



Adaptive cities? Institutional innovation under climate change

A global survey of 96 cities

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EXECUTIVE SUMMARY:

Introduction

Are cities sufficiently prepared for climate change? Answering this question critically involves considering *institutions*. Institutions are the rights, rules and procedures that influence how multiple actors interact to make decisions and take action. This can include policies and laws, organizational setups, and coordination arrangements. Institutions influence to a large extent whether or not cities are adaptive in the face of evolving pressures, shocks, and societal expectations under climate change. Yet existing institutions are widely considered to be inadequately prepared for these challenges. ***Institutional innovation is needed to enable cities to better prepare for climate change impacts and risks.***

Objectives

This report presents an overview of findings from a global survey of 96 cities across the globe exploring institutional innovation for urban water adaptation. It assesses broad patterns in the types of institutional innovation occurring in cities, possible explanatory factors for these changes, and their potential outcomes/effects. This report is the first step in disseminating survey results while further in-depth analysis is being conducted. The report aims to provide broad insights to policymakers, practitioners and researchers that can inform efforts to create adaptive cities in order to safeguard against water-related risks and vulnerabilities under climate change.

Key findings

There appears to be relatively vibrant activity occurring regarding the institutional dimensions of urban water adaptation. Types of institutional innovation occurring include:

- Changes in *policy and legal frameworks* that structure decision-making (e.g. policies, regulations, laws),
- Changes in *policy instruments* for implementation (e.g. planning, programs, communication, pilot projects),
- Changes in *organizational setups* to meet new objectives (e.g. creation of new sub-departments or staff roles), and
- Changes in *coordination arrangements* between different actors (e.g. partnerships, knowledge sharing, forms of participation).

This appears to be achieving some modest progress to date in addressing various climate-related risks (e.g. urban water supply, flooding, and sewage/sanitation risks) and increasing social preparedness (e.g. increased awareness among decision-makers).

A range of explanatory factors for institutional innovation seem to matter, including: problem recognition by different actor groups, internal drivers to address adaptation within urban water governance systems, knowledge generation and use, alignment of agendas between different actors, and leadership by key individuals.

Altogether, the findings give grounds for cautious optimism that progress is being made. However, this conclusion is tentative: more work is needed to analyze the fine-grained patterns and variability between individual cities and regions, and to assess wider effects on urban water governance systems. Are the changes identified just 'low hanging fruit' (e.g. minor tweaks to existing approaches) or deeper changes that enable urban governance systems to be more adaptive in the face of unfolding change?

Implications

Key implications are:

- Institutional innovation is likely to be needed in many cities to create more adaptive urban water governance systems under climate change.
- Institutional innovation can take different forms, which may be relatively easier or more difficult to bring about.
- It is important not to stop with 'low hanging fruit' innovations, but to also consider whether there are wider/deeper institutional arrangements that may need to be changed. These could lie within or beyond the city-scale.
- A broad range of risk reduction and social preparedness outcomes should be considered. Systematic monitoring and evaluation approaches are needed.
- A range of factors may potentially drive institutional innovation; those explored in this report may provide ideas for areas to be targeted within a specific city.
- Dominant narratives about cities which imply that they can solve problems independently of other levels of governance may need to be reconsidered.
- Greater attention to social equity outcomes is needed. Evidence from this survey reveals this as one of the most worrying outcome areas at the current time.

Next steps

The main next step is to conduct further in-depth analysis that disaggregates the data on a city-basis, compares cities across different regions and socio-environmental contexts, and analyses *processes* of institutional innovation. Further key questions to examine are: the extent to which institutional innovation can stimulate not only incremental but also more transformative change in urban governance systems; what characteristics of urban governance systems lead to differing propensity to innovate; and what an appropriate balance between stability and flexibility might look like within a well-performing adaptive urban governance system.

1. INTRODUCTION

Are cities sufficiently prepared for climate change? Answering this question involves considering not only technical and economic dimensions, but also *institutions* (e.g. policy and legal frameworks, organizational setups, coordination arrangements). Institutions play a key role in shaping how decisions are made. For example, whether or not new knowledge is taken on board, who's interests are considered, and with what consequences. Institutions influence to a large extent whether or not cities are adaptive in the face of evolving pressures, shocks, and societal expectations under climate change. However, existing institutions are often considered to be inadequately prepared for climate change. This is reflected by a growing catalogue of institutional failures in cities across the world exposed by floods, droughts, and other growing climate impacts. Institutions need to cope with both new surprises as well as chronic pressures building up over time. ***Institutional innovation is needed to enable cities to better prepare for climate change impacts and risks.*** Yet what types of institutional innovation are needed, how does it occur, and what effects might it have?

1.1 Institutions matter

Institutions shape the ways in which decisions about climate change adaptation are made, or not made. Institutions are comprised of the rights, rules and procedures (Young et al., 2008) that influence the ways in which different actors interact to make decisions. This includes both formal and informal aspects. For example, formal aspects could involve policy and legal frameworks specifying roles and responsibilities that different actors have for taking adaptation action. Informal aspects could involve relationships between different actors that help to coordinate their actions but are not be formally written down (e.g. practical working partnerships). Institutions create patterns in the way decisions are made. These can be slow to change, or may change rapidly following a crisis (e.g. drought, flood, social crisis). However, typically institutions are considered to be 'sticky' and difficult to change; not only is policy reform often difficult, but established organizational cultures and broadly-held ideas often also take time to shift (Beunen and Patterson, 2016; Jordan and Matt, 2014). Yet as the impacts of climate change are increasingly felt, institutional innovation becomes increasingly important and urgent.



Institutional innovation is needed just as much as innovation in the physical and technological infrastructure of cities. Institutions must be capable of taking into account new knowledge, uncertainties, risks, and societal objectives as the impacts of climate change unfold. Yet this is complicated because it involves considering multiple actors (e.g. government, industry, civil society, research), multiple levels of governance (e.g. municipal, metropolitan, state/provincial, national, international), and multiple sectors (e.g. water, health, environment, mobility, finance). Institutional innovation thus includes – but also goes far beyond – single organizations, forcing us to consider the complex inter-relationships between many different actors, levels, and sectors.

Institutional innovation in the context of this report refers to intentional changes in institutions that allow a city to better deal with climate change.

This could include:

- Changes in *policy and legal frameworks* that structure decision-making,
- Changes in *policy instruments* for implementation,
- Changes in *organizational setups* to meet new objectives, and
- Changes in *coordination arrangements* between different actors.

1.2 Urban water adaptation

One of the most significant ways that climate change will be felt by human society is through impacts on water systems. Climate change creates an urgent need for adaptive institutions that can anticipate and respond to increasing pressures on water systems. This means taking account of changing uncertainties, risks, and vulnerabilities, while also steering water systems towards desirable outcomes (e.g. sustainability, protection of human wellbeing/safety, enhancing equity and justice). It is commonly recognized in the academic literature that failure to sustainably manage water, despite ongoing efforts



over decades, is largely due to weaknesses and gaps in governance rather than a lack of technical knowledge alone (Araral and Wang, 2013; Pahl-Wostl et al., 2012). These challenges are magnified under climate change. Cities are a key focus for climate change adaptation because many competing interests and risks linked to water systems

converge in cities (e.g. urban water supply, droughts, floods, sewage/sanitation, water quality, human development). Of course, there are also many other adaptation challenges in cities, such as heat and health impacts, biodiversity and ecosystem health, and pressures on a wide range of infrastructure systems (e.g. energy, mobility). However, even these are often closely tied to water. Thus, *urban water adaptation* is a key focus of attention.

1.3 The global role of cities

Cities are increasingly recognized as having a key role in addressing global problems such as climate change. There are many reasons for this: cities are argued to be more agile than national governments, more readily able to experiment and advance practical solutions, and more responsive to citizens through being closer to people's lives (Barber, 2013). Yet we also know that cities do not exist in a vacuum: they are embedded within multiple levels of governance, subject to authority from higher levels of government which might either enable or constrain climate action, and may experience their own leadership failures (Johnson, 2018). Thus, while it makes a lot of sense to focus on cities as nodes of innovative action, we must also take a broad view to recognize interactions within and beyond the direct scope of the city.

At a global level, cities have long been active in debates about sustainability, and are now also recognized as key actors in the broad landscape of climate action. For example, the 2015 Paris Agreement acknowledges a key role for non-state actors such as cities in global climate change responses. The Sustainable Development Goals (2015-2030) include a goal specifically on cities. The UN-Habitat III 'New Urban Agenda' (2015-2025) advocates the importance and transformative potential of cities for tackling a wide range of global development challenges linked to urban areas. It is widely noted that up to two-thirds of the global population may come live in cities over coming decades. Cities are thus global hotspots for addressing climate impacts and risks, and also for realizing opportunities for leveraging benefits of climate change adaptation investments (see also OECD, 2016; World Bank, 2010).



1.4 The focus of this study

This study focuses on the institutional dimensions of climate change adaptation, and specifically *institutional innovation* in cities across the globe. While it is often recognized that institutions and governance systems for many issues are inadequately prepared for climate change, we still do not have a good understanding of exactly *what types of change are needed, and how these changes come about*. **This study provides a systematic global assessment of various types of institutional innovation in urban water adaptation, and possible explanatory factors for these changes.** The survey elicits expert knowledge from key actors in cities to assess the current status and experience of urban water adaptation in practice, much of which is not 'written down' in formal documents. It targets cities that are potential innovators, identified largely through their involvement in city networks, from which wider lessons can be extracted.

This report is the first step in presenting results of the survey, providing descriptive results as initial feedback to policymakers, practitioners, and researchers while further in-depth analysis is being conducted.

2. SURVEY DESIGN AND IMPLEMENTATION

Survey design, distribution, and preliminary analysis was conducted during 2016-2017. The overall process and timing of key steps in the survey development are shown in the flowchart in Figure 1. The development of the survey took inspiration and guidance from several previous city surveys that have been conducted in recent years (see Box 1). This current survey aims to build on prior work, adding-value by collecting new primary data specifically on *types of institutional innovation* and factors explaining the *processes by which it occurs* in urban water adaptation in cities across the globe. This survey is unique in collecting primary data from a diverse range of actors to capture and integrate best-available expert knowledge, and securing multiple responses for most sampled cities to strengthen confidence in the resulting data.

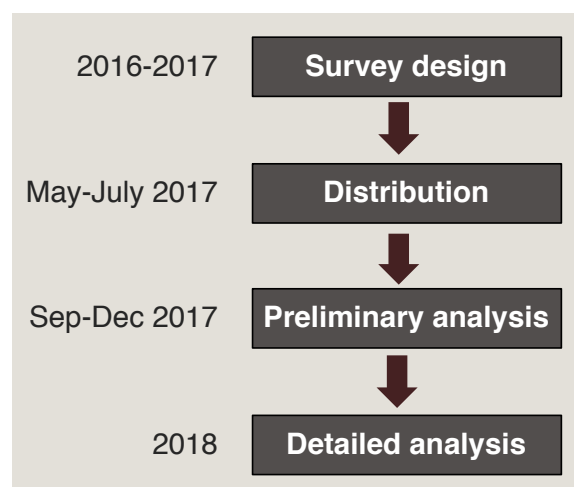


Figure 1: Overall survey process.

