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UTRECHT UNIVERSITY

Urban Water Governance

The Governance Capacity Assessment Framework

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“The fate of the Earth’s climate and the vulnerability of human society to climate change are intrinsically linked to the way the cities develop over the coming decades and century”

(Tyndall Centre 2004)

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The Governance Capacity Assessment Framework

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Photo on title page: *An aerial view of buildings standing out amid haze engulfing Wuhan, central China's Hubei province on Dec. 3, 2009* (STR/AFP/Getty Images).

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Summary

Urbanization and climate change are megatrends that have great implications for human society. Currently, approximately 50% of the global population lives in cities (UN 2012). The global population is growing and cities will absorb the bulk of this growth, especially in developing regions (UN-Habitat 2011; UN 2014). This results in higher resource extraction, consumption, and emission of greenhouse gasses (GHGs), which accelerates climate change. Weather patterns become more extreme, with intense rainfall, hotter and longer droughts and sea level rise (IPCC 2014). The majority of people, economic activities, and assets concentrate on a small surface area often in the vicinity of rivers and coasts. This increases the vulnerability to- and exacerbates the effects of- climate change, and impacts the natural environment. Also the high density of paved surfaces, buildings and concrete structures can lead to higher temperatures in cities, i.e. the Urban Heat Island effect (UHI) (EPA 2014).

Cities increasingly deal with these wicked issues of flooding, water scarcity, UHI, and water quality and resource scarcity. These issues influence- and are affected by- urban water management. The UN and OECD state that “*the water crisis is essentially a crisis of governance*” (UNDP 2003; OECD 2011). Governance determines the way water management is designed and how decisions are made. The first step in improving urban water governance is an assessment. This study aims to develop a Governance Capacity Assessment Framework (GCAF) that is consistently applicable (i.e. for most cities), comprehensive (i.e. inclusion of the most important concepts and theories in literature), and comparable (i.e. the assessment of the cities should be relative to each other).

Cities deal with a multitude of actors, interests, objectives, wicked water issues, and multi-level decision-making. The City Blueprint management assessment identifies the most threatening wicked issues. Next can be determined which stakeholders should be included in the assessment. Therefore a method for a quick-scan institutional map is developed based on empirical studies and guidebooks.

An extensive literature study has been conducted in the field of water management, water governance, adaptive capacity, transition management, innovation and social learning. This has yielded nine Governance Conditions (GCs) that are deemed the most recurrent and relevant and are necessary to develop the governance capacity to cope with wicked water issues. The GCs are: 1) *Awareness*; 2) *Useful knowledge*; 3) *Continuous learning*; 4) *Stakeholder engagement process*; 5) *Policy ambition*; 6) *Agents of change*; 7) *Multi-level network potential*; 8) *Financial viability*; and 9) *Implementing capacity*. The nine GCs have been further specified by three characteristics each. For these 27 characteristics, a heuristic ordinal classification of five levels has been developed by combining general concepts of transition management as well as characteristic features. This allows the GCAF to be applicable to a wide variety of cities and makes the inclusion of concepts from the diversity of literature possible. This research also yielded an explorative operationalization study, which provides insights for the practical application of the GCAF.

This work contributes to the urban water governance scholarship, which is emerging, yet relatively novel and unexplored. In particular, empirical studies specified to urban areas are lacking. The GCAF provides an approach that is comprehensive, consistent and comparable. Through this it promotes city-to-city learning. This research also provides suggestions for practical application; however, case studies should be used to further improve its consistency and comparability.

The GCAF can be helpful to gain insight into urban governance capacity. As such, this work hopes to contribute to the transition towards sustainable Integrated Water Resources Management (IWRM). The rapidly evolving challenges of climate change and urbanization make this increasingly urgent and, therefore, this research puts forth a plea to further empirically investigate urban water governance.

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Glossary and acronyms

Term	Description
Accountability <i>UNDP 2013</i>	Sets of controls, counterweights and modes of supervision that make officials and institutions in the public and private sector answerable for their actions and ensures that sanctions are applied against poor performance, illegal acts and abuses of power
Adaptation <i>UNEP 2007</i>	Adjustment in natural or human systems to a new or changing environment, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation
Adaptive capacity <i>IPCC 2007a</i>	The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences
Awareness, (Climate change-) <i>Wilson 2015 p.xvi</i>	Knowledge or perception ranging from fully conscious to subconscious, encompassing both cognition and feeling or sensing
Climate change <i>IPCC 2007b</i>	A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity
Decentralization <i>The World Bank 2001</i>	The transfer of authority and responsibility for public functions from the central government to intermediate and local governments or quasi-independent government organizations and/or the private sector
Engagement <i>OECD 2015b</i>	Process by which stakeholders are involved in the water-related policy/project processes and activities to ensure effective water governance. The engagement process can happen at different stages of an initiative (design/conception, development, implementation, evaluation, etc.) and can have different objectives, from information production and sharing to co-production and co-decision. Furthermore, engagement can take various forms depending on the degree of involvement of stakeholders
Governance <i>OECD 2015a</i>	Governance is the exercise of political, economic and administrative authority necessary to manage a nation's affairs
Inclusiveness <i>OECD 2015b</i>	Extent to which engagement processes involve stakeholders from diverse backgrounds and take into account their needs, assets and perspectives into the design and implementation of water policies and projects
Institution <i>UNEP 2007</i>	Regularized patterns of interaction by which society organizes itself: the rules, practices and conventions that structure human interaction. Formal institutions include law, international environmental agreements, bylaws and memoranda of understanding. Informal institutions include unwritten rules, codes of conduct and value systems
IWRM <i>UNEP 2007</i>	A process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems
Legitimacy <i>UNEP 2007</i>	Measure of the political acceptability or perceived fairness. State law has its legitimacy in the state; local law and practices work on a system of social sanction, in that they derive their legitimacy from a system of social organization and relationships
Mitigation <i>UNEP 2007</i>	Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards
Multiple-loop learning <i>Pahl-Wostl 2009</i>	Single-loop learning occurs when established routines are improved; Double-loop learning occurs when underlying assumptions are challenged; Triple-loop learning occurs when world-views, underlying values and beliefs are being questioned
NRM <i>The World Bank 2000</i>	Refers to the sustainable utilization of major natural resources, such as land, water, air, minerals, forests, fisheries, and wild flora and fauna
Organizations <i>UNEP 2007</i>	Bodies of individuals with a specified common objective. Organizations could be political (political parties, governments and ministries), economic (federations of industry), social (NGOs and self-help groups) or religious (church and religious trusts)
Policy <i>UNEP 2007</i>	Any form of intervention or societal response. This includes not only statements of intent, such as a water policy or forest policy, but also other forms of intervention, such as the use of economic instruments, market creation, subsidies, institutional reform, legal

