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Climate experimentation and the limits of top-down control: local variation of climate pilots in China

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The Low-Carbon Pilot (LCP) program in China is an important national initiative aiming to facilitate climate experimentation. Thus far, 87 local governments have become climate pilots and are tasked with developing innovative climate solutions with the hope that these innovations can be applied nationally. The LCP adopts a uniquely Chinese approach to policymaking that is characterized by both bottom-up experimentation and top-down control and has been described as a success in the official discourse. However, using two case studies from Guangdong and Jilin, we show that there could be significant variation in performance and willingness to conduct experimentation among the climate pilots. The presence of variation suggests that the top-down steering mechanisms of the LCP are not conducive to climate experimentation and have the unintended consequences of encouraging risk-averse behaviors. We further show that local factors – leadership support, communities of practice, and alignment of interests – are important factors enabling success.

Keywords: climate pilots; climate experimentation; authoritarian governance; Low-Carbon Pilot; China

1. Introduction

The National Development and Reform Commission (NDRC) launched the Low-Carbon Pilot (LCP) program in July 2010 to encourage climate experimentation among a selective cohort of local governments (Khanna, Fridley, and Hong 2014). The LCP takes a uniquely authoritarian approach to policy experimentation, in which the central government chooses and controls local pilots in an experimentation-based policy cycle (Heilmann 2008; Ko and Shin 2017). Thus far, three batches of applications have been processed and 87 climate pilots created: 13 in the first (2010), 29 in the second (2012), and 45 in the third batch (2017). These climate pilots play an important role in finding new ways to govern decarbonization and improve and diversify the country's conventional climate governance, which is dominated by command-and-control approaches (Lo 2015a; Andrews-Speed and Zhang 2018; Schreurs 2017).

Unsurprisingly, the official discourse portrays the initiative as a major success. For example, a recent document published by the National Center for Climate Change Strategy and International Cooperation, a research institute under the NDRC, highlighted successful cases of climate innovation, such as establishing the first low-carbon

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development bureau (Guangyuan), piloting inter-provincial emissions trading (Beijing), using social media to promote a low-carbon lifestyle (Zhenjiang), developing local greenhouse gas inventories (Shanghai), and introducing carbon trading with auction-based credits (Guangdong). However, the report reviewed a highly selective group of pilots, most from economically prosperous regions. The literature also lacks a critical evaluation of the LCP. In early work on the climate pilots created in the first batch, Khanna, Fridley, and Hong (2014) reported that the climate pilots were successful in introducing institutional reforms, such as establishing low-carbon advisory groups and incorporating low-carbon targets into the performance evaluation system for government officials. Wang *et al.* (2015) conducted a case study in Zhenjiang – a developed city in the wealthy Yangtze River Delta area – and reported on an innovative urban carbon management platform that utilized a high-end cloud computing system to keep track of carbon emissions. These studies focus on successful climate pilots and therefore do not always examine problems in experimentation. In contrast, this study offers a critical analysis of the LCP beyond official accounts to better understand the authoritarian and top-down approach to climate experimentation.

The value of this study is not limited to China, but has implications for the broader literature on climate governance. A significant trend in studies on climate governance in liberal democracies has been the emergence of a local perspective on policy innovation, where municipal governments and other local actors are leading experimentation in the absence of top-down commands and support (Gordon 2016; Bulkeley 2013; Bulkeley and Betsill 2013; Lee and Painter 2015; Jordan *et al.* 2015; Simon Rosenthal *et al.* 2015; Lo 2014b; Broto 2017). Climate experimentation is often conducted through partnerships between local governments and community groups (McGuirk *et al.* 2015; Aylett 2013; Heiskanen *et al.* 2015), businesses (Leventon, Dyer, and Van Alstine 2015; Schroeder, Burch, and Rayner 2013; Khan 2013), and transnational municipal networks (Busch 2015; Giest and Howlett 2013; Bouteligier 2013; Rashidi and Patt 2018). However, the effectiveness of this fragmented and decentralized approach to climate experiments has been questioned. Jones (2013) argues that this lack of interconnection between government levels has compounded the difficulties experienced by local governments when attempting to conduct climate experimentation. Harrison (2013) observes that subnational climate leaders are usually already the cleanest states and provinces, and this selectivity is due to the failure of national governments to adopt nationwide policies to level the playing field. Reacting to the dissatisfaction of neoliberal climate governance is an increasing interest in whether authoritarian regimes are more capable in climate governance (Beeson 2010; Gilley 2012; Shahar 2015). This study contributes to this debate by critically and empirically evaluating this "authoritarian advantage" perspective of climate experimentation.

