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Article

China's Carbon Market: Potential for Success?

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Abstract
What lessons emerged during the development of China's national emissions trading scheme (ETS)? It was launched in late 2017 and started operation in July 2021, beginning with online trading of emissions permits. The preceding decade was used for preparing and testing, including seven pilot markets. It was decided to start with the power sector, the largest-emitting sector, and initially cover coal- and gas-fired power plants. This article offers theory-oriented and empirical contributions to domestic-level learning, and asks what happens after a policy has "landed." We employ an analytical concept originating from diffusion theory—*learning*—and view *internal learning* as a key mechanism. We argue that having a slow and well-prepared start contributes to the potential success of the ETS; further, that the lengthy preparatory period enabled China to address various obstacles, providing a strong basis for success, singly and as part of the national mitigation policy complex. *Internal learning* has proven crucial to the development of the ETS in China, with the learning process continuing as the national ETS becomes operative. We also discuss the possibilities for linking China's carbon market with other markets, which should heed China's ETS experience and emphasize learning.

Keywords
carbon market; China; Emissions Trading Scheme; internal learning; linking carbon markets

Issue
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1. Introduction

Carbon markets are emerging worldwide. In 2011, China announced its plans for a domestic emissions trading scheme (ETS). The ensuing decade was used for preparing and testing, including operating seven pilot markets. Despite concerns that development took longer than expected, and that China's ETS might fail to curb emissions ("Can China's new carbon market take off?," 2021; Liu & Kan, 2021), we argue that the slow, well-prepared start has contributed to the success potentials of China's ETS. With a hasty start, important issues might have been dealt with on an ad hoc basis as they arose—detrimental to achieving the solid foundation needed for an effective policy instrument. We hold that the preparatory period has enabled China to address foreseen and unforeseen obstacles, offering a strong basis for the success potential of its ETS, singly and as part of the national mitigation policy complex. In examining the ETS process in China, we employ an analytical concept originating from diffusion theory: *learning*. Expanding this concept, we identify *internal learning* as a key mechanism.

This article is empirically founded on document analysis and on expert interviews. We have followed ETS developments closely since the announcement in 2011, with interview rounds in China each year, supplemented by participation in ETS workshops and conferences, and personal work experience in multilateral carbon market development projects in China. Our main sources of documentation, in Chinese and English, are government records and specialist news articles. Following a review of the literature and a presentation of our analytical

approach, we turn to China's ETS and its development, showing how learning emerged. In the conclusion, we direct our attention outwards, linking China's market with other markets, noting that such markets should heed China's ETS experience, and emphasize learning.

2. Learning as a Mechanism for Policy Change and Research Status

The international aspects of knowledge transfer and diffusion of climate policies and ETS to China are well-documented (Biedenkopf et al., 2017; Carrapatoso, 2011; Cheng, 2020; Heggelund et al., 2019). Diffusion—"a set of processes characterized by interdependent, but uncoordinated, decision making" (Elkins & Simmons, 2005, p. 35)—concerns how the same policy may occur in several jurisdictions in a relatively short time-span, usually across national borders. Often-cited diffusion mechanisms are *coercion* (when a country sees no option but to adopt the policy), *competition* (the policy is adopted to gain a comparative advantage), and *learning* (discussed in Gulbrandsen et al., 2018, pp. 18–19). All these are evident in the diffusion of ETS to China. Learning—"a deliberate attempt to adjust the goals or techniques of policy in response to past experience and new information" (Hall, 1993, p. 278)—can be said to have occurred if the process brings about policy changes.

As governments today face many of the same intermestic problems, including climate change, learning from the experience of others is a practical step for policymakers (Dodds, 2013, pp. 250–251). Diffusion mechanisms have influenced China's carbon markets, with emulation of and sophisticated learning from the EU ETS; competition was more prominent during the planning period and before commencing the national market (Heggelund et al., 2019, p. 185). The intense efforts of several countries to share their experiences and facilitate learning for the pilots led authors to label it not as "diffusion," but "infusion": "a process through which a mixture of external experiences is infused into the domestic policy process of one specific jurisdiction" (Biedenkopf et al., 2017, p. 92). These processes occurred simultaneously with internal learning, but are not the focus of this article.