Box 1: Previous work that this current survey builds on:

- OECD (2016) *Water governance in cities* – this written survey of cities in OECD countries and some emerging economy nations comprehensively mapped characteristics of urban water governance systems and socio-spatial contexts, and identified key governance gaps and needs across these cities.
- Aylett (2014) *Progress and challenges in the urban governance of climate change* – this web survey engaged municipalities globally within the ICLEI network, studying local government responses to climate change (mitigation and adaptation). It focused on climate change planning and implementation.
- Bulkeley and Castán Broto (2013) *Survey of urban climate change experiments* – this survey of documents built a database of urban experimentation. It was formative in laying the foundation for large-scale comparative study of cities, inspiring fundamental new thinking about urban climate governance.

2.1 Survey design

The survey was designed as a web survey (using a commercial package) but also allowed for completion by hand where requested by a small number of respondents. The online format allowed for broad global distribution and ease of completion by respondents. It was a *non-probabilistic survey*, which means that the cities and respondents were not selected according to conventional random sampling methods (e.g. random selection of voters in a poll), but instead targeted cities that are likely to be innovative, and people likely to key experts in these cities to provide rich knowledge and experience. This is a *pragmatic* approach to eliciting best available knowledge, much of which is not written down and thus cannot be accessed through academic or policy/planning documents alone.

The survey was structured to allow respondents to follow the overall logic of the study. The structure of the survey and the topics covered is shown in Table 1 below. The survey comprised 44 questions in total, although these varied between single responses and 'matrix' responses with multiple sub-parts. Questions were almost all 'closed answers' (i.e. selecting an answer on a scale or list, or checking a box), with opportunities and specific requests for open text to complement the closed answer questions to enable respondents to provide further information where necessary. In Section 1 (introductory information) responses were mandatory in order to proceed further, to ensure that sufficient (de-identified) information was gathered about respondents to capture relevant information about their roles/perspectives, and to allow quality control checks. All questions in Sections 2-6 were optional to encourage respondents to continue even if there were specific issues that they did not know about or did not wish to answer.

Table 1: Overall structure of the survey and topics covered by questions.

Survey section	Topics covered
1. Introduction	City, respondent role
2. Context for adaptation	Issues, actors, disturbance events
3. Institutional innovation:	
Types of innovation	Policy and legal frameworks, policy instruments, organizational setups, coordination arrangements
Processes of innovation	Broad characteristics of mechanisms of change
Effects/outcomes	Perceived risk reduction, social preparedness
4. Possible explanatory factors	a) Problem recognition by different actor groups b) Internal drivers to address adaptation c) Knowledge generation and use d) Agenda alignment between different actor groups e) Leadership by key individuals
5. Specific water issues	Attitudes and actions for water supply and flooding (not reported here)
6. Concluding section	Closing, interest in further information

2.2 City selection

Cities were selected based on several criteria: (1) potential to be 'innovative' in regards to urban water adaptation, (2) population size, and (3) global geographical distribution. The overall sequence of steps is shown in Figure 2. The survey targeted cities that are potential innovators in order to learn from these cities and extract insights that may be transferable or relevant to other cities more widely. The initial long-list of candidate cities (approximately 400) was developed by looking at various global city networks and/or similar previous surveys. Several screenings and checking steps were then applied to arrive at the final sample of 122 cities to target. Importantly, the sample was checked to ensure a relatively even global geographical distribution, resulting in a small number of additional cities being added from under-represented regions, which were also relevant to include (i.e. they face water-related urban climate change risks, and may be potential innovators in their regions). Altogether, this selection process aimed to achieve a stratified sample across 6 continental/geo-political regions.

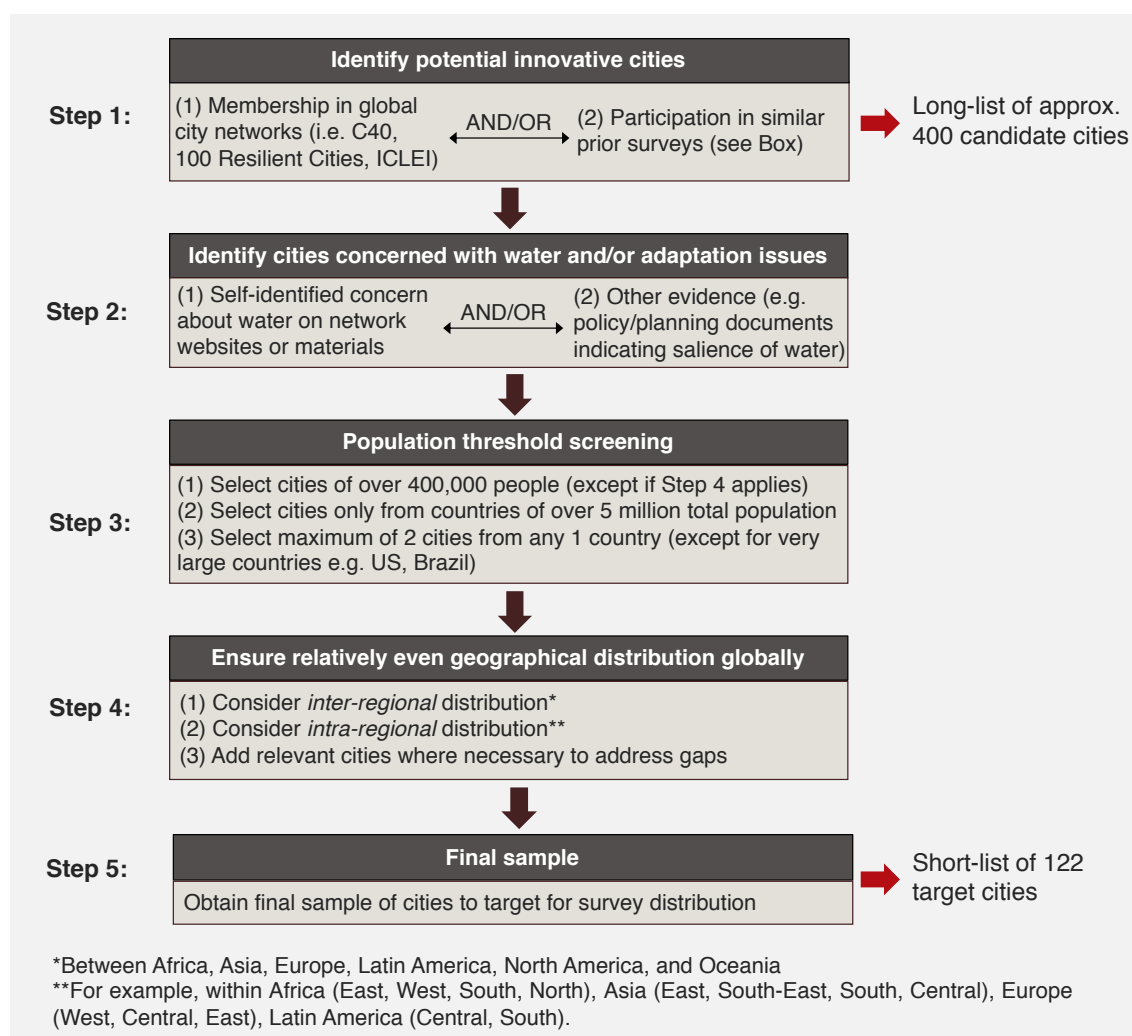


Figure 2: Process of city selection for target sample of cities.

2.3 Survey distribution

A distribution list of experts was built covering all shortlisted target cities, based on existing organizational networks and from publicly available websites and documents (policy/planning, academic). This resulted in a contact list of approximately 2,000 experts (an average of 16 per city). These experts were contacted 3 times: an initial invitation, and 2 reminders (approximately 1 month and 1 week before closing). Additionally, people contacted were invited to send the survey to other relevant colleagues ('snowballing') to ensure both *effective* distribution (i.e. that it reached the relevant experts) and *equitable* distribution (i.e. that as many relevant experts as possible had the opportunity to participate). Participants were provided with an explanation about the content and purpose of the survey, and information about how the data would be used, and how their privacy and confidentiality would be protected. Participants were removed from the contact list at any point if they chose to opt-out from receiving further communications.

The survey was made available in **7 languages** to support wide participation: *English, Spanish, French, Portuguese, Chinese, Arabic, and Russian*. These translations were produced by contracted individuals fluent in each respective language and familiar with the general topics of the survey to ensure appropriate translation of concepts and terms.

3. RESPONDENTS

3.1 Cities

Survey replies were received from respondents in 96 cities across all continents. The objective was to obtain at least 1, but ideally 2 or more individual responses from each city. Obtaining multiple responses for a city helps to increase confidence in the data obtained by allowing assessment of the consistency of responses. It is also important since respondents were drawn from a variety of sectoral perspectives (e.g. government, research, civil society, industry), and therefore may have different insights on activities occurring within a particular city, despite all being experts on adaptation and/or water issues. However, of course the most important criterion is to reach the right people to obtain good quality data – whether this results in a single response or multiple responses.

A summary of the number of city responses obtained across continents at the level of either 1, or 2-or-more responses is shown in Table 2. This shows very good global distribution across all continents, including strong coverage of cities in often under-represented regions such as Africa, Asia, and Latin America. A map of the cities for which responses were obtained is shown in Figure 3 (over page).

Table 2: Summary of responses obtained in cities across different continents.

Region	No. of cities covered	
	At least 1 response (allows inclusion)	2 or more responses (allows higher confidence)
Africa	18	14
Asia (East/South-East)	12	9
Asia (South/Central)	9	6
Europe	26	16
Latin America	13	8
North America	12	10
Oceania	6	5
TOTAL	96	68

3.2 Individual respondents within cities

Individual respondents were drawn from multiple sectors (e.g. government, research, civil society, industry) to tap into relevant experts operating across a variety of roles. This is important because urban water adaptation inherently involves multiple actors across multiple sectors and levels (Section 1). Some surveys target a specific type of actor (e.g. municipal staff) which provides a higher level of consistency in the type of respondents sampled. However, it may miss out on important insights from actors operating within other sectoral roles. This survey takes an 'open' approach in seeking to target relevant expert knowledge 'wherever it may lie'. This is useful because key actors involved in urban water adaptation may differ in different cities – different configurations of key actors might promote urban water adaptation action in one city compared to another. For example, municipalities, state/provincial governments, NGOs and community groups, or industry may take the lead in different cities. However, it makes analysis more complicated because of the need to ensure that data gathered is consistent in nature as much as possible. A summary of the overall set of respondents based on their sectoral roles is given in Figure 4. Approximately 60% of respondents were from policy/practice roles and approximately 40% were from academic roles.