Our full argument consists of three parts. First, we present empirical evidence of significant variation in climate experimentation in China – that "pioneers" and "laggards" coexist among the climate pilots. Critical case studies from two climate pilots, Guangdong Province (henceforth Guangdong) and Jilin Municipality (henceforth Jilin), are presented to support the argument. The two cases were selected to highlight differences in their experimentation strategies. Guangdong has engaged in substantive policy innovation, developing a nationally leading emissions trading scheme by overcoming significant local opposition. On the other hand, Jilin continues to rely on conventional policy approaches despite achieving the status of a climate pilot, but at the

same time engages in opportunistic behavior aimed at securing as many piloting schemes as possible.

Second, we argue that the presence of local variation in climate experimentation is fundamentally linked to the top-down steering mechanisms the central government uses to control the experimentation process. We draw on previous work by Heilmann and Göbel to identify the roles and limitations of the LCP's top-down steering mechanisms. In particular, we argue that suboptimal application procedures, lack of financial support, short project timeframes, and a quantified evaluation process means that the LCP not only fails to be conducive to climate experimentation, but also has the unintended consequences of encouraging risk-averse behaviors.

Analyzing top-down control alone, therefore, does not fully explain differences in local experimentation. In the third part of the argument, we identify three key local factors that enable some climate pilots to move beyond risk-averse behaviors: alignment of interests, leadership support, and communities of practice. The analysis explains the advantages more developed areas such as Guangdong enjoy in climate experimentation. Finally, the implications of this skewed pattern of climate governance are discussed.

The fieldwork took place from 2017 to 2018, during which 68 in-depth interviews were conducted with local officials responsible for climate experimentation at the provincial and municipal levels, research institutes that participated as collaborators, and business representatives.

2. Two climate pilots

The official discourse portrays the LCP as a successful mechanism for stimulating climate experimentation, but our fieldwork suggests that the reality is more complex. Drawing on the terminologies developed by Chung (2000), there are both "pioneers" and "laggards" or even "opportunists" among the climate pilots. In this section, we use Guangdong to illustrate the former type and Jilin the latter.

2.1. Guangdong

Guangdong's pioneering development of an emissions trading scheme presents the strongest evidence of genuine policy experimentation. An ETS allows emissions allowances to be traded, which could help achieve reductions in emissions a cost effective way. Guangdong officially launched its ETS in December 2013. In the first compliance year, enterprises with annual emissions exceeding 20,000 tons of CO_2 in four industries (electricity generation, iron and steel, cement, and petrochemicals), comprising approximately 55% of the total emissions in Guangdong, were enlisted as compliance enterprises. Unlike other ETS pilots in China, which use the free allocation of permits to reduce the financial burden on enterprises, the Guangdong Development and Reform Commission (Guangdong DRC) adopted a tougher approach by requiring compliance enterprises to buy allowances through auction. For example, the Guangdong DRC mandated that the compliance enterprises in the iron and steel industry could receive a 97% quota for free only if they purchase 3% of allowances. The government also set a high reserve price of RMB 60/ton for mandatory auction. This allocation approach is superior to free allocation because it contributes to the

identification of the proper price for carbon emissions, as well as raising money for the provincial low-carbon development fund.

By the middle of 2017, Guangdong had become the largest and most active pilot ETS in China in terms of trading volume (62.8 million tons of CO_2 equivalent) and market value (approximately $223 million) and comprised more than 240 compliance enterprises from six high emission industries, including electricity generation, iron and steel, cement, petrochemicals, pulp and paper, and aviation. Overall, Guangdong, in which a total volume of 183.3 million tons of CO_2 with a value of 638.7 million RMB has been traded since the inception of the ETS, accounts for more than one-third of the national market share. The ETS has helped Guangdong's performance in energy saving and carbon reduction: the total carbon emissions of the six industries has fallen by approximately 4% since 2013, and the carbon intensity of the compliance enterprises has also declined. Furthermore, by auctioning allowances, the government accumulated a considerable fund for the promotion of low-carbon development and played an active role in collaborating with non-state actors to explore the most efficient approach to support low-carbon development.