Dealing with the domestic factors of policy development poses a challenge to diffusion theory, however (Elkins & Simmons, 2005, p. 38). Other studies have investigated the influence of domestic factors on carbon markets in China—including the policy implications of China's sectoral emissions pattern for the national ETS (Jiang et al., 2017); how the relationship between policymakers and key market players influences market efficiency (Lo & Howes, 2013); and whether the enrolled companies understand emissions trading mechanisms sufficiently to engage as market actors (Yang et al., 2016). Many studies have covered China's ETS pilots, with recommendations as to lessons to be drawn for the national ETS (Goron & Cassisa, 2017; Wang et al., 2019; Wu et al., 2014; Yi et al., 2018). However, they lack the conceptualization of this learning process employed in our article.

We offer a theory-oriented contribution to domestic-level learning, and ask what happens after a policy has "landed." There are several possibilities: The policy could remain dormant if other policies addressing the same issue gain traction—or it could end in stalemate. Assuming that the policy is adopted, if uncontroversial or without much at stake, it may be implemented without much interference. However, if certain actors or groups stand to gain or lose much, the policy may be altered to accommodate various political interests, perhaps ending up as a patchwork of political bargains. Yet another possibility is that the policy is implemented on a small-scale trial basis for a limited time, with planned reviews before continuation. This is what we call *internal learning*: "the deliberate and focused process" (Stensdal et al., 2018, p. 181) of educating the polity on better policy options. (We intentionally avoid the term "best practices," which implies that the choices cannot be further improved.) The polity may include society in general, but will normally involve the policymakers, implementers, and the actors affected by the policy. Internal learning involves at least one phase of trials and revisions. This phase may include a time dedicated to review, or be less structured, with adjustments as lessons are drawn from experience.

It is always possible to draw lessons and make improvements to a policy. What distinguishes internal learning from other ad hoc enhancements or evaluations (and possible amendments) of policies is the period set aside for experimenting and drawing lessons from the trial period. For a policy to be subjected to internal learning it is not necessary that all challenges are expected upfront. Identifying unanticipated problems involves taking time for trials and correcting errors. Internal learning, then, is a mechanism not just for intended policy change, but also for intended policy *improvement*. That does not mean that the policy will be optimal after the internal learning period. New challenges are likely to arise over time. There might be aspects that were overlooked or not addressed during the internal learning period—or the "wrong" lessons might have been drawn (Hall, 1993, p. 293, note 20). The point about internal learning is that deliberate efforts are made to improve the knowledge-base for decision-making. Piloting and experimenting are two common features of Chinese policymaking (Heilmann, 2008), and have been cornerstones in the development of climate and energy policies (Zhao et al., 2016), including the national ETS.

3. Emissions Trading Scheme in the Larger Energy and Climate-Policy Complex

Before turning to China's specific learning experiences, we offer a glimpse at the larger policy context in which the national ETS is happening. China is the world's largest emitter, accounting for nearly 29.7% of global emissions

in 2018 (Crippa et al., 2019). Coal dominates the energy mix, responsible for 56.8% of total energy consumption in 2020 (National Bureau of Statistics, 2021). Coal consumption is the main source of carbon emissions as well as serious air-pollution incidents, with smog and ultrafine particles of less than 2.5 microns (PM2.5) concentrations reaching dangerous levels in some regions (Ahlers & Shen, 2018). China's ETS is intended as one of several policy tools for reducing carbon emissions (Heggelund et al., 2019).

