
Water scarcity and institutional change: lessons in adaptive governance from the drought experience of Perth, Western Australia.

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ABSTRACT

Urban water systems will be increasingly challenged under future climates and global pressures. Meeting challenges by reconfiguring water systems to integrate supplies and deliver multifunctional uses is technically well described. Adjusting the institutions that frame the management of these systems is not well operationalized in practice or conceptualized in theory. This study seeks to address this gap through an institutional analysis of Perth, Australia, a city where drought crisis has put under pressure both management practices and the institutional setting that underlies them. The study found that while trusted practices moderated water scarcity, the stability of the institutional setting may not facilitate a shift toward adaptable institutional configurations suited to future conditions. The results identified three key ingredients for a flexible institutional setting: i.) feedbacks in the system through better information management, ii.) reflexive dialogue and strategic use of projects to generate greater learning opportunities, and iii.) policy level support for sector-wide collaboration through progressive agendas, incentives for innovation and capacity building in stakeholder and community engagement. Further, the results suggest that a deeper understanding of institutional dynamics is needed to enable adaptive governance. The paper provides an analytical framework for diagnosing how greater adaptive capacity might be mobilized through influencing these dynamics.

KEYWORDS

Adaptive governance, adaptive capacity, institutional analysis.

INTRODUCTION

Cities around the world are facing complex water management dilemmas caused by diverse, interrelated factors. Population growth, ageing infrastructure, concerns about human and environmental health and increased frequency and severity of climatic extremes are creating increasingly complex operating conditions (Pahl-Wostl et al 2011). New water management paradigms such as Integrated Urban Water Management (IUWM) seek to address these challenges through an integration of knowledge and multi-objective management outcomes, with flexible technologies and management practices (Pahl-Wostl et al 2011). However, the lack of successful implementation has revealed an incongruence between new management paradigms and the underlying rules, norms, beliefs and assumptions vested in the institutions responsible for structuring and directing management practice (Blomquist et al 2004). In other words, 'Adaptive management... has frequently failed because the existing governance structures have not allowed it to function effectively' (Walker et al 2004:7).

Identifying and describing the urban water institutional setting to understand how it functions to organize and enable (or disable) practice change, is therefore a key knowledge gap (Young 2010). Scholarship has emerged around the concept of adaptive governance to explain and examine this issue of practice change (Huiteima et al 2009), focusing on social learning as the primary mechanism for generating the capacity to adapt (Bos and Brown 2012) and producing benchmarking tools to identify where such a capacity lies (Gupta et al 2010). There is growing recognition that this scholarship could benefit from an institutional perspective of governance regimes, to emphasize the relationships between these structures and how they organize society, with particular attention to how they adapt over time (Bartley et al 2008; Engle 2011). Scholars argue that a dynamic understanding of these complex processes of adaptation will aid development of the conceptual tools to diagnose governance failures and to navigate toward more sustainable societies (Ostrom and Cox 2010; Rijke et al 2012; Ferguson et al in press). An institutional perspective would also help to address critiques of adaptive governance that its focus on governance regimes misses the role of power relations (Sandström 2009) and the part that distributed actor agency plays in such processes of societal change (Eisenack and Stecker 2012).

Institutions can be described as socially constructed logics that societies use to make shared sense of reality and to act collectively. These shared meanings manifest in values, expectations, norms and problem frames (informal institutions) that underlie the creation, legitimization and enforcement of rules, regulations and laws (formal institutions). This study views institutional settings as dynamic interplays between formal and informal institutions (Helmke and Levitsky 2004), resulting in the on-ground practice of managing urban water (Bartley et al 2008; Huiteima et al 2009; Young 2010). Within this interplay, processes occur to change understandings, meanings, and assumptions over time. Eventually, formal institutional structures are reformed to align with this change. Institutional adaptive capacity, must address the duality of institutions acting as stabilizing structures in society while also accommodating the adjustment of societal needs and the actions to achieve them in response to changes in the operating environment. Therefore, a deeper understanding of how adaptive capacity can be instilled within an institutional setting, to create systemic change, is needed to deal with challenges over time (Young 2010). This paper takes up this issue, using an adaptive capacity perspective of institutions to examine how the urban water sector in Perth, Western Australia, responded to a prolonged drought. This study contributes insight into the functional characteristics of institutional settings, to overcome the systemic challenges they pose and integrate flexibility and adaptability into these governance arrangements.