The fact that the experimentation process did not go smoothly further demonstrates Guangdong's commitment to climate experimentation. Compliance enterprises needed significant amounts of money during the initial phase of the ETS for the mandatory auction. Consequently, climate experimentation in Guangdong generated intense opposition from compliance enterprises, especially those with high energy consumption:

> We thought the decision (mandatory auction) was improper and the government never asked for our advice on the mandatory auction. In February 2014, we were called to attend a conference held by the Guangdong DRC, and told to buy the 3% allowances through auction and fulfill our compliance obligation before June. We wrote letters to the government expressing our opinion and asked the iron and steel industry association to negotiate with them (Guangdong DRC), but could not change anything. (A compliance firm representative)

Although most compliance enterprises strongly opposed the mandatory auction, the Guangdong DRC stood firm and enforced the rules with compulsory measures:

> They (Guangdong DRC) took the ETS very seriously. The government forced us to attend the mandatory auction and fulfill our emission compliance. Before the compliance deadline, they made phone calls every day to ensure that we complete the work on time. To pursue the 100% compliance rate, the government even threatened to put our company on the blacklist, which would affect our credit record and no loan would be approved for us by banks. (A compliance firm representative)

2.2. Jilin

Despite becoming a climate pilot in 2012, Jilin's effort in climate policy innovation was lacking. We found no meaningful differences between Jilin and other industrial cities in the Northeast in terms of climate governance. Local officials relied on ineffective administrative measures such as the mandatory energy conservation program and retirement of old facilities to achieve carbon objectives. When the blunt instrument proved too difficult to be implemented, the response was to give up on enforcing

energy conservation and trying to attract new industries in the hope that new technologies would be more energy efficient. An official of the Jilin Bureau of Industry and Information Technology (BIIT) in charge of monitoring industry energy consumption explained this view:

> Jilin's Longtan district was developed as part of the first five-year plan. They are all very old enterprises, and there is little room to improve energy efficiency. It is too difficult to change them. For example, if we ask Jilin Petrochemical to change, they are not going to listen to us. Where do we start? Low-carbon cities entail starting afresh. If we build a new low-carbon industry park, every enterprise will be new or relocated here. (A Jilin BIIT official)

The view was echoed by an official from the Jilin DRC:

> Many enterprises have mandatory missions such as clean production and retiring old facilities, but are not proactive in this regard. This is related to cost. New enterprises, when started, can focus on new and energy-efficient production. However, it is very difficult to change our old industries. They are too polluted and inefficient to be changed. (A Jilin DRC official)

When we visited the Jilin Chemical Park, which was home to numerous energy-intensive enterprises and considered the hub of low-carbon industrialization innovation, we were surprised that very little climate policymaking has occurred, let alone real policy innovation. An official from the Jilin Chemical Park Management Committee (JCPMC) in charge of implementing climate policies noted:

> We do not have the resources to just give money to enterprises to help them become low-carbon. We can do two things: help enterprises expand new product lines and retire old ones. New production facilities are always more energy efficient. The second way would attract new investment and new enterprises. They come with better technologies. If some enterprises have problems meeting the energy goal, we talk to the technical staff and encourage them to find outside partners, add new productions, and retire old productions to achieve energy conservation and low-carbon effect. This is what we could do. (A JCPMC official)

These comments indicate that Jilin's climate governance faced similar challenges to that in other cities in the Northeast (Lo, Li, and Wang 2015). Facing difficulties in decarbonizing existing industries, Jilin chose to focus on attracting new enterprises. The emphasis on attracting new industries rather than improving the energy efficiency of existing enterprises was also evident in the government's spending pattern. While the government had yet to establish an energy conservation fund, it invested 100 million RMB in supporting strategic new industries and another 100 million RMB to support service industries. While attracting new industries may reduce carbon intensity, especially if the new industries are technologically more advanced and efficient, this policy action is not innovative and does not control energy consumption growth. It is business-as-usual and widely practiced by most local governments because of the economic and political benefits to fiscal income, job creation, and GDP statistics.

In addition to being a laggard in experimentation, Jilin can also be described as a *climate opportunist*. Policy attention is constantly shifting as Jilin officials spend more

effort chasing national pilot programs than on carrying out substantive policy innovation:

> Whenever there is a beneficial policy at the provincial or central level, as long as it is going to help industrial development, we will immediately notify the relevant parties, asking them to provide us with information as soon as possible. We will then try to apply to join the project, because it may help and bring in resources. (A Jilin DRC official)

This comment suggests that to the local officials in Jilin, the main purpose of becoming a national pilot was to deliver tangible economic benefits to help local development, while conducting climate experimentation was secondary at best.

