Policy & Politics • vol XX • no XX • 1–27 • © Policy Press 2023
Print ISSN 0305-5736 • Online ISSN 1470-8442 • https://doi.org/10.1332/030557321X16806127945591
Accepted for publication 04 April 2023 • First published online 08 May 2023

research article

Institutional stability and change in environmental governance

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Efforts to better understand what prevents institutions from changing to meet contemporary demands – or what facilitates the evolution of existing constructs to address new challenges – are of particular import and relevance to environmental governance. While the existing literature provides valuable conceptualisation and empirical evaluation of institutional stability and change, the lack of a consistent and holistic typology complicates the evaluation of institutions over time. In this article, we use a combined stability–change typology to assess the dominant modes of institutional change and stability over a multi-decadal timespan across three environmental governance systems – air quality governance in the US and China, and climate governance in the European Union. Across cases, we find that these modes are not mutually exclusive but can occur simultaneously, in concert or in conflict. We also find that observed patterns of change and stability are reflective of the social and political context in which systems operate, as well as the focus of the system itself (for example, localised air quality versus global climate change). Apart from providing a proof-of-concept analysis of institutional change and stability, our findings raise questions about the mechanisms underlying spatial and temporal patterns across identified modes. Indirectly, our findings also further highlight challenges to designing systems both resilient to exogenous stressors and capable of adapting to new situations. Our combined stability–change typology may help to advance understanding of whether and how such balancing has occurred in the past, thus facilitating future efforts to address contemporary challenges.

Key words environmental policy • climate policy • climate governance • institutional change • air pollution • Clean Air Act • Emission Trading System

To cite this article: Galik, C.S., Ba, Y. and Bobbitt, C. (2023) Institutional stability and change in environmental governance, *Policy & Politics*, XX(XX): 1–27, DOI: 10.1332/030557321X16806127945591

Introduction

Institutions are 'integrated systems of rules that structure social interactions' (Hodgson, 2015: 501). Often embodied in public policies and/or social conventions, institutions reflect and interact with society's expectations about who can and cannot do what, where and how (Siddiki et al, 2022). In this way, institutions help govern individual and collective behaviour (Crawford and Ostrom, 1995) and are also adaptable to new social configurations (Patterson, 2021). Recognising the essential role of institutions in shaping human conduct, scholars from across disciplines have devoted extensive efforts to disentangle theoretically and empirically significant puzzles pertaining to the design, function, evolution and performance of institutions (see, for example, Bjerregaard and Jonasson, 2014; Jarvis, 2016; Howlett, 2019; Broms, 2022; Siddiki et al, 2022; van Cauwenbergh et al, 2022). Insights from these and other efforts have shed light on how solutions to key policy challenges such as climate change, public health crises and inequality and economic growth can be better crafted (see Radaelli et al, 2012).

One particularly salient line of institutional research takes an evolutionary and dynamic approach to explore the manner in which institutions do and do not change (see for example, Greif and Laitin, 2004; Koning, 2016; Koski and Workman, 2018; Stark and Head, 2019; Guo and Ba, 2020). With regard to institutional change, scholarship has endeavoured to conceptualise exogenous and endogenous explanations of change (see Greif and Laitin, 2004; Koning, 2016), differentiate formal, informal and ideational change (see Stacey and Rittberger, 2003; Koning, 2016), and delineate trajectories and consequences of change in varied contexts (Connor and Dovers, 2004; Jackson and Sorge, 2012). With regard to institutional stability, scholars have examined important topics such as sources of stability (see Slagter and Loewenberg, 2009; Yağcı, 2017), interactions between institutional stability and socioeconomic and cultural factors such as foreign investment and ideology (Tang and Koveos, 2008; Mahmood et al, 2019), and both the durability and policy implications of stability (Weingast, 2008; Moodysson and Sack, 2016).

Efforts to better understand what prevents institutions from changing to meet contemporary demands – or alternatively what facilitates the evolution of social constructs to address new or novel challenges – are of particular import and relevance to environmental governance (Galik and Chelbi, 2021). Recent scholarship on lock-in and change has provided, for example, new insight to facilitate climate adaptation (Patterson et al, 2019; Groen et al, 2022). Similarly, analysis of path dependency has sought to identify the conditions and mechanisms capable of contributing to low-carbon transitions (Klitkou et al, 2015; Seto et al, 2016). Elsewhere, work has explored the role of institutional continuity and change in the context of water governance, providing insight into both processes and outcomes in the face of reform efforts (Herrfahrdt-Pähle and Pahl-Wostl, 2012).

While the existing literature provides valuable conceptualisation and empirical evaluation of institutional stability and change, the lack of a consistent and holistic typology complicates the evaluation of institutions over time. To address this gap, we provide a proof-of-concept exploration of both institutional stability and change using a combined stability–change typology in a set of comparative case studies. We begin with a review of the theoretical basis for our analysis, with an emphasis on the definition and empirical analysis of institutional change and stability in the literature. We follow with an overview of our methodology, including our sampling strategy

and coding technique. We follow with narrative reviews of the cases themselves – the governance of air quality in the US and China, and climate governance in the European Union – along with our assessments of institutional dynamics in each. We conclude with a summary of within- and cross-case findings, potential policy implications, a review of our study's contributions and limitations, and our suggestions for future research.

Institutional change and stability in the literature

The notion of change has long drawn the attention of institutional scholars. Better understanding of how institutions change and why they change has been the subject of seminal works by Streeck and Thelen (2005), Mahoney and Thelen (2010), and others. From these and other works, a generalised typology of institutional change has emerged, consisting of five separate modes of incremental institutional change: layering, drift, conversion, displacement and exhaustion. Though disagreement exists on the particular definitions of each mode (van der Heijden and Kuhlmann, 2017), the existing scholarship has nonetheless demonstrated the malleability of the general typology and its potential to lend further insight into characterising and assessing institutional change, be it in the context of Social Security programming in the US (Béland, 2007) or evolving climate policy frameworks in South Africa (Rennkamp, 2019).

Discussion of stability in the literature has ranged from the preventative costs of undertaking change (for example, North, 1990) to the mechanisms by which institutions are stabilised or reproduced (Streeck and Thelen, 2005; Lawrence and Suddaby, 2006; Mahoney and Thelen, 2010), yet lesser attention has been paid to institutional stability as compared to institutional change (van der Heijden and Kuhlmann, 2017; Kluttz, 2019). In the absence of a holistic organising framework, empirical exploration of institutional stability has remained challenging owing to the multiple conceptualisations of the phenomenon (Galik and Chelbi, 2021). Nonetheless, multiple assessments of what could be called institutional stability appear throughout the literature, ranging from analysis of stability in US wetland policy (Arnold and Fleischman, 2013) to the connection between institutional stability, renewable energy and economic growth in developed countries (Mahjabeen et al, 2020).

Elsewhere, scholarship has attempted to further explore the conceptual linkages between institutional stability and change. Early works by Lowndes (1996) and Thelen (1999), for example, embed their discussion in new institutionalism, approaching stability from the perspective of institutional equilibria and institutional evolution. Lindner (2003) links institutional change to the failure of certain reproduction mechanisms to ensure stability. Roland (2004) references both change and the persistence of institutions, but dedicates the bulk of analysis to the pace and stochasticity of change. Hall and Thelen (2009), meanwhile, review both institutional change and stability, speaking to the role of motivated actors in both preserving and seeking to upset existing institutional arrangements.

In recognition of the dialectic relationship between both stability and change, scholars have also examined the two phenomena in a combined and more holistic manner (Lindner, 2003; Farjoun, 2010). Examples range from the interactions between change and stability in policy and political processes (see Barnes, 2008; Geels, 2020; Dziuda and Loeper, 2021), to rhetoric, discourses and narratives of stability and change itself (see Golant et al, 2015; Vaara et al, 2016; Kaufmann and Wiering, 2022).

While these studies have been instrumental in fostering a greater understanding of institutional dynamics, they are nevertheless often confined to singular political systems.

Though these and other contributions do well to improve our understanding of institutional change and stability, broadly speaking, empirical application is complicated by the existence of multiple typologies, frameworks and areas of emphasis. We thus argue that synthesising the aforementioned mechanisms of institutional change and stability into a single typology can provide for a more complete and consistent analysis of institutions over time. Drawing from summary frameworks provided by van der Heijden and Kuhlman (2017) and Galik and Chelbi (2021), we specifically identify nine separate modes of stability or change. Though related, each mode is discernible through a unique combination of phenomena and agency of actors (Table 1).

While perhaps tempting to array each mode along some larger continuum from stability to change, Table 1 suggests that each mode is instead representative of a separate and distinct process. The existence of separate processes further implies that individual modes themselves may overlap in space and time, working in concert or competition through the actions – or lack thereof – of affected actors. The framework identified in Table 1 thus provides the conceptual basis for our analysis of environmental governance as described further in the next section.

Methods

We review the modes of institutional stability and change presented in Table 1 through a multiple case study (Yin, 2018). We selected diverse cases for our comparative analysis (Seawright and Gerring, 2008), with one case devoted to the United States, one to China, and one to the European Union. For each political entity, we focused on a singular governance system, itself defined here as a set of interrelated institutions tasked with the management of a particular resource, problem or attribute. Particular systems of study were selected based on the self-empowered, autonomous nature and multi-decadal persistence of that system. We focused on autonomy, meaning that all or a great deal of decision-making authority is retained within the studied system, so as to minimise the influence of higher order decision-making capable of exogenously determining periods of stability or change. We emphasise persistence to assess both periods of change and stability that span individual social, political, or economic developments. Cases were bound in time to correspond with the earliest iteration of the system as it exists today.

Returning to our working definition of institutions – 'integrated systems of rules that structure social interactions' (Hodgson, 2015: 501) – we operationalise our analysis through the lens of three separate observable attributes. The first attribute is *scope*, which is intended to capture change in what is being covered or addressed by a rule. The second attribute, *tool*, is intended to assess change in the structure of a rule (akin to policy styles as described by Howlett, 1991). The third attribute is *community*, which is intended to capture the social interactions affecting – or affected by – a rule.

With an emphasis on policy scope, community and tool, narratives of each governance system's initial development and subsequent evolution were developed using an array of written primary (for example, regulations, legislation) and secondary sources. To assess the discrete presence of different modes of institutional stability or change in the resulting narrative histories, we developed coding guidelines based on the description and relevant phenomena of modes of institutional stability and

Table 1: Modes of institutional change and stability as conceptualised in this analysis

Mode and definition	Description of relevant phenomena
Stability (all quotes Galik and Chelbi, 2021, page numbers noted)	
Passive stability: 'Institutional constructs are preserved through a mutually reinforcing process of framing, discourse, norm-setting, and behavior.'	'[C]haracterized by reflexive actions on the part of involved actors that collectively serve to reinforce existing institutions… through socially- or norm-induced behavior, thus constraining institutional change through established standards of what is right or acceptable.' (467)
Intended inaction: 'Actors intentionally seek to maintain existing institutional constructs by foregoing actions that could disrupt them.'	'[T]he purposeful and intentional avoidance of actions that could contribute to change… an outcome by default, one in which dominant actors choose not to pursue change that they see to be costly.' (469)
Active stability: 'Actors intentionally seek to maintain stability, proactively undertaking work to preserve existing institutional constructs.'	'[T]he distinguishing attribute is the agency of individual actors and the motivation they have to affirm and preserve advantageous arrangements.' (468)
Failed action: 'Actors seek institutional change, but it is prevented by events, organizational features, or other actors that preserve existing order.'	'[C]haracterized by the presence of unsuccessful efforts to foster institutional change. As with active stability, the agency of individual actors is an important aspect… here dominant actors or constructs work to prevent change rather than positively affirm existing arrangements.' (469)
Change (all quotes van der Heijden and Kuhlman, 2017: 538, unless otherwise noted)	
Drift: '[A] situation where there is a changed impact of existing institutions or elements in it due to shifts in the institution's environment and a lack of adjusting the institutions to these.'	'[A]n unintended consequence of not updating existing institutions.' 'Drift is closely related to conversion… under conversion the implementation and use of institutions change, while with drift changing circumstances alter the effects of institutions and policies.'
Layering: '[A] situation of gradual institutional change through a process in which new elements are added to existing institutions.'	'[N]ew elements do not replace existing ones, but are added to these and so gradually change their status and structure.'
Conversion: 'Redeployment or reinterpretation of existing elements of an institution for new purposes.'	'[I]nstitutions themselves do not change but are harnessed to serve new ends by actors that are in, or are affected by, an institutional setting.'
Displacement: '[N]ew models emerge and diffuse which call into question existing, previously taken-for-granted organizational forms and practices.' (Streeck and Thelen, 2005: 19)	'[W]ith displacement, the new eventually replaces the old, while with layering, the old remains in place.'
Exhaustion: The 'process in which behaviors invoked or allowed under existing rules operate to undermine these.' (Streeck and Thelen, 2005: 29)	'Does not so much address institutional change as institutional breakdown.'

change as described in Galik and Chelbi (2021) and van der Heijden and Kuhlman (2017), respectively (Table 1). Each author had primary responsibility for reviewing the narrative history of one case, identifying individual instances of stability or change using the coding guidelines. Each section was then coded separately by an additional author, and the two compared. In instances where disparities emerged, differences were discussed between the coders and a final determination was made as to which mode best described the observed phenomenon. Once each narrative was coded and any discrepancies resolved, identified modes were labeled

in bracketed text and arrayed along a timeline across the three observable attributes (scope, community, tools), providing the basis for the broader conclusions reached later in the article.

Cases for comparative analysis

Using the typologies introduced in Table 1, we can describe the modes of institutional stability and change seen in our three case studies, broken down into policy scope, the relevant policy community, and the policy tools in use. Reviewed in particular are air quality governance in the US and China and climate governance in the European Union. Each case begins with a brief summary, followed by a more detailed narrative review of the system itself. Expanded within- and cross-case findings follow the narrative reviews.

Stability and change in US air quality governance

Despite new environmental concerns being brought to the fore (for example, climate change, acid rain), a dramatically changing energy landscape (for example, hydraulic fracturing, expansion of renewables), and increased polarisation of both the electorate and political leadership, institutions comprising US air quality governance appear to have been remarkably stable over the last several decades. As explored later, however, instances of change have nonetheless occurred, and the mechanism leading to stability, and by extension the mode of stability, has likewise varied substantially over time (Figure 1).

The establishment of federal air quality governance (1970–1990)

Policy scope

Prior to 1970, the governance of air quality in the US was primarily a state-driven enterprise. Beginning with the Clean Air Act of 1970, however, the federal government began to play a more central role [*displacement*], a role that continues to the present day (for example, Andrews, 2006). Furthermore, the 1970 Act created several of the programmes that still form the backbone of air quality governance, particularly National Ambient Air Quality Standards (NAAQS), New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPs). In 1977, Prevention of Significant Deterioration (PSD) requirements were added to prevent air quality deterioration in areas that had already been in compliance with NAAQS [*layering*].

For the most part, US air quality governance has since emphasised a short list of so-called criteria pollutants, albeit at changing levels of stringency over time. Rare exceptions to this were nascent efforts to address acid rain-causing sulphur dioxide pollution and ozone depleting chemicals [*layering*]. Both achieved only moderate success in the years leading up to the 1990 Clean Air Act amendments. While there was growing concern with acid rain, the costs to reduce the problem-causing sulphur dioxide varied widely from facility to facility, impeding support for a command-and-control solution to the problem [*intended inaction*] (Schmalensee and Stavins, 2018).

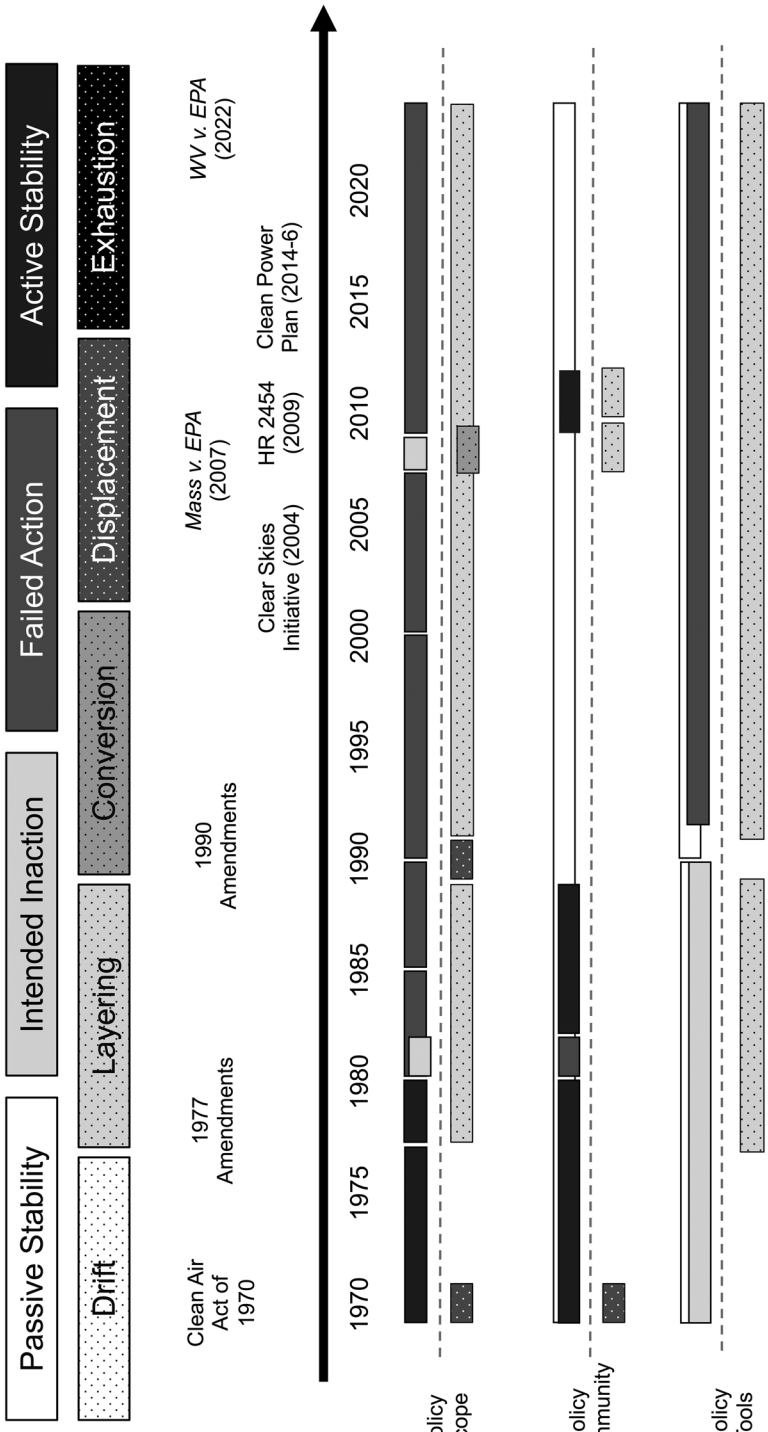


Figure 1: Timeline of major developments in US air quality governance and corresponding mode(s) of institutional stability and change

Policy community

Andrews (2006) argues that federalisation of air quality governance in the US was driven by industrial interests for a moderate and consistent regulatory framework, lest it be bound by a patchwork of inconsistent and, in some cases, more stringent requirements [*displacement*]. Indeed, the 1970 law passed with large bipartisan support in response to environmental concerns that states would engage in a 'race to the bottom', but also industry concerns about having to contend with inconsistent state policies (Schmalensee and Stavins, 2018). The years immediately following the passage of the 1970 Clean Air Act and the 1977 amendments required close partnership with the states, as it was they who were required to develop the implementation plans, issue permits and enforce violations [*active stability*]. In the years following the election of Ronald Reagan, however, existing provisions were targeted for rollback, new regulations were delayed and challenged on the basis of lack of evidence and/or benefits relative to their costs, and enforcement dipped precipitously (Andrews, 2006). Despite these efforts, multiple agency decisions were ultimately overturned by the courts and membership in environmental NGOs surged [*failed action*]. Following the 1984 election, which yielded another term for Reagan but also a stronger Democratic presence in Congress, enforcement actions by the Department of Justice for environmental-related infractions were increased in an effort to reassert the moral and regulatory authority of the EPA [*active stability*].

Policy tools

The dominant policy tools in the first few decades of contemporary air quality governance were command-and-control technology and performance standards, either in the form of rate-based or ambient emission limits. Best-practice-type approaches were favoured by those tasked with implementation of early standards [*passive stability*], and had the benefit of being easy to monitor and enforce [*intended inaction*]. Agency structure likewise remained largely unchanged from its early days, split across a mix of media, function and categorical areas [*passive stability*] (Andrews, 2006). Limited experimentation with emissions trading began in 1974 through the allowance of intra-firm netting, and inter-firm offsetting was explicitly allowed by the 1977 amendments. A tradable 'performance standard'-like approach was later developed in 1982 under the lead gasoline phasedown in light of the programme's disproportionate effects on smaller refineries, and an emissions trading programme was established in 1989 to facilitate reduction of ozone depleting chemicals [*layering*]. A broader Emissions Trading Program, consisting of NAAQS netting and offsetting, was codified by EPA in 1986, though these programmes were not widely used [*failed action*] (Schmalensee and Stavins, 2018).

The continuation of US air quality governance (1990–2022)

Policy scope

Major statutory amendments to the Act were passed in 1990 [*displacement*]. The 1990 Clean Air Act amendments were intended to address two concerns that had emerged in the 1980s: the regulation of stratospheric ozone depleting chemicals under the Montreal Protocol, and the regulation of acid-rain causing sulphur dioxide emissions from coal-fired power plants. There was a concurrent push by EPA administrators

to assess the comparative risk of different environmental problems and to use that exercise to prioritise action within the agency; the attempted pivot ultimately proved unsuccessful because of insufficient authority to forego procedural requirements otherwise specified in individual statutes [*failed action*] (Andrews, 2006).

Regulatory reform was nonetheless attempted on multiple fronts during this time period. For example, interstate nitrogen oxides (NO_x) and sulphur dioxide (SO_2) reductions were facilitated first through a 1998 EPA plan to reduce NO_x through a regional cap-and-trade programme, and further SO_2 reductions through the 2005 Clean Air Interstate Rule (CAIR) [*layering*]. CAIR was eventually invalidated by the courts, finding that EPA did not have the authority to unilaterally amend the particulars of the acid rain programme [*failed action*]. In 2015, CAIR was itself replaced by the Cross State Air Pollution Rule (CSAPR) [*layering*].

A policy priority of the George W Bush Administration's first term was the ill-fated Clear Skies Initiative. Though Clear Skies sought to expand the scope of the 1990 amendments to include both industrial polluters as well as mercury and NO_x and SO_2, it would have also replaced aspects of the technology-driven, facility-by-facility implementation of the Act [*failed action*] (Andrews, 2006). Critics maintained that it would have allowed for the dirtiest facilities to remain in operation while slowing the trajectory for the clean-up of other pollutants.

In 2007, the Supreme Court ruled in *Massachusetts v EPA* that the agency was permitted (and indeed obligated) to regulate greenhouse gases (GHGs) under the Clean Air Act in the event that it found emissions to be endangering public health or welfare [*conversion*]. An endangerment finding was not issued under the Bush Administration [*intended inaction*] but was issued early in the Obama Administration, thus obligating EPA to proceed with efforts to regulate GHGs [*conversion*]. At the same time, a bill amending the Clean Air Act to establish the policy and agency infrastructure to regulate GHG emissions passed the House of Representatives in 2009, but a companion bill was never brought up for a vote in the Senate [*failed action*].

In the absence of Congressional action, the Obama Administration undertook efforts to regulate GHGs under the existing framework of the Clean Air Act. The Clean Power Plan (CPP), released in 2014, was immediately challenged upon its finalisation in 2015 and ultimately stayed by the Supreme Court in 2016 on the grounds that the EPA exceeded the authority granted to it by the Clean Air Act in developing such a flexible programme [*failed action*]. In 2018, the CPP was replaced by the Affordable Clean Energy (ACE) rule by the Trump Administration – prioritising efficiency improvements in existing coal facilities – but was similarly struck down by the courts [*failed action*]. In June 2022, the Supreme Court's decision in *West Virginia v EPA* struck down the legal justification for the original CPP, further limiting the EPA's regulatory options to address climate change [*failed action*].

Policy community

While the 1990 amendments represented a shift in both the scope of regulation and policy tools relied upon by the Act, the period since their passage has been characterised by an intensification of political polarisation on environmental issues (for example, Shipan and Lowry, 2001). Representing in some respects the re-ascendance of environmental interests, the early years of the Obama Administration likewise saw active engagement of the business community to advance specific policy proposals.

For example, increases in vehicle efficiency were achieved largely through a negotiated rulemaking-type process with auto manufacturers in 2009 and again in 2011 [*layering*]. But as was the case in the early 1980s under Ronald Reagan, the mid-1990s under Republican control of the House, and the election of George W Bush, the rise of the Tea Party, the Republican takeover of the House of Representatives in 2010, and the election of Donald Trump in 2016 both reflected and portended a shift in engagement from business interests.

Policy tools

As in earlier decades, US air quality governance has continued to rely on command-and-control-type regulations, specifically technology and rate-based and ambient emission limit performance standards [*passive stability*]. The time period since the 1990 Clean Air Act amendments has also seen continued experimentation with emissions trading, for example trading provisions within CSAPR, and the rate-based and mass-based compliance approaches proposed under the CPP [*layering*]. Even so, the success and popularity of the sulphur dioxide cap-and-trade programme was not replicated across other programmes, however, and limited statutory authorisation for market-based programmes largely pre-empted expansion beyond voluntary initiatives even when so desired [*failed action*] (Andrews, 2006).

Stability and change in European climate governance

The European Union's Emissions Trading System (EU ETS) was born out of prior failures to enact EU-wide environmental policies, particularly the failure of the Commission to establish a carbon tax, first proposed in 1992 (European Commission, 1992) but later abandoned [*failed action*]. As an example of a maturing and evolving market for emissions reductions, the EU ETS is an important locus of study. As shown in Figure 2, the creation and continued operation of the EU ETS is characterised by a great deal of turbulence, arguably attributable to its role as a first-mover emissions reduction platform on such a large scale. This evolution is assessed next, segmented by the four established phases of the EU ETS.

Phase I (2005–2008)

Policy scope

The first phase of the EU ETS ran as a pilot programme from 1 January 2005 to 31 December 2007 [*layering*]. Each Member State had the freedom to decide how many EU Emissions Allowances (EUAs) they would distribute in total, as well as to each installation covered by Phase I (power installations, heat generation and energy-intensive sectors such as iron, steel, cement and oil refining) [*passive stability*]. The goals of the first phase of the EU ETS were to establish a price for EUAs and to create the infrastructure necessary for monitoring, reporting and verifying emissions (MRV) from covered installations. Member States had to publish their National Allocation Plans (NAPs) for approval by the European Commission to establish and clarify the commitments made under the Kyoto Protocol (European Commission, nd) [*passive stability*].

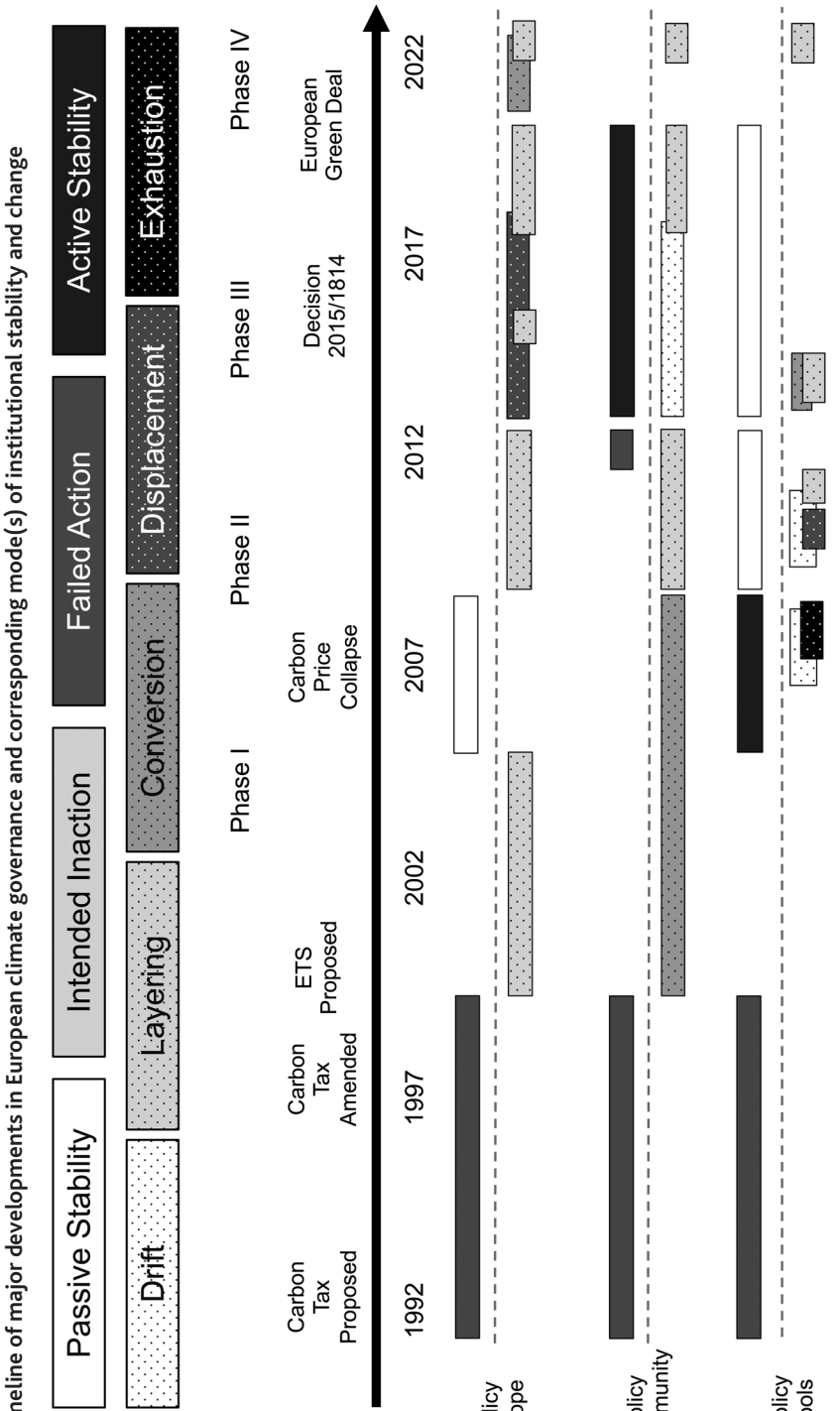


Figure 2: Timeline of major developments in European climate governance and corresponding mode(s) of institutional stability and change

Policy community

The legal basis for the EU ETS comes from The Single European Act (SEA) of 1986, which revised the Treaty of Rome (1957). The SEA set the European Community on the road to a single integrated internal market and expanded the powers of the Community, including environmental governance [*conversion*]. The key actors involved are the European Parliament (the elected representatives of European citizens), the European Commission (Europe's civil service), and the European Council (representatives of Member State governments). The Commission is the only actor with the power to initiate legislative proposals to revise or reform the EU ETS (European Commission, 2015). The European Council and EP have the authority to suggest amendments, which the Commission can either approve or deny. Any new changes to the law, however, must be approved by both the EP and the European Council in the same form for the changes to take effect (European Commission, 2015).

Policy tools

During Phase I more than 95 per cent of all EUAs were allocated for free and were based on historic emissions [*active stability*]. The goal of setting a market-based price on carbon was achieved temporarily until it became clear that there had been an over-allocation of EUAs within the system (Ellerman and Joskow, 2008) [*drift*]. The collapse in carbon prices was exacerbated by the lack of a system in place during the trial phase that would allow installations to either bank or borrow allowances between Phase I and Phase II, making all credits held at the end of Phase I worthless. In the end, it was cheaper for covered installations to purchase oversupplied EUAs rather than pay the fine or adjust their behaviours [*exhaustion*].

Phase II (2008–2012)

Policy scope

Phase II of the EU ETS was designed to coincide with the first commitment phase of the Kyoto Protocol, running from January 2008 to December 2012. The trading system also grew to include three non-EU members – Norway, Liechtenstein and Iceland – and several flexibility mechanisms created under the Kyoto Protocol – Joint Implementation (JI) projects and the Clean Development Mechanism (CDM) [*layering*]. The inclusion of these mechanisms allowed for the 'linking' of project-based emissions offsets, allowing the scope of emissions reductions to reach beyond the borders of the EU (Borghesi and Montini, 2016) [*layering*].

Policy community

During Phase II several countries sought to expand the ETS by allocating EUAs for additional GHGs, such as Nitrous Oxide (NO_x) from the production of fertilisers [*layering*]. The Commission had likewise initiated discussions of including aviation emissions during Phase I, but it was not until Phase II that regulations around aviation emissions were finalised and approved [*layering*]. The goal of the Commission was to cover aviation emissions from flights originating from or coming to the EU. The approach incurred strong opposition from non-EU countries and their desire to regulate aviation emissions through the UN body, the International Civil Aviation Organization (ICAO) (Sandbag, 2021). As a result of this opposition, the ICAO did

not come to an agreement until 2016, and the EU has maintained a 'stop the clock' enforcement derogation on international aviation emissions until 31 December 2023 (Scheelhaase et al, 2021) [*failed action*].

Policy tools

To curb non-compliance of installations by acquiring too few EUAs, the penalty for noncompliance in Phase II was increased from €40 per ton to €100 per ton (European Commission, nd) [*passive stability*]. A reduction of total EUAs was also imposed, but the Global Financial Crisis contributed to the continued surplus of allowances and thus further price decreases [*drift*]. During Phase II, most EUAs continued to be allocated for free but were increasingly based on benchmarking (that is, relative to the efficiency of installations with lower emissions) [*displacement*]. Unlike in Phase I, emitters were allowed to bank unused EUAs from Phase II into Phase III [*layering*]. During Phase II most categories of CDM and JI credits were allowed, except for LULUCF (land-use, land-use change, and forestry) and nuclear power [*layering*].

Phase III (2013–2020)

Policy scope

Because of a surplus of EUAs transferred from Phase II, the Commission feared that low prices would continue to inhibit the adoption of low-carbon innovations (Erbach, 2014). In 2009 the European Commission proposed revisions to the rules for Phase III of the ETS, eliminating NAPs in favour of an EU-wide allocation plan and decreasing the cap in a linear fashion by 1.74 per cent or 38.3 $MtCO_2e$ per year [*displacement*]. During Phase III, the number of GHG sources was also expanded to include the production of petrochemicals, ammonia, nonferrous and ferrous metals, gypsum, aluminium, as well as nitric, adipic and glyoxylic acids [*layering*].

Policy community

Since Phase II (2009) a surplus of EUAs had built up in the market. This surplus contributed to fears that carbon prices would remain unstable in the short term, and that more demanding reductions in GHGs could not be achieved in the long term (European Commission, 2021b) [*drift*]. To address these concerns, the Commission proposed reforms to increase the demand for, and reduce the supply of, EUAs (COM(2014)20/2). The first reforms involved a decrease in the European-wide cap on emissions by increasing the linear reduction factor between Phase III and IV [*layering*]. The second reform established a Market Stability Reserve (MSR) mechanism for Phase IV which would take EUAs out of circulation [*layering*]. Since its establishment, the MSR has served to better regulate the supply and demand of EUAs within the ETS and has led to an increase in the price of carbon on the market (Marcu et al, 2021).

Policy tools

During Phase III, the ETS switched to auctioning as the primary tool for the distribution of EUAs, rather than free allocation [*conversion*]. Over the entire trading period, 57 per cent of EUAs were auctioned with the remaining allowances allocated through efficiency benchmarking [*passive stability*]. Phase III also contained a new entrants reserve (NER), which allocated 5 per cent of the total allowances to assist

new installations that start carrying out regulated activities, or that have had a significant increase in capacity since their free allocation was determined [*layering*]. Any unallocated allowances from this fund at the end of the trading period were placed into the MSR.

Phase IV (2021–2030)

The goals of the ETS are currently being revised under the European Green Deal, which seeks to transform Europe into the world's first 'climate-neutral bloc' by 2050 (European Commission, 2020) [*conversion*]. The Commission has proposed to decrease emissions in sectors covered by the EU ETS by 61 per cent compared to 2005 levels, an increase of 18 percentage points beyond the existing target (European Commission, 2021a). Under the 'Fit for 55' package, emissions from maritime transport would also be added to the European Union Emissions Trading System (ETS) from 2023 (European Commission, 2021a) [*layering*]. Also proposed is the expansion of the ETS to cover new sectors and have tighter restrictions on the free allocation of EUAs, a new system to cover emissions from fuels used in transportation and building, and the introduction of a carbon border adjustment mechanism (CBAM) that prices imported goods based on their embedded emissions (European Commission, 2021a) [*layering*].

Stability and change in Chinese air quality governance

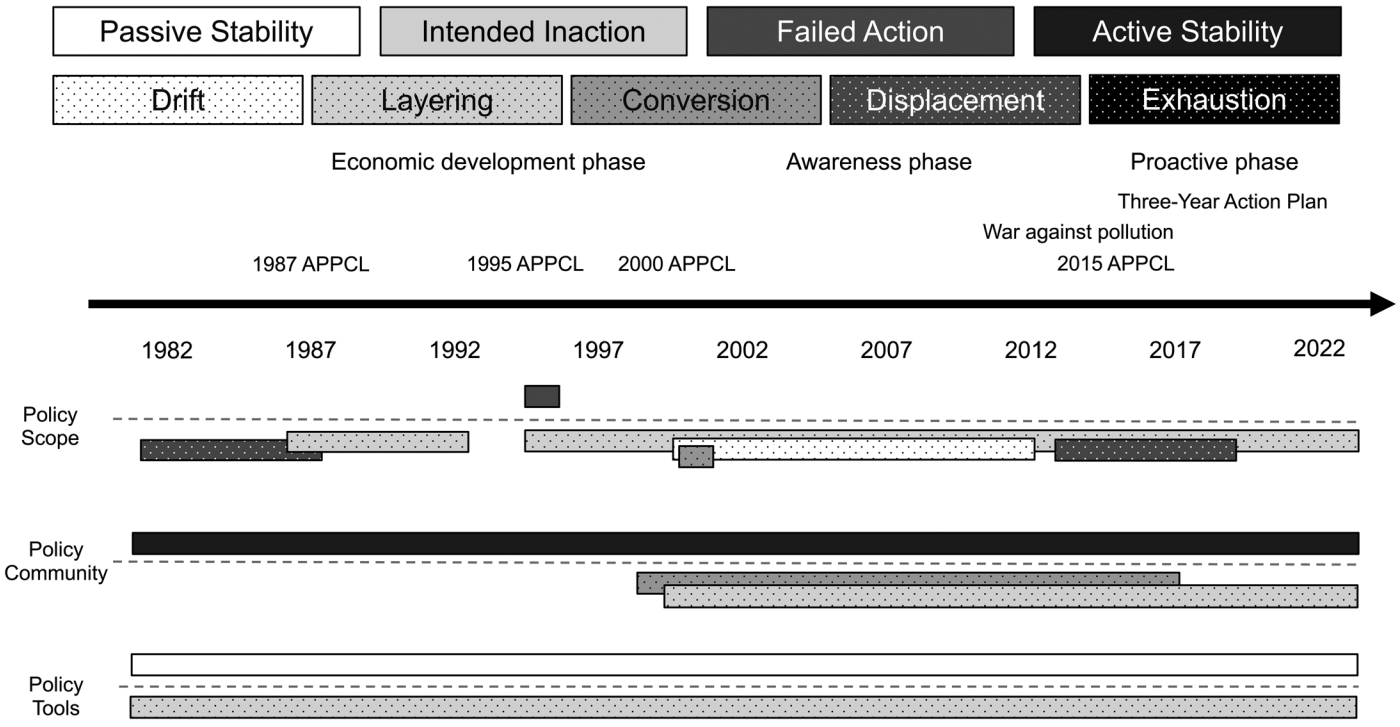
Rapid industrialisation and urbanisation over the past four decades have aggravated air pollution in China, posing significant environmental, health and socioeconomic challenges to the Chinese society (Zhang et al, 2019). Responding to these challenges, the Chinese government has undertaken a series of policies with varying levels of success (Wang, 2021). In the next section, we review air quality governance over the course of three phases of institutional evolution, and find that, while punctuated by occasional change, the overarching trend is one of stability (Figure 3).

The economic development phase (1987–1999)

Policy scope

The 1987 Air Pollution Prevention and Control Law (APPCL) marked China's first legislation on air quality regulation [*displacement*], establishing the foundation upon which China's air quality regulatory system has been evolving. In 1995, the 1987 APPCL was revised but led to limited progress due to opposition from both within and outside of the government (for example, coal and automobile industries) [*failed action; layering*]. Noteworthy revisions included promotion of clean production technologies, controlling sulphur content of coal, establishing acid-rain control areas, and phasing out leaded gasoline (Alford and Liebman, 2001; Feng and Liao, 2016). In 1996, the 1982 Air Quality Standards (GB3095-82) were also revised to include additional pollutant items. Yet real-time concentration was replaced with hourly, daily and annual averages and the yearly average for large particulate matter was relaxed due to changes in emissions (from coarse particles to fine particles) and monitoring and assay methods (Zhao et al, 2016) [*failed action; layering*].

Figure 3: Timeline of major developments in Chinese air quality governance and corresponding mode(s) of institutional stability and change



Policy community

In China, environmental issues are governed in a departmental-regional fragmented system. The regional dimension extends from central to local governments and the departmental dimension includes agencies in the central government and the same functional units in local governments (Jin et al, 2016) [*active stability*]. At the central level, the Environmental Protection Bureau (EPB) formed in 1975 was China's first national-level environmental agency and had gained full ministry rank in 1998 (Alford and Liebman, 2001) [*conversion*]. At the local level, EPBs were led by their corresponding local governments and upper-level EPBs. Such a leadership structure created an implementation dilemma given local governments' priority on economic development and upper-level EPBs' on environmental protection (Xu, 2020). Regarding air quality governance, the 1995 APPCL stalled due largely to the power struggles between two camps. Proponents included NEPA and the Environment and Natural Resources Protection Committee (ENRPC) of the National People's Congress (NPC), along with support from agencies representing public health, foreign affairs and technological development. Opponents were the NPC's Commission on Legislative Affairs as well as agencies such as the then electricity and coal ministries, local governments, as well as industrial interests (Alford and Liebman, 2001).

Policy tools

In China, goals of the national government take centre stage in environmental governance whereas policies are means to achieve goals. Important centralised goals such as those outlined in National Five-Year Plans (FYPs) steer decentralised policies, ministerial laws and regulations, local governments, the NPC, and other stakeholders (Xu, 2020). The FYPs are a cyclical process that begins with the central government issuing a series of social and economic development initiatives, many of which are 'administratively subcontracted' to local governments (Jin et al, 2016). The mechanism behind China's goal-centred policy supply lies in the tight control of government officials' promotion by the upper-level government (Xu, 2020). Yet in the economic development phase, environmental protection including air pollution control was not prioritised by either the government or broader society (Feng and Liao, 2016) [*passive stability; layering*].

The awareness phase (2000–2012)

Policy scope

Entering the twenty-first century, China began to prioritise environmental protection (Xu, 2020). This shift was primarily driven by three factors: a stronger political will of the new administration to distinguish themselves from their predecessors, the deteriorating environment, and the severe acute respiratory syndrome (SARS) outbreak that shifted the government's attention to a more balanced development approach focusing on both economic growth and public goods (Jin et al, 2016; Xu, 2020) [*drift*]. In 2000, the 1995 APPCL was revised along with the issuing of several new administrative regulations and rules (for example, Use of Pollutant Discharge Fee). The 2000 APPCL made several notable achievements including incorporating provisions that the ENRPC had previously sought in the 1995 APPCL (for example, strengthening automobile emissions regulations) (Alford and Liebman, 2001; Feng

and Liao, 2016) [*layering; conversion*]. Additionally, in 2000 and 2012, the 1996 Air Quality Standards (GB 3095-1996) were amended twice to accommodate changes in China's air pollution characteristics [*layering; conversion*]. For instance, in the 2000 Air Quality Standards (GB 3095-2000) NO_x was removed to focus on the more toxic NO_2. In 2012, however, NO_x was readded given high NO concentrations in certain parts of China.

Policy community

During this phase, the central government remained the principal player [*active stability*]. A notable difference within the central government was that support for environmental regulation had grown significantly, evidenced by the comparatively smooth passage of the 2000 APPCL (Alford and Liebman, 2001). Fuelled by a two-fold motivation, local governments' air quality governance involvement had also increased [*layering; conversion*]. First, local governments, particularly those with a larger industrial base such as Beijing, had to balance between deteriorating local environmental conditions and a limited capacity to pass stricter regulations due to laxer national ones (Alford and Liebman, 2001). Additionally, in 2005, the eleventh FYP (2006–2010) adopted the Mandatory Target Performance Evaluation System to hold local government leaders accountable for achieving the central government's environmental protection targets (Chen et al, 2018; Wang et al, 2019). During this phase, non-governmental actors such as citizens and nonprofits also became involved [*conversion*]. For instance, one of China's key environmental information disclosure organisations, the Institute of Public and Environmental Affairs, was founded in 2006. In 2007, China also established a government-sanctioned space for public engagement in environmental decision-making (Tilt, 2019).

Policy tools

Command-and-control policies are the primary policy tool in China's goal-centred air quality governance (Xu, 2020) [*passive stability*]. During this phase, the eleventh FYP (2006–2010) became the first FYP in which environmental and energy targets were quantitatively mandatory with a clearly defined evaluation and pollution reduction target distribution scheme (Jin et al, 2016) [*layering*]. Measures such as cap-and-trade, effluent emission fees, and emission taxes were also experimented with. Technological licencing from industrialised nations was likewise incorporated and became instrumental in China's air pollution mitigation (Xu, 2020) [*layering*]. Despite an increase in policy diversity and increasing policy adoption, implementation and enforcement remained inadequate due to the lack of detailed provisions at the central level and local governments' continued priority on economic development (Alford and Liebman, 2001; Jin et al, 2016).

The proactive phase (2013–present)

Policy scope

As of 2013, China has made a strategic shift from emissions control to air quality governance (that is, combating particulate matter pollution) [*displacement*]. In 2014, Premier Li Keqiang declared a 'war against pollution' and denounced smog as 'nature's warning against inefficient and blind development', demonstrating an emphasis on

reducing air pollution (Greenstone et al, 2021) [*displacement*]. In the same year, the NPC also made amendments to the 1989 Environmental Protection Law to address some recognised regulatory gaps [*layering*]. For instance, the removal of upper limits on fines for factories was designed to modify factory owners' 'pay to pollute' calculus. In 2015, the 2000 APPCL received further amendments including important measures such as mandatory assessments of government performance, a new chapter for an early warning system and measures of pollution episodes (Feng and Liao, 2016) [*layering*]. In 2018, Premier Li approved a 'Three-Year Action Plan for Winning the Blue Sky Defense Battle' to further the nation's action on air pollution control (Ministry of Ecology and Environment of China, 2018) [*displacement*].

Policy community

During the proactive phase, the central government played an even more pivotal role [*active stability*]. For instance, as part of the central government's ambitious restructuring of key ministries in 2018, the Ministry of Environmental Protection was reshuffled into a more powerful Ministry of Ecology and Environment, which assumes responsibility for both pollution control and climate change mitigation (Kostka and Zhang, 2018) [*layering*]. Increased political will also elevated local government involvement in air quality governance. Along this line, cross-jurisdictional coordination and joint control and prevention was formally introduced in the 2015 APPCL (Feng and Liao, 2016) [*layering*]. Within civil society, however, involvement of nonprofit organisations, particularly that of international ones, has been increasingly confined due to policy changes in registration and participation, reflecting the state's tighter control over civic engagement on environmental issues (Kostka and Zhang, 2018; Tilt, 2019) [*conversion*].

Policy tools

During this phase, command-and-control policies remained the primary policy tool in China's goal-oriented air quality governance [*passive stability*]. Additionally, technological innovations were likewise pursued to address air pollution. For example, in 2015, the Chinese government mandated the deployment of Ultra-Low Emission (ULE) facilities in its coal fleet by 2020 (Jin et al, 2020) [*layering*]. As for market-incentive policy tools, financial incentives have been provided to urban and rural households in key pollution control areas such as Beijing to help with the switch from coal to electricity or natural gas (Lu et al, 2020). CO_2 cap-and-trade programmes were piloted regionally, and a nationwide emissions trading system (ETS) was deployed in 2017 and became fully operational in 2021 (Greenstone et al, 2021). Lastly, decentralised policy tools such as local and regional policy pilots and local air quality attainment plans were adopted to mobilise local knowledge and capacity in China's air quality governance (Wang, 2021) [*layering*].

Discussion

Within-case findings: fraught persistence, uneven growth, and shifting priorities

A summary of the modes observed in each phase across cases can be found in Table 2. Though punctuated by occasional change, US air governance has remained generally stable. As shown in Figure 1 and summarised more succinctly in Table 2, this stability is not arising from a singular mode, but rather an interplay (and at

Table 2: Overview of observed modes of stability and change across the multiple phases of each case.

		Observed modes of stability and change		
Case	**Phase**	**Policy scope**	**Policy community**	**Policy tool**
US	'Establishment' (1970–1990)	**Stability**: intended inaction **Change**: layering, displacement	**Stability**: active, failed action **Change**: displacement	**Stability**: intended inaction, passive, failed action **Change**: layering
	'Continuation' (1990–2022)	**Stability**: failed action, passive, intended inaction **Change**: layering, displacement, conversion	**Change**: layering	**Stability**: failed action, passive **Change**: layering
EU	'Pilot' (2005–2008)	**Stability**: failed action, passive **Change**: layering, displacement	**Stability**: active **Change**: conversion	**Stability**: intended inaction **Change**: drift, exhaustion
	'Market breakdown' (2008–2012)	**Stability**: active **Change**: layering	**Stability**: failed action **Change**: layering	**Stability**: passive, intended inaction **Change**: drift, displacement
	'Reform' (2013–2020)	**Change**: drift, displacement, layering	**Change**: drift, layering	**Change**: layering, displacement
	'Expansion' (2021–2030)	**Change**: conversion	**Change**: layering	**Stability**: failed action **Change**: layering
China	'Economic development' (1987–1999)	**Stability**: passive, failed action; **Change**: layering, displacement	**Stability**: active **Change**: layering	**Stability**: passive **Change**: layering
	'Awareness' (2000–2012)	**Change**: layering, conversion, drift	**Stability**: active **Change**: layering, conversion	**Stability**: passive **Change**: layering
	'Proactive' (2013–Present)	**Change**: layering, displacement	**Stability**: active **Change**: layering, conversion	**Stability**: passive **Change**: layering

times overlapping combination) of several separate modes as conceptualised earlier. *Policy scope* has oscillated between efforts to reinforce institutional constructs (active stability, intended inaction) and unsuccessful efforts to change them (failed action). *Policy community* meanwhile has oscillated between failed action and active stability, driven also by systemic pressure to maintain the status quo (passive stability). *Policy tools* have remained largely consistent through a complex mix of failed action and passive stability. Institutional change, meanwhile, can largely be attributed to incremental layering of new approaches. In a few instances (Clean Air Act of 1970, the 1990 amendments), changes in *policy community* and *policy scope* were achieved via conversion and displacement. These remain exceptions rather than the rule, however, again speaking to the stable tendencies of the system.

In contrast, the EU-ETS experience is interesting given the complexity of the system's evolution. As shown in Figure 2 and summarised in Table 2, *policy scope* was initially characterised by failed action as the system struggled to overcome entrenched

opposition. This was followed by a period of growth in the late 1990s and early 2000s, in which the architecture of the trading programme was created and set into action. The period since has been subject to turbulence, however, buffeted by both internal (carbon price collapse) and external (global financial crisis) challenges. In the face of these challenges, stability has been actively sought by incumbents, while larger institutional change has generally failed. What incremental change that has occurred has largely been through layering, at times combined with drift, conversion, displacement and even exhaustion as carbon prices collapsed.

In China, meanwhile, stability and change in policy scope have largely followed the three phases of institutional development themselves driven by shifts in national policy agenda and political will. Among *policy scope*, *policy community* and *policy tools*, *scope* is home to the most complex interplay of stability and change (Figure 3). We see, for example, a complex mix of layering, conversion, and drift as *policy scope* evolves from the mid-1990s until 2012. As for *policy community*, China's political system and goal-oriented policy have maintained the shadow of the state, while the conventional 'non-state actor' as viewed from a western context is perhaps less relevant (Guttman et al, 2018; Ba, 2022). *Policy tools* have also changed very little over time, driven by central government top-down planning and vertical accountability (Wang, 2021). Despite the introduction of market-based approaches, command-and-control policies such as mandatory technology deployment and emissions reduction targets continue to remain commonplace.

Cross-case findings: overlap and complementarity in both institutional stability and change

Comparing the findings from our cases, a pattern of overlap between modes of stability and change repeatedly emerges (Table 2). US air quality governance has been subject to periods of simultaneous intended inaction and failed action, as well as passive and active stability. Air quality governance in China and climate governance in the EU likewise show instances of overlap in the modes of change, particularly among layering, conversion and displacement. Thus, the modes explored here should not be seen as mutually exclusive, but rather capable of documenting phenomena that are occurring simultaneously, in concert or in conflict.

Table 2 likewise exposes some interesting patterns over time, particularly in the US and EU cases. In these cases, we note a tendency for individual phases to end with either intended inaction or failed action. As the phases themselves are demarcated to reflect large shifts in policy or areas of emphasis within a governance system, the tendency to observe institutions that are either intentionally left unchanged – or where attempted change has failed – shortly before major policy change occurs is interesting. Whether similar patterns are observable in other contexts, and the reason why any association exists between failed action or intentional inaction and policy change is one area of further study. From a policy process perspective, it is possible that we are witnessing some sort of punctuated equilibrium in these cases, in which changing external circumstances are creating pressure for institutional change. From a rational choice perspective, it is possible that we are seeing the result of a failure to address recognised inefficiencies and the subsequent replacement of ineffective institutional constructs.

Another pattern displayed in Table 2 is the relative complexity of institutional stability and change in the *policy community* attribute relative to *policy scope* and *policy tool*. Across all cases, we observe that modes of stability in *policy community* are limited to active stability and failed action, if present at all, whereas change is most often expressed in terms of layering or conversion. This finding is opposed to our observations in *policy scope* and *policy tool* attributes, in which we observe both a larger number of co-occurring modes and a greater variety of modes. This is perhaps not surprising, recalling Roland's (2004) discussion of slow- versus fast-moving institutions. We might expect social interactions affecting – or affected by – a given rule to evolve slowly and more incrementally, whereas the legal scope or structure of a given rule is more vulnerable to rapid transitions, and thus subject to a wider array of mechanisms contributing to both stability and change.

The patterns observed here are further reflective of the broader social and political context in which each governance system operates, recalling the aforementioned interplay between society and its underlying institutions (Siddiki et al, 2022). The long periods of stability observed in Chinese air governance, punctuated only by slight changes (largely through layering of new objectives or approaches onto existing policies), is reflective of the state's efforts to maintain social constructs (Figure 3). Alternatively, the rapid changes observed in both the US and EU contexts, as well as the close occurrence of active stability and failed action, reflect an environment driven by both short-term shifts in dominant political parties and coalitions, as well as longer-term shifts in both policy problems and policy styles in which a greater variety of actors may employ a greater variety of policy strategies (Figures 1 and 2). This complexity is likewise observable in the number of modes cited in Table 2 for each case, with the fewest number of modes identified in the Chinese case (6), followed by the US (7) and the EU (9). Future research could delineate further the mechanisms for such complexity and assess the extent to which these general patterns hold in other cases.

Likewise apparent are indicators of the system being governed. Both Chinese and US air governance reflect a slow and methodical evolution to address increasingly complex air quality problems. This is observable in long periods characterised by layering and conversion coupled with some mode of stability (Figures 1 and 3). Contrast this with the EU-ETS and the complexity of addressing global climate change through a first-of-kind policy design necessitating cooperation among several sovereign Member States. In this latter situation, long spans of learning are reflected through layering and conversion, rapidly oscillating to times of active stability and failed action as existing constructs are challenged as the system transitions from one phase of the EU ETS to another (Figure 2). Again, the number of modes identified in Table 2 for each case reinforces this conclusion, with an increasing number of identified modes perhaps reflecting an increasingly complex institutional environment. These observations may also relate to perceived institutional effectiveness, as measurable improvements in air quality potentially reinforced the utility of existing institutional constructs in the US and China. The same reinforcement mechanism may have been absent in the EU-ETS owing to observed periods of trial-and-error in the regulation of an invisible global pollutant.

Conclusions

Our analysis demonstrates the utility of assessing both stability and change using a combined typology and across environmental governance systems. We show how patterns of change and stability are reflective of broader social and political contexts

within which a particular system operates. We likewise demonstrate that the maturity of the system itself can be observed through patterns of change and stability over time. Both have implications for research and policy.

From a research perspective, we have shown that modes of stability and change may overlap in space and time. The mechanisms underlying particular patterns of observed modes, however, remains a fruitful area of further work. The mechanisms contributing to different spatial and temporal patterns of stability and change across political systems is particularly of interest, as are the mechanisms underlying the temporal patterns between modes. We postulate a few mechanisms that might underlie or contribute to observed patterns here, but they remain to be tested.

Furthermore, when defined broadly to include both local and ambient atmospheric pollution, all three of our cases pertained to some aspect of air quality governance. Questions remain as to what comparative analysis of widely-varying governance systems would demonstrate, however (for example, biodiversity preservation, flood protection). There is also a need to undertake a more detailed and immersive analysis than the one presented here, for example relying on additional primary data such as interviews with key informants to better understand the conditions giving rise to observed instances of change or stability.

In terms of policy design, the analysis demonstrates the institutional complexity that may accompany new environmental governance systems. The interplay of multiple modes of stability and change in the EU-ETS shown in Figure 2 provides a graphical example of the fits and starts the system has faced as it has grown. Contrast this with examples from the US and China (Figures 1 and 3) in which long periods of stability are more common, a trend which has also contributed to an inability of those systems to adapt to new issues or imperatives. This at once highlights the challenge of designing systems that are both resilient to unwanted external change but also capable of adapting themselves (for example, Groen et al, 2022). Further analysis of observed instances of both stability and change can help provide insight into if and how this balancing has occurred in past governance arrangements, thus allowing future efforts to address contemporary environmental challenges to be better conceptualised from the ground up.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that there is no conflict of interest.

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