capabilities, recombine them, and advance through "bottom of the pyramid" innovation.[138] Especially in large low- or middle-income economies, there is a substantial market demand for such low-tech, affordable innovative products. Indeed, China has succeeded with this model even in foreign markets in other sectors. In smartphones, Transsion has become the fifth-largest manufacturer in the world, largely due to affordable products marketed in less developed economies. In Africa, the company has outsold Samsung and Xiaomi.[139] This strategy, however, also has its limits. Profit margins tend to be very slim—as in WHME's case—with very low possibilities of penetration in advanced economies. It is imperative, then, to simultaneously invest in new R&D, advanced technological capabilities, and to set policies to incentivize technological upgrading, as the central state in China has also been doing. This enables competition in high-end segments, which domestic brands such as BYD seem to be increasingly capable of.

The analysis presented here opens several possibilities for future research. First, with a view to increase the generalizability of findings, more empirical studies in other innovative sectors in China

(136) Breznitz and Ornston, "The Revolutionary Power of Peripheral Agencies."

(137) Ha-Joon Chang, "Understanding the relationship between institutions and economic development – some key theoretical issues," in *Institutional Change and Economic Development*, ed. Ha-Joon Chang (Tokyo, Japan: United Nations University Press, 2007), 17–34.

(138) Kaplinsky, "'Bottom of the Pyramid' innovation and pro-poor growth."

(139) Jon Porter, "There's a surprising new top-five player in the smartphone market," *The Verge*, November 1, 2023. Available at: https://www.theverge.com/2023/11/1/23941587/transsion-tecno-itel-infinix-fifth-largest-smartphone-manufacturer-canalys-idc-omdia. Last accessed: August 12, 2024.

are necessary.[140] Second, it invites comparisons with other large middle-income countries, such as Brazil and India. Third, more fine-grained analyses focusing on policy legitimacy in MOIP are in order. Wan Gang arguably played the role of a policy entrepreneur in legitimizing China's NEVs push. The interplay between Weber's legal-rational and charismatic sources of authority is an avenue to be further explored. Fourth, the notion of "dynamic capabilities"[141] could be examined in relation to China's bureaucratic capabilities. Fifth, especially for middle-income countries such as China, the challenges and contradictions arising from the mismatch between consumption patterns mimicked from advanced economies (in this case, automobiles) and an economy with much lower income per capita should be analyzed in greater depth. This mismatch was a core concern of Latin American structuralists; for Furtado,[142] it entailed growing technological dependencies, as a large portion of the population had low purchasing power, which restricts the domestic market for more advanced, higher value-added goods. An unequal income distribution reinforced the problem, limiting the domestic market even further, and as a result only the top of the social pyramid could enjoy the material benefits of industrialization. Thus, domestic companies' simultaneous promotion of low-tech, affordable products, like the ones analyzed here, combined with strong technological upgrading in high-end segments, could be analyzed explicitly from this perspective.

(140) For a recent study on stem cell therapy, see Jiang and Feng, "Policy Learning in Governing Complex Technologies."

(141) Kattel, Drechsler, and Karo, "How to Make an Entrepreneurial State."

(142) Celso Furtado, "Underdevelopment and Dependence: the Fundamental Connections," *Review of Political Economy* 33, no. 1 (2020): 7–15; Celso Furtado, "The Myth of Economic Development and the Future of the Third World," *Review of Political Economy* 33, no. 1 (2020): 16–27; Celso Furtado, *The Myth of Economic Development* (Cambridge: Polity Press, 2020).