3. Climate experimentation and the limits of central control

The case studies of Guangdong and Jilin suggest that climate pilots vary in their willingness and behavior to conduct experimentation. As the LCP is a national top-down piloting scheme, the role and limitations of the central government in coordinating and controlling climate experimentation is a key issue in understanding the presence of such local variation.

Heilmann (2008) argues that the institutionalization of policy experimentation is a crucial and unique governance mechanism in China. The concept has informed many studies that seek to understand how China formulates innovative solutions to rising socioeconomic challenges (Zhu and Zhang 2016; Zeng 2015; Teets 2015; Millar *et al.* 2016; Zhu and Zhao 2018b; Heilmann, Shih, and Hofem 2013). Heilmann conceptualizes three forms of institutionalized policy experimentation commonly used by the central government. The first, *experimental regulation*, refers to the formulation of interim regulations that are often revised after sufficient experience has been obtained during the trial period. The second, *experimental points*, refers to the use of pilots to experiment with new policies or institutions in a certain policy area. The LCP, which focuses on climate experimentation, is an example of this approach. The third, *experimental zones*, are the local governments that are provided with broad discretionary powers by the central government to generate radically new policy approaches. The Shenzhen Special Economic Zone is an example of this approach. Heilmann describes these mechanisms as *experimentation under hierarchy* in order to emphasize that the central government remains in the driving seat of the experimentation-based policy, as these mechanisms are defined by the hierarchical structure of the Communist Party's top-down cadre appointment system. However, his analysis does not clarify the specific mechanisms used by the State Council and its ministries to influence local experimentation.

To elucidate how the central government influences local experimentation, we draw on the work of Göbel (2011), which presents an analysis of the steering mechanisms used by the central government to influence local policy. Göbel's main contribution is the recognition that the central government employs both *market competition* and *hierarchical regulation* to shape local implementation. Competition means that local officials are motivated by the promise of material and non-material rewards, whereas hierarchical regulation operates through supervision and coercion by prescribing outcomes and punishing deviation. Although Göbel's main intention is to show

how higher-level administrations guide the implementation and fine-tuning of a certain policy at a lower administrative level, he also considers the limits of top-down steering. Command hierarchies are limited by information asymmetries. In the context of China's complex and locally controlled statistical system, data manipulation and fabrication to deceive the central government is a well-recognized problem (Lo 2014a; Holz 2014). On the other hand, competition hinders co-operation, may be undermined by inequality, and may not be effective if local governments perceive themselves as unable to achieve the benefits.

Göbel's conceptualization is useful in illustrating how central steering works for the LCP as well as its limitations. Competition is at the heart of the LCP. Participation in the LCP is voluntary but competitive. The NDRC periodically releases a call for application to the LCP. Interested local governments are required to submit a proposal specifying the carbon emissions targets to which they would like to commit, including carbon intensity, total carbon emissions, and the year of carbon peaking, as well as approaches to achieve them. Successful applicants are endorsed by the central government and obtain official recognition as climate pilots. Not all applications are successful. For example, in the second batch, while more than 40 local governments applied, only 29 were selected, indicating that the application process is quite competitive (Sina Finance 2012).

A closer examination of the competitive steering mechanisms, however, reveals several limitations. First, the expectation of rewards for good performance is a key incentive for competition-based steering. However, there is no funding attached to the LCP. By not making financial contributions, the central government does not just take away a major part of the incentive of becoming a pilot, but also transfers the fiscal burden of policy innovation to local governments. Second, the selection of high-quality candidates for climate experimentation is crucial. While the NDRC does not disclose the criteria for selection, our interviewees suggested that the support of top leadership from the local government, a proven record of accomplishment on climate governance, and a sound action plan were important. However, a major problem identified in our interviews was that local officials did not have sufficient time to apply for pilot status, and consequently gave little thought to the challenges of developing locally appropriate and innovative policies to address climate change and the capability of local governments to meet these challenges. According to our interviewees, part of the problem is that the NDRC gives very short notice (less than one month) to local governments to apply, which makes it difficult for them to develop evidence-based and well-considered proposals. Furthermore, "evidence" of previous climate policy work, which is used to indicate that the local government has sufficient capacity to conduct climate experimentation, is often merely a jumble of documents from previous relevant work. As such, the proposals do not provide the central government with enough information to choose high-quality applicants with a better chance of success in conducting climate experimentation.