China has introduced various energy and climate policies which partially supplement each other and aim to address air pollution and reduce carbon emissions. One such policy is that of *dual control*: targets on energy consumption and energy intensity introduced in the 12th Five-Year Plan for Energy Development (2011–2015; State Council, 2013). A shift has taken place in recent years towards technology innovation and renewables. Policies promoting renewables are picking up speed, such as "Made in China 2025," aimed at promoting innovation in 10 core industries, including the power sector—renewable energy like solar photovoltaic and wind, new energy vehicles (Korsnes, 2020). According to the New Energy Vehicle Industry Development Plan 2021–2035, electric vehicles will account for 20% of total sales of new cars by 2025 (State Council, 2020). Indeed, by the end of 2020 China had decreased its CO_2 emissions per unit of GDP (carbon intensity) by 48.4% against 2005 levels—thereby achieving the objective of 40–45% reduction in carbon intensity by 2020, as per the 2009 Copenhagen Accord, ahead of schedule (State Council Information Office, 2021). Reducing coal consumption is a cornerstone task in reducing carbon emissions. Having constituted more than 70% of China's energy consumption in earlier decades and as lately as 2011 (China Statistical Bureau, 2021), coal is now stipulated to make up no more than 56% of the energy mix for 2021 (Xu & Singh, 2021). Reducing the share of coal share is positive—but as total energy consumption has increased over the years, so have carbon emissions. President Xi has announced that coal use is set to peak in 2025, and be reduced thereafter (Stanway, 2021).

Importantly, China has set "30.60" dual decarbonization goals peaking carbon emissions by 2030 and reaching carbon neutrality by 2060 (Heggelund, 2021). It has enhanced the Nationally Determined Contribution goal of reducing GDP carbon intensity by at least 65% compared to 2005, an increase from the previous goal of 60–65% ("Full text: Remarks by Chinese President," 2020; National Development and Reform Commission [NDRC], 2015). In addition comes the Action Plan for peaking CO_2 emissions, with targets and preparation at the province level and some major emitting sectors announced at the National People's Congress in 2021 (State Council, 2021). The national ETS is seen as one of several policy tools for reducing greenhouse gas (GHG) emissions, as a key policy supplemented by other policies to promoting emissions mitigation.

4. China's National Emissions Trading Scheme

China has continuously adjusted its policy in the preparatory process to its ETS, and internal learning has already led to revised, possibly improved, policies. The national ETS, under preparation for the last decade, has moved from the planned capacity-building phase to the first compliance phase. The first few years of the national system were initially seen as a period for capacity-building and learning, particularly through pilot projects (Stensdal et al., 2018, p. 181).

4.1. Development and Status of the Carbon Market

China decided to establish a carbon market in the 12th Five-Year Plan (2011–2015), as part of its policy to "let the market play a fundamental role in resource allocation" (NDRC, 2011). According to the 2015 China–US Joint Presidential Statement on Climate Change, China planned to start its national ETS in 2017, covering such key industry sectors as iron and steel, power generation, chemicals, building materials, paper-making, and nonferrous metals. A notice and a plan were issued which set the course for the coming years (NDRC, 2017a, 2017b). Later it was decided to begin with the largest-emitting sector—power—and initially cover coal- and gas-fired power plants (International Energy Agency [IEA], 2020; NDRC, 2017a, 2017b). The plan outlined a test period which would run until 2020, with one year to set up the system and another year to simulate the market before real trading began: This was termed "construction period" by some (Hove et al., 2021; NDRC, 2017a). The ETS finally started operation in July 2021 and began online trading of emissions permits. The first phase covers 2,225 companies from the power sector, with a minimum of 26,000 tCO_2 equivalents each in annual emissions in any year during the period 2013–2019 (Ministry of Ecology and Environment [MEE], 2021). Initially, the ETS will cover nearly 40% of China's CO_2 emissions in the power-generation sector (Liu, 2021). In December 2020, having solicited public opinion, the Ministry of Ecology and Environment (MEE) issued trial rules for its national ETS, "Administrative Measures for Carbon Emissions Trading (Trial)," on these measures (MEE, 2021). Further, the MEE issued the "2019–2020 Cap Setting and Allowances Allocation Plan (Power Generation Sector) of China's National ETS" (MEE, 2020). The Administrative Measures, effective as of 1 February 2021, provide the regulatory basis, marking a significant step towards operationalization (MEE, 2021; Reklev, 2021a). The first compliance cycle, January 2021 to December 2021 (Chen & Qian, 2021, p. 11), will cover emissions from 2019 and 2020 for power-sector companies. The trading platform is based in Shanghai, perhaps because of its role as a financial centre as well as its continuous compliance rate (International Carbon Action Partnership, 2021). The registry is situated in Wuhan, Hubei, a major city in central China. They were

selected through a bidding process. Both Shanghai and Hubei were pilots since 2013, and have provided valuable lessons as to setting up a national carbon market.