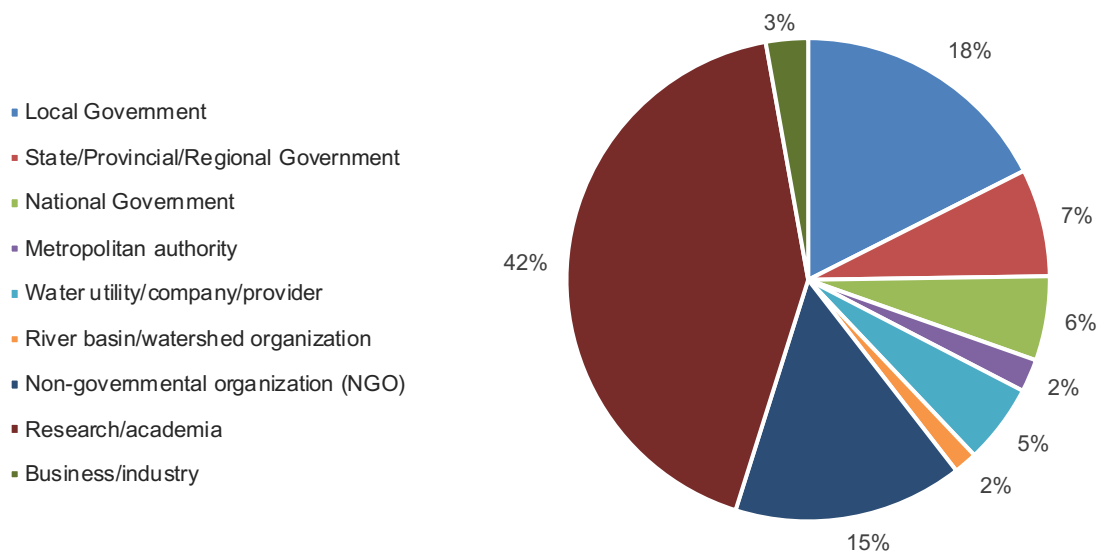


Figure 4: Summary of types of respondents across sectors.

Individual respondents provided data on urban water adaptation activities at a citywide-scale. In some cities the citywide scale corresponds well with municipal boundaries, yet in other cases the metropolitan / urban agglomeration area may include multiple municipal territories. The survey aimed to *elicit expert knowledge* about activities and experiences of their city based on their expert judgment (rather than asking about participants' own attitudes/behaviors, as is typically the case with household or community-level surveys). The focus was on capturing tangible aspects of institutional innovation, as well as less-tangible drivers and processes of innovation (e.g. socio-political dynamics). The total number of completed individual survey responses obtained was n=319. This reflects a response rate of approximately 17%ⁱ.

ⁱ This is the approximate response rate based on the total original distribution list. The 'true' response rate cannot be calculated because the survey distribution method involved 'snowballing' where respondents forward on the survey to other relevant people within their contact networks (Section 2).

4. RESULTS

This section presents descriptive findings based on the aggregated individual responses to the survey. This is the first step in reporting back findings from the survey. Findings presented give a broad overview of key patterns regarding institutional innovation in the set of sampled cities, but do not yet go into detail regarding individual cities.

Results are presented on the total responses for each question, and also disaggregated into the Global North and Global South components of each response. This is a coarse distinction, but it helps to start teasing apart similarities and differences across different developmental contexts. The Global North was taken to include cities in Europe, North America, Australia-New Zealand, and the advanced economies of East Asia. The Global South was taken to include cities in Africa, Latin America, and all other parts of Asia. Of the total of 319 survey respondents, 134 were from the Global North and 185 were from the Global South.

There are two types of charts used to present the results in this section:

- 1) A *frequency chart* (histogram) which shows the number of times a given answer was selected. This is influenced by the differing number of respondents from the Global North and South, and all these questions were optional so not all respondents answered every single question. Nonetheless, in general, we may expect a somewhat higher contribution to these charts from Global South respondents as they were more numerous.
- 2) A plot of *average scores/ratings* for a given factor. This shows the average response for questions that used scale-based answers (e.g. selecting a response on a scale such as: 'none', 'low', 'moderate', or 'high'). This was calculated by taking the average of all scores for a group, plotted on the text form of the response scale.

4.1 Context for adaptation

This section presents findings on four topics: (1) level of concern about various water-related issues under climate change, (2) general orientation towards adaptation issues within cities, (3) experience of environmental or social disturbances that may affect support for urban water adaptation, (4) governance context for urban water adaptation.

1. Level of concern about various water-related issues under climate change.

Multiple water-related issues are a concern in cities under climate change, although some in particular stand out. Respondents were asked to rate their level of concern for various urban water issues, with space also provided for additional issues to be raised (Figure 5). The 5 most highly rated concerns were: *Flooding*, *Sewage/sanitation*, *Urban water supply*, *Ecosystem health*, and *Ageing water-related infrastructure*. This is the case for both Global North and South respondents, but to differing extents. A higher priority is afforded to these issues by Global South respondents. This supports previous research identifying these as key issues for cities in adapting to climate change (e.g. Aylett, 2014; OECD, 2016). Importantly, it highlights ageing infrastructure as a strong concern, which is not often addressed in the academic literature on adaptation.

There are noticeable differences between Global South and North respondents on issues of *drinking water quality* and *lack of water-related infrastructure*, with higher responses for Global South respondents. This may be due to development-related issues in the protection of water quality and provision of water infrastructure. The apparent low overall concern for 3 issues relating only to coastal cities (*sea-level rise*, *coastal storm surges*, *saltwater intrusion*) is skewed by cities in the sample that are not situated in coastal locations. For issues of sea-level rise and coastal storm surges, there were higher scores for Global North respondents. A possible explanation for this difference may be a longer-term perspective afforded by higher development status.

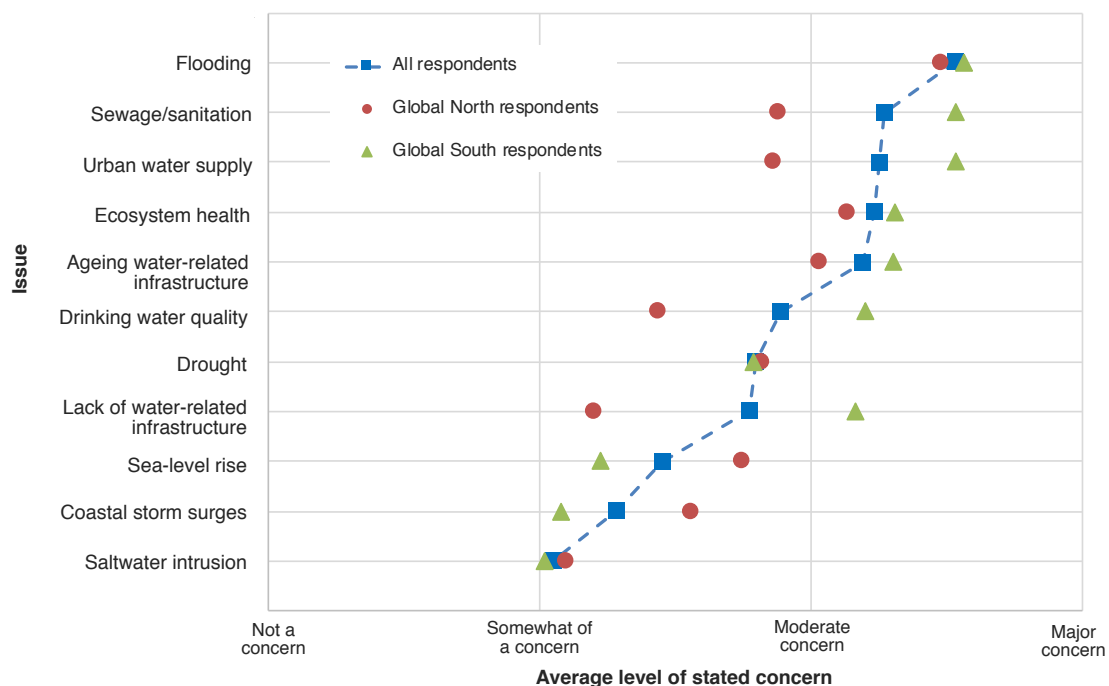


Figure 5: Urban water issues of concern under climate change.

2. General orientation towards adaptation issues within cities.

Cities seem to be supportive of the need for adaptation overall. Respondents were asked to rate their level of agreement with a set of 5 statements about how urban water adaptation is typically seen within their city (Figure 6). There was clear agreement that adaptation *is* a concern and that it requires specific attention (*statements a and e*). There does not seem to be a perception of conflict between adaptation and other developmental objectives (*statement d*), which is sometimes identified in the academic literature as a difficulty for pursuing adaptation action. Yet it does seem that urban water adaptation may often be pursued under other terms (*statement b*) or within existing sectoral processes (*statement c*), as commonly highlighted in academic literature (e.g. under terms such as ‘mainstreaming’ and ‘integration’). This highlights the importance of recognizing potentially diverse actions within the remit of adaptation in practice.

The findings here may be biased to some extent by the fact that respondents are experts in adaptation and/or water issues. Nonetheless, they point to a perhaps greater-than-expected degree of agreement about the importance of adaptation. There was little difference between Global North and South respondents, although statements d and e may reflect a slightly stronger imperative for dedicated adaptation action according to Global North respondents.



Figure 6: General orientation towards urban water adaptation in respondents' city.

3. Experience of disturbance events that may affect support for urban water adaptation.

An increasing number of cities across the world experience disturbance events that may build support for urban water adaptation through direct experience of climate-related problems. Respondents were asked to identify whether their city had experienced a variety of possible environmental and social disturbance events that could impact on their city's willingness to engage with urban water adaptation issues (Figure 7). The most commonly reported disturbance events were *Heavy rainstorms*, *River flooding*, and *Drought*, as well as *Drinking water contamination*, and *Community pressure* to address water issues. Later questions in the survey explored further the effects of these disturbance events (e.g. whether they had been utilized by policy entrepreneurs to advocate for adaptation action). This question helps to understand the recent historical context of cities regarding possible drivers for urban water adaptation.

There are noticeable differences between Global North and South respondents for *river flooding* and *drinking water contamination* events, with both being identified more strongly by Global South respondents. This may be due to development-related vulnerabilities to impacts from weather events. There are also noticeable differences between Global North and South respondents for several socio-economic-political events, i.e. *community pressure*, *economic crisis*, *public health emergency*, and *political crisis*. This indicates that how these types of broader events may be intertwined with adaptation in Global South cities in different ways compared to Global North cities.

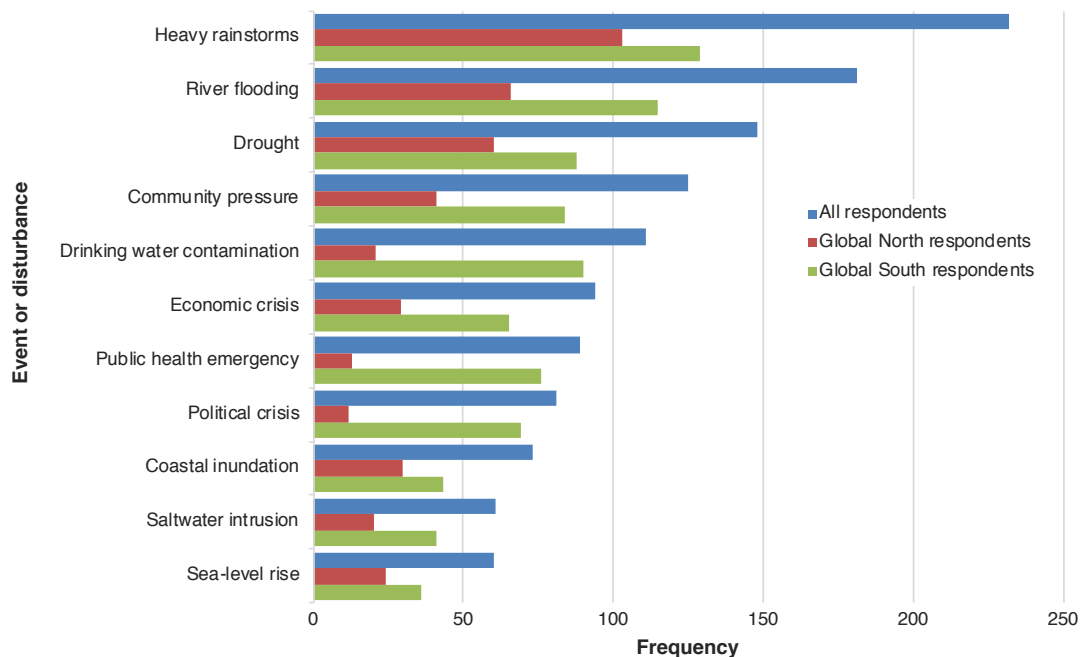


Figure 7: Major events or disturbances experienced in the last 10-15 years.

4. Governance context for urban water adaptation.

The multi-sectoral and multi-level context for urban water adaptation is reflected in the roles of **institutional levels**, **funding**, and **leadership**. Respondents were asked to identify the importance of institutional arrangements at different levels (Figure 8), the main sources of funding available (Figure 9), and the main sources of leadership shown to date (Figure 10), for urban water adaptation in their city.

All institutional levels were considered important, with a decreasing trend moving from the city-scale to broader levels. The strongest importance was attributed to *Local Government* and *Metropolitan* levels. This shows a clear recognition of the importance of the metropolitan scale (100 Resilient Cities, 2017), which may be broader than the municipal/local government scale. Higher levels of government were also scored relatively highly (i.e. *State/Provincial/Regional Government* and *National Government*). Interestingly, Global North respondents scored the importance of *National government* lower than Global South respondents. This might indicate a greater role for national governments in urban adaptation in Global South cities. Levels beyond the national (i.e. *Transnational* and *International*) were less important than the within-country levels, although still relatively important overall. This is likely to be due to their more indirect linkages to cities.

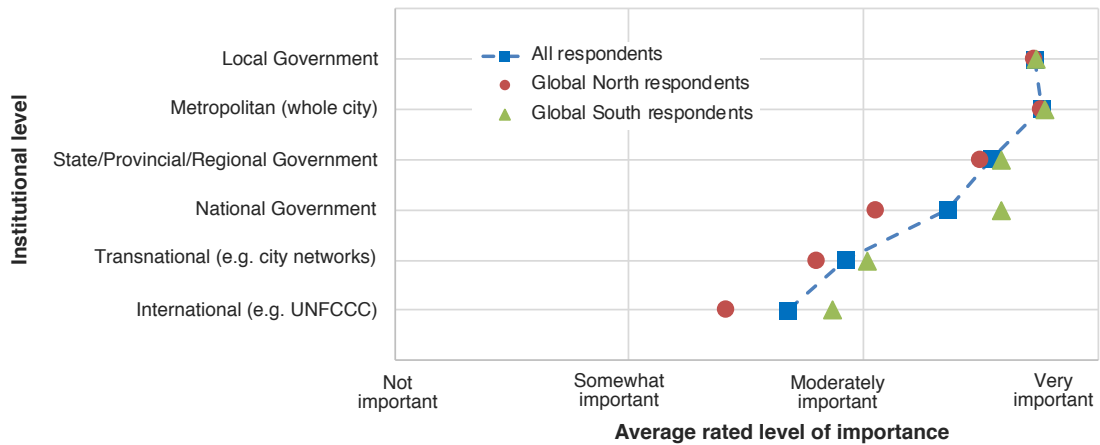


Figure 8: Perceived importance of institutional arrangements across multiple levels.

The main sources of funding identified were: *National Government*, *Local Government*, *Water Utility/Company/Provider*, and *State/Provincial/Regional Government*. This indicates a strong importance for sources of public funding within countries from entities at multiple levels. This may be due to the largely public good nature of urban water adaptation. Responses to these four categories were slightly lower for Global South respondents. However, Global South respondents quite strongly identified *Global Development Organizations* and *International NGOs*, and a perhaps slightly larger role for *Research/Academia* than Global North Cities.

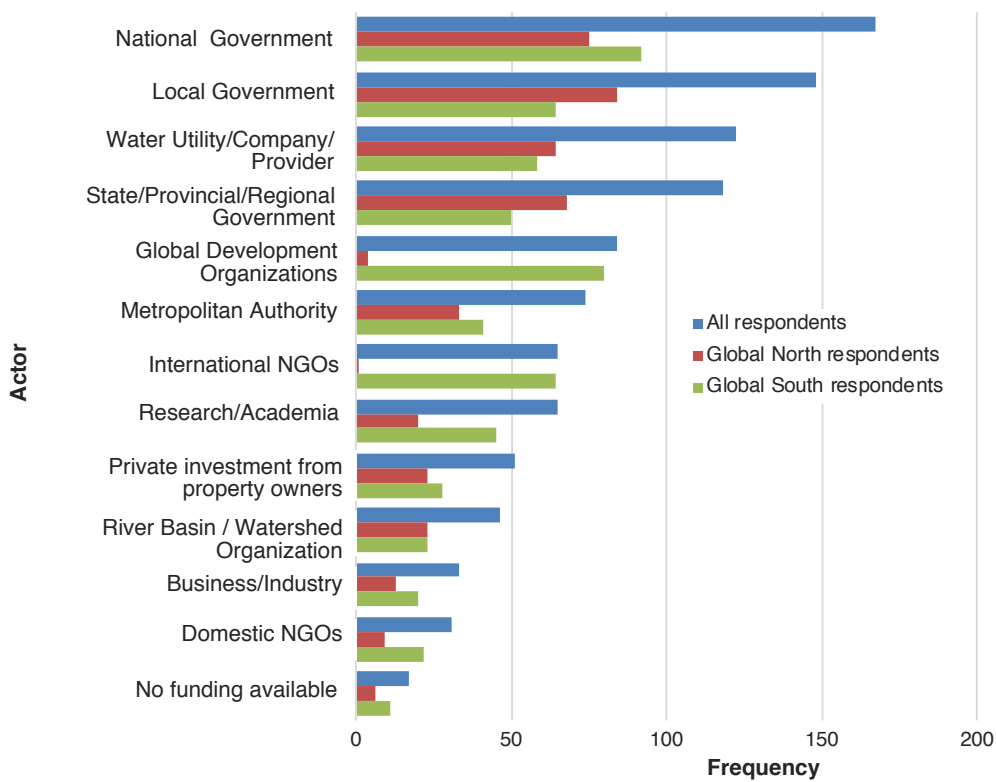


Figure 9: Main sources of funding for urban water adaptation.

The main sources of leadership identified were from *Local Government*, *Water Utility/Company/Provider*, *Research/Academia*, and *National Government*. Three of these categories align with those identified as the main sources of funding, with *Research/Academia* also identified as a main source of leadership by both Global North and South respondents. Interestingly, Global South respondents identified *Local Government* and *National Government* equally, in contrast to Global North respondents who identified *Local Government* noticeably more strongly than *National Government*. This may indicate differing views on the leadership role of Local versus National governments between the Global North and South.

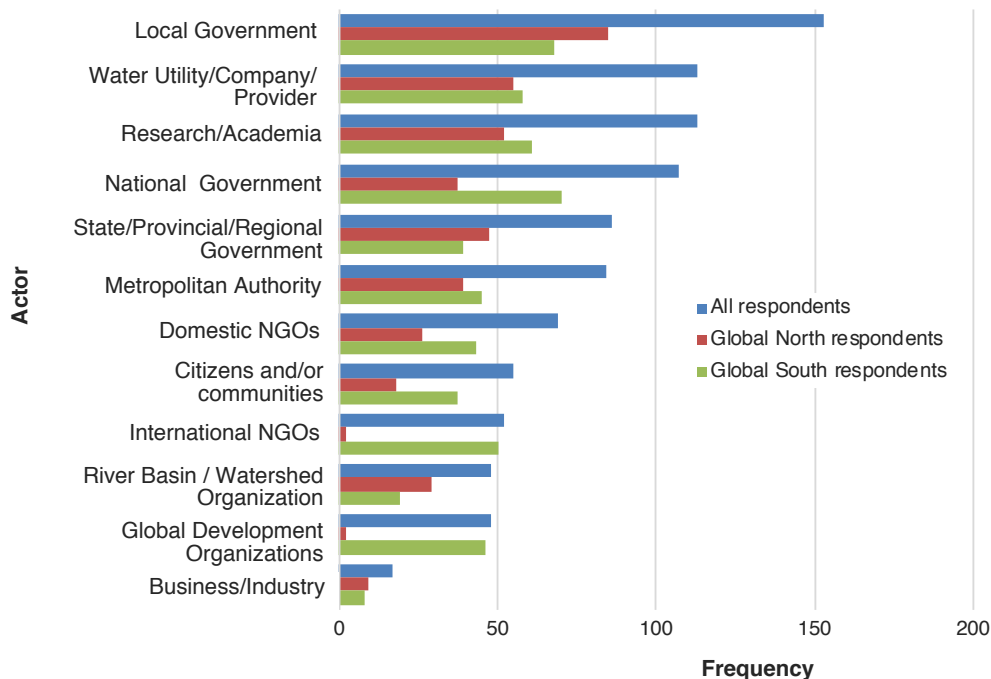


Figure 10: Main sources of leadership on urban water adaptation to date.

Overall, the importance of multiple levels, actors, and sectors for urban water adaptation is confirmed by these empirical findings. This aligns with the starting assumption in Section 1 of the need to pay attention to these interconnected factors because of the complexity of urban water adaptation. Yet it also indicates that urban water adaptation continues to be seen largely as a public good issue. The main actors providing funding and showing leadership are mostly public authorities or organizations.

4.2 Types and processes of institutional innovation

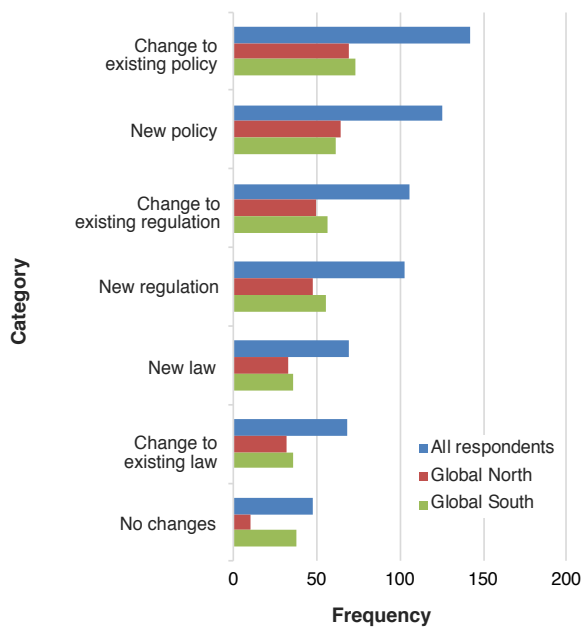
There appears to be relatively vibrant activity occurring in regards to different types of institutional innovation in the sampled cities. Four main types of institutional innovation were surveyed (following Section 1.1): Policy and legal frameworks (Figure 11-A), Policy instruments (Figure 11-B), Organizational setups (Figure 11-C), and Coordination arrangements (Figure 11-D). Respondents were asked to identify if any of these possible innovations/changes had occurred in their city in the last 10 years to support urban water adaptation. They were also asked to provide further information about these changes where possible (in text form), although this is not reported here.