reform, decentralization and institutional development. Policy can be seen as a tool for the exercise of governance. Such an intervention enforced by the state is public policy

Polycentric governance <i>Skelcher 2005, p.89</i>	Systems in which political authority is dispersed to separately constituted bodies with overlapping jurisdictions that do not stand in hierarchical relationship to each other
Stakeholder <i>OECD 2015b</i>	Person, group or organization who has an interest or stake in a water-related topic, may be directly or indirectly affected by water policy, and/or have the ability to influence the outcome positively or negatively
Transition <i>Loorbach 2010, p.166</i>	Multilevel, multiphase processes of structural change in societal systems: they realize themselves when the dominant structures in society (regimes) are put under pressure by external changes in society, as well as endogenous innovation
Transparency <i>UNDP 2013</i>	The level of openness of governance processes and access to information. It also refers to the extent that public decision-making processes and outcomes are open to scrutiny by citizens, the media, and others
Urbanization <i>OECD 2003</i>	Increase in the proportion of a population living in urban areas or the process by which a large number of people becomes permanently concentrated in relatively small areas, forming cities
Wicked problems <i>Roberts 2000</i>	Wicked problems have the following characteristics: (i) there is no definitive statement of the problem, in fact, there is abroad disagreement of what the problem is; (ii) the search for a solution is open ended. Stakeholders compete to propose their preferred solutions which reflects their preferred problem definition; (iii) problem solving is complex as constraints are constantly changing; (iv) constraints also change because they are generated by numerous interested parties who “come and go, change their minds, fail to communicate, or otherwise change the rules by which the problem must be solved”. Consequently, solving them is by definition impossible; they can merely be ‘tamed’ or coped with

Acronyms

BCI	Blue City Index
CL	Characteristics Level
GC	Governance Condition
GCAF	Governance Capacity Assessment Framework
GDP	Gross Domestic Product
GHG	Green House Gas
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
LECZ	Low Elevation Coastal Zone
NRM	Natural Resources Management
OECD	Organization for Economic Co-operation and Development
SNA	Social Network Analysis
TPF	Trends & Pressures Framework
TPI	Trends & Pressures Index
UHI	Urban Heat Island
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund

1. Introduction

Urbanization and the effects of climate change pose one of the biggest challenges our society is- and increasingly will- face, as it greatly affects urban water resources. This is elaborated in the problem description, after which a short overview is given of previous work done to address these problems. Further on the objectives of this research regarding societal aspects, positioning in scholarship and the perspective of the internship organization (KWR) are described, followed by the research question.

1.1. Urbanization

Urbanization is a global phenomenon that is expected to persist in the coming decades. The global urban population has increased fivefold since 1950 and, at present, approximately half of the world's population lives in urban areas, while the urban population is expected to double by 2050 (Fig. 1.1) (Corfee-Morlot et al. 2009; UN 2012; UN-Habitat 2011; Van Staden 2014). In 2011, there were 447 cities with a population of >1 million and it is estimated that in 2020 this number will grow to 527 cities. Furthermore, the average population of the 100 largest cities on the planet will grow from 7.6 million in 2011 to 8.5 million in 2020 (UN-Habitat 2011). It can be observed that cities of all sizes contribute to global urbanization (UN 2014) as shown in Fig. 1.2.

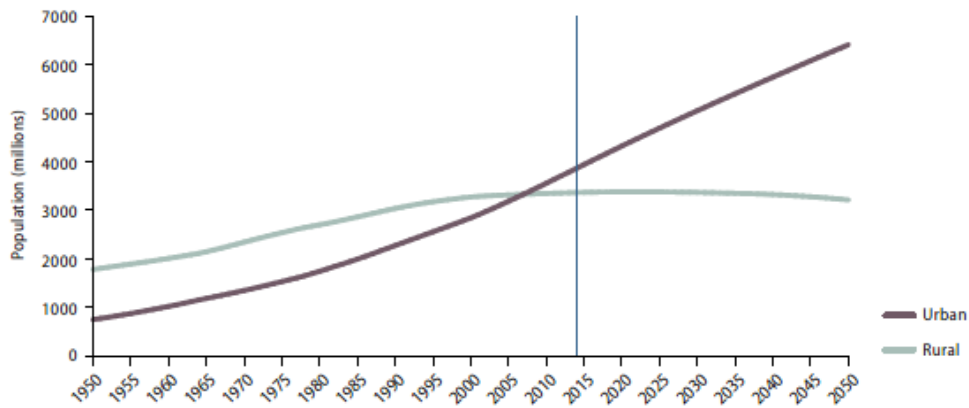


Figure 1.1 Global urban and rural population, 1950 – 2050 (UN 2014)