METHODS

The case study method of Yin (2009) was applied to examine the underlying day-to-day practices and interactions of the institutions within the urban water sector of Perth, the capital city of Western Australia.

Case study context

Below-average rainfall since the mid-1970s has significantly changed operational conditions for supplying water to Perth citizens. Greater extraction from groundwater supplies has ensured water supply, but, with sustainability of this source questionable, a portfolio of options to secure supplies has been adopted (Water Corporation 2009). These include demand management, desalination, water trading, experiments with aquifer recharge schemes, and potential inter-regional transfers. This 'security through diversity' is a significant shift from the infrastructure, management techniques and philosophical standpoints of current centralized, reticulated supply systems. Tension between rhetoric and entrenched solutions in

Perth has been identified (Werbeloff and Brown 2011). Thus, practice changes are unlikely to sit comfortably within current formal institutions, which have evolved to legitimize past practices. Processes of adjustment to find congruence between new management practices and legislation and regulations legitimizing their implementation are likely to be underway. Therefore, the case of Perth provides an opportunity to explore processes of institutional adjustment and to identify the capacities and dynamics that underscore them (for more detail on the Perth case context, refer to Bettini et al 2011). This study forms part of a larger multi-case research project, of which Perth provides an illustrative case.

Analytical framework

The study sought to describe how the urban water sector in Perth responded to drought. This required understanding the dynamic interplay between the formal and informal institutions structuring the city's urban water management practice. Other scholars have identified the lack of conceptual tools that can capture structural components of a system along with the functional dynamics within it (Ostrom and Cox 2010; Ferguson et al in press). Using structuration theory (Giddens 1984), the urban water sector can be understood not only as institutional rules that shape and guide actions, but which also enable actors to change these rules. In this study, two institutional scholarships were drawn together to provide an analytical framework. The Institutional Analysis and Development (IAD) Framework (Ostrom 2005) described the institutional setting, while Institutional Work Theory (Lawrence and Suddaby 2006) added a dynamic aspect by focusing on the agency of actors. The key concepts behind these two scholarships are defined below:

Unit of Analysis: Rules-in-use are various laws and social conventions that guide and shape the way actors (individuals, networks, organizations) act and interact. These formal (documented) and informal (tacit) rules constitute the institutional setting (Ostrom 2005).

Institutional Dynamics: Institutional work consists of the activities that actors undertake, influencing the rules-in-use. Lawrence and Suddaby (2006) identify three types of institutional work:

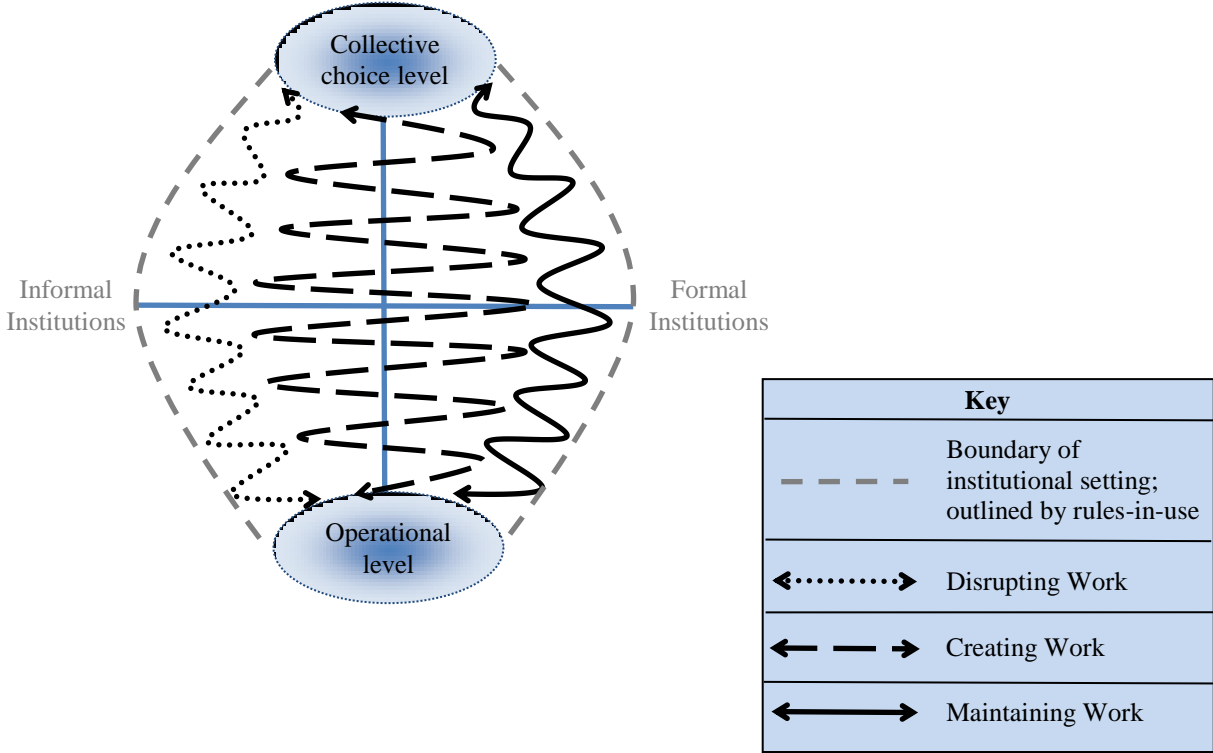
- *Maintaining.* Conforming to current rules-in-use, thereby enforcing their legitimacy.
- *Creating.* Generating new rules-in-use by questioning the assumptions and conventions underlying current rules-in-use.
- *Disrupting.* Explicitly challenging current rules-in-use or undermining their legitimacy, creating an opportunity for institutional change.