All four types of institutional innovation appear to be active. Broad patterns in the aggregate responses on each type of institutional innovation are:

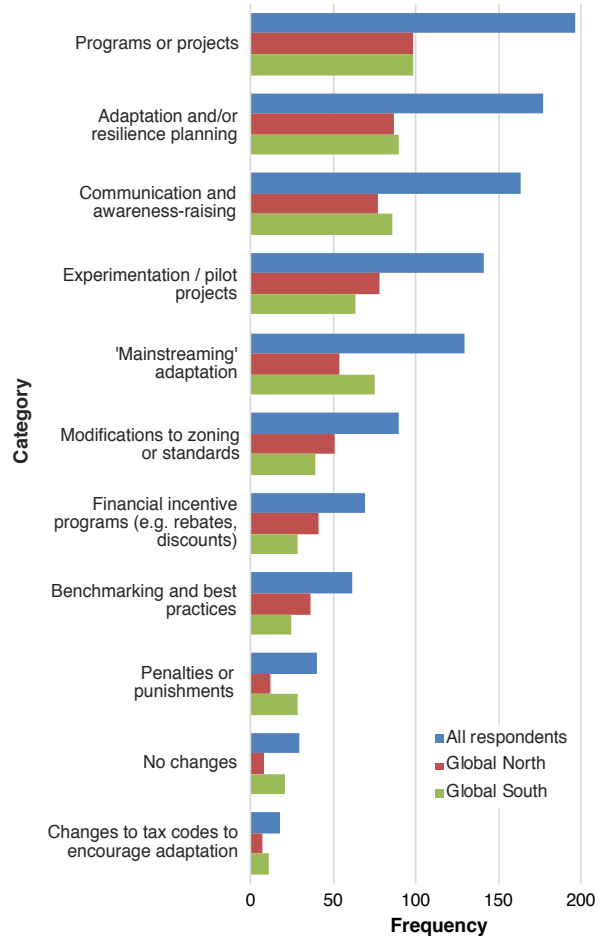
- For **Policy and legal frameworks**, the main categories identified were *New policies* or *Changed policies* relating to urban water adaptation, with a decreasing trend for regulations and laws. This may be because policy changes are typically less difficult to achieve than changes in regulations and laws, and thus are more likely to occur first. Yet there was nonetheless notable indication of activity regarding regulation.
- For **Policy instruments**, the main categories identified were *Programs and projects*, *Adaptation and/or resilience planning*, and *Communication and awareness-raising*. This reflects quite typical practices in cities. For example, municipalities increasingly develop and implement specific programs and projects, conduct various planning initiatives, and conduct outreach activities. Yet *Experimentation / pilot projects*, and *'Mainstreaming' adaptation* were also identified, indicating specific efforts towards adaptation.
- For **Organizational setups**, the main category identified was *Changes to existing organizations* (e.g. new departments, roles/responsibilities). This may reflect initial steps to bring adaptation into the remit of existing organizations, which could possibly lead to further institutionalization of adaptation over time. Yet *New staff position/s*, and even *New organizations* were also identified, indicating efforts to allocate new responsibilities for urban water adaptation.
- For **Coordination arrangements**, the main categories identified were *Collaboration*, *Partnerships and networks*, and *Knowledge sharing*. This may be because urban water adaptation issues are often cross-cutting, and a common first step is to engage in some form of collaboration and knowledge sharing to link various actors involved. Yet *Participation and consultation*, *Taskforces and working groups*, and *Policy coordination* were also identified, indicating a broad range of ways in which coordination is being pursued.

Interestingly, reported totals were relatively similar for Global North and Global South respondents. However, given that there was a greater proportion of Global South respondents in the total sample (Section 4.1), we would expect slightly higher reported totals from Global South respondents if the rates of each category and sub-category of innovation were the same across the Global North and South. Thus, the findings indicate that the propensity for institutional innovation is somewhat higher in the Global North cities compared to the Global South cities.

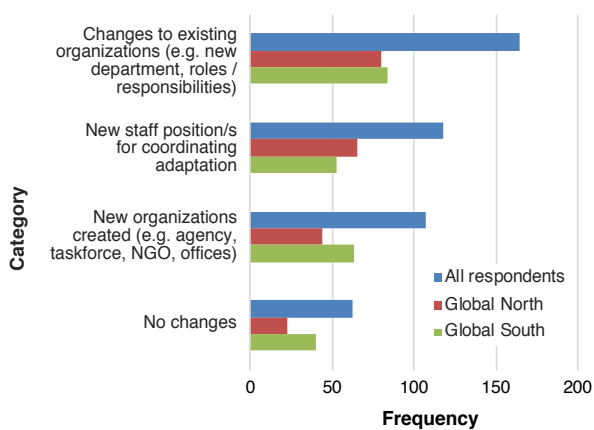
A: Policy and legal frameworks



B: Policy instruments



C: Organizational setups



D: Coordination arrangements

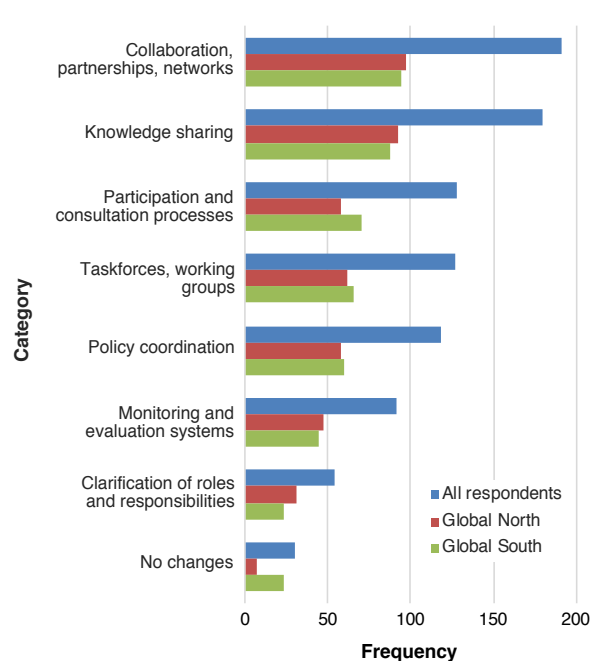


Figure 11: Four types of institutional innovation investigated.

Following from the identification of types of institutional innovation, questions arise about the processes by which these innovations are occurring. As a first step in understanding processes of institutional innovation, data was gathered to characterize the broad mechanism/s by which changes were being introduced (Figure 12). Respondents were asked to rate their level of agreement with various statements reflecting the overall mechanism/s by which the institutional innovations identified in their city were occurring.

Two mechanisms were the most highly scored: '**Layering**' of new arrangements on top of existing ones (i.e. *statement a* – new arrangements being introduced alongside existing arrangements), and '**Conversion**' of existing arrangements to meet new objectives (i.e. *statement b* – existing arrangements being reinterpreted or adapted to meet new objectives). Respondents in both the Global North and Global South scored all statements similarly, indicating consistency in these findings across contexts.

The importance of *Layering* and *Conversion* may be because these mechanisms do not necessarily make extensive demands on existing institutions to be disrupted or removed. Instead, they allow institutional innovations/changes to be introduced within existing institutional setups, either by adding new arrangements on top of what already exists (i.e. layering) or by converting existing arrangements for new ends (i.e. conversion). In contrast, '*Replacement*' of existing arrangements (*statement c*) makes greater demands on institutional setups because it requires not only the introduction of something new, but also the removal of existing arrangements (e.g. major policy or legal reforms). Nonetheless, replacement may occur anyway to a lesser extent over time through the 'natural' renewal of policies and plans.

These findings are a coarse anecdotal assessment of mechanisms of institutional innovation/change, providing a first glimpse into the patterns by which such changes are occurring.

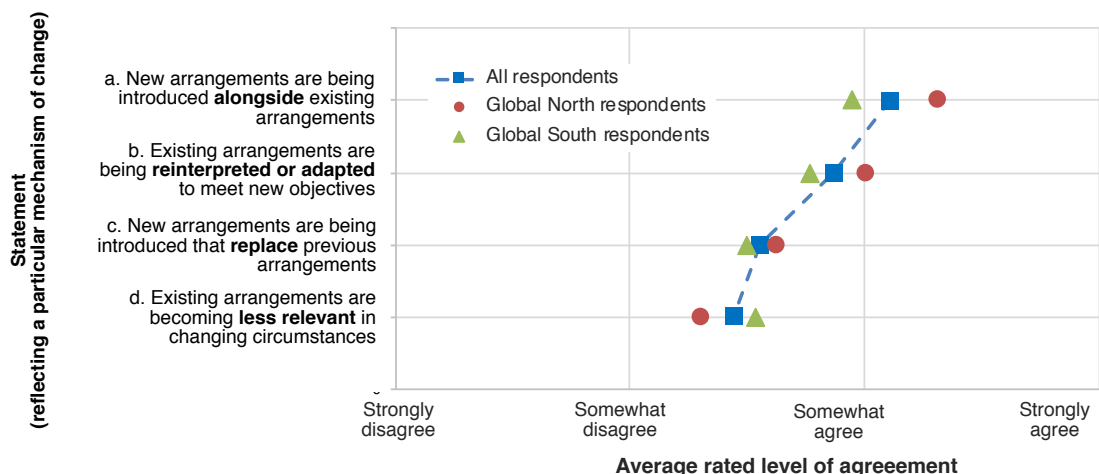


Figure 12: Overall mechanisms by which institutional innovations are occurring.

4.3 Outcomes/effects

What outcomes or effects are being achieved by these institutional innovations to date? Many different outcomes are potentially important, including risk reduction outcomes, and social preparedness outcomes. Assessing outcomes of institutional innovation / change is difficult because the effects will be largely intangible in the short-term, and methods for assessment and attribution remain under-developed. Therefore, as a first step towards assessing outcomes, respondents were asked to provide their expert judgment on certain outcomes/effects in their city to date as a result of the institutional innovations identified previously. This included questions on: perception of overall climate change risk reduction, identification of improvements in the management of specific water-related climate risks, and identification of social preparedness outcomes.

Firstly, respondents were asked to subjectively assess the overall extent to which climate-related risks to urban water systems had been reduced in their city, as a result of the institutional innovations they had previously identified (Figure 13). This helps to broadly gauge the extent of progress or magnitude of outcomes to date. The average score was “somewhat” of a reduction in risks, with both Global North and Global South respondents answering similarly.

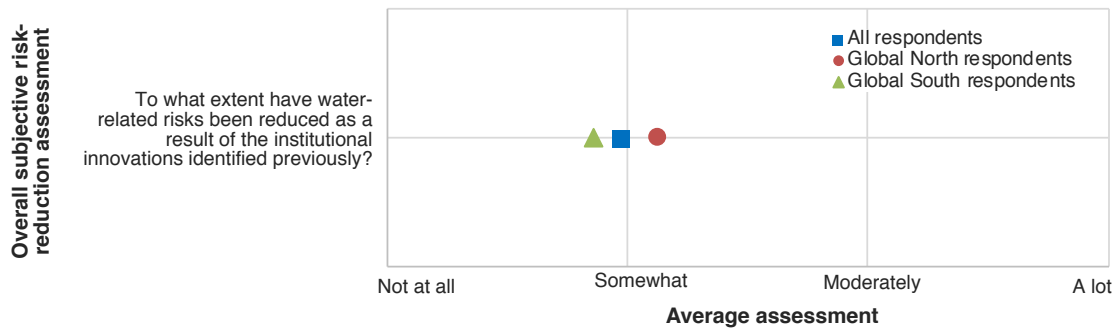


Figure 13: Overall assessment of water-related risk reduction in participants' cities due to changes identified in Section 4.2.

Secondly, respondents were asked to identify whether there were improvements in managing specific water-related risks in their city as a result of the institutional innovations they had previously identified (Figure 14). The most reported categories of improvement were *Flooding*, *Urban water supply*, and *Sewage and sanitation*. The other two priority issues identified in Section 4.1 – *Ecosystem health* and *Ageing infrastructure* – were somewhat less identified, along with *Drought*, and *Drinking water quality*. Overall, these findings seem to portray a somewhat optimistic picture of the extent of progress in addressing various priority urban water adaptation issues. A key next step is to verify these findings against technical/economic assessments, or at least to gather further expert advice, to ascertain whether these apparent grounds for optimism actually do hold. Nonetheless, it is important to keep Figure 13 in mind to qualify the magnitude of the improvements identified in Figure 14.

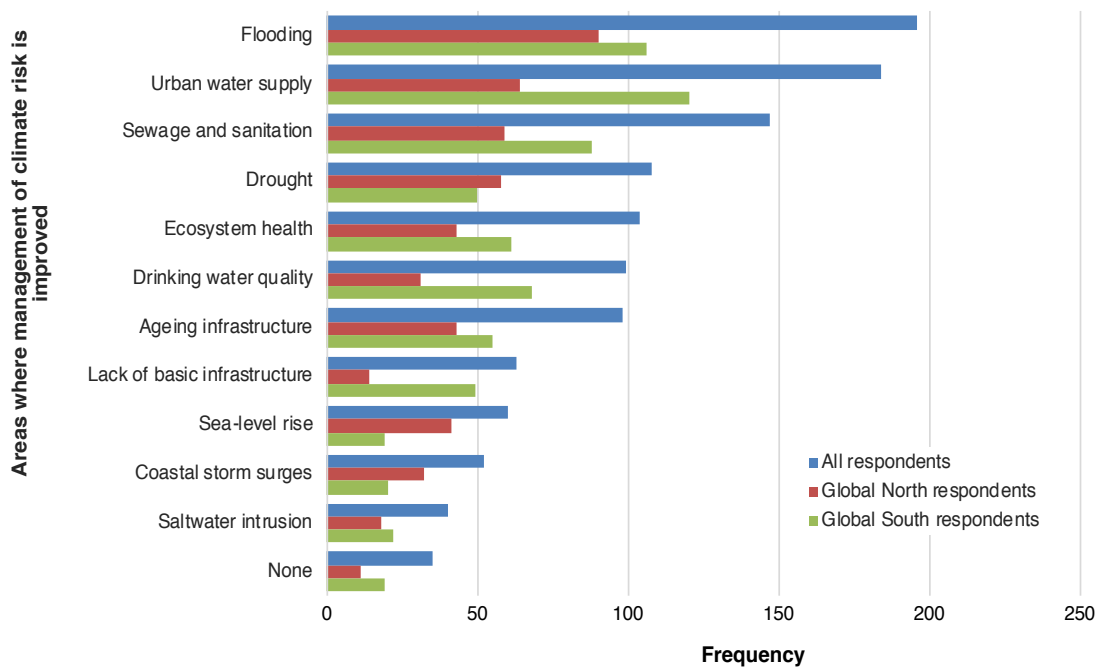


Figure 14: Areas where the management of climate risks are believed to have been improved as a result of the institutional innovations in Section 4.2.

Lastly, respondents were asked to identify whether there were improvements in various social preparedness outcomes in their city as a result of the institutional innovations they had previously identified (Figure 15). The most reported category of improvement was *Increased awareness about adaptation among decision-makers*. Other categories that were most identified related to *general preparedness, awareness among citizens, stimulating learning about adaptation, recognition of vulnerable groups, and building collaboration and trust for adaptation*. These findings reveal a relatively broad range of social outcomes/effects occurring. However, outcomes regarding *protection for vulnerable groups* and the *capacity of vulnerable groups to adapt* were the two lowest rated response categories. This raises questions about tangible commitment to these issues across both the Global North and South. Although, improvements reported across all three vulnerability outcomes were notably higher among Global South respondents than Global North respondents.

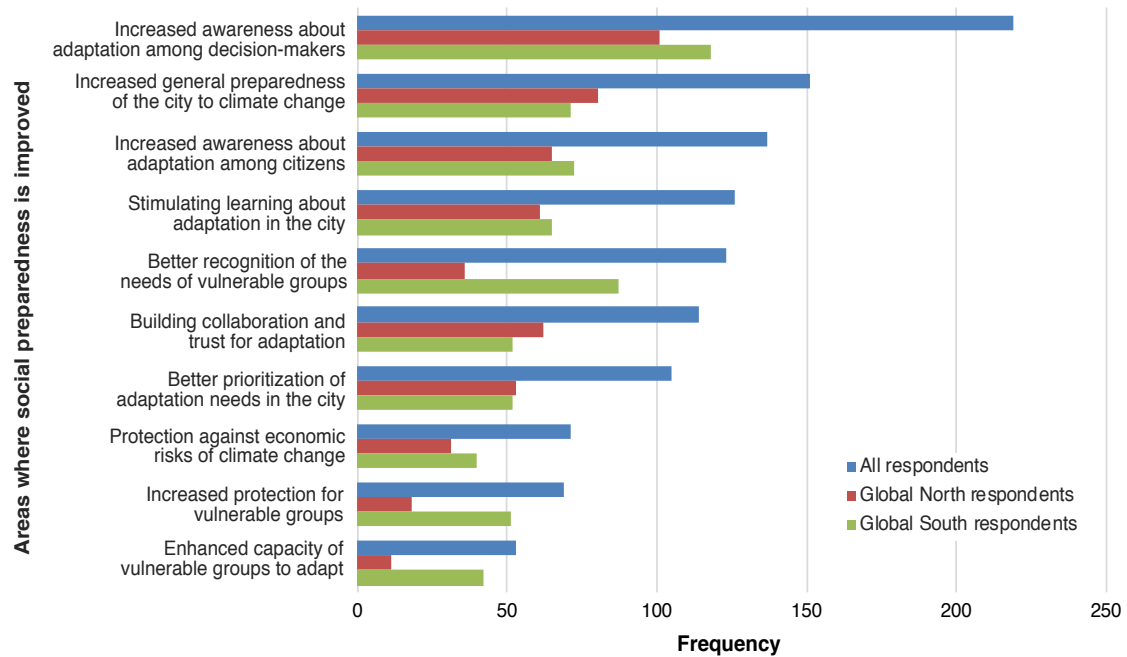


Figure 15: Areas where social preparedness is believed to have been improved as a result of the institutional innovations in Section 4.2.

Altogether, the findings on outcomes/effects point to a perceptible but so far relatively small overall improvement in urban water risks faced under climate change. Nonetheless, the fact that respondents indicated noticeable improvements in a range of areas is potential grounds for optimism: these experts see some progress being made and attribute this, at least partially, to institutional innovations / changes occurring in their cities. On the other hand, the findings could also be interpreted skeptically as showing little progress to date. However, given the complexity of urban water adaptation issues, such progress seems to point towards at least incremental improvements. Clearly, this requires further in-depth analysis of outcome variability across cities.

A key question is whether outcomes so far are due to 'low-hanging fruit' improvements (e.g. minor tweaks to existing governance systems), or whether more fundamental problems that need to be tackled for successful adaptation are being addressed (e.g. reforming ineffective/obsolete approaches, dealing with new accountability challenges, developing greater responsiveness and foresight to future change). The overall assessment of Figure 13 points to only a modest improvement at best. The seemingly weak outcomes in regard to addressing vulnerability issues may also be a litmus test on the extent of progress to date from a social equity perspective.

4.4 Possible explanatory factors

The final set of findings explores possible explanatory factors behind the institutional innovations identified. This covers several key areas: a) Problem recognition by different actor groups, b) Internal drivers to address urban water adaptation, c) Knowledge generation and use, d) Agenda alignment between different actors, and e) Leadership by key individuals. These factors are not yet tested or parsed for their explanatory power – this analysis is ongoing. Here the aggregate findings are presented in order to examine broad patterns. The five categories correspond to key ideas in the academic literature about socio-political factors that could explain the occurrence of institutional innovation.

a) Problem recognition by different actor groups

These indicators explore the extent to which urban water adaptation issues are recognized as a problem by key actors. This aims to test the idea that increased problem recognition (or problem pressure) leads to institutional innovation. Several indicators were surveyed relating to government, business/industry, and citizens/community (Figure 16). Urban water adaptation was reported as more highly recognized as a problem by government than by citizens and business/industry, with close agreement among Global North and South respondents on these indicators. There was more divergence on the extent of community support for government action on adaptation, with the average score of Global South respondents higher than that of Global North respondents. This may be because urban water adaptation issues are linked to other development-related issues in the Global South, although the reason for the relatively lower score from Global North respondents is not immediately clear.

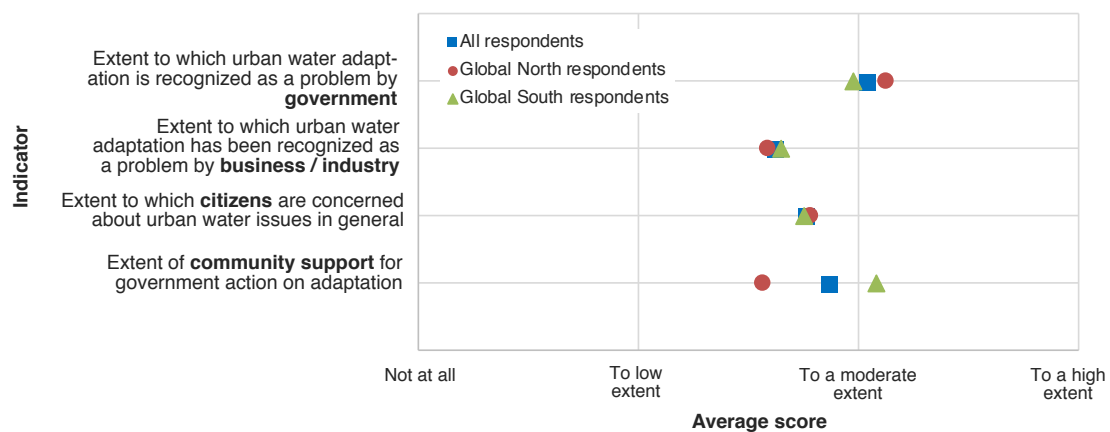


Figure 16: Indicators of *problem recognition* by different actor groups.

b) Internal drivers within urban water governance systems

These indicators explore perceptions on internal drivers to address adaptation within urban water governance systems. This aims to test whether urban water governance systems that recognize and support adaptation are more innovative, or conversely, whether poorly performing systems might trigger innovation. Several indicators of institutional performance were surveyed, relating to: powers, coordination, guidance, roles/responsibilities, mandates, and wider institutional arrangements (Figures 17-19).

The perceived locus of power for decision-making on urban water adaptation was split mostly between the *city as a whole* and *higher levels of government* (Figure 17). Interestingly, Global North respondents indicated the *city as a whole* more strongly, whereas Global South respondents indicated *higher levels of government* more strongly. This aligns with a similar difference observed in Figure 8. It seems to indicate that Global North respondents focus relatively more on the city-scale, whereas Global South respondents also attribute a strong role to levels of government beyond the city scale.

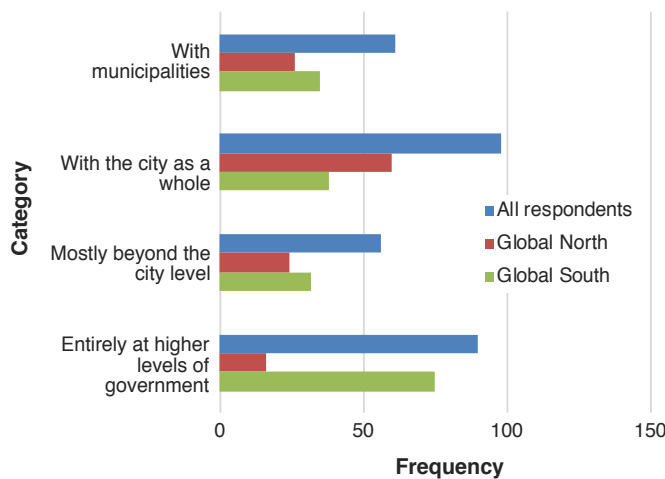


Figure 17: Perception of institutional level where *power* for urban water adaptation decision-making mainly lies.

Indicators on several aspects of institutional performance were scored between a “a low extent” and a “moderate extent” (Figure 18). The lowest average score was regarding clarity of guidance for adaptation, although this value was not markedly different to the other indicators. Global North respondents scored the extent of coordination higher than Global South respondents. The differences between Global North and South respondents were otherwise not notable for the other indicators. Altogether, this seems to indicate a somewhat ambivalent assessment of the performance of current urban water systems in providing internal drivers for climate change adaptation.

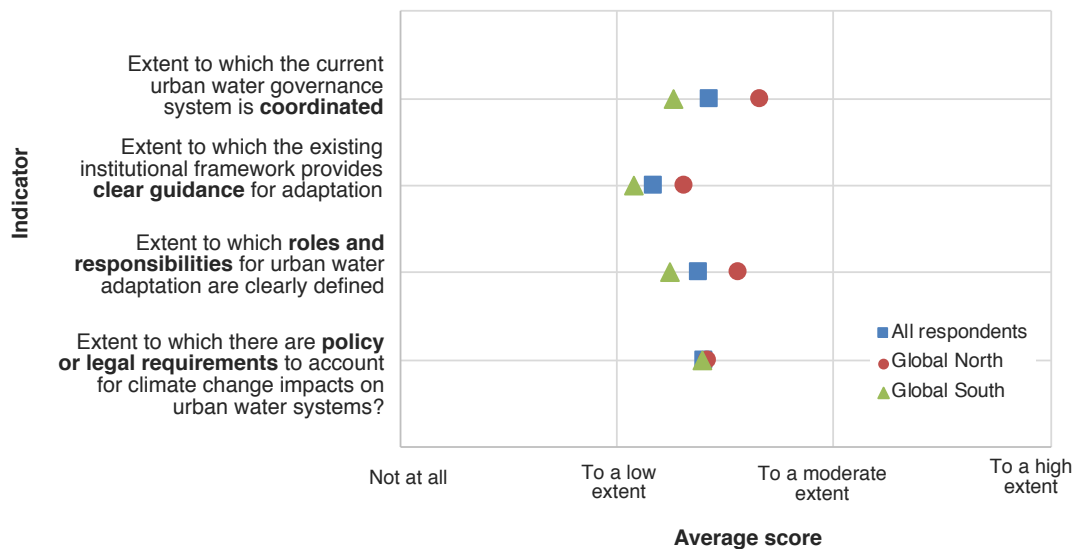


Figure 18: Indicators of several aspects of institutional performance.

The extent to which adaptation is supported or constrained within wider urban water systems was scored on average as neither supported nor constrained (Figure 19). Both Global North and Global South respondents showed close agreement on this indicator. This finding, in combination with Figure 18, seems to indicate that ways of dealing with urban water adaptation issues are on-the-whole not yet well defined or institutionalized in many cities.

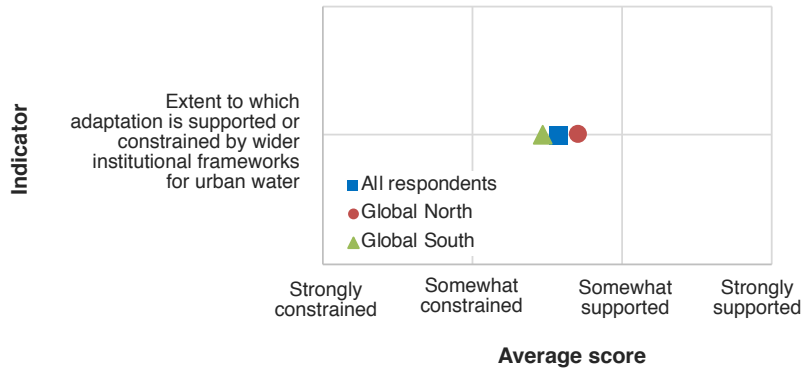


Figure 19: Extent of *support or constraint* on addressing adaptation within the wider urban water governance system

c) Knowledge generation and use

These indicators explore the extent to which knowledge is being generated and used in urban water adaptation. This aims to test the idea that increased knowledge availability leads to institutional innovation. Several indicators were surveyed (Figure 20). The two highest scored indicators were regarding the sufficiency of existing knowledge and the uptake of external ideas, although these were still rated as less than a “moderate” extent. Both were scored somewhat higher by Global North respondents than Global South respondents. The third indicator on monitoring and evaluation was scored markedly lower, by both Global North and Global South respondents, indicating a specific deficiency globally in this area.

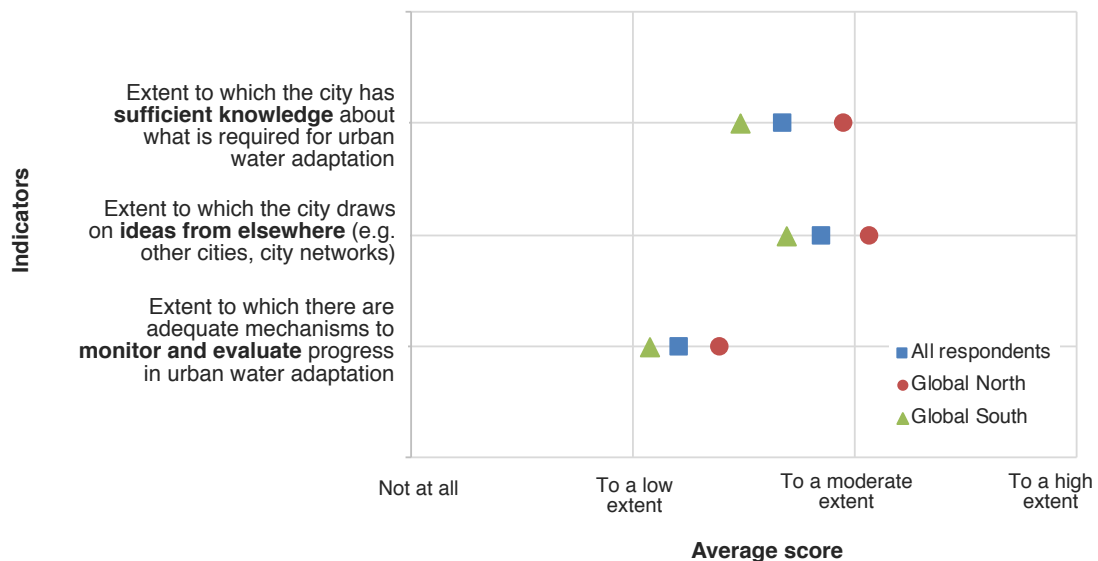


Figure 20: Indicators for *knowledge generation and use*.

d) Agenda alignment between different actors

These indicators explore the extent to which different actor groups are aligned around an agenda for urban water adaptation. This aims to test the idea that increased alignment of agendas leads to institutional innovation. Several indicators were surveyed (Figure 21). Indicators of *political support from higher levels of government* and on *stakeholder agreement about what is required* were the two most highly scored, although these were still rated as less than a “moderate” extent. The extent to which *agendas are aligned across institutional levels* was scored lower. Global North and Global South respondents showed close agreement on these indicators.

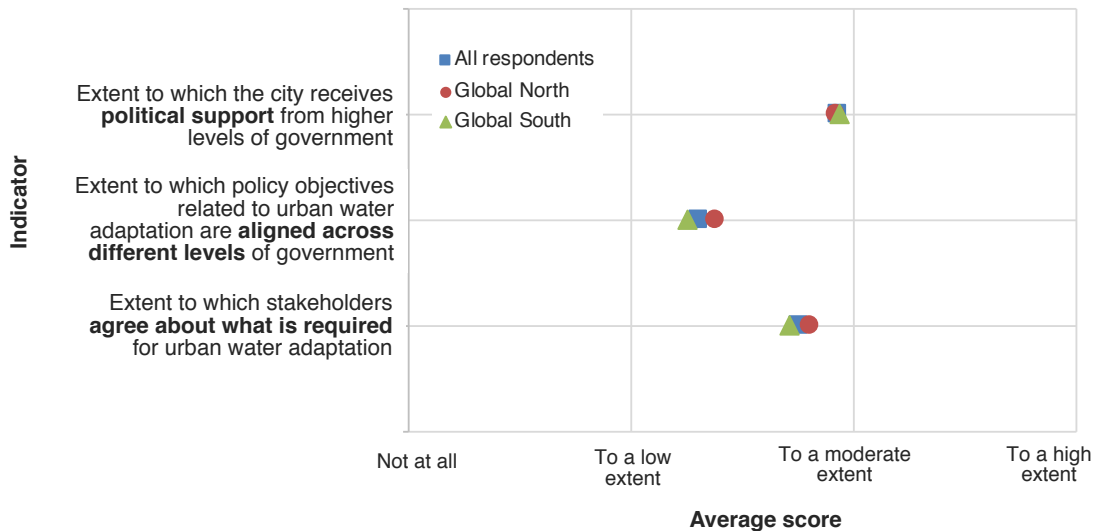


Figure 21: Indicators for *agenda alignment* between different actors.

e) Leadership by key individuals

The final area of possible explanatory factors surveyed was leadership by key individuals. An earlier question surveyed leadership of various organizational actors (Figure 10). This section focuses on the role of individuals and the strategies used to promote urban water adaptation. This aims to test the idea that increased leadership activity leads to institutional innovation.

Firstly, the overall importance of leadership by key individuals was scored as being important to a “moderate” extent (Figure 22). There was little difference between Global North and South respondents. This indicates a potentially important role for this factor.

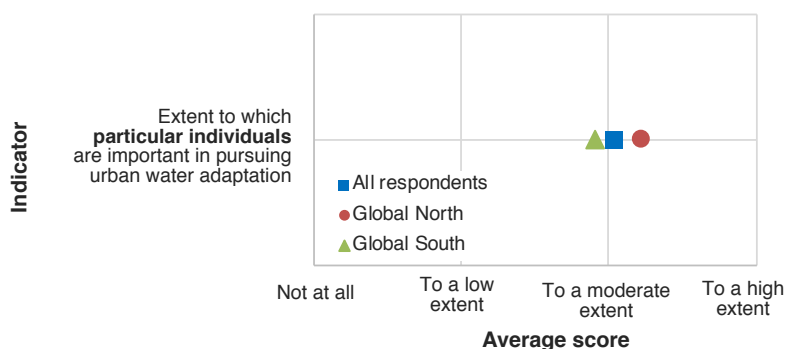


Figure 22: Overall perceived importance of leadership by key individuals.

Secondly, the specific strategies utilized by leaders (or ‘entrepreneurs’) were explored in more depth (Figure 23). Responses cluster around a score of “moderate” extent, with a notable but small difference between Global North and Global South respondents. Global North respondents consistently scored these leadership/entrepreneurship strategies slightly higher than Global South respondents. This highest scored indicator regarded the *use of climate-related events or disturbances to highlight the need for adaptation* (also compare with Figure 7, Section 4.1). Overall, these findings indicate a potentially important role for leadership / entrepreneurship by key individuals in driving institutional innovation for urban water adaptation.

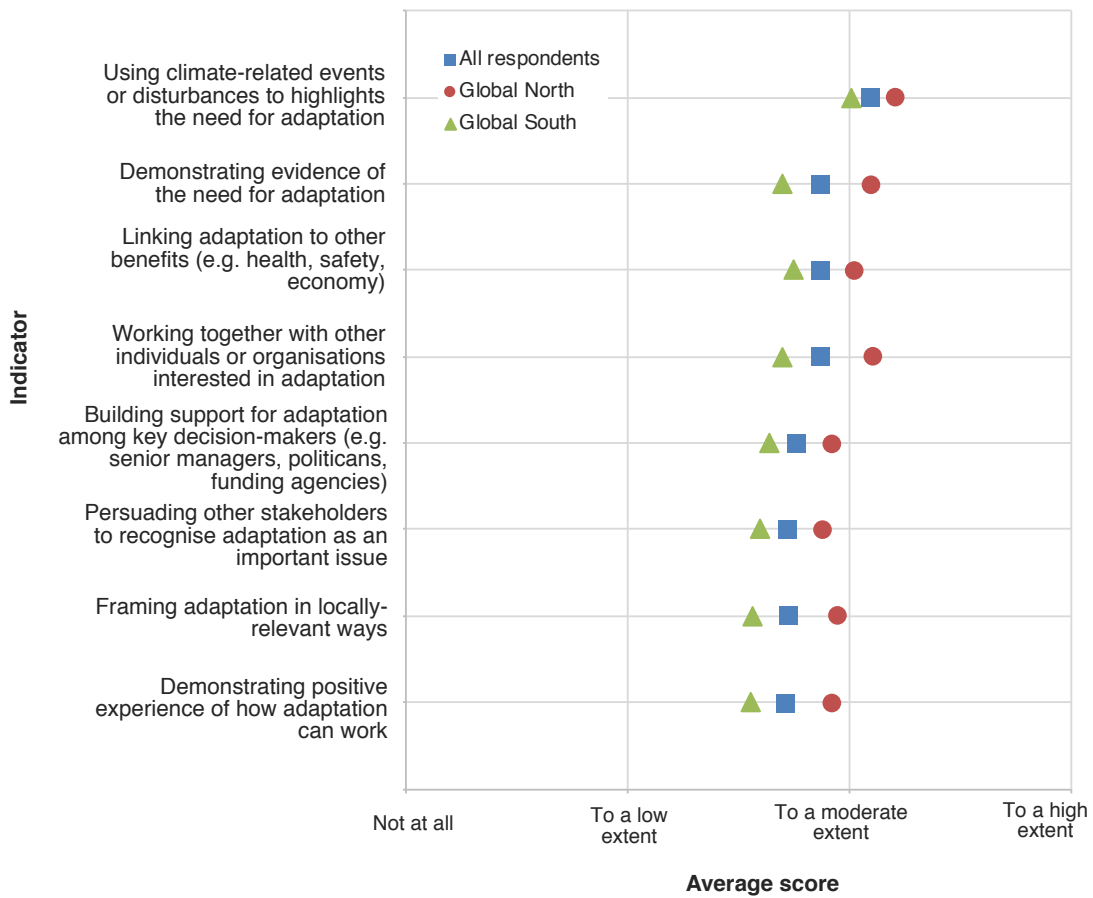


Figure 23: Indicators of various leadership/entrepreneurship strategies (categories developed based on Brouwer and Huiteima, 2017).

5. ASSESSMENT OF FINDINGS

5.1 Key messages

1. An assessment and reference point for studies of institutional innovation.

This survey provides a first-of-its-kind assessment of institutional innovation for urban water adaptation in cities across the globe. This provides a reference point for similar future studies and longitudinal analysis. It highlights the need for greater attention on the institutional dimensions of climate change adaptation, and provides insights on new ways of understanding and analyzing how institutions can innovate and change.

2. Relatively vibrant activity occurring.

The key finding of this survey is that there seems to be a relatively vibrant domain of activity already occurring regarding the institutional dimensions of urban water adaptation. This gives grounds for cautious optimism that progress is being made. However, this conclusion is tentative: more work is needed to analyze the fine-grained patterns and variability between individual cities and regions, and to assess the wider effects on urban water governance systems. Are the changes identified just 'low hanging fruit' (e.g. minor tweaks to existing approaches), or in fact deeper changes that genuinely enable urban governance systems to be more adaptive in the face of unfolding change?

3. Multiple possible explanatory factors for institutional innovation.

The survey reveals the presence of a range of possible moderately important explanatory factors. This does not reveal any 'silver bullets', although given the complexity of the problem of urban water adaptation, this should not be expected. Nonetheless, evidence on the relative importance of various possible factors opens up avenues for further scrutiny. This is a key topic of ongoing analysis from this survey.

4. Insights on specific substantive aspects of urban climate change adaptation.

- Thinking beyond the city-scale: Global South respondents tended to identify a stronger role for National Government than Global North respondents. Global city discourses often emphasize municipalities and mayors over higher governance levels. This assumption may not resonate as strongly with Global South cities.
- A public good issue: Findings point to a continued central role for government in urban water adaptation. There was a lack of evidence for a notable role by business and private sector. This needs more work to verify, but does not seem to align with common rhetoric about the role of the private sector in adaptation.
- Struggling to address social equity outcomes: Findings relating to vulnerability outcomes reveal a troubling picture for addressing social equity in urban water adaptation to date. This demands systematic attention in future work.

5.2 Policy implications

Policy implications should be extracted on a case-by-case basis, according to the needs of government, public authorities, civil society, and industry/business actors in a particular city. This report aims to provide ideas for 'entry points' to inform practical efforts to realize institutional innovation.

Nonetheless, key implications that are broadly applicable across cities are as follows:

1. **Institutional innovation is likely to be needed** in many cities to create more adaptive urban water governance systems under climate change.
2. **Institutional innovation can take different forms**, which may be relatively easier or more difficult to bring about.
3. **It is important not to stop with 'low hanging fruit' innovations** (although these may be important for getting started and building momentum), but to also consider whether there are wider/deeper institutional arrangements that may need to be changed. These could lie within or beyond the city-scale.
4. **It is important to consider a broad range of possible risk reduction and social preparedness outcomes.** Making inroads into ways of systematically monitoring and evaluating outcomes in order to track progress is a key need.
5. **A wide range of factors may potentially drive institutional innovation**, and those explored in this report can provide ideas for strategies in a specific city.
6. **There is a need to reconsider dominant narratives about cities** that sometimes imply that they can solve problems independently of other levels of governance. Findings in this survey and in wider academic literature highlight the interdependence of cities with broader actors and institutional arrangements, which may help or hinder in different ways in different places.
7. **There is a crucial need for greater attention to social equity outcomes** in pursuing urban water adaptation. Evidence from this survey reveals this aspect as one of the most worrying outcome areas at the current time.

5.3 Limitations of this report

Two main limitations of this report are:

1. **Findings are presented in aggregate form.** Results must therefore be interpreted cautiously as they reveal only summary trends and do not show the variability present between individual cities and regions. Further analysis is ongoing.
2. **The survey focuses on large, 'frontrunner' cities.** Results must therefore be interpreted cautiously, especially when drawing lessons for other cities outside of the current sample. Cities selected are potential innovators, as identified through the selection criteria in Section 2.2. Many lessons are likely to be transferable to other cities to some extent, but there may also be factors missing in the current study that are important for non-frontrunner cities, and small-to-medium sized cities.

6. NEXT STEPS

1. Disaggregate the data on a city-basis.

This will involve analyzing explanatory factors for institutional innovation across different regional and socio-environmental contexts. This analysis is where much of the variability in the data will be seen. This will lead to *process-based explanations* of institutional innovation to understand why and how different types of institutional innovation occur, under what conditions, and with what consequences.

2. Address several key related academic and policy questions.

Further key questions to examine are:

- To what extent can institutional innovation stimulate not only incremental but also more transformative change in urban governance systems (Kates et al., 2012; O'Brien, 2012; Patterson et al., 2017)?
- Do different types of urban governance systems have differing propensity to innovate, and if so, what characteristics enable this (Jordan et al., 2015, 2018)?
- What is an appropriate balance between stability and flexibility within a 'well-performing' adaptive urban governance system (Beunen et al., 2017)? How do we know an adaptive system when we see it?

3. Conduct further research to address key gaps of this current study.

Specific lines of research needed include:

- Developing approaches to track a comprehensive range of adaptation outcomes, and evaluating if and how these are causally linked to institutional innovation.
- Understanding what kinds of institutional arrangements (and innovations) are needed to realize social equity outcomes in urban water adaptation.
- Studying institutional innovation in small-to-medium sized cities which may possess quite different characteristics and ways of operating, as well as challenges and opportunities, as compared to the larger cities considered in the current study.

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