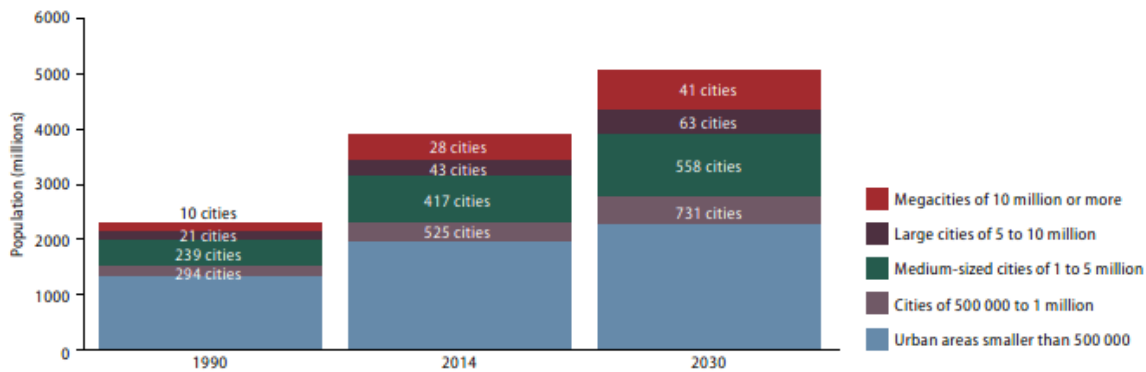


Figure 1.2 Cities of all sizes contribute to global urban population growth (UN 2014)

Most of this growth will take place in developing countries. In fact, developing countries account for 90% of the global urban population growth (UN-Habitat 2011; UN 2014). By 2050, the urban population of Africa will likely triple and that of Asia will increase by 61% (UN 2014). The trend of global urbanization has been associated with economic and societal processes. These have brought greater geographic mobility, lower fertility, higher life expectancy, and aging population. Urban living is often associated with higher levels of education, better health, access to social services, and enhanced opportunities for cultural and political participation (UN 2014). For example, urban areas in OECD countries with a population of >500.000 inhabitants account for roughly 55% of the gross domestic product (GDP) and with only 4% of the land cover (OECD 2015d).

1.2. Climate change

The reality of global climate change is reaching a consensus. Indeed, since the 1950's many of the observed changes are unprecedented over decades to millennia. The increase of greenhouse gasses (GHG) in the atmosphere results in higher temperatures of the troposphere and the oceans, which has implications for many, if not all, climatic systems and processes (IPCC 2013). The rising global temperatures will cause the oceans to expand resulting in higher sea levels, amplified by melting glaciers and arctic ice (Fig. 1.3). The weather patterns will become more extreme, with intense rainfall events as well as longer, hotter droughts (Hunt and Watkiss 2011; IPCC 2013; IPCC 2014; UN-Habitat 2011).

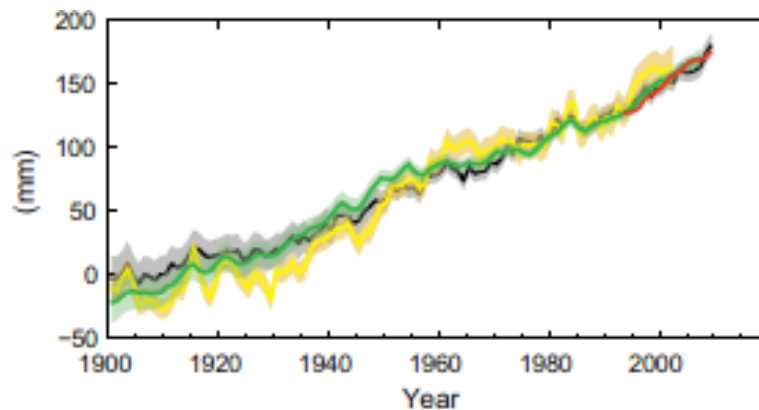


Figure 1.3 Global mean sea level rise relative to the 1900-1905 mean of the longest running dataset. The colored lines indicate different datasets (IPCC 2013)

Global warming also has a profound effect on hydrological and meteorological processes. The increase in temperature, exacerbated in the urban environment, will affect evaporation and precipitation patterns. In the period 1900-2005, the wetter regions (North and South America, Northern Europe and Northern and Central Asia) have seen an increase in precipitation, while the dry regions (the African Sahel, the Mediterranean, Southern Africa and parts of Southern Asia) have become dryer. Climate models project that the difference between the arid and humid regions in terms of extreme weather events will further increase (UN-Habitat 2011).

1.3. Problem description

“...the effects of urbanization and climate change are converging in dangerous ways which threaten to have unprecedented negative impacts upon quality of life, and economic and social stability.”

(UN-Habitat 2011, p.1).

Global urbanization and climate change, particularly in developing countries, are treacherous trends, as the fastest growing urban areas are also the least equipped to deal with climate change. Even without climate change, the poor and marginalized in these areas are exposed and vulnerable to natural weather phenomena and dangerous living environments (UN-Habitat 2011). One of the biggest challenges in dealing with urbanization is managing the urban water system. Potable water, sanitation, waste disposal, and dealing with marine-, pluvial- and fluvial flooding are vital to sustainable urban growth (Fig. 1.4).