The LCP also employs hierarchy as a steering mechanism through interim and end-of-term evaluations. Similar to other forms of top-down evaluations, the LCP evaluations are mainly quantitative and focus on levels of energy intensity and carbon intensity, rather than actual policy innovation. Measurable policy outcome is more concrete as a form of performance measurement and shows that the central government does not want just policy innovation, but tangible results. However, there are several limitations to these hierarchical steering mechanisms, which render

them ineffective and may have unintended consequences. First, the target-based evaluation may not actually encourage policy innovation. Quantitative evaluations coupled with a frequent evaluation schedule incentivize local officials to produce visible outputs to impress central authorities, while ignoring less tangible and long-term goals such as real policy innovation (Shin 2018). Furthermore, the pilots are required to complete their experiments and demonstrate their experimentation in three years, which is unrealistically short. As the recent experience with carbon emissions trading in China indicates, substantive policy innovation is a painful and time-consuming learning process involving both the regulator and regulated (Huang 2013). Unsurprisingly, during our fieldwork, the evaluation process was a common subject of complaint by local officials:

> After becoming a pilot, the central government evaluates our progress using many decarbonization indicators. However, none of the indicators make sense to us. The municipality does not even have data on these indicators. (A Jilin official)

Therefore, our analysis suggests that the short timeframe and quantified evaluation process are not conducive to policy experimentation; rather, they contribute to risk-averse behavior, wherein officials are incentivized to stick to their familiar policy instruments to achieve results quickly. Furthermore, the evaluation of pilots relies almost exclusively on the responses of local authorities. The sole reliance on self-reporting gives rise to the problem of local data manipulation, which has been shown to be prevalent in the context of environmental and climate policies (Lo 2014a; Wu *et al.* 2017). This makes it difficult for the central government to judge the performance of pilots and to decide whether policy experimentation is worthy for expansion (Zhu and Zhao 2018a). Finally, failures in experimentation are often quietly swept away and almost never face public scrutiny (Teets 2015). Our interviews also revealed that no punishment is associated with not achieving the goals of the LCP. This lack of negative consequences and accountability seriously undermines the hierarchical steering mechanism.

4. Differentiating local factors

The presence of pioneers and laggards suggests that some climate pilots are able to move beyond risk-averse behaviors and engage in genuine experimentation. Our fieldwork suggests that local factors are influential in determining the success and failure of climate experimentation. Drawing on previous literature, we seek to explain the differences between Jilin and Guangdong from three perspectives: alignment of interests, leadership support, and communities of practice.

4.1. Alignment of interests

Internationally, several studies have argued the importance of the local co-benefits of climate change policies, such as alleviating congestion and reducing air pollution, in incentivizing local experimentation (Koehn 2016; Harlan and Ruddell 2011; Smeds and Acuto 2018). In China, a renewed emphasis on pragmatism in the reform era means that local officials are liberated to become better representatives of local interests (Lo 2015a). Responding to local needs, then, has also become an important

motivation for local officials to experiment (Teets 2015). For example, the Changchun government in the northeast initiated an ambitious compulsory building energy efficiency retrofit program to solve the problem of insufficient indoor heating (Lo 2015b). Opportunities for economic development such as supporting existing industries or attracting new investments are also very important motivators for experimentation (Wu 2012; De Jong, Wang, and Yu 2013). Therefore, synergies between climate innovation and local priorities are an important enabling factor for climate experimentation.

Sprawled along China's southern coast near Hong Kong, Guangdong has been known as being "one-step ahead" in China's reform for the past three decades (Vogel 1989). Therefore, Guangdong is commonly regarded as a showcase of China's economic achievements (Mulvad 2015). This has benefited the area immensely: Guangdong's growth rate has been among the highest over the past three decades and it has emerged as one of the wealthiest provinces in China. Climate experimentation in Guangdong aligns well with several local priorities.