4.2. Governance Structure for the National Emissions Trading Scheme

According to the Administrative Measures (MEE, 2021a), China's national ETS is to have a multi-level governance system: a CO_2-intensity-based trade scheme with unified rules for all province-level regions. The central authority will issue the regulations and overall allocation targets/quotas, while the provinces have responsibility for implementation and distribution of allowances to the enterprises, in accordance with rules established by the central authority. Responsibility for overseeing compliance with rules is assigned mainly to the province authorities.

In the 2018 governmental reshuffle, the MEE was given responsibility for the climate portfolio, including the carbon market ("China to establish ministry of ecological environment," 2018). The National Development and Reform Commission (NDRC) had been in charge of climate policy and the development of the carbon market from 2011 to 2018, laying much of the ground for ETS in China. Particularly important was the personal involvement of the then-NDRC vice-chairperson Xie Zhenhua, China's climate-change envoy. As the head of the State Environmental Protection Administration (now the MEE), he was also responsible for the SO_2 trading pilot in the late 1990s and early 2000s (Hart & Ma, 2014; Zhang et al., 2016). Although the SO_2 pilot was not deemed a success, it may have provided some lessons/experience relevant to the ETS, particularly for the MEE, now in charge of the ETS. The 2018 decision was reversed in May 2021, and responsibility for coordinating the efforts for dual carbon targets was returned to the NDRC, which was to take the lead in preparing a plan for emission cuts, and roadmaps with goals for cleaning up carbon-intensive sectors ("China puts most powerful agency," 2021). This included establishing an office for a "leading group" of high-level officials, like one Vice Premier, the Ministers of Ministries and Commissions such as Finance, the NDRC, Science and Technology, Ecology and Environment, Industry and Information Technology, and the state-owned Assets Supervision and Administration Commission, among others ("China puts most powerful agency," 2021; "High specifications!," 2021). The MEE would retain responsibility for the carbon market.

On the one hand, the reorganization/creation of the MEE and local environmental authorities entailed some delays: Staff responsible for climate change moved over to the MEE from the NDRC, and new capacity-building needs arose because the staff of the local authorities were not familiar with the ETS and lacked relevant capacity. As the MEE was charged with both climate change and environmental issues, the intention was for the ministry to coordinate the two areas, even contribute to better/stricter enforcement of climate policies in general. With its inspection and monitoring experience in the provinces, the MEE would be able to follow up closely on implementation. Additionally, the consolidation of environmental responsibilities in one ministry would help to align various environmental strategies and policies, including the carbon market. One concern that was raised was that the responsibility for energy policy remained with the NDRC and the National Energy Administration (NEA)—necessitating close coordination among the MEE, the NDRC, and the NEA. The NDRC has considerable influence on climate policy through its macro-economic, social development, and energy policy (Hart et al., 2019). Now, with the recent change, and the NDRC back at the helm of carbon work in China, some of the coordination challenges might perhaps diminish.

4.3. Learning From Pilots: Market Design and Regulations

In China it is common to run pilot schemes—an institutionalized *internal-learning* mechanism: "Any major policy to be implemented nationwide must first be piloted in certain regions to test its applicability and to identify possible improvements to be made" (Duan et al., 2017, p. 59). Seven pilots were launched in 2013 and 2014: in Beijing, Tianjin, Shanghai, Guangdong, Shenzhen, Chongqing, and Hubei, representing a range of economic, social, and geographic criteria. The intention was to gain experience and learning from different ETS designs to inform the design of the national ETS. The pilots were stand-alone markets with differing designs based on local conditions. These piloting regions were granted full flexibility, thus ensuring diversity. Local economic and energy circumstances influenced many design details, particularly in choices on sector coverage and allocation approaches (see Heggelund et al., 2019, Table 1). Moreover, the pilots received extensive capacity-building training from international partners, which has been found to facilitate diffusion and policy transfer (see Biedenkopf et al., 2017, Table 2).