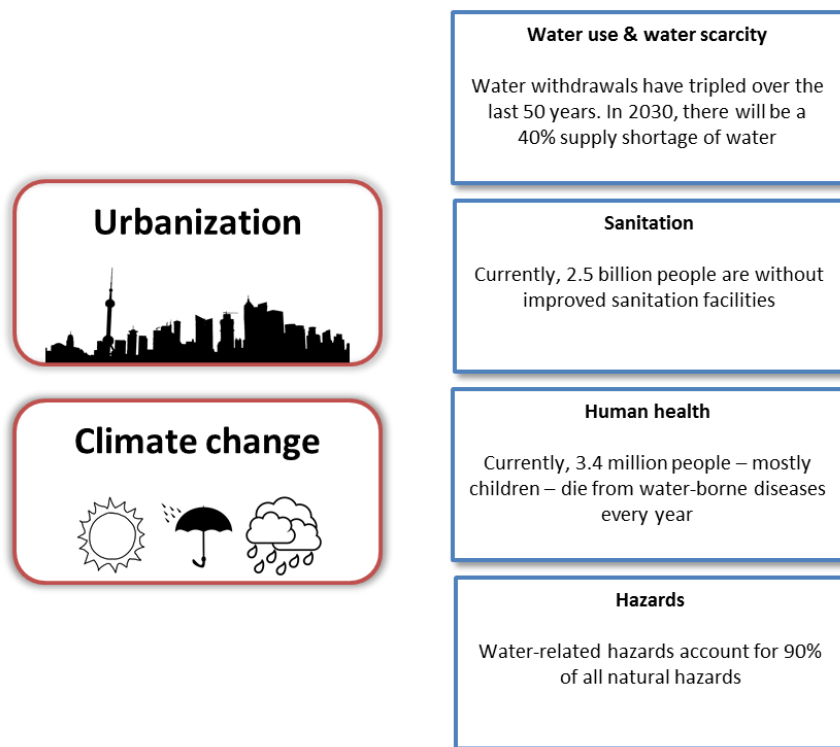


Figure 1.4 The megatrends of urbanization and climate change will pose challenges for urban water cycle services (adjusted from Koop and Van Leeuwen 2016)

The urban water challenges are affected by both urbanization and climate change. Urbanization may exacerbate the effects of climate change and increase vulnerability to water-related challenges. For example, the warming of the oceans causes sea level rise and threatens low lying coastal urban centers with flooding (Corfee-Morlot et al. 2009; Dircke et al. 2010; UN-Habitat 2011; Van Staden 2014).

The Low Elevation Coastal Zone (LECZ) comprised of just 2% of global land area in 2000, but accounted for 10% of the world's population and 13% for the global urban population. In fact, two-thirds of the cities with >5 million inhabitants are located in the LECZ. Sea level rise and land subsidence can cause marine flooding, salt water intrusion and coastal erosion in the LECZ, devastating the highly populated and valuable urban areas, livelihoods and ecosystems (Corfee-Morlot et al. 2009; Van Staden 2014). For example, with a 0.5 m sea level rise the population at risk could be more than tripled. With the current rate of increase in GHG emissions, a 1 m rise in sea levels can be expected by the end of this century. Moreover, the higher temperature of tropical seas may trigger more extreme weather events such as storm surges, hurricanes and typhoons (UN-Habitat 2011; Van Staden 2014).

A higher frequency and intensity of extreme rainfall events can result in more frequent fluvial and pluvial floods. Especially in cities, where there is little area for infiltration and limited drainage capacity, floods can cause serious damage. In the rapidly growing cities of the developing world, the new urbanites often build informal settlements on river banks and steep hill slopes. They, although not exclusively, will bear the brunt of the damaging floods and landslides that result from extreme downpour (Corfee-Morlot et al. 2009; UN-Habitat 2011; Van Staden 2014). Poor waste management can cause severe pollution of the surface water and a reduction in the discharge capacity of urban drainage systems which increases the magnitude and frequency of floods. Combined sewer overflows¹ (CSOs) will also become more frequent as the drainage system is overwhelmed by the

¹ A combined sewer drains both wastewater and stormwater in the same system. In case of an extreme rainfall event, the system will discharge untreated water to surface water.

excess of rainwater. This has negative effects for the urban surface water quality and possibly the public health (Van Staden 2014; Gasperi et al. 2008).

A phenomenon unique to cities is the Urban Heat Island (UHI) effect. Buildings, roads and other infrastructure replace open land, water, and vegetation. Surfaces that were once permeable and moist often become impermeable and dry. Reduced vegetation limits shade and evapotranspiration, thus increasing surface temperature. The built environment generally has a lower albedo and thermal emissivity, and a higher heat capacity (EPA 2014; Yamamoto 2006; UN-Habitat 2011). Furthermore, heat released by machines, industry, transport, etc. as well as the local greenhouse effect, due to fine particulate air pollution, contribute to the UHI (Yamamoto 2006). This may threaten vulnerable groups, such as the elderly, increase energy consumption for cooling, elevate GHG emissions, and develop an impaired water quality (EPA 2014; Yamamoto 2006).

Cities inherently extract natural resources for a large number of people on a relatively small surface area. Moreover, 80% of the GDP is produced in cities and approximately 75% of the energy and materials are consumed in urban areas (UNEP 2013). This exerts great stress on the finite (local) natural resources, including fresh water. Urbanization occurs particularly in developing countries, as the developed world is for a large part already highly urbanized (OECD 2015d; UN 2014). Irrespective of a city's level of development, the water challenges need to be addressed to ensure a sustainable urban living environment (OECD 2015c). Urbanization and climate change will increase pressure on the water system, while policy- and decision-makers are dealing with increasing uncertainties. Sustainable water governance may be the most important aspect in enabling the transition towards Integrated Water Resources Management (IWRM) and sustainable urban development (OECD 2011; Andersson 2015; Otieno 2011).

This study focuses on urban water and climate adaptation issues which are often referred to as 'wicked problems'. Wicked problems are complex, highly inter-related, cover different sectors and are typically dealing with conflicting interest. They have the following characteristics: (i) there is no definitive statement of the problem, in fact, there is a broad disagreement of what the problem is and every problem is a symptom of another problem; (ii) the search for a solution is open ended because stakeholders compete to propose their preferred solutions which reflects their preferred problem definition; (iii) problem solving is complex as constraints are constantly changing; (iv) constraints change because they are generated by numerous interested parties who "come and go, change their minds, fail to communicate, or otherwise change the rules by which the problem must be solved" (Roberts 2000). Consequently, solving them is by definition impossible; they can merely be 'tamed' or coped with (e.g. Rittel and Webber 1973; Roberts 2000; Head and Alford 2013; Termeer et al. 2015). There is a consensus amongst scholars that an integrative, proactive and learning perspective, across temporal, institutional, and spatial scales, is required (e.g. Adger et al. 2005; UNECE 2009; Head and Alford 2013). Although empirical evidence is not conclusive, most scholars agree that polycentric or network-oriented governance systems are better able to solve wicked problems and encompass more adaptive capacity (Folke et al. 2005; Lemos and Agrawal 2006; Huitema et al. 2009; Pahl-Wostl 2008).