First, climate innovation dovetails with the economic strategy of Guangdong, which is geared toward high-technology, innovation, and the knowledge-based economy (Huixuan, Qing, and Guicai 2016). Local officials perceive climate policies as important drivers for the desired economic reform. Second, as one of the wealthiest provinces in China, Guangdong is experiencing a growing need among its people for a better quality of life, especially for curbing air pollution (Jiang *et al.* 2015; Steinhardt and Wu 2016). Consequently, environmental protection has become a priority for the Guangdong government, and the co-benefits of climate policy, especially air pollution control, are an important driver for local climate innovation (Cheng *et al.* 2015; Zhong *et al.* 2018). The Guangdong government has been increasingly paying attention to quality of life and actively formulating environmental and climate policies, such as developing renewable energy, carbon cap, and emissions trading (Cheng *et al.* 2016; Zhou *et al.* 2018). Consequently, Guangdong is a leading environmental state in China, performing well on indicators such as air pollution and carbon intensity. Third, conventional energy resources are limited in Guangdong and the government sees climate policies as a way of reducing the area's dependency on energy imports.

Jilin is an important industrial city in the Northeast, a region known as the "Rustbelt of China" because of the high concentration of old and failing industries, many of which were established during Mao's socialist centrally planned era (Tan *et al.* 2016; Li *et al.* 2016). In sharp contrast to Guangdong, failure to adapt in the reform period resulted in long-term economic hardship in the region, which is still defined by the dominance of the state-owned economy (Li, Lo, and Wang 2015). Jilin's economy remains dominated by energy-intensive state-owned enterprises, with petrochemicals, automotive, metallurgy, and electricity as the four pillar industries. Economic hardship also contributes to the lack of resources, and local officials understandably focus on development rather than environmental issues. The city's economic strategy focuses on developing new industrial zones to attract more investment in heavy industries, which is not consistent with climate mitigation. Consequently, the city has one of the country's highest carbon intensities and suffers serious air pollution problems (Guo, Lo, and Tong 2016; Song *et al.* 2015). Furthermore, the Northeast has abundant energy reserves, especially in coal. The availability of cheap energy has supported the heavy industries in Jilin, and this economic model is difficult to change.

With a struggling and carbon-intensive economy and highly constrained fiscal resources, Jilin lacks a genuine interest in climate experimentation and controlling carbon emissions. Local interest is poorly aligned with climate policy and works against it. In our interviews, there is strong sentiment among local Jilin officials that low-carbon policies are just not something they should be worried about. In this context, the officials in Jilin mainly see the instrumental value of becoming climate pilots, as becoming a national pilot could be considered as a political achievement and bring in additional resources and investments. Therefore, climate strategy in Jilin is geared toward achieving pilot status rather conducting genuine policy experimentation.

4.2. Leadership support

In China, the hierarchical political structure gives local government leaders, especially the "first hand" (i.e. leader of the local party branch) and "second hand" (i.e. leader of the local government) overwhelming power in shaping policy development (Chung 2000). Securing political support from top leadership is therefore a very important enabling factor for climate experimentation (Teets 2015). With the establishment of the Energy Conservation Target Responsibility System (ECTRS) in 2006, these local government leaders are under pressure from the central government to lead climate policy development and implementation. However, problems are associated with hierarchical control, which reduces the effect of the system. Furthermore, frequent leadership rotation, another unique governance feature in China designed to strengthen central control over local politics, has the unintended consequence of incentivizing local officials to only focus on short-term goals at the expense of long-term climate objectives, and heightening policy discontinuity as new leaders are more inclined to initiate new projects for political achievement (Eaton and Kostka 2014). Therefore, whether local leaders take climate experimentation seriously cannot be taken for granted.

We found that a key factor in the success of Guangdong's climate experimentation is the consistent involvement of top leadership. As early as 2008, the then Guangdong Party Secretary (i.e. the first hand) Wang Yang, endorsed the development of a low-carbon economy. After Guangdong became a climate pilot in 2010, a working group, led by Governor (i.e. the second hand) Zhu Xiaodan, was established to provide leadership on climate experimentation. In November 2010, the meeting group decided to add low-carbon development as a core indicator for evaluating officials' performance across all levels. In addition, a cross-government meeting system was established to promote the implementation of national low-carbon pilot work, with Standing Vice Governor Xu Shaohua as the first convener. Regarding the ETS development, a coordination team was formed and the Director of Guangdong DRC, Li Chunhong, served as the team leader. Moreover, the provincial government established the Division of Climate Change (under Guangdong DRC), which is responsible for the organization, coordination, and supervision of the Guangdong carbon market.

