Land Use Policy 75 (2018) 538–548

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Towards network governance? The case of emission trading in Guangdong, China

Alex Y Lo[a,b,*], Lindsay Qianqing Mai[c], Anna Ka-yin Lee[d], Maria Francesch-Huidobro[e], Qing Pei[f], Ren Cong[b], Kang Chen[b]

[a] HKU Shenzhen Institute of Research and Innovation, Shenzhen, China
[b] Department of Geography, University of Hong Kong, Hong Kong, China
[c] Department of Geography, Durham University, UK
[d] Centennial College, Hong Kong, China
[e] Konrad Adenauer Stiftung, RECAP, Germany
[f] Department of Social Sciences, The Education University of Hong Kong, Hong Kong, China

ARTICLE INFO

Keywords:
Climate change policy
Governance
Network
Capacity building
Emissions trading
China

ABSTRACT

The article explores issues about governing domestic cap-and-trade systems for mitigating carbon emissions. The implementation of these systems in China warrants investigation, because they could restructure the governing relationships between public and private actors and create conditions for networked forms of governance. The study identifies key challenges presented by an emerging network supporting carbon market development in Guangdong. It provides an assessment of network functioning in terms of capacity building, actor engagement, and rule setting and implementation. The research is based on semi-structured interviews with non-state network constituents, coupled with a review of policy development. We find that this emerging network has demonstrated some of the key network functions, mainly capacity building, and can be seen as a partial substitute for the state in this area. However, more could be done to strengthen participation and enable power sharing in steering and coordinating the decision-making process. The key features of reflexivity and power sharing in decision-making and steering are not clearly represented, leading to a conclusion that this governance network remains underdeveloped. This article contributes to the debates on the contested role of cap-and-trade systems in displacing hierarchical approaches and empowering a wider range of actors.

1. Introduction

Governance can be defined as an assemblage of actors and institutions that operates across state and non-state, public and private domains, and is embedded in concrete practice and achieved through practical means that order and regulate activities towards particular objectives (Bulkeley et al., 2016). During the past two decades, the governance of climate change has ascended to new heights in scholarly debates, particularly on policy-relevant topics such as interstate negotiations (Pattberg and Stripple, 2008), the formation and dynamics of public-private partnerships (Bäckstrand, 2008), and multi-level governance (Bulkeley and Betsill, 2003; Schreurs, 2017). A converging perspective is that non-state actors and networks play an increasingly important role in the climate governing regimes (Andonova et al., 2009; Bulkeley, 2005; Pattberg and Stripple, 2008; Tosun and Schoenefeld, 2017).

In the climate change arena, governance takes place in manifold ways and the locus of authority varies. Pattberg (2010) suggests that networks are a more advanced mode of steering towards governance objectives than hierarchical and market-based ones. Most governing regimes involve elements of two or more governance modes and tend to move towards the non-hierarchical ones, as an increasing number of civil society and business actors are brought into the system. These tendencies are particularly evident in transitioning political or governing systems that experiment a certain form of institutional or policy innovation, such as emission trading (Schröder, 2011; Lo and Spash, 2012; Paterson et al., 2014). The pilot emission trading schemes (ETS) of China represent such an innovation. There are, however, remarkable tensions in policy practice and expectation between state and non-state actors (Chen and Lees, 2016; Shen, 2015, 2017).

China has introduced new policy instruments to strengthen its efforts on greenhouse gas (GHG) mitigation. The past ten years have seen its climate policy preference shifting from the conventional 'command-and-control' instruments towards a market-based ones (Cong and Lo,

* Corresponding author at: Room 1030, 10/F, The Jockey Club Tower, University of Hong Kong, Pokfulam Road, Hong Kong, China.
E-mail address: alexloyh@hku.hk (A.Y. Lo).

https://doi.org/10.1016/j.landusepol.2018.04.021
Received 24 May 2017; Received in revised form 9 April 2018; Accepted 9 April 2018

2017; He et al., 2012; Pei et al., 2013; Schröder, 2011; Zhang, 2015a, b). The implementation of ETSs in eight provinces and municipalities of China from 2013 marked a watershed in the history of Chinese climate policy. These schemes attempt to lay a foundation for a nationwide scheme. Indicative estimates provided by the World Bank (2016, p. 22) suggest that if a national ETS is implemented in China, global GHG emissions covered by carbon pricing initiatives will rise from 13 per cent to 20 to 25 per cent. The ways in which these pilot schemes - and the carbon markets arising from them - are governed and their outcomes will have significant implications for national policy development in China as well as the future of the global carbon economy.

This paper aims to ascertain what governance challenges the development of carbon markets in China present. Many ETSs are 'cap-and-trade' systems, which require a legitimate entity, typically an authorized government agency, to set up and enforce binding emission reduction targets. ETSs also enable business and market actors to represent their interests through carbon markets and their governing bodies, which are more inclusive and flexible. The interwoven linkages and interactions between the public and private domains create a polycentric networked system by which climate change and energy issues are negotiated (Newell and Paterson, 2010; Paterson et al., 2014). The networks that play a crucial role in the delivery of Chinese ETSs are likely to be different from those of mature market economies that are set up by coalitions of state and non-state actors. Although climate governance in China appears to be steered toward a market- or even a network-based approach (Mai and Francesch-Huidobro, 2015; Schreurs, 2017; Shen, 2017) and local governments assume a greater role (Lo and Francesch-Huidobro, 2017; Lo, 2015b), primary political authority rests upon the authoritarian state (Chen and Lees, 2016; Gilley, 2012). The intriguing combination of decentralizing and top-down practices creates mixed opportunities for policy innovation and implementation, which are relatively less evident in established liberal market economies operating an ETS.

This paper focuses on one of the emerging networks that support the Guangdong ETS and related activities in the Province. We assess its performance in terms of three network functions, namely, capacity building, actor engagement, and rule setting and implementation. A series of in-depth, semi-structured interviews were conducted in Guangzhou, the capital city of Guangdong, to record network constituents' first-hand experiences in dealing with relevant government agencies and policy initiatives. Before introducing their roles and describing the policy background, the next section further elaborates on the key elements of network governance informing our analysis.

2. Key functions of governance networks

Network governance can be understood as a particular process of collective decision making, steering, and coordination (Parker, 2007; Robins et al., 2011; Secco et al., 2017). It "requires the state to steer society in new ways through the development of complex networks and the rise of more bottom-up approaches to decision making" (Stoker, 2006, p. 41). These networks enable and coordinate a more decentralized and pluralistic decision-making process, allowing a wider range of participants, especially non-state actors, to be seen as legitimate members of the decision-making process in the context of considerable uncertainty and complexity (Robins et al., 2011; Stoker, 2006). Key non-state actors brought into these networks include corporations, civil society organizations, and research institutes and think tanks. The decentralizing and pluralistic tendencies engender multiple loci of governance; examples have been found in the diffusion of carbon emission trading systems, which demonstrates a polycentric model involving both public and private actors (Paterson et al., 2014).

The rise of network governance represents a shift from hierarchical to non-hierarchical ways of governing. In the climate change arena, the capacity of individual and collective actors to change the course of events or the outcome of processes is increasingly located in sites beyond the state, and many of them "deliberately form social institutions to address the problem of climate change without being forced, persuaded or funded by states and other public agencies" (Pattberg and Stripple, 2008, p. 374). As Bäckstrand (2008) argues, networks are emblematic of the continuing transition from "government" to "governance", displacing top-down modes of steering and traditional regulation (see also Kooiman, 2003; Rhodes, 1996). In pursuing a collective decision, networks promote a sense of shared ownership and an awareness of mutual influence (Parker, 2007), and enable a process of social learning among state and non-state actors (Tosun and Schoenefeld, 2017). The network process should also demonstrate reflexive rationality, which requires a continual commitment to dialogue to generate and exchange information, reflections on practice and worldviews, and institutionalized negotiations to mobilize consensus and build mutual understanding (Jessop, 1998, 2002).