1.4. Previous work

1.4.1. The City Blueprint Framework

The City Blueprint® Framework is a first attempt to perform a baseline assessment of IWRM and the required steps to facilitate sustainable and integrative solutions. The indicator assessment evaluates the actual state of a city's IWRM. The City Blueprint allows for comparison with other leading cities and promotes city-to-city learning. The City Blueprint provides a quick scan of the state of the whole urban water cycle. The baseline assessment serves as a vital step to develop a long-term strategic planning process to improve the city's performance, as shown in Fig. 1.5 (Van Leeuwen et al. 2015b). The City Blueprint aims to facilitate the consecutive steps that need to be taken to realize sustainable urban IWRM.

The City Blueprint aims to support decision makers; therefore simplicity (easy to calculate), transparency and ease of communication are key elements. The City Blueprint can be applied: (i) to

communicate a city's IWRM performance and exchange experiences, (ii) to select appropriate water supply and sanitation strategies, (iii) to develop technological and non-technological options as future alternatives for the water cycle, where several possible changes in the use of technology, space and socio-economic scenarios can be introduced. This should finally lead to: (iv) a selection of measures, including an evaluation of their costs and benefits under different development scenarios, and how to integrate these in long-term planning of investments (Van Leeuwen 2013).

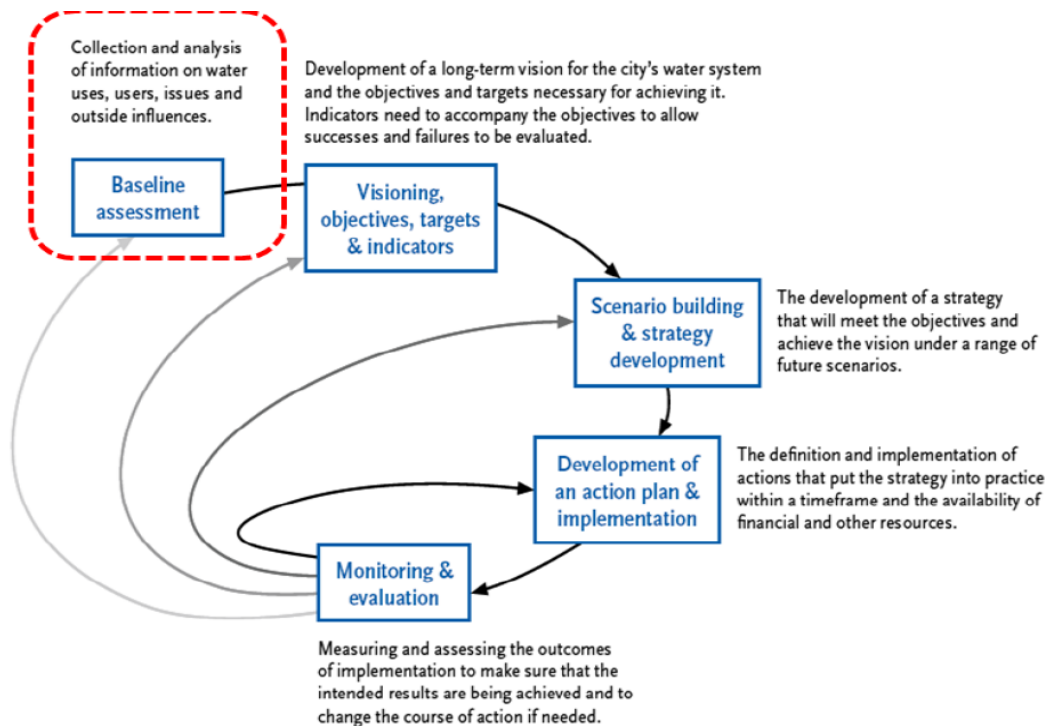


Figure 1.5 The baseline assessment is the first step towards the development of sustainable IRWM (Philip et al. 2011).

The assessment of a city is done in an interactive multi-stakeholder approach in which discussion and exchange of knowledge and experiences are key. Data for the indicator assessment comes partly from public sources and is partly provided by the cities themselves by means of a questionnaire which is available online on the City Blueprint website (EIP-Water 2016). The City Blueprint consists of the 25 indicators that receive a score between 0 and 10 (where 0 indicates the necessity of further attention and the score of 10 represents an excellent score). The geometric average of all 25 indicators is the Blue City Index (BCI).

The City Blueprint also includes the Trends and Pressures Framework (TPF). The TPF provides a wider context and is complementary to the BCI. In order to promote city-to-city learning, it is important to strictly separate urban water management performances from trends and pressures on which local water managers have negligible influence. For example, a city located in an arid region may experience water scarcity due to the low natural availability, not necessarily due to over consumption or poor management. The performance-oriented assessment can therefore be more adequate in showing a city's performance when the TPF is considered. This will provide better insight into the opportunities and limitations for urban IWRM (Koop and Van Leeuwen 2015). The City Blueprint and TPF of Amsterdam are shown in Fig. 1.6 and Fig. 1.7. Based on the indicator assessments, interactive discussions are held among all stakeholders, resulting in a proposal for follow-up actions, implementation and evaluation.