Institutional Levels: Ostrom (2005) defines institutional settings as nested sets of rules-in-use, guiding activities at different levels. There are two levels relevant to this study:

1. *Operational.* In this study, this level involves day-to-day water service delivery, described by rules and regulations and their interpretation by practitioners. Water service providers and resource managers predominantly conduct institutional work at this level.
2. *Collective Choice.* At this level, day-to-day operational rules, which are described in strategic planning, policy and political processes, are monitored, evaluated and sometimes altered. As new rules-in-use must be understood and shared collectively in order for them to become legitimate and enforced, this institutional work is generally conducted by executive management within organizations, policy makers and regulators, in consultation with operational actors and broader stakeholders, such as the public.

These concepts are used to understand the various processes of change occurring within the urban water institutional setting (see Figure 1) and to provide the analytical framework for exploring the dynamics of change.

Figure 1: Analytical framework of Institutional Dynamics.



The different levels of institutional activity (y axis) are bounded by both formal and informal institutions (x axis). The three forms of institutional work mediate between these levels, enacting both types of rules-in-use to manage urban water at an operational level, or generating interplay between operational and collective choice levels and/or formal and informal rules-in-use to alter this setting. Maintaining work enforces formal rules and regulations, thus conforming to these rules-in-use. In contrast, disrupting work seeks to challenge and undermine formal institutions, relying on informal rules beyond the sanctions imposed by formal rules to do so. Creating work mediates between these two, questioning formal rules with insights from disruptive activities, and using passive strategies of mimicry, advocacy and education to ‘bend’ the formal rules to accommodate and eventually legitimize these new ideas.

Data collection and analysis

The research was conducted in three phases. The first aimed to understand the broader operating context of the urban water management. The second sought to identify the institutional setting that underpinned practices, including tacit conventions and assumptions shaping the sector’s drought response and the dynamic interplay between these and formal governance arrangements. The final phase described some of these dynamic processes by examining the actions and strategies of actors navigating this setting and how their institutional work altered the rules-in-use. The methodological approach for each of these three phases is described below. The data and their interpretation were validated by individual participants at the end of phases 1 and 2 and by participants at a workshop at the conclusion of phase 3.

Phase 1: Semi-structured interviews were conducted with urban water professionals of five or more years experience from a range of water management roles (n=10). Interviews identified management changes occurring as a result of the drought, how changes came about, and key challenges the sector faced. A modified form of axial coding (Strauss and Corbin 1998) was applied to transcripts, which revealed themes or domains of important influences affecting Perth's urban water sector. These domains of change were used to focus the analysis of data in subsequent phases. Domains were described by drawing together the narratives of interview participants, supported and enriched by content analysis of various secondary sources.