Compared to Guangdong, we found that, in Jilin, climate experimentation does not receive the same level of top leadership support. No leadership group has been established for climate experimentation. Discussing the impact of leadership in Jilin climate governance, our interviewee noted:

> Climate change and energy conservation as a policy issue have never made it to the level of municipal leaders. It was mainly just the responsibility of the head of our department. (A Jilin DRC official)

One important reason Jilin was not engaged by the leadership was that local leader attention had already shifted to other areas. In the past decade, Jilin has had four mayors. The new leaders have different priorities, such as the Eco-Civilization Pioneer Demonstration Zone initiative jointly established in 2014 by the Ministry of Finance and the Ministry of Environment. Jilin was selected to participate in the pilot in 2016.

> Low-carbon was a topic of interest a few years ago, but now it is seldom mentioned. Everyone is now talking about eco-civilization and we are part of the Eco-Civilization Pioneer Demonstration Zone program. Eco-civilization is a broader concept than low-carbon cities and a better fit with the central government's eco-prioritization (*shengtaiyouxian*) principle. Now, our mayor and party secretary are in the leading group of the Eco-Civilization Pioneer Demonstration Zone. (A Jilin DRC official)

4.3. Communities of practice

Successful climate experiments are seldom conducted through the sole action of local governments, but through communities of practice, which refer to informal networks of people and organizations interested in particular areas of work and who share and exchange their information, knowledge and ideas (Wenger 1998). Communities of practice can contribute to creating innovative ideas, and knowledge gained through networks enhances local officials' understanding of the importance and cost of policy experimentation (Teets, Hasmath, and Lewis 2017; Shin 2017).

Climate experimentation in Guangdong benefits from robust networks of local and global organizations interested in low-carbon transition. These non-state actors played an influential role in Guangdong's becoming a climate pilot before the local government became involved. As early as 2008, the Division of Climate Change and Energy of the British Consulate-General Guangzhou (BCG) collaborated with the Guangzhou Institute of Energy Conversion (GIEC), Chinese Academy of Sciences and published a report entitled "Low Carbon Development Roadmap for Guangdong." The report was a pioneering work in climate-related planning provincially, if not nationally. To achieve the low-carbon transition, the report recommended introducing an ETS to cost-effectively reduce carbon emissions using a market-oriented approach. Following up with the report, in 2009, the GIEC prepared several proposals for Guangdong's LCP application, including the Guangdong Provincial Climate Change Action Plan and Guideline for Guangdong's Low-Carbon Economic Development.

After Guangdong became a climate pilot, while the government firmly controls the policy process, it has maintained consistent collaboration with non-state actors throughout the experimentation period. There was a keen awareness that government organizations in Guangdong did not have sufficient knowledge to design the ETS mechanism and, thus, the government turned to research institutes and state-owned enterprises:

> In the early days, we (governmental actors) had no idea about carbon trading, not to mention how to set up the carbon market. We turned to the research institutes for help, and although ETS was a new concept to them as well, they had enough manpower and

> expertise to conduct primary studies and support us in taking the first step. (A Guangdong DRC official)

> When the government made the decision to set up a carbon market in Guangdong, they took immediate action. Some research institutes were appointed as key supporting organizations. Experts were convened to form a task force, and they (government leaders) asked us to finish the institutional building as soon as possible. (A research institute representative)

Two consulting organizations were formed by the Guangdong DRC to support allowance allocation. One was the Technical Assessment Panel of Industry Allowance, which consisted of industry experts and company representatives tasked with collecting industry feedback on allowance allocation. Panel members submitted assessment reports to the Guangdong DRC and provided suggestions for adjusting the allowance for different industries. Another assisting organization was the Committee of Allowance Allocation Review, which was responsible for reviewing the allowance allocation proposals. Committee members include Guangdong DRC officials, low-carbon experts, and representatives from various industry associations and enterprises, with no less than two-thirds of industry experts. The two consulting organizations provided a communication channel between industry actors and government officials, and contributed toward the scientific and fair distribution of emission allowances.

Communities of practice also played a vital role in laying the foundation for Jilin to become a climate pilot, but their roles diminished significantly after Jilin successfully obtained pilot status. In 2006, Chatham House (an independent policy think tank with strong government links) led an initiative known as "The Interdependencies on Energy and Climate Security for China and Europe" project, which was funded by The UK Foreign and Commonwealth Office. In 2008, building on the relationship developed during the project, Chatham House, E3G (a British non-governmental organization focusing on sustainable development), the Chinese Academy of Social Sciences (CASS), and Energy Research Institute (ERI), which is a research arm of the National Development and Reform Commission (NDRC), began identifying a local partner with whom to conduct a low-carbon study. Jilin was selected because (i) it had local support for the low-carbon concept and (ii) was a carbon-intensive industrial city. The project was also supported by an advisory committee, which was tasked with presiding over meetings and reviewing the research output. The committee comprises government officials from China and abroad, including the NDRC, Delegation of the European Union to China, UK Foreign and Commonwealth Office (FCO), and local government (provincial and municipal) officials. The aim of the project was to develop a strategic planning document to provide building blocks for Jilin to achieve low-carbon development and become a low-carbon leader in China.