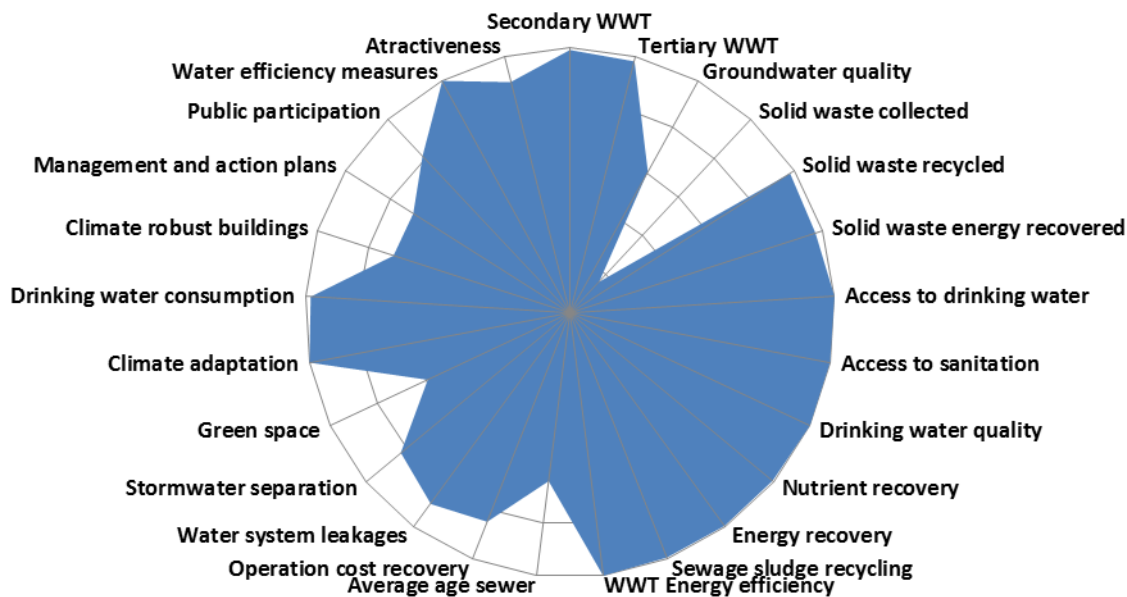


Figure 1.6 The City Blueprint baseline assessment of Amsterdam. A score of 0 (center of the diagram) indicates that further attention is required; a score of 10 (periphery of the diagram) indicates an excellent score on the indicator. The overall performance score, i.e., the Blue City Index (BCI) for Amsterdam is 8.3 (Koop and Van Leeuwen 2015)

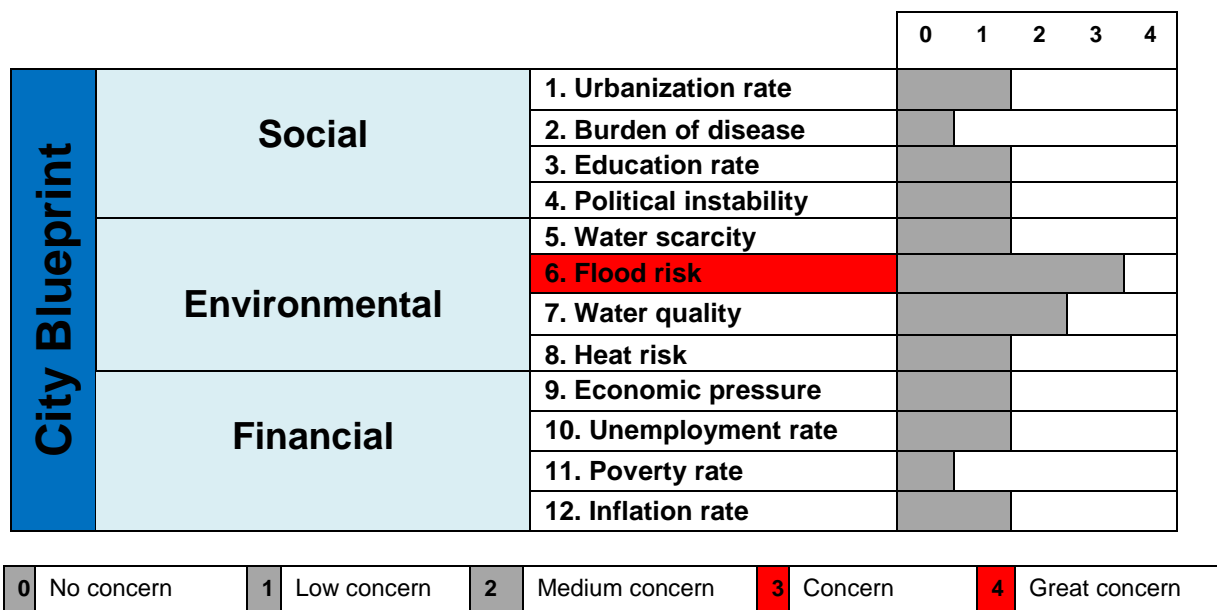


Figure 1.7 Trends and pressures in Amsterdam. This figure shows the key areas of concern that may affect the urban water cycle services (Koop and Van Leeuwen 2015)

1.4.2. Water Governance Indicators and Measurement Frameworks

Water governance is crucial in providing administrative rules, practices and processes that support sustainable decisions. The Organization for Economic Co-operation and Development (OECD) has recognized the importance of water governance and –management in the development of cities, regions and countries and has therefore launched the Program on Water Governance. The objective of this program is to take stock of recent experiences, identify good practices and develop practical tools to assist different levels of governments and other stakeholders in engaging effective, fair and sustainable water policies (OECD 2016b).

The OECD has accumulated data and analytical work on water policy since 2007. They recognized that the implementation of sustainable and effective water policies requires appropriate governance. The OECD published a report in 2011 which in particular focusses on the challenges presented by multi-level governance (OECD 2011). The OECD argues that in most countries water governance is fragmented and would economically and environmentally benefit from a stronger rationale and efforts to co-ordinate water policy. The OECD has since produced numerous reports and publications focusing on empirically identified governance gaps that inhibit the realization of sustainable IWRM (for example OECD 2011; OECD 2013; OECD 2014; OECD 2015a). The framework has been used to review the water governance of 17 OECD countries and 13 Latin American countries and to provide more in-depth analysis for Mexico (2013), the Netherlands (2014), Jordan (2014), Tunisia (2014) and Brazil (2015).

From the comprehensive work of the OECD, the principle co-ordination and governance challenges across ministries and public agencies, between levels of government, and across local actors involved in water policy, have been identified (OECD 2011). The so-called governance gaps identified by the OECD are displayed in Fig. 1.8 and shortly described in Table 1-1.