A few examples of lessons from the pilot systems into the national system: *Permits* are to be handed out mainly for free at the beginning, with a benchmarking approach based on actual output of the installations covered. Using real output rather than historical output for allocation enables adaptation to other industrial development policies such as phasing-out of over-capacity, and has been widely tested in the pilots. The shift from historical output-based benchmarking and the grandfathering approach to actual output-based benchmarking approach in some pilots also affected the choice of free allocation approaches in the national system (Deng et al., 2018). Companies would be less reluctant to join the national market if the burden were low initially. *Auctions* were tested in some pilots, but were not used in the national ETS, although they may be introduced gradually (Hove et al., 2021, p. 62) Additional costs of buying

allowances through auctions entail increased costs for enterprises (Slater et al., 2020, p. 39, text box). Some pilots, as in Guangdong, tried to earmark auction revenues for low-carbon development purposes but found this very difficult due to objections from the local finance authorities, who preferred to include the revenues in the general budget. This has also been experienced concerning the design of China's national system.

Further, *regarding price fluctuations control*, the national ETS introduced a price-stability mechanism to limit the daily price swing to within 10% (Liu, 2021). In 2015, Shanghai changed the rules for dealing with rapid drops in allowance prices, which resulted in the Exchange limiting the daily price variation from 30% volatility (the price was not allowed to decrease/increase more than 30% in one day) to 10% volatility (Heggelund et al., 2019, Table 1; Stensdal, 2020).

As to *compliance enforcement*, most pilots tested a comprehensive set of rules, including financial penalties. Due to legal constraints, the highest financial penalties for non-compliance in pilots (except Beijing and Shenzhen) have been very limited, necessitating the use of other forms of punishment. This proved a wise choice, laying a solid practice foundation for the development of a national system which would face the same legislative challenge (Duan & Zhou, 2017). The national ETS Administrative Measures (MEE, 2021a, Art. 39) set fines between 10,000 and 30,000 CNY for non-compliance and/or falsified information. In the draft ETS regulations, much higher penalties are proposed, in line with the market value of the outstanding allowances, in the case of a sufficient number of allowances not being surrendered.

The *Monitoring Reporting and Verification* (MRV) *system* has been developed gradually; by 2016, there were 24 sectoral guidelines for accounting and reporting of emissions from enterprises (Duan et al., 2017). In the development of these guidelines, MRV rules in the pilots have been an important reference, and the experiences and lessons learnt during their implementation have been taken into consideration, mainly through the intensive involvement of relevant pilot experts. The MRV rules in the pilot projects have undergone a continuous process of improvement; new experiences and lessons have also been taken into account in fashioning MRV rules for the national system, including the March 2021 Guidelines for Accounting of GHG Emissions and Reporting for Power Generation Units and the Guideline for Verification of Enterprise GHG Emissions Report (MEE, 2021b).

Also the *legal basis* for ETS has evolved gradually, based on learning experiences. To prepare the ground for the ETS, the NDRC issued Interim Management Rules on Emissions Trading in December 2014 (NDRC, 2014). In early November 2020, the MEE issued a draft of the "Administrative Measures for Carbon Emissions Trading (Trial)" for public comment; the measures were formally announced in December 2020 following consultations (MEE, 2021a). This document clarifies/adds several design aspects of the national carbon market not specified previously, such as the ratio of offset credits for company compliance and the financial penalties for non-compliance (Slater et al., 2020, p. 1). However, both the Interim Management Rules and the Administrative Measures are ministerial decrees, low in the legal hierarchy, and cannot establish certain rules, e.g., high financial penalties for non-compliance. Both the NDRC and the MEE when acting as the ETS authority have been pushing hard for a State Council regulation on the national ETS. The NDRC submitted to the State Council a proposed version of the State Council Regulation in 2015, but no significant progress was made until the government restructure in 2018. In 2019 the MEE submitted its proposed version of an interim State Council Regulation. After intensive consultations between the MEE and the Ministry of Justice, responsible for the drafting of State Council regulations, and other relevant ministries, the State Council included in its work plan for 2021 the drafting of an interim regulation on the national ETS, indicating the high possibility of release of the interim regulation in 2021. In the process of drafting both the ministry decrees and the proposed (interim) State Council regulation, pilot experiences concerning ETS legislation have been given careful consideration, also through written input and workshops.

4.4. Key Learning Points Going Forward

China began planning for a national ETS more than a decade ago. From the beginning, a stated intention has been to learn and draw on experiences in the pilots for the national ETS. Now the national ETS has begun real trading. Here we raise four matters of relevance to the implementation process.

First, after having indicated that eight sectors would be covered, it was eventually decided, in 2017, to begin with the power sector. This would seem a good decision as the national ETS will initially cover nearly 40% of China's CO_2 emissions in the power-generation sector, which amounts to 15% of global CO_2 emissions (Liu, 2021). It underlines the importance of management of the coal sector that will be essential if China is to meet its climate goals and other sustainable energy goals (IEA, 2020). The statistical system in the power sector is relatively complete, making the availability and quality of data in the sector needed for ETS design and operation better than those in the other sectors. Further, the power sector consists of many state-owned enterprises, that might be easier to control in an initial phase. Gas plants are exempted from surrendering allowances in the first compliance period, but may be asked to do so later (MEE, 2021b; Refinitiv, 2021b). With a few years of internal learning based on the power sector, it is important to include other sectors as soon as possible; otherwise, ETS efficiency in curbing emissions will be reduced accordingly. There is no specific timeline for including seven additional selected sectors, but cement and electrolytic

aluminium producers seem likely to be included during 2022 (Reklev, 2021b).

Moreover, the power sector, where substantial reforms are being implemented in parallel with the carbon market, may affect carbon trading (IEA, 2020). The power-sector reform was launched in 2015, and if not carried out effectively, it could impact negatively on the ETS. The sector is still largely managed by administrative mechanisms, and is not market-based (Liu, 2021). Experts recognize the need to speed up power-sector reforms to enable a good start for the ETS (Liu, 2021).

Second, unlike the case of other carbon markets, the initial emissions cap of China's national ETS is intensity-based, not absolute. Here the pilots' experiences provide examples that "cap-and-trade" systems can function in China too. The reasons for choosing an intensity-based cap probably stem from efforts to ensure cohesion between the ETS and other climate and energy policies, as described in Section 3. Also, according to Slater et al. (2020, p. 4), the government has deemed carbon intensity "as best suited to achieve the dual demands of economic growth and emissions reduction." However, an absolute cap is expected to be introduced before 2030 (Refinitiv, 2021b). This also relates closely to the next point: carbon price.

Third, the carbon price has been in focus, as a low price would undermine the ETS. China's pilot projects have greatly varying experiences with price levels, but none had prices high enough to incentivize changing the companies' emissions trajectories. The lesson for the national ETS is that the carbon price should be higher than the case in the pilot markets (ranging from 2–60 CNY per September 2021). It is not possible to borrow allowances from the national system; moreover, regional allowances may not be used in the national system. As such, the pilots are closed circuits, and will not link to the national market, although enterprises in the power sector that are based in pilot regions will be included in the national ETS. In the national market, allocations are free now, but this could change, as described in the Measures (MEE, 2021a, Art. 15). This may be a lesson from the pilots: Easing companies into the scheme makes for more willing participants than if there are additional expenses (like buying allowances) from Day One. The first allowances in the national market traded in July 2021 were a batch of 160,000 tonnes of emissions at 52.78 CNY (€6.8) each, totalling 7.9 million CNY (Refinitiv, 2021a), but prices have since dropped to around 40 CNY/t (€5.2/t). Several aspects influence the carbon price, and including the other sectors might impact positively. Also, setting an absolute cap is likely to increase the price (Refinitiv, 2021a).