The results of the project were reported in the "Low Carbon Development Roadmap for Jilin" (Chatham House 2010). In many ways, the roadmap was a breakthrough as one of the first municipal-level climate change strategic planning documents. The study comprised three parts. First, the ERI performed a scenario-based analysis to understand the impact of the policy on emissions. A major finding from the scenario analysis was that business-as-usual means that carbon emissions would grow beyond 2030. However, introducing new low-carbon policies would significantly reduce Jilin's carbon emissions to the extent that they could peak around 2020.

Second, CASS developed an indicator-based system to evaluate low-carbon cities, which showed that Jilin was far from being low-carbon at the time of assessment. Third, the report proposed various recommendations for policy and governance innovation, with the main policy recommendation being the introduction of the ETS. Using this report, Jilin successfully applied to the LCP in 2012. However, we noticed that the community of practice ceased their function after the completion of the Jilin City Low-Carbon Report. This is unfortunate, because their input could be beneficial for the conduct of climate experimentation in Jilin.

5. Concluding remarks

The LCP is a national initiative that aims to facilitate local climate experimentations and represents a distinct governance mode in which the central government creates "policy laboratories" (Bulkeley and Broto 2013) and shapes the conduct of local experimentation through competition and hierarchical steering mechanisms. However, while the LCP is ostensibly centrally coordinated, ineffective (at best) and counterproductive (at worst) steering means that in reality the process is much more fragmented and decentralized in ways not unlike those experienced in liberal democracies (Bulkeley 2015; Lo 2014b; Broto and Bulkeley 2013). Similar to local authorities in liberal democracies, the local conditions of the climate pilots, including local interests, leadership support, and communities of practice determine the success of the experiments. Guangdong, which has a highly developed but energy-dependent economy, a government experienced in market reform, and is facing increasing demand for quality of life improvement, developed a strong and genuine bottom-up interest in climate innovation, especially emissions trading. In contrast, the local government of Jilin, which is dealing with an energy-intensive, highly industrial, although struggling, economy, could not find much common ground on which to build synergies between climate innovation and local priorities. Consequently, their participation was mainly driven by the need to fight for more top-down resources. In other words, the "Guangdong Advantage" (Cheung 2015) and "Northeast Problem" (Zhang 2008), often used in explaining the success and failure of the respective region in economic reform, are also relevant in the context of climate policy reform. Thus, our research on China's climate experimentation reaches a conclusion shared by those who study climate governance in liberal democracies: leaders in climate policy innovation are usually already the leading environmental states. However, the implications of this skewed and limited distribution of successful climate pilots raise questions over the broader applicability of policy discoveries.

Given the ineffectiveness and inefficiencies associated with existing climate governance in China, which still centers around command-and-control (Lo, Li, and Wang 2015; Lo 2015a; Kostka 2016), there is no doubt that policy innovation is crucial to China's low-carbon transition. While we do not think that the central government's attempt to encourage local policy experimentation is fruitless, the steering mechanisms clearly need improvement. Four recommendations are proposed here. First, the lack of funding for climate pilots is a crucial problem, not only because it weakens the incentives of the pilots to conduct experimentation, but also because it unfairly burdens those already struggling financially. As successful policy innovation can benefit the whole country, it is important for the central government to provide fiscal and non-fiscal investment in the pilots. The number of pilots could be reduced to concentrate

resources. Second, both the application and evaluation period could be lengthened. A longer application period prevents local governments from rushing to apply and gives them time to evaluate their suitability. The central government can require local governments to conduct a preliminary feasibility study. A longer evaluation period can prevent pressuring local officials into pursuing quick results. Third, the central government should publicize regular reports on the results of policy innovation. This not only allows for more transparency and facilitates policy learning, but also pressurizes participating local governments into actually developing new policies. Fourth, the central government can also consider integrating policy innovation in the ECTRS. This would allow the local leadership to pay more attention to developing locally appropriate and innovative policies.

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