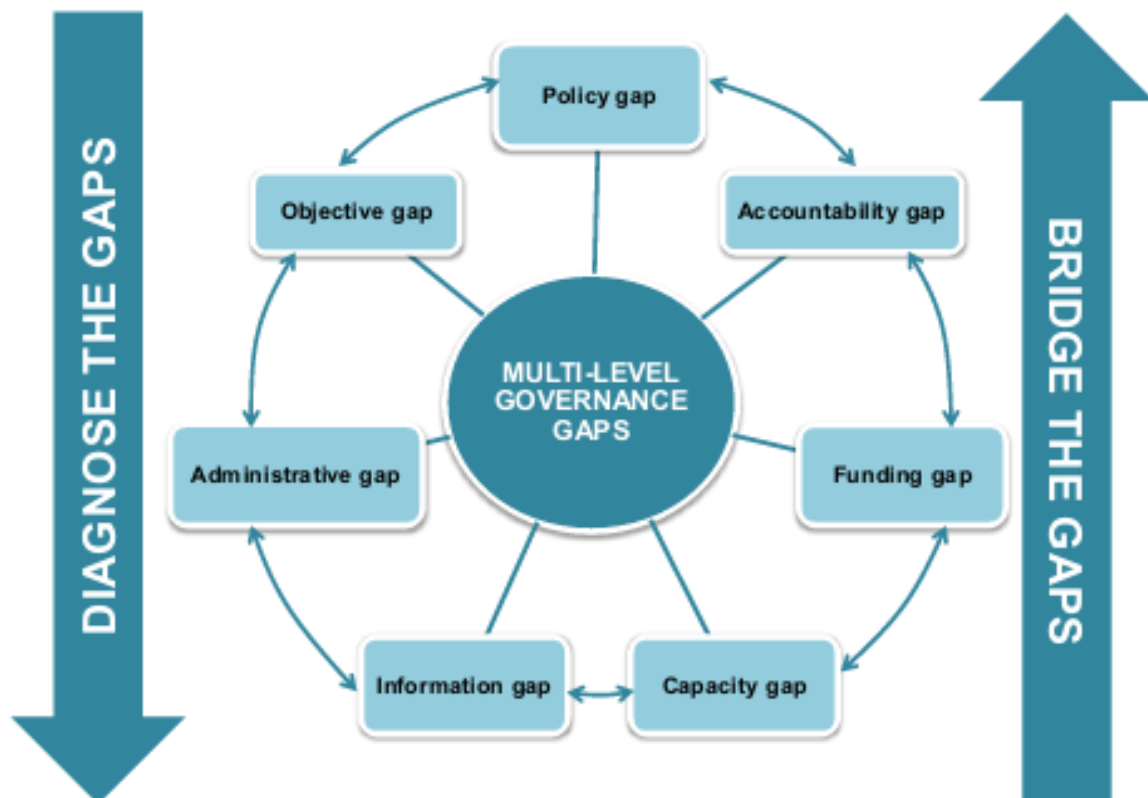


Figure 1.8 The governance gaps identified by the OECD through empirical analysis (surveys amongst cities in member states). Source: (OECD 2011)

Table 1-1 The governance gaps identified by the OECD (2011)

Multi-level governance gaps	Proxy indicators
<i>Funding gap</i>	Unstable or insufficient revenues of sub-national governments to effectively implement water policies
<i>Capacity gap</i>	Lack of technical capacity, staff, time, knowledge and infrastructure
<i>Policy gap</i>	Overlapping, unclear allocation of roles and responsibilities
<i>Administrative gap</i>	Mismatch between hydrological and administrative boundaries
<i>Information gap</i>	Asymmetries of information between central and sub-national governments
<i>Accountability gap</i>	Lack of citizens concern about water policy and low involvement of water users associations
<i>Objective gap</i>	Intensive competition between different ministries

Despite the increasing attention for water governance and sustainable urban development, there are still few frameworks that have been applied on a large scale. The work of the OECD forms an exception in that respect. Nonetheless, the study and assessment of water governance is emerging and gaining momentum. Fig. 1.9 shows that urban water governance is still uncharted compared to related study fields. Scholarship on water governance, for example, refers also to river basin management, agriculture, etc.

Most of the indicators and frameworks focus on a specific part of governance, water management, environmental impact, the socio-economic context or geographic location (Akhmouch and Romano 2015). Furthermore, the term governance is not always defined in the same manner. However, aspects of the frameworks and indicators may prove to be useful for this research. The field of urban water governance is still relatively unexplored. However, there are more works that are strongly related with urban water governance in the fields of, for example, climate adaptation (e.g. Alexander Ballard Ltd 2008; Gupta et al. 2010) and natural resource management (Lockwood et al. 2008).