Finally, coordination is essential. Being subnational entities, the pilot markets could not offer in-depth lessons on organizational coordination. The national scheme is managed by the national bureaucracy, and implemented by the provincial authorities. The NDRC is now back at the helm of national carbon efforts, with responsibility for leading some key carbon mitigation and energy issues. The NEA retains responsibility for the energy sector, and active coordination with the MEE is essential on the carbon market. The shifts regarding responsibility for China's climate-change portfolio have entailed certain costs, such as time delays, staff movements, and need for additional capacity-building. Furthermore, attention must be paid to competing policies with the ETS, such as the trade in energy-use rights in four pilot regions. If successful, national expansion would allocate energy-consumption quotas to companies, which will have to eliminate outdated capacity or buy extra quotas if they exceed the limit (Slater et al., 2020, p. 42).

In sum, despite some delays, the preparatory decade has been used well, demonstrating the flexibility and dynamics of the system. As to company readiness for the ETS, the carbon pricing survey (Slater et al., 2020, p. 33) finds that companies in the pilot projects that were given training are now prepared for the ETS. This underscores the importance of learning and capacity-building in the preparatory period. Moreover, the implementing period still centres on learning and experience aimed at improving the ETS.

5. Concluding Remarks: Potential for International Success?

Good policies frequently take time. Often the lag is caused by political brokering and differences, and not a deliberate period of education and learning. This has also been the case with the ETS in China. Some delays have been due to differing interests and bargaining among stakeholders, organizational reshuffling, and, more recently, Covid-19. However, *internal learning* has remained crucial to the development of China's ETS. This learning has involved dedicated learning, as well as unplanned learning along the way. At some point, any policy must enter into force in order to address the policy issue, despite possible shortcomings. The authorities should continue the "learning mentality" into national ETS operations. Learning will also be central in case China decides to link internationally.

International markets are seen as a cost-effective way of reducing GHG emissions. The market mechanisms in Article 6 of the Paris Agreement are still under negotiation, but existing markets have linked up. Examples include the EU and Swiss ETS systems, and the Western Climate Initiative, covering markets in California, Nova Scotia, and Quebec. China's ETS, as the largest emissions trading programme in the world, will be pivotal in any international market. Indeed, there is interest in linking with China. Since 2016, China has participated in trilateral talks with Japan and South Korea on a linked East Asian market (World Bank, 2016), although little has materialized as yet. Furthermore, the EU, which devoted nearly €3 million to the EU–China Clean Development Mechanism Facilitation Project 2007–2010, has been keen to ensure the success of China's ETS (Biedenkopf

et al., 2017, p. 102), and research has studied potential effects of linking the Chinese and EU markets (Li et al., 2019).

Wisely, Chinese officials have stated that China is currently more concerned with its domestic market than with linking (Timperley, 2018). As discussed in Heggelund et al. (2021), linkage at some point in the future seems more feasible. Future international markets will not depend solely on China: Several other factors are crucial for making linked markets. The uniform carbon price and reduced carbon leakage offer advantages for cost-effective emissions reduction and levelling the playing field for industries cross-nationally, but there are challenges as well. The economic and political costs can be high. Power distribution among the linked authorities may be imbalanced, in turn affecting operation of the linked markets. China is a major country, also in terms of its ETS. Countries differ in their purchasing power, so linking may entail strong distributional effects. As an ETS is usually not the only mitigation policy, other regulations such as taxes and subsidies may impede the levelling of the playing field that linkage provides. Creating an ETS is complicated—linking two or more markets is an even more complex endeavour. Here, China's domestic process can offer lessons. China's ETS has been 10 years in the making, with emphasis on internal learning, time, and communication; likewise, learning between the markets' governments is a condition for successful linking. Such a learning period should include surveys of other relevant policies of the participating countries, discussions of distributional effects, and how to deal with future possible challenges.

The East Asian trilateral talks facilitate learning across the three countries, and may prove invaluable, should they decide to link their markets. Further, linked markets need to be compatible in such aspects as price and supply management, and offset regulations. If one market is already operating and another is under development, it may make sense to adapt to the existing market. If two or more markets are already operating, a slow, stepwise process of convergence, with a focus on learning, may help to lay the foundations for success.

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Conflict of Interests

The authors declare no conflict of interests.

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