In practice, however, governance networks differ in their power structure and role. Pattberg (2010), for instance, finds that many public-private partnerships that emerged from the 2002 Johannesburg World Summit on Sustainable Development are dominated by state actors in terms of leadership and general membership. Market-based systems, such as those governing the carbon markets, are found to be driven by business-led coalitions along with state institutions (Newell and Paterson, 2010). Furthermore, not all networks function as a decision-making and coordinating entity; some of them act as a networking hub only and their role is limited to providing training and mentoring services to its members, failing to bring all relevant actors into policy development (Parker, 2007). The mere transmission of action-enabling expertise enables a cognitive form of engagement that emphasizes information and knowledge diffusion, but not necessarily critical reflections and negotiations. Thus, the quality of a governance network depends on, among other factors, the type of actors with primary responsibilities for establishing and managing a governance network, and the role of this network. These two dimensions characterize Andonova et al. (2009) typology of climate change governance networks.

The first dimension, i.e. the type of actors, concerns how the authority of governance is established and maintained. Andonova et al. (2009) have identified three types of networks based on actors involved. *Public* networks involve actors such as state agencies, legislators, and intergovernmental organizations, whereas *private* networks involve a wide range of actors, who broadly include businesses, non-governmental organizations (NGOs), and other non-state actors. *Hybrid* forms of networks involve collaboration between public and private actors. Most 'cap-and-trade' systems, such as the European Union ETS and the Regional Greenhouse Gas Initiative (RGGI), involve public governance networks in which authority rests upon governments or intergovernmental institutions (Andonova et al., 2009).

The second dimension concerns the governance functions provided by the network and specifies the means through which networks steer their constituents. The three functional categories derived by Andonova et al. (2009) include 1) *information-sharing* (producing and diffusing knowledge), 2) *capacity building and implementation* (providing resources to enable action), and 3) *rule-setting* (establishing rules intended to guide and constrain constituents). Different networks have their own functional priorities and strengths, and some of them are particularly poor in achieving one or more of these goals, indicating a network failure. This dimension of network is useful for understanding how networks are clustered and perform, and more fundamentally, whether they can be regarded a functioning governance network.

We adapt this analytic account to a study of an emerging public governance network in Guangdong. This loosely structured network supports the implementation of a market mechanism (i.e. ETS) in various ways and has shown some potential for demonstrating the three network functions mentioned above. This basic framework is used to ascertain the extent to which, and in what aspects, the public network supporting GHG emission reduction activities in Guangdong has performed its key functions. Our

Table 1
Key features of Guangdong Province and Guangdong Emission Trading Scheme (ETS).

Guangdong Province	
Total Population (2015) (percentage of country)[a]	108 million (7.9%)
GDP (2015) (percentage of country)[a]	USD 1124.2billion (10.7%)
GDP per capita[a]	USD 10,422
Overall GHG emissions (excluding LULUCF) (2012) (percentage of country)[b]	610.5 $MtC0_2e$ (5.6 %)
Guangdong ETS	
Launch date	19 December 2013
Percentage of GHG emissions covered by the ETS[b]	60%
Cap on GHG emissions (2016)[c]	422 $MtCO_2e$
Sectors covered[c]	Electricity generation, Iron and steel, Cement, Petrochemicals, Pulp and paper and Aviation
Number of liable entities[c]	244 existing enterprises (2016)
Inclusion thresholds[d]	20,000t CO_2/year or energy consumption 10,000 tons coal equivalent (tce)/year.
Allowance allocation[d]	Electricity generation sector: 95% free allocation, 5% auction Iron and steel, cement, petrochemicals sectors: 97% free allocation, 3% auction
Trading mode	Spot trading, block trades, negotiated transfers
Banking and borrowing of allowances[e]	Banking is allowed during the pilot phase. Borrowing not allowed.
Offsets and credits[e]	Domestic project-based carbon offset credits — China Certified Emission Reduction (CCER) — are allowed. The use of CCER credits is limited to 10% of the annual compliance obligation. At least 70% of CCERs need to come from Guangdong. Pre-CDM credits are not eligible as are credits from hydropower and most fossil fuel projects.

Sources:
[a] National Bureau of Statistics of China (data.stats.gov.cn). The GDP estimates originally in Chinese yuan were converted to US dollars at the rate of 6.4778 (USD/CNY) based on the Federal Reverse's exchange rate records (31 December 2015).
[b] International Carbon Action Partnership (ICAP) (icapcarbonaction.com). Accessed 23 August 2017.
[c] Guangdong Development and Reform Commission (2017). Notice on the Allocation of Carbon Emission Allowances of Pulp and paper, Aviation and White Cement in Guangdong Province 2016. Guangzhou: People's Government of Guangdong Province, People's Republic of China. Available at http://www.cnemission.com/article/news/ssdt/201701/20170100001201.shtml [in Chinese]. Accessed 23 August 2017.
[d] Guangdong Development and Reform Commission (2016). Notice on the Allocation of Carbon Emission Allowances in Guangdong Province 2016. Guangzhou: People's Government of Guangdong Province, People's Republic of China. Available at http://dtfz.ccchina.gov.cn/archiver/LowCD/UpFile/Files/Default/20160714093558793864.pdf [in Chinese]. Accessed 23 August 2017.
[e] People's Government of Guangdong Province (2014). Trial Methods of Emission Management of Guangdong (No. 197, Decree of Guangdong Provincial Government). Guangzhou: People's Government of Guangdong Province, People's Republic of China. Available at http://zwgk.gd.gov.cn/006939748/201401/t20140117_462131.html [in Chinese]. Accessed 23 August 2017.

study design was informed by Andonova et al. (2009) analytic account.[1] Nevertheless, we modified elements of this framework when describing our case study for reasons explained below.

3. Methodology

3.1. The case study

In 2011, the Chinese central government formally appointed two provinces (Guangdong and Hubei) and five municipalities (Beijing, Shanghai, Tianjin, Chongqing, and Shenzhen) to run trial ETSs. Located on the South China Sea and including the Pearl River Delta, one of three vast urban agglomerations in China, Guangdong is a highly urbanized and industrialized province with a total population of over 108 million in 2015 and a total GDP of USD1124.2 billion in 2015. (Table 1). Guangdong's per capita GDP was USD 10,422 in 2015, putting it at the eighth nationally. Being the largest single economy within China, Guangdong Province is home to nearly all kinds of industries, including some world leading ones (e.g. electronics, machinery and petrochemicals). The Province has recorded a relatively high level of GHG emissions because it remains dominated by the manufacturing sector, which is highly emission-intensive. In 2012, Guangdong generated a total of 610.5 million tonnes of carbon-equivalent emissions, which is about 5.6 per cent of the country's total[2].

Guangdong officially launched its ETS in December 2013, meaning that the system for regulation and trading was set up around two years after the central government mandated the pilot ETSs in October 2011. The Guangdong ETS has not yet been given a formal legislative basis. Instead, the political legitimacy of this scheme is given by the People's Government of Guangdong Province through a formal administrative document titled the 'Notice on Publishing the Implementing Plan for Carbon Allowance Trading Pilot of Guangdong' released in September 2012 (People's Government of Guangdong Province, 2012). The Guangdong Government, subsequently, made public the operational requirements and rules of the ETS by issuing a decree titled 'Trial Methods of Emission Management of Guangdong' in 15 January 2014 - one month after the ETS came into force (People's Government of Guangdong Province, 2014).

According to the Guangdong Government, the Guangdong ETS covers 244 existing polluting entities (Table 1). In 2014 and 2015, a total of 408 million tonnes of CO2 emission allowances were issued, and tightened to 386 million in 2016, making the world's third largest carbon market after the European Union and South Korea. The allocation subsequently rose to 422 million when two new sectors, Pulp and paper and Aviation, were brought into the scheme. The volume of allowance auction and market trading exceeded 24 million tonnes, and a turnover of 1.0 billion yuan was recorded. By the middle of 2017, these figures increased to 62.8 million tonnes and 1.48 billion yuan (approx. 223 million USD), respectively, exceeding all other pilot ETSs in China (Figs. 1 and 2). Thus, Guangdong accounts for more than one-third of the national market share, in which a total volume of 183.3 million tonnes CO2 at the value of 638.7 million USD has been traded since the inception of the ETS. Allowance prices, however, stand at a relatively low level. In October 2017, emission allowances issued by Guangdong were sold at about US$2.14 per tCO2e, lower than those under other

[1] Our analysis does not deeply engage with the first dimension of governance network described by Andonova et al. (2009), because authority clearly falls onto the state's hands and the network is primarily a public one. Instead, we seek evidence from the experience of actors who contribute to network functioning.
[2] The 2012 estimate on Guangdong's GHG emissions is the latest one we can find, due to the lack of transparency in data reporting.

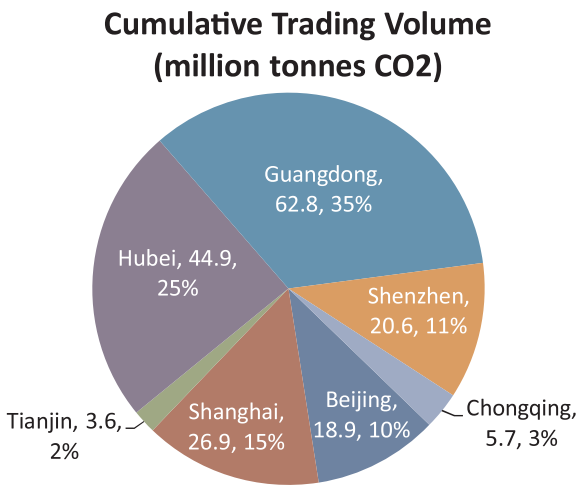

Fig. 1. Cumulative trading volume of emission allowances under the seven pilot emission trading schemes of China (up to 30 June 2017).
Source: IDEACARBON (ideacarbon.org/archives/36877). Updated 23 August 2017.

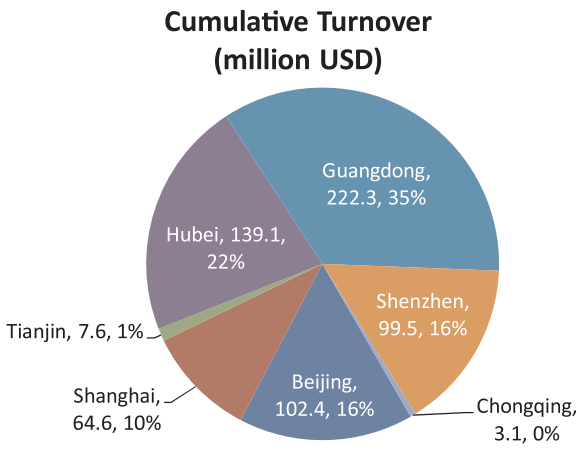

Fig. 2. Cumulative turnover of emission allowances under the seven pilot emission trading schemes of China (up to 30 June 2017).
Source: IDEACARBON (ideacarbon.org/archives/36877). Updated 23 August 2017. The turnover estimates originally in Chinese yuan were converted to US dollars at the rate of 6.64 (USD/CNY) based on the Federal Reverse's exchange rate records (2016).

similar schemes, including the Beijing, Shanghai, Hubei and Shenzhen ETSs (Table 2).

3.2. Data collection and analysis

Our study began with a review of relevant policy documents and other printed and online resources to understand the policy background and progress of the Guangdong ETS. These include various implementation and regulatory 'notice' (*tōng zhī*), 'rules' (*xì zé*), and 'plan' (*fāng àn*) issued by the People's Government of Guangdong Province, and consultancy and applied research reports, such as Wu et al. (2014) and the Sun Yat-sen University's Research Center for Climate Change of Guangdong (2016). Carbon market information was also solicited.

The analysis is mainly based on a series of in-depth, semi-structured interviews conducted in Guangzhou. Members of the research team contacted and interviewed 18 individuals from 12 organizations to record their first-hand experiences in dealing with relevant government agencies and policy initiatives. The snowball sampling technique was used to identify the first batch of interviewees, starting with the existing contacts of members of the research team and then their own contacts

Table 2
Carbon prices under various emission trading schemes (ETS) and cap-and-trade (CaT) systems.

Country / Region	Scheme	Allowance price on April 1, 2017 (tCO_2e, US$)[a]	Total trading volume (MtCO2e)[b,c]
China	Guangdong ETS	2.14	29.15 (2016)
	Hubei ETS	2.22	13.56 (2016)
	Beijing ETS	7.46	7.18 (2016)
	Tianjin ETS	1.29	1.17 (2016)
	Shanghai ETS	2.49	10.62 (2016)
	Chongqing ETS	0.26	5.36 (2016)
	Shenzhen ETS	4.26	4.83 (2016)
	Fujian ETS	3.42	(2016)
European Union	EU ETS	8.57	6,685.82(2015)
United States	RGGI	4.35	240.74(2015)
	California CaT	14.75	754.39(2015)
Canada	Quebec CaT	14.75	Not available
	Ontario CaT	14.88	Not available
Korea	Korea ETS	18.53	Not available
Switzerland	Swiss ETS	6.67	Not available
New Zealand	NZ ETS	13.17	Not available

Sources:
[a] ICAP Quarterly - Global Trends in Emissions Trading, Issue 15, 18 October 2017. Available at https://icapcarbonaction.com/zh/newsletter-archive/mailing/view/listid-/mailingid-66/listtype-1.
[b] China: IDEACARBON, available at ideacarbon.org/archives/36877, updated 1 July 2017. EU and US: Carbon Markets 2015 data for NCSC, Bloomberg New Energy Finance (January 2016).
[c] Notes: The trading volume estimates for the seven China's piloting ETSs are based on a one-year period from 30 June 2016 to 30 June 2017, which is a complete compliance year in China's carbon market, whereas those for the EU ETS, RGGI and California CaT run from 1 January 2015 to 31 December 2015.

who have relevant expertise or experience. Other interviewees were identified from a web search and contacted by email. These individuals are senior members of local businesses, social organizations, and research institutes (Table 3). All of them actively engage in emission trading and/or emission reduction in Guangzhou city and other jurisdictions within Guangdong Province. Their core business activities range from applied research for policy development to consultancy and trading services for regulated enterprises and other market participants. The interviews were completed within a one-year period beginning from March 2016. Each lasted for 45 to 90 min.

Our search for informants did not include representatives of government and regulated enterprises, because the study primarily focused on the experience of non-state actors in contributing to network functioning. Also, scientific studies of state actors and climate governance in China have previously been reported by others as well as ourselves (Shen, 2015; blinded for review). It should be noted that whether or not the regulated enterprises in China should be defined as non-state actors is contested, because most of those currently covered by the ETSs in China are owned by the state, and their top leadership is transferred from the public service system and appointed by the government.

Nonetheless, the interviewing processes revolved around the current progress in various activities related to network functioning (e.g. capacity building workshops, joint meetings), the role of our informants and their interactions with government agencies and regulated enterprises in participating or organizing these activities, what governance issues their repeated interactions have exposed. It is noteworthy that the 12 organizations have been working closely with both government agencies and enterprises. This means that they understand how the governance network is shaped by state actors, but are not bound to accepting their practices and preoccupations.

In analysing data, we used Andonova et al. (2009) framework with modifications to recognize the specifics of our case study. We explore opportunities for 'actor engagement', instead of 'information sharing'.

Table 3
List of informants.

Type of affiliation	Number of informants	Position	Portfolio (specialization)
Private company	4	Deputy Director Business Managers	Trading services (emission rights)
	1	Senior Energy Efficiency Assessor	Measuring, Reporting and Verification (MRV)
	2	Chairman Engineer and lawyer	Carbon asset management
	1	Director	Carbon asset management
Research institute	2	Director Deputy Director	ETS design
	1	Research team leader	ETS design
	1	Carbon trading specialist and auditor	Carbon auditing and consultancy
Social organization	1	Deputy President	Consultancy (low carbon business)
	2	Deputy President Chief Engineer	Consultancy (energy)
	1	Secretary General	Consultancy (clean production)
	1	Deputy Secretary-General	Consultancy (low carbon business)
	1	Vice Secretary General	Consultancy (clean production)

Andonova et al.'s typology of governance networks was developed in a transnational setting where state authorities are not unitary. Our case study, however, focuses on a relatively small group of local actors based in one Chinese province, whose core businesses are concentrated in a handful of cities and local areas. The close proximity to each other and the widespread use of information technology have overcome certain technical barriers to the sharing of information among these actors. Instead, the governance network could play a more important role in diffusing new norms and engaging otherwise uninterested parties, notably business managers, in low-carbon production practices. Such norms and practices might include seeing emission reduction as an asset rather than a liability, controlling the use of energy and emission of GHGs, and participating in the trading of emission allowances or credits. This specific function is implied in the framework advanced by Andonova et al. (2009), who argue that:

> Information sharing takes on a governance function when it is recognized as authoritative and serves to direct constituents within the network. This may take place through norm diffusion, consensus building, or changing practices (Andonova et al., 2009, p. 64).

Our adaptation highlights the role of governance network in directing its constituents. We put an emphasis on motivation and behavioural drivers to make more explicit the distinction from the function of capacity building. The case study presented below shows that the governance network investigated, as it currently stands, is well placed to achieve one end but not the other. Our adaptation can reveal a clearer structure of network functioning at work.

Moreover, our case study involves a unitary state that is, to a large extent, empowered to implement the policy concerned. As we show below, the governing activities concerning implementation of rules and policy measures related to the ETS are predominantly led by the state, demonstrating a different configuration of authority from the rather decentralized capacity building activities. We therefore discuss 'implementation' separately from 'capacity building' and along with a cognate function of governance network, i.e. 'rule setting', which is a similarly top-down activity.

Thus, network functions are described in this paper in terms of *capacity building, actor engagement*, and *rule setting and implementation*. These analytic categories cover a wider range of issues, such as policy implementation and personnel training, that are particularly important for a newly introduced and relatively novel domestic policy programme (i.e. ETS in China) and repeatedly mentioned by the informants. The following section describes these three aspects of the governance network supporting the Guangdong ETS and emission trading activities in the Province.

4. Findings

4.1. Key actors

The Guangdong ETS is said to be steered by an inclusive group of actors, which is chaired by the Governor of Guangdong and includes representatives of government agencies, research institutes and universities, enterprises and industry associations (Research Center for Climate Change of Guangdong, 2016). The key actors involved in the governance of this ETS and related issues (e.g. energy saving and clean production) are indicated in Fig. 3. The Development and Reform Commissions (DRCs) at three levels play different roles. The top-tier National DRC (hereafter, NDRC) is the macro-economic branch of the State Council of China and charged with overseeing the eight pilot ETSs and setting up the prospective national ETS. The Guangdong DRC holds the portfolio of economic development and planning, and administers the Guangdong ETS. Although the approval for setting up ETSs is granted by the NDRC in a top-down fashion, provincial DRCs are given

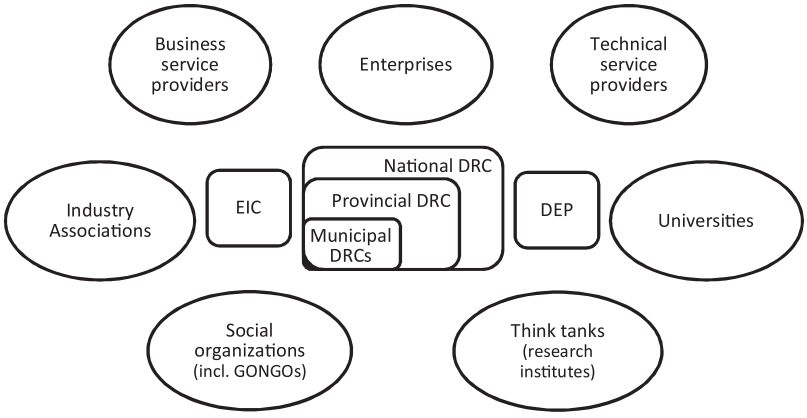

Fig. 3. Key parties involved in governing carbon market in Guangdong.
EIC: Economic & Information Commission of Guangdong Province; DEP: Department of Environmental Protection.

a relatively high degree of autonomy in designing their own pilot ETSs (Zhang et al., 2014; Zhang, 2015a, b). Municipal DRCs submit emission data to provincial DRCs for determining the allocation of emission allowances and are not the main driver of policy change.[3]

Guangdong's climate policies gain legitimacy from the Guangdong Leading Group Addressing Climate Change and Energy Efficiency. This Leading Group was based in two separate units, i.e. the DRC and Economic and Information Commission (EIC) of Guangdong until August 2014, when the Group's administration was transferred to the DRC. Promotion of energy efficiency in the province falls within the remit of the EIC. Guangdong's Department of Environmental Protection (DEP) supports clean production generally across the province. The responsibilities for addressing climate change specifically go to the Climate Division of Guangdong DRC. These institutional arrangements result in the DRC playing a mixed role as both an economic and environmental manager (Lo and Yu, 2015), and fragmentation in the governance of climate change and related issues in the province (Wu et al., 2014), as we further discuss later.

Members of the epistemic communities include university-based research institutes and official think tanks. Sat Yat-sen University (SYSU) is the most prominent higher education institution in Guangdong. In partnership with, and with funding from, the Provincial DRC, the SYSU set up the Research Center for Climate Change (RCCC) in 2015, which plays a principal role in advising the DRC on ETS design and creating an emission data inventory for the province. Official think tanks in China, such as the Chinese Academy of Sciences and the Chinese Academy of Social Sciences, are established by government. Like universities, they advise government departments on the scientific and technical aspects of public policy, but are generally more dependent on the state, both financially and institutionally. These epistemic institutions act as the technical arm of government.

The role of social organizations in climate governance in China is rarely explored (see, however, Francesch-Huidobro and Mai (2012). Their formation is a product of the state's retreat from a planned economy. Since the late 1970s, a variety of voluntary associations and NGOs have sprung up in China to provide various social welfare services that previously fell in state hands (Ho, 2007). Some of them specialize in environmental protection and energy saving, such as the Guangdong Energy Conservation Association. At odds with the "Western concept of voluntary associations and NGOs that can protect citizens' rights or counterbalance state power" (Ho, 2007, p. 192), social organizations in China substitute the state in the area of service provision and act in the space between the state and the society. They have access to state institutions and are sometimes offered opportunities for providing policy inputs and negotiating greater rights to pursue organizational interests and goals (Wu, 2003). Industry associations are led by state-owned enterprises (SOEs) and serve to protect members' interests, rather than providing social welfare or professional environmental services. Currently, four energy-intensive industries are covered by the Guangdong ETS, namely, energy, iron and steel, cement, and petrochemicals.

Enterprises require business and technical support for managing the costs and time required for compliance with ETS requirements. The former group includes exchanges and carbon asset management and consultancy firms. Environment or carbon exchanges, such as the Guangzhou China Emissions Exchange, provide essential support to the development of carbon market infrastructure and trading platforms. Carbon asset management firms advise businesses and help them manage their allocated emission allowances or develop emission reduction projects aimed at producing carbon credits and creating new revenue streams.

Technical service providers include quality control and certification agencies, such as the China Quality Certification Centre, Canton Branch (a service organization managed as a SOE) and the China Electronic Product Reliability and Environmental Testing Research Institute (commonly known as CEPREI) Certification Body (a SOE). They assist businesses and government in measuring GHG emissions and verifying emission reductions, and play an instrumental role in building capacity and formulating carbon auditing standards and guidelines for the DRCs. In Guangdong, representatives of exchanges and certification agencies serve on several expert panels organized by the DRC and related to carbon market development and the ETS. These companies, together with research institutes and enterprises, have a strong presence in two highly active technical committees advising the Guangdong DRC, namely, the Committee of Allowance Allocation Review and the Technical Assessment Panel of Industry Allowance (Research Center for Climate Change of Guangdong, 2016).

As described above, a group of non-state actors is well connected to state institutions. They take part in the process of ETS policy formulation and implementation in Guangdong, and frequently communicate and collaborate with each other in this process. Through the deep engagement in the governance of Guangdong ETS, they have discerned a number of problems and challenges that could preclude the governance network from meeting its goals. We found some consensus among our informants, mainly about the current state of carbon market in China. Fewer of them expressed similar views about governance or related issues, due to their different experiences and attitudes. This is discussed in the following three sub-sections.

4.2. Capacity building

In Guangdong, network contacts have provided favourable conditions for capacity building, which is essential to enabling action. Despite their peripheral role in the making of key decisions and the inherent difficulties in motivating businesses, non-state actors are able to utilize their own expertise and extensive connections to strengthen the capabilities of enterprise managers, government officials, and developers of emission reduction projects, and other interested parties.

Both social organizations and service providers have organized various training workshops, sharing sessions, or other forms of capacity building activity over the past three years. Many of them are also involved in sharing sessions and industry conferences that are open to national audience. The Guangzhou China Emissions Exchange, for example, is the key player in Guangdong, hosting 14 training workshops on emission trading in 2016. These workshops and activities equip participants with relevant skills and knowledge about the general policy context, the mechanisms of allowance allocation, management rules and regulatory restrictions, trading procedures and account management, and the requirements of project development and registration, etc. Most of these training activities attract incomes.

The imperative of developing capacity benefits from the network comprising state and non-state actors. Core service providers are able to help practitioners develop capacity because of their prior experience in working with related mechanisms (e.g. Clean Development Mechanism), relevant skillsets (e.g. carbon / energy auditing), or extended period of research and training. Some of them are 'designated' training agents, being invited by a DRC to offer training sessions for local governments, particularly those in poorer provinces, such as Guangxi and Jiangxi (Research Center for Climate Change of Guangdong, 2016):

> Their [local governments'] capacity is low and they require training and exchange. Guangdong Province wants to be become the [emission training] training centre in South China. Many provinces will come to learn about emission trading and exchange. *(interview with technical service provider, March 2016*).

Officials of these local governments are usually called upon by the NDRC or their local counterparts, indicating the importance of this

[3] - except Shenzhen, which is a municipality and its ETS is administered by the Municipal DRC of Shenzhen, instead of the Guangdong DRC.

central network 'node' in legitimizing coordinating initiatives. The strong influence of these DRCs, notably NDRC, is also instrumental to mobilizing enterprises managers: "*in the early days, enterprises were pressured by the government and had no choice but sending their people to us for training*" *(interview on with a service provider, March 2016*). Although DRCs continue to call for training and mobilize officials and enterprise managers, service providers have increasingly become a network node, more actively promoting their fee-paying training workshops and professional services. Service providers partially substitute the state by delivering capacity building services to meet demands created by the latter.

Regular collaborations exist among network constituents. The lack of in-house expertise within DRCs (including the Guangdong DRC) themselves has provided conditions for the network to contribute and develop mutual trust. For instance, the panel speakers of the training workshops organized by exchanges always include other network constituents, such as research institutes, consultancy firms, financial institutions, and other service providers. Such collaborations are reciprocal; representatives of exchanges are often invited to speak in similar training activities hosted by other network constituents. While service providers deliver training services for a wide range of individuals, some research institutes are more 'institutionalized'. The most notable example is the SYSU's RCCC. The Climate Division of the Guangdong DRC currently (early 2017) consists of only six staff members. On the DRC's invitation, some of the RCCC's researchers are based *in* the office of Climate Division for an extended period of time and work very closely with DRC officials. They do not only provide advice on policy design and operation, but also contribute to the transfer of professional knowledge and skills.

Unlike their counterparts in Europe, carbon exchanges in China have little collaboration with conventional environmental NGOs. Yet, social organizations offered many forms of training and capacity building services, covering emission trading as well as carbon auditing and energy conservation. These initiatives are one of the main income sources of the smaller social organizations. A representative of a social organization indicated that the government's efforts on capacity building are far from adequate and they fill the gap by providing training services, making room for some 200 social organizations specializing in low-carbon development and energy conservation to exist in just one province (Guangdong). Comparing with research institutes and exchanges, these social organizations provide a more flexible mix of training services and focus on specific industries or themes, depending on their organizational goals and strengths. Collaborations among network constituents also exist in delivering these services.

In the area of capacity building, the network can be considered as properly functioning. It helps coordinate the transfer of knowledge and skills, and the tendencies for state domination in this process are declining. As the collaborative approach can reduce the costs of capacity development by virtue of specialization, there are an increasing number of such initiatives across China as many local governments and enterprises from other provinces embark on the preparation for the national ETS.

4.3. Actor engagement

Non-state actors could contribute to the governance network by motivating other actors, notably businesses, to participate in emission trading. Whereas the state assumes leadership in rule setting and implementation, social organizations and service providers (e.g. exchanges) help achieve the network goal by coordinating various public and private activities for introducing the idea of emission trading and the role of carbon markets to enterprises. Difficulties are found not mainly in informing enterprise managers, but in creating a normative environment for participation. The problem arises from the lack of incentives, which is beyond the ability of the network and its participants to fix, except the state. The ETS is adopted and implemented in a top-down fashion, and most of the regulated enterprises are forced to respond and make adjustment.

At the early stages of implementation, many regulated enterprises, notably the larger ones, were reluctant to cooperate (although they could not refuse due to the strong influence by the state). Changes in corporate practice were incremental. As the authority of decision-making asymmetrically rests upon the state, the coordinating efforts made by social organizations and service providers are effective only within a limited range. A barrier to coordination, particularly at the early stages, is the lack of understanding:

> The main barrier is lack of understanding. Initially, enterprises refused to cooperate, as the imperatives of energy conservation and environmental protection have already put them under great pressures, and there is yet another one [i.e. emission reduction]. *(interview with research institute, May 2016)*.
>
> Enterprises do not have an adequate understanding of the policy. Their professional practice, willingness to cooperate, and facilities and measurements are all falling short of requirement. *(interview with technical service provider, March 2016*).

All parties recognized the need for training and capacity building. The problem is that the main driver of business motivation is ill-constructed. During the first few years of policy implementation, there was a sense of forced consciousness:

> I think it was a forced response at the beginning, or some kind of coercive learning. *(interview with business service provider, March 2016*).
>
> I believe that most enterprises do not fully understand. It is a government mandate to participate in [emission] trading. As it is mandatory, enterprises simply follow the rules and do not offer any informed advice; they do not see themselves a specialist *(interview with social organization, May 2016)*.

Although the state continues to compel enterprises to respond, business reluctance is declining and awareness is increasing - a passive response to the reality of a top-down policy change. Many large SOEs, such as the China Huaneng Group Corporation, have set up new departments or subsidiaries to manage their emission allowances and the mix of carbon assets. Even the smaller ones have come to realize that controlling their GHG emissions has become an imperative and the failure to do this will threaten their survival. However, the slowly rising interest in *trading* is driven by market more than state factors.

Corporate interest in trading depends on 'market openness', and business awareness is a product of a cost-benefit calculation:

> Enterprises do not participate in emission trading simply because of awareness. It depends on their own business conditions and cost considerations. *(interview with social organization, May 2016)*.

While business conditions vary, cost considerations are relative to benefits, or potential gains from trading in the market. Price signals offer a basis for cost-benefit calculation, and this is where the main problem lies. The Chinese carbon markets are currently far from competitive and the trade prices of emission allowances do not reflect the marginal costs of emission abatement (Lo, 2016; Munnings et al., 2016; Zhao et al., 2016). According to Munnings et al. (2016), market liquidity in three pilot ETS sites, including Guangdong, is quite low. They believe that "local governments and exchanges may play a strong role in orchestrating trades – including determining the buyer, seller, and transaction price of some transaction" (Munnings et al., 2016), p. 696). This is concurred by one of our informants: "*the current price is not a market price, but determined by the government" (interview with service provider, March 2016*). We found that this and other informants have a good understanding about market principles and in what aspects the current system falls behind.

The low carbon prices create a poor market signal. High price levels can attract investments in the development of low-carbon technologies

and emission reduction projects that can generate carbon credits, and encourage the trading of emission allowances to hedge risks, whereas low price levels mean that these investments are not likely to yield high returns and the best strategy would be purchasing cheap allowances or credits to fulfil compliance requirements. The extended period of low price levels in Guangdong's carbon market renders the prospect for break-even unclear. Also, financial institutions are cautious of creating new products linked with the ETS and investors lack confidence in the market, due to the lingering uncertainties associated with policy change (Wu et al., 2014; Lo and Yu, 2015; Lo, 2015a). The barely competitive market environment reduces incentives for making investment and participating in allowance trading. Coordinating efforts made by other network constituents are not as effective as expected.

The network function of motivating businesses is affected by the ways in which the carbon market is steered. Coercive means were used by the government to drive early action, but sustained efforts on the part of enterprises depend on price signals and economic incentives. Since the carbon market conditions are created and shaped by a policy programme crafted by state institutions, and non-state actors play merely an advisor role, altering the incentive structure is beyond the ability of network constituents other than the state itself. This suggests that the key barrier is largely exogenous to the network structure. Although the governance network is able to share information and build capacity, it has achieved a modest success in motivating businesses. One of the main drivers of motivation falls outside the network.

4.4. Rule setting and implementation

Non-state actors have expressed concerns about network coordination in the process of policy formulation and implementation. The operation of the Guangdong ETS cuts across two interrelated policy areas, i.e. climate change, and energy efficiency and emission reduction. These policy areas, however, are administered by two separate 'Working Groups' that are hosted by two departments, i.e. DRC (for climate change and ETS) and EIC (for energy efficiency and emission reduction). This institutional arrangement creates confusion and complexities in liaison, reporting, and collaboration. Interestingly, there is some confidence in state leadership and the centralized system, despite the tendencies for administrative decentralization across China. Both factors could pose a challenge to the emergence of an advanced form of network governance.

The poor coordination of responsibilities can impede communication and collaboration among existing and potential network constituents. When responding to our questions about ETS and (carbon) emission reduction, a representative of a social organization repeatedly pointed out our (alleged) confusion between the two, implying that they fall into two different domains. A specialist in environmental technologies and processes, he contended that the Provincial DRC is one part of it (governance), the EIC is another one, and the DEP is yet another one. This requires specialist organisations to put in diverted resources when initiating collaboration with different streams of provincial governing. Although he and his colleagues collaborate with the EIC and the DEP on a regular basis, they have not established strong links with the DRC that would allow them to represent the environmental sector. It is then not surprising that most other informants failed to name any *environmental* NGO (not being a social organization) actively engaging in ETS policy development. This comes into contrast with international studies showing that such NGOs are often a core member of climate governance networks (e.g.Tosun and Schoenefeld, 2017). As the Provincial DRC does not assume formal responsibilities for environmental protection and energy efficiency, enterprises and service providers have to liaise and build linkages with multiple agencies when responding to the demands of emission trading. These communication channels are not always effective (Arnstein, 1969). As a group of close observers have indicated:

> the [Guangdong] government uses a one-way method to communicate with other stakeholders, even with direct executive agencies, resulting in a deviation of policy implementation and limited cooperation among all the stakeholders. No official channels for feedback or questions are provided." (Wu et al., 2014, p.23).

As a consequence, the transaction costs involved in compliance and service provision might increase, compromising the efficiency of the system.

A more important issue is that this arrangement results in regulatory duplication. To implement the ETS and enforce binding emission reduction targets, the DRC has to monitor and manage GHGs emitted by regulated enterprises. However, such a direct intervention into business operation has always been overseen by the EIC. Under the ETS, the authority of the DRC is extended and overlaps with that of the EIC. Despite their overlapping responsibilities and services, these two agencies do not work closely with each other nor seek formal clarifications. One informant described this situation as 'double-headed supervision', a source of confusion on the part of enterprise managers. Representatives of another service provider used exactly the same term to describe a similar issue they have encountered. Despite working for a private company, they found themselves reporting to two levels of government, i.e. the Provincial DRC and the Municipal Government of Guangzhou. This is because the Municipal Government is the main shareholder of their parent company and oversees organizational matters, but the Provincial DRC administers the ETS and sets up the carbon market in which they are deeply involved. This critical service provider has to deal with two different sources of authority, both of which have a say on its product and service mixes as well as daily operation. Nonetheless, this is seen as a double-edged sword. Suggested advantages of having two lines of reporting for service providers include greater access to resources and closer linkages with the centre of authority, providing legitimacy and convenience to service delivery and product development.

While there is general support to decentralizing governance and using market mechanisms for mitigating GHG emissions, the possibility – or perhaps, reality – of fragmentation is an issue of concern. Looking beyond Guangdong, the implementation of pilot ETSs has exposed various problems associated with central-local relations, conflict of interests and responsibilities between NDRC and other commissions and ministries, such as the China Securities Regulatory Commission overseeing the financial regulation of carbon markets, and the one-way communication between government and other stakeholders (Qi and Cheng, 2015; Wu et al., 2014). This has led one of the non-state actors from the private sector to applaud the top-down approach. Recognizing the importance of cross-sectoral collaboration and discussion among stakeholders and policy-makers, he nonetheless believed that delegating the authority of decision-making and creating binding rules to a small number of state actors (e.g. NDRC or Provincial DRCs) is advantageous to system functioning.

> We might struggle for three to five years, but take only one year to roll it out. This is our so-called 'democratic centralization'. You are allowed to discuss, but after that, [the government] will act quickly. This is the advantage of a centralized regime. *(interview with business service provider, July 2016)*.

A similar response from financial institutions in China is reported by Lo and Yu (2015), indicating a preference for state leadership and control in ETS policy development. The hierarchical mode of steering is seen as necessary for avoiding administrative failures at the lower levels of government and compatible with the use of market mechanisms. For service providers, it also ensures certainty of implementation when rolling out new policies and operational mechanism.

In Guangdong, as in other piloting locations, the implementation and regulation of ETS are dominated by state institutions. Among network constituents, there is some frustration at governance

fragmentation and partial confidence in the productive elements of the state-led approach. These beliefs could potentially undermine the case for power sharing and displacing hierarchical approaches.

5. Discussion

Cap-and-trade systems put market principles at the forefront of policy development and enable a wider range of actors to contribute. The implementation of these systems in China would be meaningful and important to the extent in which they restructure the governing relationships between public and private actors and create conditions for effective governance - and ideally, networked forms of governance. In China, the transition from government to governance has exposed numerous tensions across all areas of public policy, including climate change and energy (Cheung et al., 2017; Lo and Howes, 2015; Mai and Francesch-Huidobro, 2015; Schreurs, 2017; Schröder, 2011; Tao and Mah, 2009). These tensions might preclude advanced modes of governance from emerging.

Situated in this context, our study attempted to assess the key functions of a governance network in China. We examined the tensions arising from the governance of the pilot ETS and carbon market in Guangdong Province. The analytical framework developed by Andonova et al. (2009) was adapted and used to ascertain the extent to which, and in what aspects, the public network supporting GHG emission reduction activities in Guangdong has performed its key functions. The analysis focused on three aspects of network functioning, namely, capacity building, actor engagement, and rule setting and implementation.

The governing regime in Guangdong is marked by a relatively more liberal approach that is open to a range of non-state actors, who are able to form an advocacy coalition in the arena of climate policy generally (Francesch-Huidobro and Mai, 2012). Collaborative, bottom-up initiatives are most common in the diffusion of knowledge and skills through professional training activities and sharing sessions. There is some evidence on mutual learning, a requirement of network governance (Tosun and Schoenefeld, 2017). Some of the capacity building arrangements are manifest as a partial substitute for government (Parker, 2007). These opportunities arise from the lack of expertise within the DRCs and enterprises, creating demand for collaboration with other actors and network coordination. Yet, it is essentially a form of cognitive engagement, restricted to the transmission of action-enabling expertise and learning from the best practice. In defining an ideal case of network function, Andonova et al. (2009, p. 64) suggest that capacity building "is a process entangled with negotiation over rights and responsibilities and struggles over the nature of the problem and its appropriate solutions". In Guangdong, although there is critical reflection upon technical issues, capacity building activities do not pursue a process of negotiation and problem definition.

More generally, the governing system has demonstrated only a modest form of reflexive orientation. According to Jessop (2002), network process is based on 'reflexive rationality', which requires attempts to negotiate and steer the process of decision-making, leading to common worldviews among actors and coordinated solutions (see also Parker, 2007). In a similar vein, Bulkeley et al. (2016, p. 5) argue that climate governance takes place through the "problematisation of particular entities", such as energy systems. In our case study, such entities include the environmental policy-making institutions that have adopted top-down, command-and-control approaches. Corroborating earlier reports (e.g. Qi and Cheng, 2015; Lo and Yu, 2015; Shen, 2015), network constituents find difficulties in motivating enterprises to participate in emission trading and make investment in carbon asset management. The low levels of carbon price, which stem from a series of conservative policy interventions (e.g. restrictions on trading options and price movements), are suggested to be the key reason.

Here, the problem is linked back to the hierarchical power relations that privilege state control and contribute to market distortion, triggering attempts to reflect upon the nature of a market mechanism and the very reason for creating one in China, i.e. displacing the command-and-control approaches. Nevertheless, this problematique is a discursive one, as the conventional practice is highly resilient and considered to be productive in some aspects. Displacing state control would be unrealistic.

In the area of implementation and regulation, network functioning has a lot to improve. Some non-state actors, such as service providers and researchers, are included in the decision-making process in the capacity of panel experts. Other non-state actors, such as social organizations, play a modest supporting role outside the centre of power, whereas environmental NGOs are absent. The limited involvement of environmental NGOs in this process can be explained by the tight administrative controls imposed on them and their relatively short history in shaping policies and politics in the socialist regime of China. The first environmental NGO in China was established in 1994, and subsequently similar organizational forms were given 'favorable political opportunities' and 'indigenous organizational strength' to 'organize and participate in civic action' while sometimes also to 'test political limits' (Ru and Ortolano, 2009; Yang, 2005). With strong government sponsorship, an increasing number of environmental NGOs have recently developed a low carbon portfolio. Many of them are 'government organized' NGOs, or so-called 'GONGO' (Wu, 2003), that run awareness raising and capacity building activities in partnership with industries and deliver technical services to them. These organizations tend to operate within political boundaries prescribed by or acceptable to the state. Thus, the authority of decision-making is concentrated in state institutions, and the ways in which they govern cross-sectoral issues, such as the ETS, have demonstrated some degree of fragmentation. However, it is not clear that these concerns have evolved into a strong transformative impulse.

An international study presented by Paterson et al. (2014) has shown that the governance of emission trading systems tends to be a polycentric one, with multiple loci of governance and without a coercive power forcing a particular way to do emission trading. However, most of the emission trading systems analysed by Paterson et al. (2014) exist in an international or cross-regional policy venue, whereas the Guangdong ETS is restricted to one province. The governing regime in Guangdong is legitimized by a political mandate from the central government and managed by the Provincial DRC. There is a clear structure of hierarchy, particularly in rule setting and implementation processes. The introduction of the market mechanism constitutes a small turnaround in practice, and conditions for polycentric governance remain premature. Government mandates continue to play a central role in setting up and sustaining the carbon market. For example, if local enterprises are not put under pressure by a powerful DRC, they will have low motivation to cooperate and engage in emission trading in meaningful ways. Delays in rolling out, or even reversals of, key policy measures might also eventuate.

Therefore, despite their understanding and belief in market principles, some network constituents did not categorically reject the conventional, top-down practice. The corporate participants of ETS generally accepted that the price signals of carbon credits be regulated by the state. The implicit, passive support to hierarchical modes of steering could potentially undermine the conditions for networked forms of governance to develop. What is obvious, however, is that the climate change governance system in China is in a transition process. While network governance is in its infancy, multi-level governance appear to have gained some momentum. Both the pilot ETSs and previously the CDM involve a transfer of some responsibilities, resources and power from central authorities to municipal and provincial governments as well as industries (Schröder, 2011; Schreurs, 2017). Movement of non-

state actors across scale has also become more frequent. For example, some of our informants, who are affiliated with provincial non-state institutions, have been recruited as expert panel members to participate and contribute to the ongoing decision-making process in Beijing in the lead-up to the launch of the national ETS. Whether or not such initiatives will strengthen the case for networked forms of governance, despite the barriers identified above, is a question for future research.

6. Conclusions

In this article we explore issues about governing domestic cap-and-trade systems for mitigating carbon emissions. We identify key challenges presented by an emerging network supporting carbon market development in Guangdong Province. Evidence from this study suggests that the governance network supporting the Guangdong ETS and carbon market, in its present form, remains underdeveloped. Although it has demonstrated some of the key network functions, mainly capacity building, more could be done to strengthen engagement and enable power sharing in steering and coordinating the decision-making process.

We echo Parker (2007) call for making a distinction between 'networked governance' and 'network'. A loosely structured network has emerged from the accelerated process of establishing the ETS and developing the carbon market in Guangdong. It coordinates capacity building activities and can be seen as a partial substitute for the state in this area. However, the key features of reflexivity and power sharing in decision-making and steering are not clearly represented. These findings also call into question the dichotomous view that governance through markets should be seen as a non-hierarchical one (Pattberg and Stripple, 2008). Such a governance mode may retain hierarchical elements, particularly when a system is in transition to another form in which the system operator has little successful prior experience. That being said, much is yet to be seen, as the national ETS of China has not gained a clear shape and might present more complexities than the pilot schemes have displayed.

Acknowledgements

This research was supported by the National Natural Science Foundation of China through the Young Scientists Fund (Grant No.: 41601605).

References

Andonova, L.B., Betsill, M.M., Bulkeley, H., 2009. Transnational climate governance. Global Environmental Politics 9. pp. 52–73.
Arnstein, S.R., 1969. A ladder of citizen participation. Q. J. Econ. 35, 216–224.
Bäckstrand, K., 2008. Accountability of networked climate governance: the rise of transnational climate partnerships. Global Environ. Politics 8, 74–102.
Bulkeley, H., 2005. Reconfiguring environmental governance: towards a politics of scales and networks. Polit. Geogr. 24, 875–902.
Bulkeley, H., Betsill, M.M., 2003. Cities and Climate Change: Urban Sustainability and Global Environmental Governance. Routledge, London.
Bulkeley, H., McGuirk, P.M., Dowling, R., 2016. Making a smart city for the smart grid? The urban material politics of actualising smart electricity networks. Environ. Plann. A 48, 1709–1726.
Chen, G.C., Lees, C., 2016. Growing China's renewables sector: a developmental state approach. New Polit. Econ. 21, 574–586.
Cheung, L.T.O., Chow, A.S.Y., Fok, L., Yu, K.-M., Chou, K.-L., 2017. The effect of self-determined motivation on household energy consumption behaviour in a metropolitan area in southern China. Energy Effic. 10, 549–561.
Cong, R., Lo, A.Y., 2017. Emission trading and carbon Market performance in Shenzhen, China. Appl. Energy 193, 414–425.
Francesch-Huidobro, M., Mai, Q., 2012. Climate advocacy coalitions in guangdong, China. Admin. Soc. 44, 43–64.
Gilley, B., 2012. Authoritarian environmentalism and China's response to climate change. Environ. Politics 21, 287–307.
Guangdong Development and Reform Commission, 2016. Notice on the Allocation of Carbon Emission Allowances in Guangdong Province 2016. Guangzhou: People's Government of Guangdong Province, People's Republic of China. Available at http://dtfz.ccchina.gov.cn/archiver/LowCD/UpFile/Files/Default/20160714093558793864.pdf [in Chinese]. Accessed 23 August 2017.
Guangdong Development and Reform Commission, 2017. Notice on the Allocation of Carbon Emission Allowances of Pulp and paper, Aviation and White Cement in Guangdong Province 2016. Guangzhou: People's Government of Guangdong Province, People's Republic of China. Available at http://www.cnemission.com/article/news/ssdt/201701/20170100001201.shtml [in Chinese]. Accessed 23 August 2017.
He, G., Lu, Y., Mol, A.P.J., Beckers, T., 2012. Changes and challenges: China's environmental management in transition. Environ. Dev. 3, 25–38.
Ho, P., 2007. Embedded activism and political change in a semiauthoritarian context. China Inf. 21, 187–209.
Jessop, B., 1998. The rise of governance and the risks of failure: the case of economic development. Int. Soc. Sci. J. 50, 29–45.
Jessop, B., 2002. The Future of the Capitalist State. Polity. Cambridge. .
Kooiman, J., 2003. Governing as Governance. SAGE Publications, London.
Lo, A.Y., 2015a. National development and carbon trading: the symbolism of Chinese climate capitalism. Eur. Geogr. Econ. 56, 111–126.
Lo, A.Y., 2016. Challenges to the development of carbon markets in China. Clim. Policy 16, 109–124.
Lo, A.Y., Francesch-Huidobro, M., 2017. Governing climate change in Hong Kong: prospects for market mechanisms in the context of emissions trading in China. Asia Pac. Viewp. 58, 379–387.
Lo, A.Y., Howes, M., 2015. Power and carbon sovereignty of a non-traditional capitalist State: the carbon trading discourse of China. Global Environ. Politics 15, 60–82.
Lo, A.Y., Spash, C.L., 2012. How Green is your scheme? Greenhouse gas control the Australian way. Energy Policy 50, 150–153.
Lo, A.Y., Yu, X., 2015. Climate for business: opportunities for financial institutions and sustainable development in the Chinese carbon Market. Sustain. Dev. 23, 369–380.
Lo, K., 2015b. How authoritarian is the environmental governance of China? Environ. Sci. Policy 54, 152–159.
Mai, Q., Francesch-Huidobro, M., 2015. Climate Change Governance in Chinese Cities Routledge. New York. .
Munnings, C., Morgenstern, R.D., Wang, Z., Liu, X., 2016. Assessing the design of three carbon trading pilot programs in China. Energy Policy 96, 688–699.
Newell, P., Paterson, M., 2010. Climate Capitalism : Global Warming and the Transformation of the Global Economy. Cambridge University Press, Cambridge.
Parker, R., 2007. Networked governance or just networks? Local governance of the knowledge economy in Limerick (Ireland) and Karlskrona (Sweden). Polit. Stud. 55, 113–132.
Paterson, M., Hoffmann, M., Betsill, M., Bernstein, S., 2014. The micro foundations of policy diffusion toward complex global governance. Comp. Polit. Stud. 47, 420–449.
Pattberg, P., 2010. Public–private partnerships in global climate governance. Wiley Interdiscip. Rev. Clim. Change 1, 279–287.
Pattberg, P., Stripple, J., 2008. Beyond the public and private divide: remapping transnational climate governance in the 21st century. Int. Environ. Agreem. Politics Law Econ. 8, 367–388.
Pei, Q., Liu, L., Zhang, D.D., 2013. Carbon emission right as a new property right: rescue CDM developers in China from 2012. Int. Environ. Agreem. Politics Law Econ. 13, 307–320.
People's Government of Guangdong Province, 2012. Notice on Publishing the Implementing Plan for Carbon Allowance Trading Pilot of Guangdong (No. 264, Letter of Guangdong Provincial Government). Avaialble at. People's Government of Guangdong Province, Guangzhou [in Chinese].. http://zwgk.gd.gov.cn/006939748/201209/t20120914_343489.html.
People's Government of Guangdong Province, 2014. Trial Methods of Emission Management of Guangdong (No. 197, Decree of Guangdong Provincial Government). Available at. People's Government of Guangdong Province, Guangzhou [in Chinese].. http://zwgk.gd.gov.cn/006939748/201401/t20140117_462131.html.
Qi, S., Cheng, S., 2015. A Comparative Study of China's Pilot Emission Trading Schemes. Brookings-Tsinghua Center for Public Policy, Beijing.
Research Center for Climate Change of Guangdong, 2016. Guangdong Pilot Emission Trading Scheme Report 2014-2015. Research Center for Climate Change of Guangdong, Sun Yat-sen University, Guangzhou.
Rhodes, R.A.W., 1996. The New governance: governing without government. Polit. Stud. 44, 652–667.
Robins, G., Bates, L., Pattison, P., 2011. Network governance and environmental management: conflict and cooperation. Public Admin. 89, 1293–1313.
Ru, J., Ortolano, L., 2009. Development of citizen-organized environmental NGOs in China. VOLUNTAS: Int. J. Volunt. Nonprofit Organ. 20, 141–168.
Schreurs, M., 2017. Multi-level climate governance in China. Environ. Policy Gov. 27, 163–174.
Schröder, M., 2011. Local Climate Governance in China. Palgrave Macmillan, Basingstoke.
Secco, L., Favero, M., Masiero, M., Pettenella, D.M., 2017. Failures of political decentralization in promoting network governance in the forest sector: observations from Italy. Land Use Policy 62, 79–100.
Shen, W., 2015. Chinese business at the dawn of its domestic emissions trading scheme:

incentives and barriers to participation in carbon trading. Clim. Policy 15, 339–354.
Shen, W., 2017. Who drives China's renewable energy policies? Understanding the role of industrial corporations. Environ. Dev. 21, 87–97.
Stoker, G., 2006. Public value management. Am. Rev. Public Admin. 36, 41–57.
Tao, J., Mah, D.N.-y., 2009. Between market and state: dilemmas of environmental governance in China's sulphur dioxide emission trading system. Environ. Plan. C Gov. Policy 27, 175–188.
Tosun, J., Schoenefeld, J.J., 2017. Collective climate action and networked climate governance. Wiley Interdiscip. Rev. Clim. Change 8 e440-n/a.
World Bank, 2016. State and Trends of Carbon Pricing 2016. World Bank Group, Washington, D.C.
Wu, C., Cai, H., Du, W., Lo, M., 2014. Analysis of Climate Finance Policies and Innovative Finance Mechanisms in Guangdong Policy Mapping and Case Studies. The Climate Group, Beijing.
Wu, F., 2003. Environmental GONGO autonomy: unintended consequences of State strategies in China. Good Soc. 12, 35–45.
Yang, G., 2005. Environmental NGOs and institutional dynamics in China. China Q. 181, 46–66.
Zhang, D., Karplus, V.J., Cassisa, C., Zhang, X., 2014. Emissions trading in China: progress and prospects. Energy Policy 75, 9–16.
Zhang, Z., 2015a. Carbon emissions trading in China: the evolution from pilots to a nationwide scheme. Clim. Policy 15, S104–S126.
Zhang, Z., 2015b. Crossing the river by feeling the stones: the case of carbon trading in China. Environ. Econ. Policy Stud. 17, 263–297.
Zhao, X.-g., Jiang, G.-w., Nie, D., Chen, H., 2016. How to improve the market efficiency of carbon trading: a perspective of China. Renew. Sustain. Energy Rev. 59, 1229–1245.