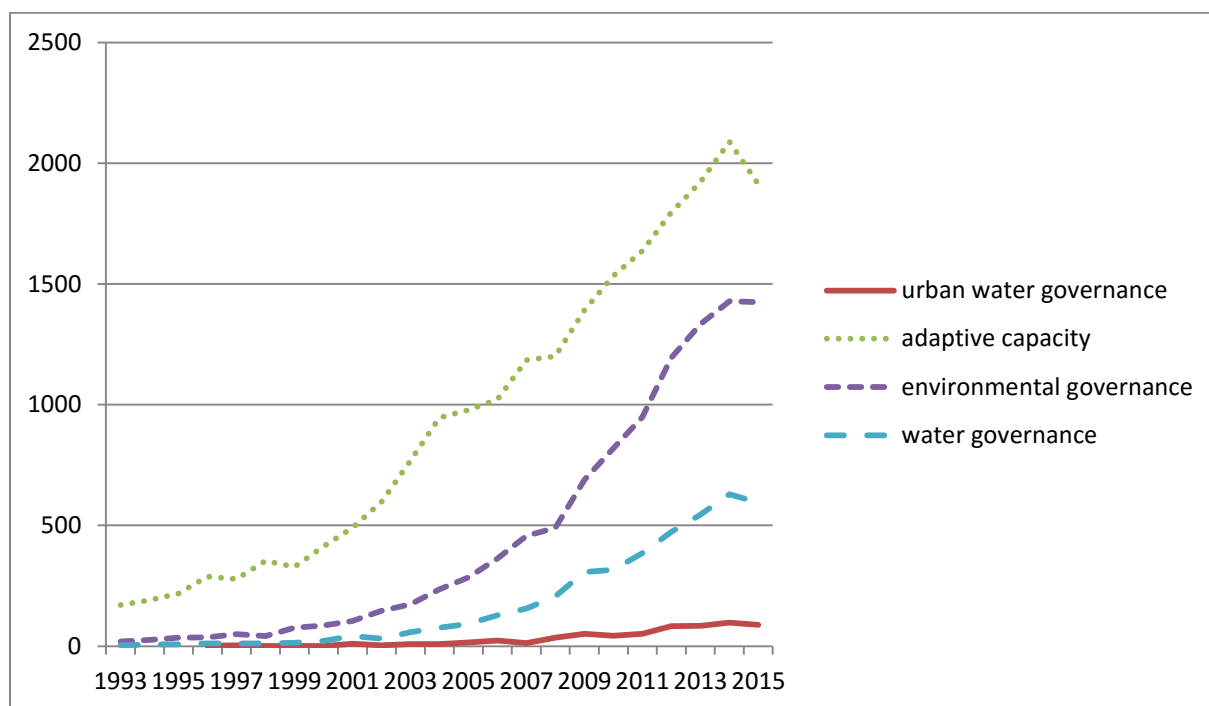


Figure 1.9 Number of publications per query in Scopus from 1993-2015

1.5. Research objective

Cities play a crucial role in economic development, but are also major sources of environmental pressures. Conversely, the potential to alleviate these pressures is largest in cities. Adaptation to urban challenges requires active civil societies, including the public sector, with visionary local government (Economist Intelligence Unit 2009). It requires a long-term strategy, a bottom up approach and collaboration amongst cities (Loftus et al. 2011). Moreover, grounding climate change on the local scale means that the associated risks, or benefits, are more relevant to private and public agents. Analysis at the city scale is likely to coincide with the local administrative boundaries and thus facilitates decisions on the appropriate level of governance (Hunt and Watkiss 2011). This shows that governance, i.e., the interaction between different actors, sectors and governance levels, is key to establish sustainable IWRM and climate adaptation in cities.

The research's objective is to contribute to the improvement of urban IWRM and climate adaptation for cities. This has been done by developing a Governance Capacity Assessment Framework (GCAF) that focusses on the governance of the urban water system and services. Through the application of the GCAF, decision- and policy-makers will be able to gain insight into the conditions that could be improved to develop the governance capacity to deal with urban water challenges. The term 'governance capacity' in light of the GCAF is defined as: *key set of city-scale governance conditions that should be present or developed to enable change that will be effective in solving long-term urban water issues of flooding, urban heat islands, water scarcity, and water quality and resource scarcity.*

Fig. 1.9 indicates that the field of urban water governance is emerging, but still relatively marginal. The existing works often have an explorative nature and provide guiding principles through which sustainable and adaptable governance can be realized. Through the GCAF, this research aims to contribute to the transition from theory to practice.

The City Blueprint already assesses the performance of urban water management. The GCAF aims to complement this work with the assessment of urban water governance. Through this, the City Blueprint working group can provide a more complete set of tools to assist cities in their transition towards sustainable water management. The UN stated in the First World Water Development Report (2003) that "*the water crisis is essentially a crisis of governance and societies are facing a number of social, economic and political challenges on how to govern water more effectively*" (UNDP 2003, p.370). This emphasizes the urgency and importance of improving water governance, to which this work contributes. In short, the objective can be formulated as follows:

- *This study aims to develop a governance capacity assessment framework that is consistently applicable (i.e. for most cities), comprehensive (i.e. inclusion of the most important concepts and theories in literature), and comparable (i.e. the assessment of the cities should be relative to each other).*

1.6. Research questions

This study aims to answer the following research question and sub-questions (SQ):

- **What are the most important conditions required for the governance capacity to enable (the transition to) sustainable urban Integrated Water Resources Management and how can they be measured?**
- SQ1: *Who are the most relevant actors in the urban governance arena and how can they be identified?*
- SQ2: *What are the most important governance capacity frameworks and governance conditions identified in literature and how can these conditions be combined in a comprehensive assessment framework?*
- SQ3: *How can this framework be operationalized?*

1.7. Reader's guide

The structure of the report is further elaborated in this section. Chapter 2 describes the methodology of the research. Chapters 3-5 provide the results of the research as follows: Chapter 3 describes how a stakeholder and network analysis can be performed, which considerations are relevant for this research and some practical handholds. Chapter 4 gives the conditions that are necessary to create the urban governance capacity to deal with water issues. For each condition three characteristics have been determined for further specification. In chapter 5, the operationalization is addressed. The possible methods of data collection are discussed as well as the relevant considerations related to this research. Chapter 6 includes the discussion of the research and subsequent recommendations, while the conclusion is described in chapter 7.

2. Methodology

2.1. Introduction

This chapter describes the methodology that is used to develop the Governance Capacity Assessment Framework (GCAF). The GCAF intends to provide the key set of city-scale governance conditions that need to be present to enable change that will be effective in solving long-term urban water issues of flooding, urban heat islands (UHIs), water scarcity, and water quality and resource scarcity. In other words, the methodological approach aims to produce a well-balanced and comprehensive set of conditions that together determine the governance capacity to address water problems.

To gain acquaintance with the City Blueprint Framework, a baseline assessment of urban water management is done for the City of Leicester (UK). This also provided insight into the water issues and how these may be manifested in a city. