Scalar mismatches in metropolitan water governance
A comparative study of São Paulo and Mexico City
van den Brandeler, F.A.

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2. METHODOLOGY

2.1 INTRODUCTION

This chapter develops the qualitative methodology employed to answer the research questions. The methodology has several components: the comparative case study method (see 2.2), a literature review (see 2.3), an analytical framework (see 2.4), the units of analysis (see 2.5), the qualitative content analysis of the policies (see 2.6), the fieldwork and ethical considerations (see 2.7) and the integration of these different elements (see 2.8).

2.2 THE COMPARATIVE CASE STUDY METHOD

2.2.1 JUSTIFICATION FOR THE COMPARATIVE CASE STUDY METHOD

This research adopts an inductive comparative case study approach examining São Paulo in Brazil, and Mexico City in Mexico. The case study methodology is useful when studying phenomena that are highly context-dependent, where predictive theories may not be valuable (Flyvbjerg, 2006). Case studies, through in-depth analysis of a single unit, may allow for the identification of causal mechanisms between an X and a Y (Gerring, 2018). This can be for phenomena too complex (i.e. too many potential variables) for surveys or experimental strategies, or to describe an intervention and the context in which it occurs. For this research, this means investigating the metropolitan water challenges in Mexico City and São Paulo in the context of the interrelations between water governance at urban scale and at river basin scale. Many driving forces and institutional factors shape such challenges and a case study may help elucidate their links (Gehring and Oberthür, 2008). This type of ‘instrumental’ case study provides insights into an issue or helps refine a theory (Stake, 1995).

Comparative analyses allow me to build upon case studies of institutions in different settings (IDGEC 2005). This study uses a relational approach to comparison, where the purpose is not to measure cases against a universal yardstick, but rather to gain insights that could not be attained by observing a single case (Ward 2010). In the urban context, the comparative case study method is developed to press toward generative theoretical insights relevant beyond the observed location, although not universalized (McFarlane and Robinson 2012). Comparisons brings attention to similarities but also to differences between case studies, and the latter is a productive means for conceptualizing contemporary urbanism (McFarlane and Robinson 2012). Considering similar problems in different locations and contexts is important to gain valuable insights on policy processes at multiple levels and the performance of similar regimes (e.g. the inclusiveness and sustainability of water governance regimes in metropolitan regions) (Young et al., 2008; Kuzdas and Wiek, 2014). Comparisons may thus enable me to gain a clearer perspective on or understanding of phenomena in two or more cases, without necessarily aiming for generalizations or falsifications. In other words, the use of case studies can help to “learn something” rather than to “prove anything” (Eysenck, 1976).
2.2.2 THE CHOICE OF SÃO PAULO AND MEXICO CITY

Latin American countries have played an important role in global debates on the causes and solutions to environmental challenges and climate change (Hogenboom et al., 2014). In this region, environmental governance has been reshaped by the emergence of social movements and their promotion of social and environmental justice and new environmental discourses (de Castro et al., 2016). Nevertheless, inequality, poverty, weak institutions and the concentration of power by elites remain rampant and hinder the effective implementation of governance initiatives at multiple levels (Hogenboom et al., 2014).

Brazil and Mexico are the most populated countries of Latin America and are both highly urbanized. In both countries, people and water resources are unevenly distributed, and the population is more densely concentrated in relatively water scarce regions. Besides experiencing seasonal climate variation, both countries are likely to suffer increases in extreme weather events due to climate change (see 5.2 and 7.2).

Brazil and Mexico have relatively similar GDP per capita (i.e. USD 9,812 in Brazil and 8,910 in Mexico in 2017) and both are upper middle-income economies with stark socio-economic inequalities (high Gini coefficients of 53.7 in Brazil and 43.4 in Mexico in 2016) (World Bank, 2019a, 2019b). In Mexico, economic growth has been concentrated in the drier parts of the country, while the humid Southeast has only 16% of economic output (Hearne, 2004). In Brazil, the South and Southeast are significantly wealthier than the rest of the country. Both experienced rapid population growth, have inadequate urban planning, and serious water-related challenges for urban dwellers (Tortajada, 2008; Kelman, 2015).

Both countries are federal regimes, with responsibilities shared between three levels of government (federal, state and municipal), which has important implications for water resources management, water services and water-related risks. The implementation of IWRM is estimated to be relatively advanced in comparison to other Latin American nations, and slightly above average for their HDI (Human Development Index) score (UNEP, 2018). They were also the first two countries in Latin America to have legally mandated river basin organizations (Tortajada, 2001). These are significant developments for the relatively young democracies: Brazil began transitioning to democracy in 1985, and Mexico initiated democratic reforms in the early 1990’s (Martínez-Lara, 1996; Vegelin, 2016; Ginsburg, 2017).

