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Institutional innovation in urban governance: The case of climate change adaptation

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Urban governance systems need to be adaptive to deal with emerging uncertainties and pressures, including those related to climate change. Realising adaptive urban governance systems requires attention to institutions, and in particular, processes of institutional innovation. Interestingly, understanding of how institutional innovation and change occurs remains a key conceptual weakness in urban climate change governance. This paper explores how institutional innovation in urban climate change governance can be conceptualised and analysed. We develop a heuristic involving three levels: (1) "visible" changes in institutional arrangements, (2) changes in underlying "rules-in-use", and (3) the relationship to broader "governance dilemmas". We then explore the utility of this heuristic through an exploratory case study of urban water governance in Santiago, Chile. The approach presented opens up novel possibilities for studying institutional innovation and evaluating changes in governance systems. The paper contributes to debates on innovation and its effects in urban governance, particularly under climate change.

Keywords: Institutional change; cities; transformation; water; evaluation

1. Introduction

Creating adaptive urban governance systems requires considerable attention to institutions, and the ways in which institutions can innovate to address new risks and pressures that are emerging, for instance, under climate change. Institutions refer to the "clusters of rights, rules and decision-making procedures that give rise to social practices, assign roles to the participants in these practices, and guide interactions among occupants of these roles" (Young, King, and Schroeder 2008, xxii). Institutions are a key aspect of governance systems, but also interact with other aspects, such as "belief systems, norms, culture, and a sense of community" (Young, King, and Schroeder 2008, 15). In urban governance systems, institutions are typically established around specific issue areas (e.g. water, health, infrastructure, spatial planning) within municipalities, and sometimes at a citywide scale that includes multiple municipalities, which also interact with broader levels of governance (e.g. state/provincial, national,

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international). Thus, in seeking to understand how urban governance systems can become more adaptive it is necessary to consider issue-specific institutions, as well as their embeddedness within overarching institutions, within their biophysical and societal contexts (following Eakin *et al.* 2017; Hughes 2015).

Urban governance systems need to be adaptive to deal with unfolding uncertainties, dynamics, and pressures of climate change (Birkmann *et al.* 2010; Carter *et al.* 2015; Mazmanian, Jurewitz, and Nelson 2013). Cities across the globe face multiple increasing climate change risks (e.g. droughts, floods, storms, sea-level rise, heatwaves, diseases). In the Global South, these risks arise within contexts that frequently involve substantial existing socio-economic inequalities and differential vulnerabilities (Bulkeley, Edwards, and Fuller 2014; Pelling 2011; Rodima-Taylor, Olwig, and Chhetri 2012). Hence, whilst climate change adaptation involves dealing with unprecedented new risks, it also magnifies many existing socio-economic and environmental challenges (Kraas *et al.* 2016; UN-HABITAT 2017). Moreover, institutional failures are increasingly being exposed in practice in cities across the Global North and South through increasing experiences of, for example, floods and droughts in recent years, many of which are unprecedented in magnitude and impact. In this context, adaptive urban governance systems are needed to steer cities towards socially desirable goals (e.g. safety, sustainability, resilience, social equity) within complex and changing circumstances (Huitema *et al.* 2016, 2009; Pahl-Wostl 2009). Yet, existing urban governance systems are often ill-prepared for this challenge.

Institutional innovation is likely to be vital for realising adaptive urban governance systems under climate change (following Anguelovski and Carmin 2011; Eakin *et al.* 2017; Larsen *et al.* 2016; Noble *et al.* 2014; Rodima-Taylor, Olwig, and Chhetri 2012). Institutional innovation, in this paper, refers to intentional changes in collective choice institutions that allow cities to be more adaptive and better prepared under uncertain and evolving climate change futures. Practically, this could include changes in policy and legal frameworks that structure decision-making, changes in policy instruments for implementation, changes in organisations to meet new objectives, and changes in coordination arrangements between different actors. Scholars have begun to study innovation in climate change governance, both within cities and at broader scales, quite extensively in recent years. For example, this includes initiatives described as policy innovation (Jordan and Huitema 2014a, 2014b), urban experimentation (Bulkeley, Cástan Broto, and Maassen 2014; Bulkeley and Castán Broto 2013; Hoffmann 2011), and urban laboratories (Evans and Karvonen 2014; Voytenko *et al.* 2016), involving different combinations of government, business, and civil society actors. However, what is missing to date is a strong focus on analysing the institutions that structure, and supposedly change as a result of, such innovative activities. An institutional approach provides significant new insights into the ways in which urban governance systems may or may not actually change as a result of climate change adaptation efforts.

This paper explores how institutional innovation in urban governance under climate change can be conceptualised and analysed. The central objective of this paper is to develop a heuristic for conceptualising institutional innovation in collective choice arenas, particularly focusing on the multi-level nature of such processes, and to test this conceptual heuristic in an exploratory case, to assess its utility and potential to offer novel insights. Firstly, the paper critically surveys various approaches to thinking about innovation in the institutional/governance sphere, focusing on, but not limited

to, urban climate change governance literature. Secondly, it develops a heuristic for conceptualising institutional innovation comprised of three levels: (1) "visible" changes in institutional arrangements, (2) changes in underlying "rules-in-use", and (3) the relationship to broader "governance dilemmas"; and the interplay between these levels. Thirdly, the conceptual heuristic is applied in the empirical domain of urban water governance, through an exploratory case study of the city of Santiago, Chile. Finally, we reflect on the contributions and limits of the approach.

Overall, the paper provides a novel approach for studying institutional innovation that can be applied in multiple policy domains of urban governance. The approach presented opens up novel opportunities for studying institutional innovation, particularly for evaluating the ways in which "visible" institutional interventions influence governance systems. This is important because the complex and long-term nature of climate change responses means that evaluating adaptiveness based on material outcomes (e.g. risk reduction, improved preparedness) is very difficult. Thus scholars increasingly recommend evaluation on the basis of improvements in the capacity to govern climate change challenges (Bulkeley *et al.* 2014; Hildén, Jordan, and Rayner 2014). The approach presented in this paper provides a basis for analysing such changes in urban governance systems, therefore offering new possibilities for evaluation. The paper contributes to ongoing debates about innovation in urban governance, and within polycentric climate governance systems more broadly (Jordan *et al.* 2015). It also contributes to the novel conceptual challenge of understanding institutional dynamics (Mahoney and Thelen 2010; Young 2010) by applying core insights about the nested nature of institutions (Ostrom 2005; Young, King, and Schroeder 2008) in new ways to analyse dynamism through interplay across levels.

2. Literature review

2.1. An institutional lens

An institutional lens can take many forms, including an emphasis on incentives and strategic action, behavioural norms, historical contingency, and ideas (Hall and Taylor 1996; Peters 2000; Young, King, and Schroeder 2008). Institutional strands of thinking in the environmental governance literature pick up on these diverse approaches in various ways, oftentimes rooted in a concern for collective action dilemmas, but notably also emphasising the nesting of multiple levels of institutional order. Ostrom (2005) observes that institutional order in human society is comprised of multiple nested levels of rules, ranging across operational, collective choice, constitutional, and metaconstitutional levels. Along similar lines, Young, King, and Schroeder (2008) observe that issue-specific institutional regimes are linked to deeper norms/principles of societal organisation.

A nested institutional perspective is valuable in studying urban climate change governance because innovative action in cities depends not only on agency within cities, which have nested sets of rules themselves, but also on many factors beyond the city scale (Bulkeley and Betsill 2013; Johnson 2018). Recent scholarship on polycentric climate change governance emphasises a key role for 'overarching rules' that structure decision-making fora and their interactions (Jordan *et al.* 2018), indicating a concern with nested institutional orders. The perspective adopted in this paper takes a nested understanding of institutions as its primary point of departure. It reflects a largely 'realist-materialist' approach, in contrast to an 'ideational-constructionist' approach

(following Bisaro and Hinkel 2016), although this does not necessarily exclude ideational and cultural explanatory factors (Bisaro and Hinkel 2016, 354).

2.2. *Approaches to innovation in the governance/institutional sphere*

Innovation in the institutional/governance sphere has been approached in varying ways by different communities of scholars. This includes scholars concerned with innovation specifically in urban contexts, as well as those concerned with innovation in policy and governance systems more broadly. A common concern is to understand the emergence, diffusion and performance of novelty in the governance of public goods and services. Yet common challenges are to not only define innovation unambiguously, but also to theorise innovation processes within multi-actor (cf. single organisation) settings.

2.2.1. *Urban climate change governance*

In urban contexts, scholars have explored topics including policy innovation, experimentation, and urban laboratories (Evans and Karvonen 2014) – all of which involve explicit attempts to innovate urban governance systems to better address climate change issues. These different approaches focus on innovative activities undertaken by differing combinations of government, civil society, business, and research actors. Policy innovation studies typically emphasise governmental actors, experimentation typically centres on non-state actors, such as civil society and business, and urban laboratories often centre on knowledge co-production processes involving research as a key actor along with others.

From a policy innovation perspective, scholars have identified diverse activities in cities across the globe. For example, in studying urban climate governance in three Canadian cities, Burch (2010) identifies multiple concurrent initiatives, including corporate strategic plans for municipal operations, municipal green building strategy, community planning, and inter-departmental collaboration. In studying adaptation policy innovation in three cities in India, Chu (2016) identifies differing strategies arising out of specific place-based concerns, as well as multi-actor collaborations extending beyond the city territory. In reflecting on global experiences of urban climate governance, Anguelovski and Carmin (2011) identify nascent examples of policy innovation across the global North and South, but largely position this as an open topic needing further scrutiny. Within this line of focus, scholars have emphasised the importance of endogenous dynamics, such as the complex internal structure of municipalities (e.g. within and between departments) (Aylett 2013; Bulkeley and Betsill 2013; Hughes 2017), organizational positioning of climate change (e.g. as a self-standing sector, within specific existing sectors, or at a higher strategic level) (Burch 2010; Hardoy and Romero Lankao 2011; Hughes 2017), and organisational culture (e.g. support for collaboration and innovation, ideological tensions) (Aylett 2013; Burch 2010). Daniell, Coombes, and White (2014, 2415) emphasise the importance of paying particular attention to the politics of innovation, such as the influence of powerful coalitions, which in the water sector may involve “water utility providers, private companies, experts, communities and all levels of government”, in both supporting or blocking certain innovations.

From an experimentation perspective, scholars have identified diverse forms of activity beyond government or the global climate governance regime enshrined in the Kyoto Protocol and Paris Agreement. For example, starting from the premise that there is a need "to engage with the ways in which government is accomplished through social and technical practices", Bulkeley and Castán Broto (2013, 361) conduct a global survey of urban experimentation, revealing a rich landscape of activity occurring in non-traditional ways. Hoffman (2011) surveys the landscape of experimentation in climate change governance from local to global levels, identifying experimentation within and between cities as a key node of activity. In urban water management, scholars have argued that experimentation as both a practice and a philosophy is important even in an "unsympathetic regime" for focusing diverse actors on common goals and stimulating mutual learning (Farrelly and Brown 2011). Urban experimentation is increasingly considered as a governance strategy (Bulkeley *et al.* 2016; Frantzeskaki, Kabisch, and McPhearson 2016); the promise of which lies in the 'permission' it grants to step outside the status quo and enact unconventional governance arrangements, create novel learning opportunities, and provide sources of inspiration for broader change (Hoffmann 2011). In a recent review, Kivimaa *et al.* (2017) identify several possible roles of urban experimentation: niche creation, market creation, spatial development, societal problem solving.

From an urban laboratories perspective, scholars have identified the potential for structured processes of knowledge co-production involving end users (e.g. business, civil society) as innovative sources of activity. Urban laboratories are understood as "spaces designed for interactions between a context and a research process to test, develop and/or apply social practices and/or technology to a building or infrastructure" (Voytenko *et al.* 2016, 46). They seek to formalise knowledge production about the real-world application of an urban technology or practice, ultimately geared towards its upscaling (Evans and Karvonen 2014). While urban laboratories are increasingly important in debates about innovation in cities, they tend to focus at a more operational rather than collective choice level in urban governance. However, an experimentation perspective may see potential for reconfiguring institutional relations through embedding and/or upscaling of successful urban laboratories.

2.2.2. Broader policy and governance

Innovation is also an important theme among scholars studying policy and governance at other levels beyond cities, both in public administration generally and regarding climate change specifically.

In public administration, Moore and Hartley (2008) propose that innovations in governance involve: looking beyond single organisations to the interplay between multiple actors, drawing on new pools of resources, recognising the unique forms of authority held by government, changes in notions of value, and evaluation in terms of not only effectiveness and efficiency but also other criteria such as social justice. As can be gleaned from this summary, these authors take an inter-organizational perspective as their starting point, moving beyond a conventional view of innovation in products and services within a single (often private) organisation, to instead consider "changes in structures and processes operating above the level of a single organization" (Moore and Hartley 2008, 5). More recently, however, de Vries, Bekkers, and Tummers (2016) conduct a systematic review of empirical literature on public sector

innovation over 2.5 decades, finding a worrying lack of grounding in theory which hampers the ability to evaluate whether innovations "really matter and really make a difference" (161–2).

In climate change governance, scholars have brought particular attention to innovation in recent years, recognising a variety of conceptual orientations (Jordan and Huitema 2014a, 2014b). These include invention of new policies, diffusion of policies between different places and across levels, and evaluation of the effects of policies in triggering durable change in governance systems and/or impacts on material problems (Jordan and Huitema 2014a, 2014b). Evaluation is identified as a particularly underdeveloped area (Jordan and Huitema 2014a). In response, Auld *et al.* (2014) examine the relationship between the design of innovative policy instruments for low-carbon technologies and their effectiveness, usefully linking both state and non-state led innovation, although questions about changes in governance systems are left open. From another angle, Howlett (2014) highlights the politics of policy innovation in climate governance, especially the role of 'blame avoidance' behaviour among decision-makers, which means that policy innovation may be more or less likely under certain combinations of contextual and political conditions. More recently, these lines of thinking are being reframed from a perspective of 'polycentric' climate governance, where the capacity for innovation is dispersed among many possible centres of decision-making and action, such as cities (Jordan *et al.* 2018, 2015).

2.3. Limitations of current approaches

The various approaches surveyed above reflect a vibrant domain of thinking about innovation related to urban climate governance, and many insights emerge regarding innovation among governmental and non-governmental actors. However, looking across these approaches reveals a need for an explicit focus on institutional innovation/change as a dependent variable. Institutional theory has much to contribute to understanding the nature and dynamics of change processes. Realising intentional change in institutions is often regarded as a notoriously difficult challenge. Institutions may be path-dependent (Barnett *et al.* 2015; Dovers and Hezri 2010), 'sticky' (Harries and Penning-Rowsell 2011), and a source of 'lock-in' to undesirable trajectories (Seto *et al.* 2016); tied to deeper social forces such as entrenched habits (Hodgson 2006), norms, culture, and beliefs (North 2010; Ostrom 2005; Young, King, and Schroeder 2008). Thus, achieving institutional innovation is unlikely to be a trivial matter, even though talk of innovation abounds in contemporary debates about cities and climate change.

In particular, questions arise regarding the extent to which 'visible' institutional interventions (such as changes in policy and legal frameworks, policy instruments, organisations, and coordination arrangements) become durably embedded and institutionalised within an urban governance system, to ultimately improve (however defined) how certain issues are governed. Especially when existing institutions structuring collective choice arenas do not accommodate these interventions, there will be a mismatch between the intended innovation and actual underlying practices. Furthermore, the dynamic and evolving nature of the biophysical and social world, particularly under shifting boundary conditions caused by climate change, is likely to create ongoing sources of instability for institutions, as the limits of institutional performance are tested and societal preferences evolve. Altogether, this means that understanding and evaluating processes of institutional innovation requires thinking beyond the

introduction of 'visible' institutional interventions alone, to also interrogate associated changes in deeper levels of institutional order.

3. Conceptualising institutional innovation

This section focuses on conceptualising institutional innovation. It develops a heuristic involving three levels: (1) "visible" changes in institutional arrangements brought about through intentional interventions, (2) changes in underlying "rules-in-use" in collective choice arenas, and (3) the relationship to broader "governance dilemmas" that cities face in dealing with climate change. The purpose of this heuristic is to identify different levels of institutional ordering, and interplay between them, that should be considered when studying institutional innovation. This is important for assessing the likely durability of an intervention (the potential for its embedding/institutionalisation or 'sticking'), as well as for evaluating the effects on broader institutional order. In other words, whether or not governance systems change as a result. The overall approach is inspired by Ostrom's (2005) framework of nested action situations. We seek to build on this approach by applying it to the problem of climate change adaptation in urban governance, focusing specifically on collective choice arenas. The three key elements of the heuristic are explained in turn, followed by an explanation of the overall heuristic.

3.1. Level 1: Visible changes in institutional arrangements

The first level focuses on intentional changes in "visible" institutional arrangements for making collective choice decisions about climate change adaptation. This includes changes in *policy and legal frameworks* that structure decision-making, changes in *policy instruments* for implementation, changes in *organisations* to meet new objectives, and changes in *coordination arrangements* between different actors (Table 1). These changes are hypothesised to have potential to enhance adaptiveness in urban governance systems, because they are both intentional and substantive (following Dupuis and Biesbroek 2013). Importantly, they provide an empirical entry point in studying institutional innovation, as they are visible interventions that can be readily observed in an urban governance system.

3.2. Level 2: Changes in underlying rules

The second level focuses on the 'rules-in-use' that structure collective choice arenas. This refers to the working rules that develop in practice, arising from the combination of both formal aspects, as well as informal understandings, agreements, and practices that shape behaviour and mediate interactions between actors, and may not necessarily be formally articulated (Ostrom 2005). Thus, rules-in-use comprise both formal and informal rules as they operate in practice (e.g. following Eakin *et al.* 2017) in structuring of collective choice arenas. Considering the underlying rules-in-use helps to dig below the surface of the visible institutions that are the focus in Level 1, zooming in on the practices and logics that manifest around a certain issue (i.e. climate change adaptation) in a specific situation (i.e. a city). The idea of rules-in-use also incorporates the effects of rules from the deeper 'constitutional level' that condition the collective choice level. This view of rules-in-use also aligns with Hodgson (2006, 3) who argued that "rules include norms of behaviour and social conventions as well as legal rules".

Table 1. Types of 'visible' changes in institutional arrangements for adaptation (source: authors' own compilation).

Type of change	Sub-category	Examples
Policy and legal frameworks	Policy	Modifying existing policies to account for climate change; Creating new policies for adaptation.
	Legislation	Modifying existing legislation or regulation to better account for climate change; Creating specific climate laws.
Policy instruments	Planning	Conducting adaptation and/or resilience planning; Incorporating adaptation provisions into existing spatial, sectoral or strategic planning.
	Standards	Adjusting building regulations; Adjusting spatial planning / zoning.
	Incentives	Creating financial incentive programs; Changes to tax codes to encourage adaptation action.
	Sanctions	Creating and enforcing penalties or punishments e.g. fines, court cases, reputational impacts.
	Monitoring and evaluation	Systems to track policy implementation; Benchmarking or evaluation against 'good practice' elsewhere.
	Communication	Campaigns and engagement initiatives; awareness-raising, knowledge-sharing.
Organisations	Governmental	New organisation (e.g. agency, taskforce, department); Changes to existing organisation (e.g. taking on new roles / responsibilities, creating new staff position/s).
	Non-governmental	New organisation (e.g. NGO, business, citizen group); Changes to focus of existing organisation (e.g. taking on new roles / responsibilities).
Coordination arrangements	Multi-actor collaboration	Broad collaboration (e.g. partnerships, platforms, networks); Issue-specific collaboration (e.g. taskforces, advisory groups).
	Policy coordination	Policy alignment across sectors and levels for adaptation.
	Monitoring and evaluation	Systems to track overall adaptation progress at citywide level.
	Role clarity	Clarification of roles / responsibilities for adaptation activities.
	Knowledge sharing	Systems to share knowledge among different actors.
	Participation	Mechanisms for diverse participation and consultation.

Ostrom (2005) identifies seven types of rules-in-use in collective action situations: Boundary, Position, Scope, Choice, Aggregation, Information, and Payoff rules. Boundary rules refer to which actors are included in an action situation; position rules refer to the roles that different actors can and cannot take (e.g. decision-makers, users); scope rules refer to common understandings among actors about which resources/ goods can or cannot be accessed; choice rules refer to the range of acceptable choices

Table 2. Rules-in-use likely to be relevant in understanding institutional innovation (source: Huitema and Meijerink 2014).

Rule type	Explanation	Examples from adaptation in cities
Authority rules	• Institutional positions that actors can take • Which actions are allowed and how they can be taken • Scope of authority (i.e. competencies, powers)	Actors that have authority over adaptation in urban governance, and ways in which they exert authority.
Aggregation rules	• How individual and collective interests are weighed up • Both practical decision-making and principles guiding this (e.g. utilitarianism, equity)	Approaches by which different actors' concerns are brought into decision-making about adaptation.
Boundary rules	• Geographical and jurisdictional scope • Which actors are included or excluded	Bounding of adaptation issues and actors considered to have a legitimate stake in them.
Information rules	• How different types of information are sourced, processed, and applied in decision-making	Information drawn on and ways in which it is used in decision-making for adaptation.
Payoff rules	• Distributional impacts (i.e. sharing of benefits and costs to participants and others affected)	Recognition and treatment of differential distributional impacts associated with adaptation.

available for action in a particular position; aggregation rules refer to rules controlling the range of choices available; information rules refer to the use and control of information and who it is, and is not, available to; and payoff rules refer to the distribution of costs and benefits, as well as how monitoring occurs and sanctions are enforced for non-compliant behaviour (Ostrom 2011, 2005). In response to prior suggestions in the literature about consolidating this set of rules to reduce overlaps, Huitema and Meijerink (2014) propose a condensed set of 5 important types of rules (Table 2).

3.3. Level 3: Relationship to broader governance dilemmas

The third level focuses on governance dilemmas that condition a collective choice arena. Jordan *et al.* (2010) identify key governance dilemmas that arise in the governance of climate change mitigation and adaptation, relating to: problem perception, level and scale of responses, timing and sequencing of responses, mode and instrument choices, distributions of costs and benefits, and methods of implementation and enforcement (Table 3). These dilemmas point to persistent questions and choices that need to be made in urban governance systems, yet they may also be fluid due to evolving climate knowledge, experience, and socio-political priorities. In essence, the dilemmas translate key biophysical, social, and economic attributes identified by Ostrom (2005) and others as important underlying factors shaping collective choice

Table 3. Governance dilemmas faced in dealing with climate change (source: Jordan *et al.* 2010).

Dilemma	Key concern	Aspects of dilemma
Problem perception	What is the problem?	• Problem scope/delineation (e.g. simple, complex, wicked) • Problem framings, including ambiguities and contestations • Level of attention on policy and political agendas
Level and scale	At what level should responses be taken?	• Distribution of responsibilities across levels (local, national, global) • Implications of responses at different levels (e.g. accountability, transparency)
Timing and sequencing	When should action be taken?	• Sequence of action in light of varying costs and benefits over time • Addressing different preferences for action (e.g. risk taking, profit making, assertive/preventative vs reactive)
Modes and instruments	How should action be taken?	• Selecting a package of policy instruments • Modes of governance (e.g. hierarchies, markets, networks)
Costs and benefits	Who wins and loses?	• Addressing tensions between effectiveness, fairness, and legitimacy • Dealing with costs and benefits to impacted groups • Political dynamics created (e.g. resistance) that can affect success
Implementation and enforcement	How can policy change be secured?	• Adequate goal clarity and administrative strength • Dealing with ambiguous goals and implementation gaps • Policy style and implications for policy change

arenas, into a set of practical decision-making challenges that are faced within collective choice arenas. Importantly, from an analytical perspective the notion of governance dilemmas also turns these biophysical, social, and economic attributes from somewhat static contextual factors into relationally-embedded features of collective choice arenas.

Empirical experience points to the relevance of these dilemmas. Huitema *et al.* (2016) demonstrate the role of governance dilemmas in governance of adaptation, and their manifestation across 17 cases of adaptation governance spanning the global North and South, highlighting the salience of these dilemmas across diverse contexts. Schlager and Heikkila (2011) apply common pool resource thinking to studying water resource compacts in river basins, highlighting the importance of rules in determining the adaptability of governance systems under climate change. In this light, these authors highlight the relevance of core insights from commons literature that: (1) "the performance of institutions depends on how well the rules are matched to the biophysical and social setting in which they are applied", and (2) "Equally important is how well rules reflect important social norms and practices, particularly in how they distribute the benefits and burdens of governing" a resource (Schlager and Heikkila 2011, 462). This points to the importance of considering the interplay between rules and their

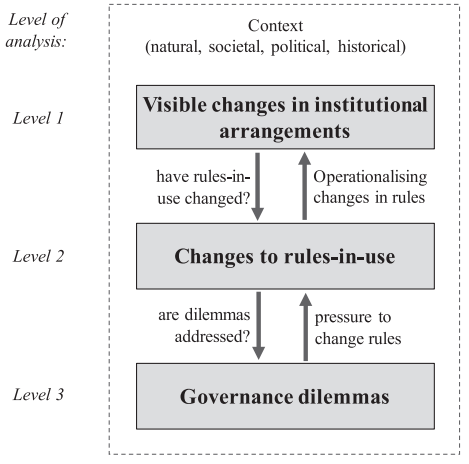

Figure 1. A heuristic for studying institutional innovation.

biophysical, social, and economic setting, and more broadly, the role of governance dilemmas (such as distributional processes and outcomes) in understanding how rules function in practice.

Conceptually, the relevance of governance dilemmas in studying institutional innovation is that the way in which they are addressed may create ongoing sources of instability in the governance system, and pressure on the rules-in-use (especially when the resolution of the various dilemmas is not aligned). Institutional innovation may not be durable if it is undermined by severe contestation, vis-a-vis governance dilemmas. For example, if the issue of climate change adaptation falls from the policy/political agenda (or never really gets on it in the first place), then the potential for innovation may be weak due to lack of interest. On the other hand, if the city becomes a key focus of climate change adaptation within political debates then the potential for institutional innovation may increase. Yet, if political resistance from groups affected by an innovation becomes too strong, then the innovation may be watered-down or abandoned. Thus, the durability of innovation needs to be considered in the light of broader governance dilemmas faced in dealing with climate change in any particular urban setting.

3.4. A conceptual heuristic

The conceptual heuristic for studying institutional innovation is presented in Figure 1. The basic structure is comprised of the three levels explained in Sections 3.1-3.3. Interplay occurs between these levels in both 'downward' and 'upward' ways. Visible changes in institutional arrangements (Level 1) may create an imperative for changes in rules-in-use (level 2), which in turn raises questions about the extent to which broader governance dilemmas are addressed (Level 3). Conversely, increasing severity of governance dilemmas (Level 3) may impose instability or pressure on rules-in-use (Level 2), which in turn may be operationalised into changes in institutional arrangements in the collective choice arena (Level 1). Overall, the heuristic organises broad categories of variables, but the development of detailed hypotheses about causal mechanisms will need to be done in largely case specific ways. The idea of interplay

between different levels of institutional order resonates with broader scholarship on institutions in environmental governance. For example, Underdal (2008, 56–57) identifies how a focus on vertical interplay opens up opportunities to better understand the bidirectional interactions between issue-specific institutional setups (e.g. regimes) and the deeper norms and ordering principles on which these setups are constructed.

Importantly, the study of institutional innovation needs to be contextualised within its governance context (e.g. wider natural, societal, political, and historical aspects). This matters not only in analysing the collective choice arena, but also normatively in deciding on what is considered to be 'innovative' because this may vary substantially between different contexts. For example, a small change may be deemed to be relatively innovative in a city without much prior adaptation activity or where taking such action is particularly difficult. Yet, in another case, such as a place that is more experienced, ambitious, or well-resourced in pursuing adaptation, the same change may not be considered equally innovative.

Applying this heuristic involves beginning with identifying visible changes in institutional arrangements (Level 1) and working downwards to probe at sequentially deeper levels. This might involve asking whether, for a visible change in institutional arrangements, there have also been associated changes in rules-in-use and, furthermore, whether key governance dilemmas are likely to be better managed as a result. Subsequently, it could also be helpful to work in the opposite direction, enquiring into what the key governance dilemmas are in addressing adaptation within a city, what 'upward' pressure these governance dilemmas may have on rules-in-use, and whether this may indicate an opportunity or need to make certain changes in visible institutional arrangements. Hence, the heuristic has descriptive value in directing attention towards certain categories of variables and identifying the necessary scope of consideration, and it also has analytical value as a tool for structuring the analysis of relationships between variables.

The litmus test for a successful institutional innovation is ultimately a combination of analytical judgements about durability, and normative judgment about context-specific substantiality/impact. This might be observed through change/s in visible institutional arrangements that are also associated with changes in underlying rules-in-use, indicating a deeper embedding within a collective choice arena. At the same time, pressing governance dilemmas would also need to be better addressed. On the other hand, if rules-in-use do not accommodate a change in visible institutional arrangements, or pressing governance dilemmas remain unresolved, it is less likely that a 'surface level' change will be durable. The value of the heuristic is that it directs attention to thinking about a fuller range of factors than just what is seen 'on the surface' in evaluating processes of institutional innovation.

4. Exploratory case study

The conceptual heuristic is now applied in the problem domain of urban water governance through an exploratory case study of Santiago, Chile. The purpose of the case study is twofold: firstly, to examine the Santiago case as an example of a large city facing major climate change adaptation challenges, and secondly, to test the utility of the heuristic in terms of its insights and limitations. Methods involved an informed analysis of documentary material (academic and grey literature) within a larger research project. Climate change adaptation is a relatively new agenda in Santiago

(approximately 2012 onwards), yet a substantial body of literature has already accumulated which is drawn on and reinterpreted here. The single case study approach was chosen to allow for in-depth analysis. The aim is to understand and assess possible institutional innovation based on the urban adaptation activity being observed in practice, in the light of growing water-related risks faced under climate change.

4.1. Problem domain: Urban water governance

Water is one of the most pressing issues for climate change adaptation in cities across the globe. Many key impacts and risks of climate change are related to water systems (e.g. flooding, droughts, water supply challenges, sewage/sanitation, and ecosystem health) (Jiménez Cisneros *et al.* 2014; Major *et al.* 2011; UN-WWAP 2012). High concentrations of people living in urban areas, often including sizeable groups at socio-economic disadvantage, particularly in cities in the Global South, potentially exposes residents to many water-related risks under climate change. There are, of course, many other key issues for adaptation in cities, including heat, health, spatial planning, and infrastructure. Here, we focus on adaptation in urban water governance as a complex, cross-cutting issue, which is often also linked to many others.

'Water governance' is commonly taken to refer to "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall 2003, 7). Risks to water systems arise due to 'nonstationarity' (i.e. where historical records are no longer accurate for predicting the future), and even the possibility of abrupt and permanent hydrological shifts in some places (e.g. changed rainfall patterns) (Fane *et al.* 2011; Mazmanian, Jurewitz, and Nelson 2013). However, climate risks arise not only due to physical hydrological impacts, but also depend on the characteristics of the human systems affected by them (e.g. hazard, exposure, vulnerability) (Cardona *et al.* 2012, 69). Thus, urban water governance systems need to be adaptive within uncertain, evolving, and socio-economically heterogeneous contexts.

4.2. Introduction: Santiago, Chile

Santiago is a large city of over 6 million people located in a semi-arid climate at the foothills of the Andes mountains (Bonelli *et al.* 2014; Krellenberg and Hansjürgens 2014). The urban population is growing and is expected to reach 8 million by around 2030 (Barton 2013). The city shows significant socioeconomic variability spatially, with the north-east areas of the city being much more affluent than the rest of the city (Krellenberg and Hansjürgens 2014, 8; Romero-Lankao *et al.* 2013).

4.2.1. Urban governance context

Santiago is set within a centralised national political system, but itself involves "fragmented administrative structures" (Romero-Lankao *et al.* 2013, 789). The Greater Santiago metropolitan area (i.e. the main urban extent, the city) contains 34 municipalities, and is situated within the Metropolitan Region of Santiago (RMS) which covers a broader extent of 52 municipalities. The RMS is one of 13 Regions across the country. The regional government (GORE) is headed by an *Intendente* appointed by the President. Furthermore, Regional Secretariats of National Government ministries

operate alongside GORE, such as SEREMI MMA (Regional Secretariat of the Ministry of the Environment). The National Government delegates authority and resources to Regional Secretariats. Thus, urban governance is closely connected to the centralised nature of the political system. Yet there are ongoing debates about decentralising political powers, with tentative steps towards this in recent years. For example, regional councillors have been directly elected by citizens since 2009 (Law 20.390), whereas previously they were elected by municipal councillors. In 2020, a new elected position of Regional Governor will be created (Law 20.990), which will sit alongside the Presidential delegate.

4.2.2. Water governance context

Importantly, understanding climate change adaptation in urban water governance requires close attention to the setup of the national water governance system. The 1981 Water Code remains the current legislative foundation of the national water governance system, which establishes a water market approach to water resource allocation (Bauer 2015; Bonelli *et al.* 2014; Valdés-Pineda *et al.* 2014). This is linked to the National Constitution which recognises water as a public asset, but also confers the ability to create private water rights through legislation (Bauer 2015; Bonelli *et al.* 2014; Valdés-Pineda *et al.* 2014). The Water Code was modified in 2005 (Law 20.107) to improve information systems, strengthen regulatory capacity for future water rights (but not existing rights), include new environmental provisions, and establish fees for non-use of water rights over a certain time period (Bauer 2015, 152; Valdés-Pineda *et al.* 2014). However, these changes arguably "barely touched the core principles of private property rights, market forces, and a weak state" (Bauer 2015, 154). Further changes have been pursued since 2011. One amendment strengthening regulatory enforcement powers (i.e. information, inspection, sanctions) has been approved (Law 21064). However, the status of another, seemingly more contentious, amendment relating to competing uses of water (productive uses, drinking water, ecosystem protection) (Boletín 7543-12) remains unclear after being sent for review to the Agricultural Commission in August 2017.

A core matter is the ambiguous relationship between public and private interests in regard to water across constitutional and legislative levels, and the questions this raises about addressing future water conflicts under climate change. Water rights in the Maipo Basin (in which Santiago is located) are fully allocated. The main water utility Aguas Andinas owns about 25% of these rights, which it has been gradually increasing over recent years (Bonelli *et al.* 2014, 366), with the rest of the consumptive water rights owned mainly by agricultural and mining companies. Water allocations are proportional with legislative recognition of the need to prioritise drinking water. However, at the same time, existing water rights are perpetual and there are strong political coalitions of existing owners. It is believed that the system is not able to deal well with water conflicts, or prioritise different water uses (Bauer 2015; Valdés-Pineda *et al.* 2014, 2562).

4.2.3. Risks under climate change

Santiago faces growing risks under climate change, particularly due to declining water availability (Boisier *et al.* 2016; Bonelli *et al.* 2014; McPhee *et al.* 2014; MMA 2011,

Chap. 1). This is due to changing precipitation patterns, as well as shrinking glaciers which are a key source of water supply in the dry non-winter months (Bonelli *et al.* 2014; MMA 2011, Chap. 1; Valdés-Pineda *et al.* 2014). The region in which Santiago is situated has been under extended drought since 2010 (CR2 2015). These risks are exacerbated by the full allocation of water rights in the Maipo river basin. The city currently has high reliability of water supply from the main water utility, although it is believed that nonstationary hydrology will place unprecedented pressure on the current proportional water allocation system (Bonelli *et al.* 2014). In a drought situation "the aim is to ensure water supplies by means of Decrees dealing with water shortage conditions", however so far "debate about reforming the legal and the constitutional water regime fails to consider drought as a recurring or long-lasting condition" (CR2 2015, 20). Another key climate risk is flooding due to intense winter rains (Krellenberg and Hansjürgens 2014; Lehn, Simon, and Oertel 2014; MMA 2011, 125; Valdés-Pineda *et al.* 2014), which has been experienced several times over the last decade. Interestingly, flooding risks cut across socio-economic groups, affecting both poorer and wealthier parts of the city (Barton, 2013, 1924).

4.3. Climate change adaptation activities

Adaptation efforts within Santiago involve developments at both national and urban-regional levels over the last 5-10 years, and national activity has been a key driver for urban-regional activities.

A key starting point for climate change action in Chile overall is the 2006 National Strategy, and the 2008 National Action Plan (*Plan de Acción Nacional de Cambio Climático 2008-2012*) that was the first step towards enacting the National Strategy (Barton 2013; MMA 2011, Chap. 2). At a similar time, institutional capacity for environmental issues generally was being strengthened, following a 2005 OECD recommendation, which led to the creation of the Ministry of the Environment (*Ministerio del Medio Ambiente – MMA*) and associated institutional capacities (Barton 2013, 1917). Importantly, this included an Office of Climate Change within the MMA (Law 20.147), which has since been spearheading climate change activities from a national level. The 2008 National Action Plan did not specifically address urban issues, although it highlighted links between climate change impacts and spatial planning and the need for improved coordination between urban planning and river basin management (Barton 2013, 1921). Recently, the next National Action Plan was released (*Plan de Acción Nacional de Cambio Climático 2017-2021*), which places adaptation on an equal footing as mitigation, and gives significant attention to cities, although it provides only the broad outlines of actions needed.

Urban adaptation is a relatively new agenda, beginning since the early 2010's (Barton 2013; Krellenberg and Hansjürgens 2014; Romero-Lankao *et al.* 2013). At an urban-regional level, a key activity was the production of a regional adaptation plan for Santiago in 2012 (*Plan de Adaptación al Cambio Climático para la Region Metropolitana de Santiago de Chile – PARMS*). This was produced through several years of scientific studies and stakeholder collaboration involving international researchers, local researchers, GORE, and SEREMI MMA. Other urban governance instruments have practical bearing on adaptation issues, but do not always acknowledge this. Barton (2013) identifies several instruments, including the 1994 Inter-Municipal (Metropolitan) Regulatory Plan which is foundational in defining urban

growth extent, the Regional Urban Development Plan (National Ministry of Housing and Urban Development), and Local regulatory and development plans (Municipalities), noting that none paid attention to climate change. The 2013 National Urban Development Policy (National Ministry of Housing and Urban Development – *MINVU*) advocates a strong connection between sustainability issues and spatial planning, but does not explicitly acknowledge climate change (MINVU and UNDP, 2014). In 2017 a national adaptation plan for cities being prepared by the MMA (*Plan de Adaptación al Cambio Climático para Ciudades*) was under public consultation.

In recent years, some municipalities have begun taking steps on climate change adaptation for the first time, particularly linked to activities of a local NGO (*Adapt-Chile*). Adapt-Chile formed in 2013 and has been active in facilitating collaboration among municipalities for adaptation planning. For example, it created the Chilean Network of Municipalities for Climate Action (RMFCC) in 2014, which provides a platform for coordination between municipalities in Santiago. Municipalities have previously not played a strong role in climate change adaptation in Santiago. Their sheer number across the city fragments institutional responses, and they also face differing fiscal situations between poorer and richer parts of the city. Nonetheless, in 2015, six municipalities released local climate change plans (Adapt-Chile 2015), indicating a growing desire for some municipalities to take climate action.

4.4. Applying the heuristic

Table 4 provides a summary of three key institutional innovations for adaptation in urban water governance in Santiago using the categories of the conceptual heuristic. These innovations are identified from the case study characterisation in Sections 4.2–4.3 above, qualified also by a subjective (and tentative) assessment of durability and impact. The collective choice arena is centred on the city scale (i.e. the urban governance system). Yet, this can differ somewhat, because (following Ostrom, 2005) an 'action arena' comes into being whenever multiple actors interact regarding a social dilemma. This means that adaptation in urban governance may involve several differing, yet overlapping, collective choice arenas through different combinations of actors coming together in different ways.

The institutional innovations in Table 4 are each associated with changes in certain rules-in-use and contributions to addressing certain governance dilemmas. By no means do they address all of these areas. The innovations together touch on most rule types, but not necessarily strongly, although attention to *payoff rules* is noticeably lacking. Some governance dilemmas relating to recognition of the problem of urban adaptation are tentatively addressed, but *timing and sequencing* and *costs and benefits* remain largely unaddressed. Together this indicates that difficult decisions with potentially distributive consequences are not yet being addressed. Importantly, rules relating to the Water Code sit largely outside the collective choice arena for urban adaptation because they are strongly tied to the national political system (legislatively and constitutionally). Hence, it is difficult to change associated *payoff rules* or address *costs and benefits* dilemmas within an urban collective choice arena; the national water governance system effectively becomes 'constitutional'. Yet, this may be where much attention is needed in order to genuinely progress adaptation in urban water governance.

Table 4. Summary analysis of the Santiago case.

Institutional innovation	Collective choice arena	Levels of heuristic: Type of visible change in institutional arrangements[a]	Levels of heuristic: Changes in rules-in-use[b]	Levels of heuristic: Addressing governance dilemmas[c]	Durability and impact
Office of Climate Change created in 2010 within the national Ministry of the Environment.	National-Urban	Organisations: • Governmental (new organisation created).	Authority rules: • New institutional positions created for dealing with climate change. • New actions become possible. • New authority structure created. Information rules: • New means and objectives for synthesising information about adaptation issues, both nationally and at urban-regional level.	Problem perception: • Climate change recognised institutionally as a national concern. • Level of policy and political attention greatly increased. Level and scale: • National level attention given to climate change which helps to address and confer legitimacy on these issues at city level.	High durability reflected through Office of Climate Change being later upgraded to status of Department. High impact through enabling climate change action in Santiago, first indirectly, and increasingly more directly.
Climate Change Adaptation Plan developed in 2012–2014.	Urban-Regional	Policy instruments: • Planning (conducting adaptation planning). • Communication (awareness raising). Coordination arrangements:	Boundary rules: • Efforts to cultivate an urban (i.e. citywide) scope for tackling adaptation. • Efforts to include broad range of actors as a norm in adaptation decision making.	Problem perception: • Urban adaptation issues framed comprehensively for first time. • Level of policy and political attention increased. Modes and instruments:	Low durability since plan implementation seemed to stall after formal adoption. High impact by building collaboration on an urban adaptation agenda for the first time. Idea of an urban scope seems to have stuck and

(*Continued*)

Institutional innovation	Collective choice arena	Levels of heuristic: Type of visible change in institutional arrangements[a]	Changes in rules-in-use[b]	Addressing governance dilemmas[c]	Durability and impact
		• Multi-actor collaboration (building new networks). • Participation (multiple consultation forums).	Information rules: • Efforts to stimulate new ways of synthesising information about adaptation issues.	• Policy instrument developed (adaptation plan) with actions. • Provides reference point for future action.	informed subsequent activities.
Municipal collaboration initiated from approximately 2014 onwards.	Municipal-Urban	Organisations: • Non-governmental (new NGO created). Coordination arrangements: • Multi-actor collaboration (developing joint adaptation activities). • Knowledge sharing (sharing knowledge about adaptation).	Authority rules: • Municipalities building competencies and authority for adaptation in new ways. Aggregation rules: • Municipalities considering cumulative benefits from collective action beyond their borders.	Level and scale: • Local level attention given to climate change which is vital for addressing and conferring legitimacy on these issues. Implementation and enforcement: • Municipal action vital to implementing city-wide urban adaptation agenda.	Moderate durability due to dependence on a small NGO itself reliant on donor funding. Moderate impact since participating municipalities are a subset of the whole city.

[a]See Table 1
[b]See Table 2.
[c]See Table 3.

4.5. Case study conclusions

The urban governance of climate change adaptation is both crowded with many actors having authority relating to adaptation (e.g. blurred and overlapping roles of National, Regional, and Municipal Governments), but at the same time somewhat of a void with a lack of clarity over specific roles, responsibilities, and leadership. Regional Government is often believed to be well positioned to pursue urban climate change adaptation due to its scalar fit with the territory of Santiago and the potential for integration across sectors; however, it does not have the same authority and financial capacity as regional secretariats of national ministries (Barton 2013, 1922). However, one of the most glaring issues in terms of urban water, is that urban adaptation activities are largely separate from arrangements for water governance. Practically, urban adaptation is intimately tied to water issues, but institutionally they are largely separated. This highlights the importance of finding ways to enhance institutional connectivity between urban adaptation and water governance. Exactly how this can be done, given the rigid water market setup and established political interests around water resources, is unclear.

Bauer (2015, 167) makes several pragmatic suggestions for improving the national water governance system, including affirming the legitimacy of private water rights, but subjecting these to stronger public interest duties and obligations, and strengthening government regulatory capacity to manage water in the public interest. This is likely to benefit urban adaptation since a key challenge is dealing with potential conflicts from declining water availability and drought that are tied to the broader Maipo Basin. The latest modifications to the water code to improve the capacity of the national regulator (the *Dirección General de Aguas – DGA*) regarding information, inspection and sanctions (Law 21.064) may indirectly benefit Santiago through efficient water administration. The other modification currently in progress (Boletín 7543-12) which aims to provide capacity to balance water for production, drinking, and ecosystems, may also indirectly benefit Santiago by creating new standing for public interest claims about water. In terms of planning, Barton (2013, 1927) recommends addressing urban adaptation in Santiago through mainstreaming adaptation into existing processes, procedures, and instruments, as well as strengthening cross-sectoral capacities, to avoid any additional complexity of pursuing adaptation separately. In material terms, others have advocated increasing water purchases by the main water utility (*Aguas Andinas*) and improving urban water efficiency (Bonelli *et al.* 2014; Lehn, Simon, and Oertel 2014).

Overall, this case shows deep interconnection between national and urban-regional levels when it comes to adaptation in urban governance, challenges to reconciling urban water priorities with the national water governance system, and linkages between urban adaptation and ongoing socioeconomic development challenges. Regional government seems well placed to play a leadership role in Santiago, as it best aligns territorially with the city. However, there seems to be a key need to build stronger connectivity with municipalities to align urban adaptation activities both spatially and jurisdictionally. Forthcoming changes to regional governance in Chile regarding the introduction of publicly elected regional governorships is an opportunity for elevating leadership on urban adaptation. Yet, the seemingly ambiguous relationship of this position to existing regional appointees of the President, and the ongoing discrepancies in power and resources between regional government and the regional committees of the

national government, means that the need for productive interplay between regional and national governments will remain central.

5. Conclusions

This paper explores how institutional innovation can be conceptualised and analysed. The heuristic developed opens up new ways of critically reflecting on institutional innovation by allowing a deeper analysis beyond 'visible' changes to also consider whether or not rules-in-use have also changed, and the relationship to broader governance dilemmas that impose pressure on an urban governance system. This provides a practice-centred approach through a focus on 'visible changes' as the entry point for analysis, which brings together rules from across multiple levels as they are relevant to structuring a collective choice arena, which more closely resembles practice than looking at different levels just in formal jurisdictional terms. The heuristic also opens up opportunities for systematic comparative study.

The paper has relevance to several broader theoretical questions. Firstly, it sheds light on the issue of 'what counts' as institutional innovation, and how we can judge when this occurs (Jordan and Huitema 2014a). Findings indicate that a genuine institutional innovation is likely to involve changes in underlying rules-in-use and better address governance dilemmas, along with the more obvious ('visible') changes in institutional arrangements. Secondly, the paper provides new insights on institutional dynamics within processes of institutionalisation or 'mainstreaming' in climate change adaptation (Runhaar *et al.* 2017; Uittenbroek 2014). Findings indicate that studies of institutionalisation should pay attention to changes in rules-in-use and governance dilemmas over time, in order to assess the durability and impact of institutional innovation. Thirdly, the paper provides novel insights relevant to understanding transformations in urban governance systems (Pahl-Wostl 2009; Patterson *et al.* 2017). Findings provide ideas about how innovation may have transformative effects, for example in relation to reinforcing dynamics (Pierson 2000), habit formation (Hodgson 2006), and embedding value into new structures (Peters 2000, 7–8).

A key next step is to explicitly investigate the temporal dynamics of institutional innovation. For example, this might involve studying mechanisms of institutional change (Mahoney and Thelen 2010) within the nested settings identified here. Furthermore, in the case study presented it is difficult to definitively evaluate the ultimate intended outcome, that is, whether the institutional innovations identified have contributed to greater adaptiveness. Such an evaluation is difficult because of the long-term nature of climate impacts, the interaction with many other social and political factors, and the difficulty of attributing outcomes to specific institutional changes. Nonetheless, this is also a key area for future attention.

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