Phase 2: This phase sought to describe the institutional setting of water management in Perth. The informal elements of this setting, i.e. problem frames, norms and professional conventions, lie within the tacit knowledge of practitioners. Thus, a method was developed to identify and draw on their experiential knowledge. This involved three activities conducted at workshops with practitioners. The first activity provided participants with time and space to reflect on positive and negative influences on their professional activities and experiences. The second activity used a focus group approach to open discussion of these influences, identify common or contrasting experiences, and draw out the moral codes, decision logics and other implicitly shared understandings behind professional practice (Ambrosini and Bowman 2001). Thirdly, qualitative conceptual mapping techniques (Petrucci and Quinlan 2007) were used to connect the different influences and further draw out their implications for contemporary water management practices. Three workshops were conducted with a total of 21 participants, who responded to an open invitation. Participants held roles from operational to senior executive levels and included practitioners from local and state government (water, environment, planning and health areas), the water utility, natural resource management authorities, land developers, private consultants, and peak industry bodies.

Phase 3: The final phase explored the domains of change identified in phase 1 in more depth using data from phases 1 and 2. Interview transcripts and supporting data from workshop activities were coded using the concepts described in the analytical framework as theoretical codes (Strauss and Corbin 1998). This enabled an exploration of the way Perth's institutional setting functioned, by understanding the actions of actors within this setting and how these served to maintain, create and/or disrupt the rules-in-use. Based on the coded data and using the contextual narratives (phase 1) and concept maps (phase 2) to compare and contrast the results, institutional dynamics were identified and described for each domain. Complementary and contradictory accounts were also identified to further refine the interpretations. The insights from the research data allowed, these institutional dynamics to be assessed, using a traffic light system. This indicated the influence (significant, limited or insignificant) of each type of institutional work (maintaining, creating, disrupting) within each domain, thereby providing an overall snapshot of the influence of institutional dynamics in Perth's urban water sector, with supporting commentary and illustrative maps.

RESULTS AND DISCUSSION

The domains of change in Perth's urban water institutional setting in response to drought were identified during phase 1 of the research. These are listed below:

- *Governance setting*: Regulation, legislation, levies, policies and other formalized incentives and disincentives that shape the industry's operational environment.
- *Policy direction*: The purpose of water management in society, articulated and communicated in a policy agenda subscribed to across Government.

- *Inter- and intra-organizational relations*: The relationships and working culture of organizations across the urban water sector.
- *Strategic support*: Managerial support for reinterpretation of roles and responsibilities, and networks of frontrunners to disseminate and champion innovations.
- *Discourse*: Public debates and perceptions of water management, as understood by practitioners. Professional discussions on the beliefs, cognitive frames, professional identities and other assumptions underlying the current water management paradigm.
- *Information and feedbacks*: Information on system performance, opportunities, emerging issues and pressures from the broader contextual environment in which the urban water industry is situated.
- *Space for innovation and learning*: The culture of learning and experimentation across the sector, and the supporting structures provided by organizations and individuals for such activities.
- *Professional capacity*: Skills, capabilities and technical knowledge to manage urban water systems, and to develop innovative approaches to this task.

Using the analytical framework and research data, institutional dynamics within these domains were assessed (Table 1), revealing whether the three types of institutional work had a significant, limited or insignificant influence at each level of the institutional setting (operational or collective choice). A significant rating indicates an impact on urban water management practice in Perth. A limited influence suggests that, while activities may be occurring, the dynamic produced had no substantial effect on practice. An insignificant influence indicates that the institutional work occurring had negligible effect on the way the overall water sector operated.

Table 1: Institutional Dynamics in Perth

Institutional domains	Operational Level			Collective Choice Level		
	Maintaining	Creative	Disruptive	Maintaining	Creative	Disruptive
<i>Governance Setting</i>						
<i>Policy Direction</i>						
<i>Inter/Intra-org relations</i>						
<i>Strategic Support</i>						
<i>Discourse</i>						
<i>Information and feedbacks</i>						
<i>Innovation and learning</i>						
<i>Professional Capacity</i>						
Key:						
Significant	Dynamics had an impact on urban water management practice					
Limited	Dynamics had no substantial effect on practice					
Insignificant	Dynamics had negligible effect on the way the water sector operated					

Analysis of the interview and workshop data (summarized in Table 1) helps to understand the way in which the dynamics within these domains influenced the city's response to drought. For example, it can be clearly seen that maintaining dynamics prevalent at the operational level, i.e. day-to-day water management activities, are effectively locking the sector into its current practices. Similarly, the limited influence of creative institutional work in the innovation and learning and professional capacity domains at both levels has led to little

innovation in practice. At the collective choice level, a lack of disruptive dynamics has generated no significant driver for reforms to be pursued. Also at this level, few creative dynamics exist to promote alternative practices and catalyze a shift in the current water management paradigm at the operational level.

These results are discussed in more depth in the following sections, with direct quotes from participants used to illustrate the results presented in Table 1. Recommendations based on these results are then discussed to enhance the capacity within Perth's institutional setting to adapt to water scarcity. In addition, these results have implications for current scholarship on adaptive governance.

Maintaining dynamics

Perth's urban water institutional setting is characterized by maintaining dynamics, as shown in Table 1. These dynamics predominate, primarily as a result of problems with feedback from monitoring and evaluation processes. Firstly, within the information domain, participants mentioned the lack of reliable and/or relevant information to inform the development of alternative approaches, and problems accessing information to review or challenge current solutions and the decision-making logics that select them. As a result, feedback informing the water sector of its performance within its operating context and the suitability of its objectives were suppressed.

'It's such a big concern when Water Corporation still hold all the information that will help people actually really work out what the cost-benefit is of these alternative sources of water.' – Consultant

A second significant form of feedback is public perception of water management, represented within the discourse domain. The community's expectations for water management (reliable, safe, cheap water with autonomy over its use) set criteria by which the Government's performance is judged.

'People can look out [at] our river from the city and they can see the dolphins jumping... then they go "What's the problem?"' – State Government, Water Department.

Social norms, beliefs and understandings that underlie community expectations may no longer be realistic under drought conditions. However, due to past political platforms and campaigns, water issues are framed as potential 'failures of Government'. As a result, water managers strive to meet these community expectations, often against their own professional judgment.

Connected to these feedback issues, maintaining dynamics also stem from lack of direction and leadership (strategic support domain). It is acknowledged within the sector that governance arrangements are not responsive to the new environmental conditions and that entrenched practices are becoming inappropriate. However, because of political sensitivities around water, it has been difficult to acknowledge these deficiencies, challenge their inappropriateness, and build the support and momentum for reform.

'The higher levels are scared of getting sacked.' – Peak Industry Body

Without the cohesion provided by a shared understanding of the water management problem, and vision and leadership support to address it, the sector suffers confusion over the appropriateness of practices, and competing agendas arise. The coping strategy is to fall back on formal organizational positions, rules and processes, as, being embedded in current formal rules, these practices are not subject to risks, challenges or penalties.

Creating dynamics

The corporatized arrangements for water management in Perth do not encourage the creative dynamics needed to improve water management techniques through innovation (innovation and learning and governance domains). Water management has been separated functionally and philosophically into distinct services (supply, sewerage and drainage) to be delivered in optimized ways. Organizations delivering services are penalized if they operate outside the prescriptions of their licenses. Thus, they have little room to be inventive or to question service objectives.

'We don't have any government position in relation...alternative water supplies; it's got to compete with our current one.' - Water Utility

This prescriptive structure makes it difficult to alter objectives for water management in response to changing circumstances, for example, to shift to multi-functional drainage systems to harvest stormwater, as other Australian cities have done in response to drought. In Perth, due to the maintaining influences in the governance domain, objectives can only be adjusted through legislative reform.

'...until you change the policy, change the guidelines, change the standard... then the implementers will continue to implement.' – State Government, Water Department

A Department of Water has been created to take overall responsibility for water resources management but has not developed professional capacity, public support or political will to overcome maintaining dynamics (i.e. creative activities in policy direction, strategic support and professional capacity domains).

'The Department of Water is still an embryonic organisation, they're still building capacity.' - Researcher

Alternatively, creative activities can focus on changing the normative and cognitive assumptions behind legislation and regulation as a starting point for reform. However, in Perth, due to a long, proud history of the water professional's role in State development, there is a strong sense of professional identity connected to current management philosophies. To question or challenge the assumptions underlying professional practice threatens this identity.

'Everyone knows what their comfort zone is, what they know and love and have been doing for the last 30 or 40 years.' – State Government, Water Department

Some actors use formal rules to undermine or discredit creative and disruptive activities, to protect their sense of professional identity.

'... people 'pushing back' and only doing what's strictly in their job description...' – NRM agency

This generates a strong maintaining influence in the professional capacity domain that counters creative work needed in discourse, strategic support and innovation and learning to reassess the underlying beliefs, assumptions and problem frames of water management practice.

Disrupting dynamics

Questioning and challenging current practice is limited, due to the lack of public acknowledgement that the drought is putting water use practices under pressure and the political, organizational and professional sensitivities around water management (discourse, strategic support, inter-intra organization relations and professional capacity domains). This

creates powerful disincentives for disruptive activity, as actors expose themselves to formal and informal sanctions.

'No-one will make the first step...no-one's going to go over the trench because they're going to, the machine guns are going to mow you down.' - State Government, Water Department.

This phenomenon of professional agency entrapment has been identified in other cases of urban water crises in Australia and internationally (Brown et al 2011; Werbeloff and Brown 2011). As a result, local practice innovations occur but they are implemented *ad hoc* and not highlighted or connected to develop professional discussion about the limitations of traditional practice.

'...they do some really good stuff and yet unless it's business as usual, you don't really hear about it.' - Consultant

Without connecting the learnings from these projects with messages about the dissonance between formally and informally accepted practices, broader acceptance and momentum for institutional change is not built at the necessary collective choice level. This type of disruptive activity requires strategic maneuvering by leaders or champions (strategic support), but as discussed, water is too politically sensitive in Perth for such activities to occur.

'And people don't quite know how to challenge it and work their way through with you know, new sort of opportunities.' - Consultant

Recommendations

This study revealed that greater opportunities for creative and disruptive dynamics need to be generated in Perth to balance the dominance of maintaining dynamics. Analysis of dynamics within key domains of the institutional setting identifies where change is needed and where systemic interventions might generate preferable dynamics. For example in Perth, some of these leverage points and intervention strategies may include:

Creating system feedbacks by:

- Improving information collection and dissemination and addressing knowledge gaps.
- Instigating monitoring and reporting aimed at demonstrating the efficient, effective performance of the water sector overall, beyond service delivery objectives.
- Working towards better transparency and accountability throughout the sector.

Learn how to learn together by:

- Encouraging and facilitating professional discourse to generate shared problem frames, cognitive understandings and norms.
- Identifying projects where collaboration can share technical learnings as well as the governance implications of these initiatives.

Foster action at the Collective Choice level by:

- Providing direction to and support for change experiments in clearly formulated, forward-looking policy agendas, and use these to open a collaborative dialogue across the sector.
- Identifying and addressing the perceived risks and sanctions of doing things differently, and providing incentives to encourage champions of innovation to emerge.
- Providing capacity building in stakeholder and community engagement skills to activate networks and build momentum for change.

Further, the Perth case illustrates that efforts of reform through IUWM approaches have only been partially successful because of gaps in these dynamics. By focusing on reforming formal legislative and regulatory rules – and not adjusting the informal rules-in-use – past efforts have not generated the fundamental change (paradigm shift) in the institutional setting needed to create and mainstream practice change.

These results also revealed a contrary perspective to that presented in adaptive governance literature (Folke et al 2005; Young 2010): a crisis may not be sufficient to create a window of opportunity for change. Despite a significant crisis in water availability, Perth has been resilient to scarcity through the stable, certain and trusted way in which to respond to drought. Over time, the predominance of maintenance dynamics may ‘lock-in’ Perth to these practices, making the city vulnerable to future changes. In this crisis, Perth has been unable to utilize the opportunities provided by scarcity to reconsider and, where necessary, revise its water management practices (Keath and Brown 2009). The results of this study suggest that creative and disruptive dynamics are needed to review, question and sometimes challenge the suitability of current water management approaches. Therefore, a capacity for change within the institutional setting is critical to preparing for, utilizing and even generating opportunities: external drivers and pressures like crises alone may not be adequate to trigger change.

CONCLUSION

This research, through its focus on the dynamics within Perth’s urban water institutional setting, revealed preliminary insights into processes and characteristics of adaptive governance. The analysis identified significant maintaining dynamics within particular domains of influence, such as strategic support, governance arrangements and inter-and intraorganizational relations. However, the analysis goes beyond identifying barriers, revealing the importance of disrupting and creative dynamics within the rules-in-use (or being part of an adaptive process). The former is crucial to challenge entrenched understandings, beliefs and assumptions, while the latter is needed to form new cognitive frames and norms and the supporting rules-in-use needed to underpin practice change. The case revealed that, for an adaptive capacity to be generated through these creative and disruptive dynamics, institutional work that catalyzes and brokers connections between operational and collective choice levels is also necessary. These features enable the reflexivity and social learning that are recognized as cornerstones of adaptive governance and are key to governance arrangements that can adapt the management of urban water resources over time.

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