São Paulo and Mexico City are two of the world’s largest urban agglomerations, and the largest in Latin America. Throughout the 20th century, they experienced explosive demographic growth and rapid industrialization prompted by the Import Substitution Industrialization policies of the 1930’s (see Figure 2.1) (Blouet and Blouet, 2015). As of the 1970s and 1980s, their population growth was concentrated in their peripheries (Escamilla and Santos, 2012). They have similar population and surface area sizes and are composed of a large

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10 According to the 2010 census, Brazil had a population above 190 million inhabitants, 87% of which was urban (IBGE 2010). In Mexico, nearly 77% of the population was urban out of approximately 119 million inhabitants in 2010 (Kim and Zangerling 2016; INEGI 2015). Mexico’s population quadrupled since 1950 and went from being predominantly rural (57.4%) to mainly urban (76.5%) (INEGI 2015).

11 Mexico has 31 states and the federal entity of Mexico City. Brazil has 26 states and the Federal District.
number of municipalities (see Table 2.1). Mexico City is the capital of Mexico, whereas São Paulo is a state capital. However, both are the financial and economic centres of their country. The former spreads over three different federal entities, whereas São Paulo is contained within one state.

**Figure 2.1 Demographic Growth in the metropolitan regions of São Paulo and Mexico City**

The two megacities are both located inland and upstream in their river basins (see Map 2.1 and Map 2.2). They are experiencing extreme transformations of their natural landscape to accommodate growing populations and their demand for water, and to protect themselves from flood risks. However, they both continue to struggle with water-related challenges in terms of quantity, quality and the effects of extreme weather events. The Valley of Mexico Basin endured a water crisis in the Spring of 2009, after facing floods months earlier. Similarly, in 2010 and 2011 the Upper-Tietê Basin, where São Paulo is located, experienced heavy precipitations and floods. In 2013-2015 the region suffered a historical drought. These extreme contradictions in such short timeframes could be linked to climate change, but also indicate a failure in the water management model.

In sum, the two cases share many common features in terms of size, economic development and historical background. Their experiences addressing water-related challenges – both successful and unsuccessful – can bring valuable insights to many cities in the Global South that have similar biophysical, political, economic and demographic characteristics, and that are likely to face growing water-related challenges.
Map 2.1 Spatial characteristics of São Paulo

Map 2.2 Spatial characteristics of Mexico City

Source: Author
Table 2.1 Characteristics of Mexico City and São Paulo

<table>
<thead>
<tr>
<th></th>
<th>National capital</th>
<th>National GDP per capita</th>
<th>City proper pop.</th>
<th>Metro pop.</th>
<th># of municipalities in metro area</th>
<th># of federative entities in metro area</th>
<th>Surface area of metro area</th>
</tr>
</thead>
<tbody>
<tr>
<td>São Paulo</td>
<td>No</td>
<td>9,821.4 USD in 2017</td>
<td>12 million</td>
<td>21.5 million</td>
<td>39</td>
<td>1 state</td>
<td>7,946 km²</td>
</tr>
<tr>
<td>Mexico City</td>
<td>Yes</td>
<td>8,902.8 USD in 2017</td>
<td>9 million</td>
<td>21.6 million</td>
<td>60 + 16 districts of Mexico City</td>
<td>3 states</td>
<td>7,866 km²</td>
</tr>
</tbody>
</table>

Sources: (EMPLASA, no date; World Bank, no date; World Population Review, no date; State, 1994; INEGI, 2014; Brazil, 2015)

2.3 LITERATURE REVIEW

2.3.1 LITERATURE REVIEW ON KEY CONCEPTS

To address the research questions, I conducted an extensive literature review on UWM, IWRM, IRBM and MWM, Inclusive and Sustainable Development, Multilevel Governance and Institutional Analysis. I identified the scholarship on the relevant principles and instruments and included scholarship from both the Global North and Global South. For UWM/IWRM/IRBM/MWM, the literature survey first took 1970 as a starting date, but then focused on articles published between 1990 and 2018, as earlier literature on these topics was virtually non-existent. I short-listed approximately 100 articles from the initial search. These were published in journals, including Current Opinion in Environmental Sustainability, Ecology and Society, Geoforum, Global Environmental Change, Nature Sustainability, Urban Studies and Water Policy (see Table 2.2).

The literature review on IWRM/IRBM and Integrated Urban Water Management (IUWM)/Sustainable Urban Water Management (SUWM)/Metropolitan Water Management (MWM) allowed for an assessment of the evolution of publications over time. This search was conducted in ScienceDirect and was limited to the occurrence of these terms in titles, abstracts and key words between 1970 and 2015. The resulting graph (see Figure 2.2) reveals the quasi non-existence of all five terms prior to 1990. IWRM shows the steepest rise, increasing from 19 publications in 1995, to 54 in 2005 and 183 in 2015. IRBM is marginally ahead of IUWM and SUWM, with 62, 38 and 50 publications respectively in 2015. Finally, the graph shows that the publications on MWM are negligible, with results only entering the double digits in 2013, and 113 results in total for the 1970-2015 period. When the search is conducted with quotation marks (which limits search results to publications where the term ‘metropolitan water management’ appears as a whole), results were significantly lower for all terms (see ANNEX A – LITERATURE REVIEW). In the case of MWM, there were no results between 1970 and 2015. This indicates that there is no clearly defined metropolitan water management approach.
Table 2.2 Journals selected in the literature review

<table>
<thead>
<tr>
<th>Concept</th>
<th>Selected journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWRM</td>
<td>Ecology and Society; Environmental Science and Policy; Hydrogeology Journal;</td>
</tr>
<tr>
<td></td>
<td>International Journal of Water Resources and Environmental Engineering;</td>
</tr>
<tr>
<td></td>
<td>International Journal of Water Resources Development; Journal of Environmental</td>
</tr>
<tr>
<td></td>
<td>Management; Journal of Water Resource and Protection; Physics and Chemistry of</td>
</tr>
<tr>
<td></td>
<td>the Earth; Sustainability: Science, Practice, &amp; Policy; Water Alternatives; Water</td>
</tr>
<tr>
<td></td>
<td>International; Water Policy; Water Resources Management</td>
</tr>
<tr>
<td>IRBM</td>
<td>Climate and Development; Environmental Monitoring and Assessment;</td>
</tr>
<tr>
<td></td>
<td>Environmental Science and Policy; Geoforum; International Journal of River Basin</td>
</tr>
<tr>
<td></td>
<td>Management; Water International; Water Policy</td>
</tr>
<tr>
<td>UWM</td>
<td>Built Environment; Ecology and Society; Environmental Innovation and Societal</td>
</tr>
<tr>
<td></td>
<td>Transitions; Global and Planetary Change; Global Environmental Change; Environment</td>
</tr>
<tr>
<td></td>
<td>and Urbanization; Nature Sustainability; OECD; Rainwater and Urban Design; Science;</td>
</tr>
<tr>
<td></td>
<td>Science of the Total Environment; Utilities Policy; Water Research; Water Resources</td>
</tr>
<tr>
<td></td>
<td>Management; Water Science and Technology</td>
</tr>
<tr>
<td>MWM</td>
<td>Hydrology and Earth System Sciences; International Journal of Water Resources</td>
</tr>
<tr>
<td></td>
<td>Development; Journal of the American Water Resources Association (JAWRA); The</td>
</tr>
<tr>
<td></td>
<td>Professional Geographer; Urban Studies</td>
</tr>
<tr>
<td>Inclusive and Sustainable</td>
<td>Current Opinion in Environmental Sustainability; Environmental Science &amp; Policy;</td>
</tr>
<tr>
<td>development</td>
<td>Habitat International; International Environmental Agreements: Politics, Law and</td>
</tr>
<tr>
<td></td>
<td>Economics; The European Journal of Development Research</td>
</tr>
<tr>
<td>Multilevel governance</td>
<td>American Political Science Review; Current Opinion in Environmental Sustainability;</td>
</tr>
<tr>
<td></td>
<td>Ecology and Society; Environmental Policy and Governance; Environmental Politics;</td>
</tr>
<tr>
<td></td>
<td>Policy Studies; Nature Climate Change</td>
</tr>
<tr>
<td>Institutional analysis</td>
<td>Current Opinion in Environmental Sustainability; Ecology and Society; Environmental</td>
</tr>
<tr>
<td></td>
<td>Science and Policy; Global Environmental Change; Institutions and Environmental</td>
</tr>
<tr>
<td></td>
<td>Change; Policy Sciences; Journal of Hydrology</td>
</tr>
</tbody>
</table>

Source: Author

In a second step, I analysed the urban-river basin linkages by examining the incidence of terms in titles, abstracts and key words between 1970 and 2015 associated with the urban (i.e. urban, city/ies, megacity/ies and metropolitan) in the IWRM/IRBM literature, and to the river basin (i.e. river basin, watershed and catchment) in the IUWM/SUWM/MWM literature. The results did not coincide or overlap between the two sets of literature (see Figure 1.5). Of the articles that included the term Metropolitan Water Management in their titles, abstracts or keywords, only 7 contained the terms river basin, catchment or watershed in the body of the article. The literature therefore does not differentiate water management in metropolitan regions from other urban areas, nor does it link to the scales relevant for IWRM/IRBM.
2.3.2 LITERATURE REVIEW ON CASE STUDIES

Prior to conducting fieldwork, I conducted literature reviews for each case study on the existing scholarship on water governance, urban governance, multilevel governance and environmental issues in Mexico City and São Paulo. This included international journals such as Environment and Urbanization, Journal of Latin American Geography, Climate and Development, Water Resources Research, Current Opinion in Environmental Sustainability, Journal of International Affairs, World Development, Earth Perspectives, as well as national journals such as Cadernos Metrópole; Estudios Avanzados; Revista Latinoamericana de Recursos Naturales; Tecnología y Ciencias del Agua; and Revista Iberoamericana de Ciencias.

In addition, fieldwork preparation involved the review of approximately 50 policy documents and a dozen legal documents for each case study. This involved legal and policy documents at local, state and federal levels on water resources management and urban water management, but also environmental policy, climate change and urban planning.

2.4 ANALYTICAL FRAMEWORK

To address my research questions, I use the institutional analysis model of the Institutional Dimensions of Global Environmental Change (IDGEC) as the foundation for my methodological framework (IHDP/IDGEC, 2005). This framework is part of a stream of analysis known as ‘new institutionalism’, which focuses on how institutions affect society. More specifically, it examines environmental and resource regimes, which are types of institutions that address situations where actions can degrade ecosystems through overuse of natural resources or due to unintended side effects (Young et al., 2008). This led to the
following six-step framework, which allows for examining the causal mechanisms of metropolitan water challenges, the effectiveness of instruments that address these and the (re)design of such instruments for more sustainable and inclusive water governance:

(1) Define the major drivers of water challenges in the metropolitan region

First, I analysed the driving forces of the water-related tensions between the metropolises and the river basins (see 5.2 for São Paulo, and 7.2 for Mexico City). This evaluation was initially done through document analysis and the results were then triangulated through semi-structured interviews with a variety of respondents. This answered Research Question 2a.

(2) Actor and Institutional analysis

The next step was to identify the key actors addressing water challenges in the metropolitan regions of São Paulo and Mexico City at multiple levels (Research questions 2b and 2c). A crucial element when examining environmental and resource regimes are the spatial boundaries of specific institutions and their environments. To examine metropolitan water challenges, this research considers both the institutions addressing water-related issues at the urban scale (UWM regime) and at the hydrological scale (IRBM regime). This further required awareness of the linkages between cities and the surrounding environment that sustain them (i.e. assessing urban water demand and appraising investment needs beyond the traditional city boundaries) (OECD 2015a).

I defined actors as entities that represent specific interests and have mandates relevant for addressing metropolitan water challenges. Who the actors are and how they frame the policy problems is crucial as this process is highly political and reflects power imbalances in society (Majoor and Schwartz, 2015: 121). Their behaviour is shaped by driving forces but also by the institutions in place. More specifically, the institutions analysed were chosen because they aim to influence challenges linked to water quantity, water quality and climate variability and change in terms of sustainability and inclusiveness (see 5.3, 6.3, 7.3 and 8.3).

(3) Instrument design analysis

The institutional framework in place determines the policy instruments that help or hinder key actors to address metropolitan water challenges. The instrument analysis serves to identify the regulatory, economic, suasive, coordination and infrastructural instruments in place within the urban water and river basin governance regimes that target challenges linked to water quantity, water quality and climate change adaptation (Research questions 3a. 3b and 3c). A comparable mix of instruments for both case studies was selected based on their estimated salience for water-related challenges (see 5.4 and 6.4 for São Paulo and 7.4 and 8.4 for Mexico City). The design of each instrument is examined in terms of its objectives, scale of implementation and its main characteristics. Instrument design is assessed in terms of whether it considers sustainability and inclusiveness criteria.
(4) Effect on actors given drivers

Driving forces and institutional factors can both influence actors’ behaviour. This thesis assesses the effectiveness of policy instruments in terms of key actors’ behavioural changes given contextual drivers (Research question 3). To determine the effectiveness of instruments, this thesis looks at whether UWM and IWRM/IRBM actors fulfill their mandates in relation to the instruments’ specific objectives (see 5.4 and 6.4 for São Paulo and 7.4 and 8.4 for Mexico City). It measures this effectiveness based on the instruments’ stated goals (identified through content analysis) and the perception of respondents on the extent to which these goals are met (based on semi-structured interviews and other sources\textsuperscript{12}). Beyond the focus on actors’ compliance, this step also involves evaluating additional changes in behaviour (Underdal, 2008).

In addition, policy instruments are usually created and used by those in power (Gupta \textit{et al.} 2015: 218). This is important to consider when analysing these instruments for a comprehensive understanding of their effects. The analysis may also highlight whether the current instruments in place fail to address certain drivers.

(5) Impacts

Ultimately, the goal of designing institutions is to effectively address the challenges deriving from human/environment interactions. Changes in actors’ behaviour do not guarantee impacts on the challenges at hand, in this case metropolitan water challenges, and as such they can prove unsatisfying if they remain the only dimension for evaluating institutional performance (Mitchell, 2008). The impact of instruments is therefore considered (based on semi-structured interviews, technical and scientific assessments, newspapers) in the context of existing driving forces and assessed in terms of the four dimensions of sustainable and inclusive development, defined in section 1.5.1.

The instruments’ design, their effect on actors given drivers and their impacts in terms of sustainability and inclusiveness have been measured through an ordinal scale and inductive ‘calculations’ of institutional performance. This calculation is an estimation of each instrument’s aggregated effects, symbolized by “--” (very negative), “-” (negative), “0” (neutral effect), “+” (positive) and “++” (very positive). The choices of scores reflect estimates based on available quantitative and qualitative data and perceptions from key actors. They mainly should be considered in relation to each other to assess which instruments have a comparatively more positive or more negative effect. A score of “--” or “++” therefore does not mean that an instrument could not perform any worse or better. A neutral effect means either that there is no discernible effect of the instrument in question, or that the positive effects are balanced out by the negative effects. It is important to distinguish between the potential positive and negative effects of each instrument when considering suggestions for redesign (Research question 3).

\textsuperscript{12} Newspaper articles, evaluation reports and technical assessments.
(6) Redesign (of instruments)

Finally, the proposals to redesign policy instruments of the urban water and river basin
governance regimes are based on the instruments’ effects on actors and impacts in terms of
sustainability and inclusiveness. The thesis proposes to maintain instruments that met these
goals, to discard or alter ineffective instruments, and to redesign existing or design new
instruments that could address gaps (see 5.5, 6.5, 7.5 and 8.5). It considers overall policy
coherence across multiple levels and between urban and river basin scales (Research question
4).

The analytical scheme below illustrates the analytical framework (see Figure 2.3).
Figure 2.3 Analytical framework for an institutional approach to urban water challenges

(1) DRIVERS OF TENSIONS BETWEEN THE URBAN AND BASIN
- Levels:
  - Global
  - National
  - Regional
  - Local
- Types:
  - Socio-economic development
  - Demographic trends
  - Land use changes
  - Climate

(2) INSTITUTIONS
- Basin
- Urban
- Global
- Transboundary
- National
- State
- Local

(3) INSTRUMENT DESIGN
- Types:
  - Economic
  - Regulatory
  - Coordination
  - Surplus
- Focus:
  - Water quantity
  - Water quality
  - Climate change adaptation

(4) EFFECT ON ACTORS
- Levels:
  - Basin
  - Urban
  - Global
  - National
  - State
  - Local
- Focus:
  - Water quantity
  - Water quality
  - Climate change adaptation

(5) IMPACTS ON SUSTAINABILITY AND INCLUSIVENESS
- Social:
  - (a) Affordability
  - (b) Sufficient in quantity and quality
- Ecological:
  - (a) Use
  - (b) Contamination
  - (c) Adaptability
- Economic:
  - (a) Efficiency
- Relational:
  - (a) Access to info
  - (b) Participation in decision-making
  - (c) Access to funds

(6) REDESIGN
- Maintain effective instruments / Eliminate ineffective instruments
- Redesign instruments with potential
- Introduce new instruments when needed

How do multiple drivers as well as urban water and river basin governance structures shape current metropolitan water challenges (causality)?

How can more appropriate instruments be (re)designed to address metropolitan water challenges, with the aim to guide metropolitan regions towards inclusive and sustainable development (design)?

What is the adequate spatial scale to understand and address metropolitan water challenges and how can policy instruments from river basin and urban water governance frameworks be (re)designed to sustainably and inclusively respond to these?
2.5 Units of Analysis

This research is based on three units of analysis – drivers, institutions and instruments – and the linkages between them.

2.5.1 Direct and Indirect Drivers

Drivers unfold at multiple levels, they can be direct or indirect and they need to be addressed by governance systems (Gupta and Pahl-Wostl, 2013; cf. GEO 2019). Examples of drivers are demographic trends, socio-economic development patterns (i.e. concentration of wealth, water use that is proportional to population growth), or land use changes that affect regional ecosystems and biodiversity. Direct drivers include land use change such as deforestation, and pollution, whereas indirect drivers concern climate change and variability, demography, economy, infrastructure and technology (Postel and Richter, 2003; Gupta and Pahl-Wostl, 2013).

2.5.2 Institutions

Institutions consist of formal and informal norms, laws, and policies, and can both cause and solve problems with environmental governance (Vatn and Vedeld, 2012). Within the context of the Anthropocene, where human action has increasing influence over the environment, creating effective institutions becomes crucial. Institutions play a prominent role both “as sources of large-scale environmental problems and as elements in the responses humans make to actual or anticipated environmental problems” (IHDP/IDGEC, 2005: 35). This research examines institutions of both the urban water governance regimes and river basin governance regimes at multiple levels within each case study.

2.5.3 Typology of Instruments

This thesis defines policy instruments as the mechanisms and techniques of governance used by state or non-state actors and involving the utilization of state resources or their conscious limitation, in order to achieve policy goals (Howlett and Rayner, 2007; Anderson, 2010). The potential of a policy instrument lies not in its isolated application but in its contribution to a policy mix (Chapman, 2003; Howlett and Rayner, 2007). The choice of instruments reflects the mode of governance, and changes in instruments tend to signify a shift in governance modes (Majoor and Schwartz, 2015, p. 114). This choice is not neutral, but rather reflects the balance of power between actors (Kassim and Le Galès, 2010; Majoor and Schwartz, 2015). Policy instruments may also shape and shift power relations. This research distinguishes four types of instruments:
- **Regulatory instruments**

These instruments consist of regulatory measures enforced by government or institutions with legal mandates (Hurlbert, 2016), and which prohibit (i.e. bans), empower (i.e. property rights) or compel behaviour (i.e. standards) (Majoor and Schwartz, 2015). They tend to be effective as they have a direct impact on their goals and are relatively predictable (Ibid). On the other hand, they are top-down and often inflexible, they do not provide incentives for actors to achieve more than the minimum standards and their coercive nature may lead to resistance (Ibid). These instruments may enhance sustainability and inclusiveness by applying legally binding principles (e.g. equity, human rights), social norms (e.g. good governance), standards and mandatory inclusion targets, inclusive spatial planning, the provision of civic amenities and public infrastructure (i.e. water and sanitation), safety net schemes and target subsidies (Gupta, Pfeffer, et al., 2015).

- **Economic instruments**

These instruments follow market rather than government directives and aim to encourage and discourage certain behaviours (rather than enforcing or prohibiting them, as in the case of regulatory instruments) through financial incentives and disincentives (Stavins, 2003; Majoor and Schwartz, 2015). They are seen as more politically feasible than regulatory instruments as they do not directly intervene in actors’ affairs (Bähr, 2010; Majoor and Schwartz, 2015). However, their costs can vary considerably according to the instrument and context, and they are less self-enforcing than regulatory instruments. They often have to be supported by regulatory mechanisms.

- **Suasive instruments**

Suasive instruments aim to internalize behaviour into individual decision-making through persuasion (Majoor and Schwartz, 2015, p. 112). This requires the provision of information, such as general education programmes, guidelines and codes of practice, training programmes, and research and development (Aramyan et al., 2016). They are most effective when applied in combination with other types of policy instruments (Majoor and Schwartz, 2015). While relatively cheap and less intrusive than regulatory instruments, as they rely on voluntary compliance, their impact is uncertain and dependent on the quality of information available (Majoor and Schwartz, 2015).

- **Infrastructural instruments**

Infrastructural instruments can directly shape actors’ behaviour and impact the goals they are designed to attain, by physically generating certain behaviour (Majoor and Schwartz, 2015). To be effective, they require considerable knowledge of social and biophysical processes (Ibid).

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### Table 2.3 Examples of potential instruments

<table>
<thead>
<tr>
<th>Instruments</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **Regulatory** | Water quality standards: Regulatory limits for the amounts of certain contaminants in water provided by public water systems (Helmer and Hespanhol, 1997)  
Environmental Impact Assessments: Evaluation of the likely environmental impacts of a proposed project or development, and development and assessment of measures to avoid or minimize these (Kominková, 2008)  
Water use permits: Rights to withdraw water from rivers and aquifers, typically allocated by national or state governments for different water uses (i.e. domestic, industrial and agricultural uses) (OECD, 2011). These are meant for quantitative and qualitative control of water resources, and to guarantee the right to access water resources  
Environmental licensing: Legally binding requirements to protect human health and the environment applied by a public authority. It should be carried out as part of the planning process, prior to the approval of projects (World Bank, 2012) |
| **Economic** | Payment for ecosystem services (PES): Incentives offered to people in exchange for preserving ecosystems and their services. Some argue that protecting certain ecosystems is only viable if their economic value is considered. Others claim that this valuation should be a strategy to create a new ‘rural-urban compact’, where cities reward rural dwellers for their provision of private and public goods (Corbera et al., 2009)  
Polluter-pays principle: Those who pollute must internalize its costs into their production costs (Porto and Costa, 2004)  
Other instruments include subsidies and bounties, tax concessions, special purpose grants, performance bonds and guarantees, tradable quotas, resource rents and royalties, and sliding charges for utilities (Buckley, 1991) |
| **Infrastructure** | From small-scale technology to large-scale infrastructure, this includes water metres, water-saving technology, public toilets, rainwater harvesting systems and inter-basin water transfers |
| **Suasive** | Campaigns to reduce water consumption, environmental education programmes, demonstration projects, labelling schemes (i.e. trademarks and brand names that assure buyers of the authenticity of a seller’s product(s) or service(s)), the provision of information to the public, flood warnings, and more |

*Source: Author*

In practice, instruments can frequently be classified in more than one category. For instance, Payment for Ecosystem Services (PES) programmes are an economic instrument as they involve a financial incentive for a certain behaviour, but they may also be considered a suasive instrument as they are usually voluntary. Nonetheless, using the labels above to reflect their primary goals is useful in terms of classifying and evaluating the effectiveness of these instruments. Furthermore, in practice instrument mixes are more effective than single instruments.
2.5.4 INSTRUMENT SELECTION AND EVALUATION CRITERIA

To be selected for this study, instruments had to fulfil multiple criteria to ensure relevance in relation to the research questions and comparability between the two cases (see Table 2.4). First, selected instruments had to, directly or indirectly, address metropolitan water challenges through the urban water or river basin governance regimes, in order to determine how they affect these (positively or negatively). The focus of each instrument must be on water quantity, water quality or climate change adaptation, or a combination of these. They should be designed to impact water-related challenges in terms of inclusiveness and sustainability. Moreover, they must be either a regulatory, economic, infrastructural or suasive instrument. The instruments may be implemented at national, state, basin, metropolitan or municipal levels, as long as they aim to address the water-related tensions between cities and their basins.

This led to a comprehensive list of instruments to potentially analyse in both case studies (see Annex ANNEX B – COMPREHENSIVE LIST OF POLICY INSTRUMENTS). This was further refined to a selection of several instruments by considering available data and feasibility, and these were analysed in Chapter 6 and Chapter 8 (for an overview of selected instruments see ANNEX C – POLICY INSTRUMENTS SELECTED FOR ANALYSIS). The major focus is on regulatory and economic instruments, the most common and relevant in both cases. The same or similar instruments are often implemented at different administrative levels in each case.

Table 2.4 Criteria for instrument selection

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>UWM and IWRM/IRBM</td>
</tr>
<tr>
<td>Focus</td>
<td>Water quantity; Water quality; Climate change adaptation</td>
</tr>
<tr>
<td>Instrument goal</td>
<td>Inclusiveness and sustainability, in terms of environmental, social,</td>
</tr>
<tr>
<td></td>
<td>economic and relational dimensions</td>
</tr>
<tr>
<td>Type of instrument</td>
<td>Regulatory; Economic; Coordination; Suasive</td>
</tr>
<tr>
<td>Levels of implementation</td>
<td>National; State; Basin; Metropolitan; Municipal</td>
</tr>
</tbody>
</table>

Source: Author

Generally, policy instruments are not implemented in isolation, but rather different types of instruments are used simultaneously and interact with each other (Howlett and Rayner, 2007). This mix of instruments is embedded within a particular socio-political context and reflects a particular ideological foundation (Majoor and Schwartz, 2015). While a large range of instruments may be available, government authorities tend to use specific combinations of instruments, based on cost, effectiveness, feasibility and an estimation of their joint effect (Lascoumes and Le Gales, 2007; Perevochtchikova and Torruco Colorado, 2014). However, their design and use also reflects the power balance between actors and are therefore political (Kassim and Le Galès, 2010; Majoor and Schwartz, 2015). Consequently, it is essential to consider the context in which instruments are selected and the possible motivations and constraints behind this. Instruments are not a panacea and have often had mixed results in
practice, and their potential to induce behavioural change has to be put in perspective, especially for complex systems such as large cities (Majoor and Schwartz, 2015).

2.6 CONTENT ANALYSIS

Content analysis can be defined as a method for “making inferences by objectively and systematically identifying specified characteristics of messages” (Holsti, 1969: 14). The purpose is to examine meanings and patterns in certain documents in a way that allows the researcher to understand social reality (Zhang and Wildemuth, 2017). This thesis makes use of a qualitative analysis of content through a directed analysis of content with coding categories derived from the problem definition and the literature review.

As a first step, it uses content analysis to assess the SDGs and linkages between their specific targets and urban/metropolitan water challenges in a context of anthropogenic climate change. It identified SDG 6 (Clean water and sanitation), 11 (Sustainable cities and communities) and 13 (Climate action) as the main SDGs aiming to address these issues (see 1.2.2). This was based on the SDGs’ targets and indicators, as well as progress reports.

Following this, this thesis uses content analysis to identify and analyse the drivers, institutions and instruments at multiple levels of governance in both case studies that related to urban water and river basin challenges. This was done through a systematic examination of the relevant laws, policies, regulations and other information such as planning documents (master plans, plans for the metropolitan regions, river basin plans), newspaper articles and local government publications. The purpose is to describe and make inferences about the characteristics of drivers, institutions and instruments that related to metropolitan water challenges. Materials were categorized in terms of policy problem (i.e. water quantity, water quality, climate change), different geographic levels (i.e. international, transboundary, national, provincial and local) and focus on the urban or river basin scales. Instruments were also categorized according to their typology (i.e. regulatory, economic, infrastructural and suasive). The literature identified UWM and IWRM/IRBM as the main paradigms from which institutions and instruments are derived to address such challenges. Documents were analysed for language relating to the main characteristics of these paradigms, the effectiveness of instruments and impacts in terms of sustainability and inclusiveness. This was further supplemented by a review of previous studies on Mexico City and São Paulo. The resulting themes were then complemented and triangulated with the transcripts from semi-structured interviews. This forms the core of chapters 5, 6, 7 and 8.

2.7 FIELDWORK

2.7.1 FIELDWORK RESEARCH APPROACH

I conducted fieldwork to collect primary and secondary data on metropolitan water challenges and how these are addressed by the urban water and river basin governance regimes in the metropolitan regions of São Paulo and Mexico City. Semi-structured interviews were used to
discover perceptions of key informants on the drivers, institutions and instruments related to metropolitan water challenges. The more structured approach of content analysis was thereby complemented with the more open, inductive nature of semi-structured interviews, enabling me to access complicated themes and get at deeper issues of meaning and attitudes (Corbetta, 2003; Cloke et al., 2004). These were particularly useful to analyse the effects of instruments on actors and their impacts in terms of sustainability and inclusiveness. The difficulty to establish causal linkages within environmental and resources regimes means that it is difficult to use statistical procedures to explain the causal significance of institutions (Young et al., 2008, p. 20). The combination of the results from the content analysis and a wide range of perspectives from key informants allowed for a balanced assessment. However, this method includes certain limitations such as the bias of the interviewer and power relations between the interviewer and the respondent that can influence the data produced (Cloke et al., 2004).

The fieldwork took place in two stages: From February to August 2016 in Mexico City, and from September 2017 to January 2018 in São Paulo. Sixty respondents were interviewed in Mexico City and 38 in São Paulo (see ANNEX D – INTERVIEW LIST). Interviews were conducted with state and non-state actors at multiple levels of governance with influence on the metropolitan and river basin spatial scales. These were then coded through Atlas.ti, which allowed identification of a set of themes and classification of interview responses to allow for interpretation and addressing the research questions (Ritchie et al., 2013). In addition, I attended academic and professional events related to the research topic, attended meetings of basin organisations and public hearings on water services, visited neighbourhoods affected by severe water-related challenges as well as sites such as wastewater treatment plants and flood control infrastructure.

13 The second fieldwork was shorter as I was more familiar with the context thanks to previous research.
2.7.2 ETHICAL ASPECTS AND REFLECTIONS ON THE FIELDWORK RESEARCH PROCESS

As this research involved qualitative methods, including semi-structured interviews and participant observation, ethical considerations were important in the research design and implementation. In both case study sites, there are significant tensions around the topic of urban water challenges and their governance, as well as corruption and illegal activities. I was aware that exposing certain respondents could lead to repercussions in their personal and professional lives.

Obtaining informed consent from participants is crucial and I considered this throughout the data collection process. Respondents were contacted by email or through a phone call through which I first introduced myself and explained the purpose of the study, the interview procedure and their role in the process to each potential respondent. Their participation was entirely based on their own choice and they could refuse to answer questions or withdraw their participation at any moment. I also asked for their permission to record the interviews and explained that the recordings and transcripts will be kept in a secure location that only I can access. In the large majority of cases, respondents agreed to be recorded.

The water challenges in São Paulo and Mexico City are highly political in nature and involve multiple interests. Cases of corruption, criticism of politicians and administrators, and other sensitive issues were brought up by respondents during interviews. Respondents also highlighted – directly or indirectly – issues within their own organization. Therefore, it was critical to protect their anonymity and right to privacy, and this allowed for building a relationship of trust with respondents. This was done by using codes when transcribing interviews, and respondents’ answers were described such that they could not be identified. The identity of activists and residents of areas affected by water-related challenges were protected. Respondents were promised a digital copy of the thesis upon completion.

As most of the fieldwork took place in offices of key informants, there were no significant safety risks. I was aware of my position as a young, foreign, female researcher and took basic precautions in my movements around both cities. This involved avoiding specific neighbourhoods or visiting these with a gatekeeper who was familiar with the surroundings.

2.8 INTEGRATION

This chapter has explained the value of conducting a comparative case study to gain in-depth knowledge of specific cases and identify causal mechanisms, and then identify similarities and differences that support theory-building. As this research investigates only two cases, it aims to provide insights on the causal mechanisms of metropolitan challenges and the effectiveness of institutions and instruments that address these and, if possible, to identify lessons learnt for other metropolises. This is supported by an analytical framework based on the IDGEC’s institutional analysis approach and that focuses on water related challenges and their drivers, and the institutions and instruments that address these. Such an approach allows for exploring the roles of both urban water governance regimes (see Chapter 3) and river basin governance.
(see Chapter 4) in shaping water challenges in the metropolitan regions of São Paulo and Mexico City.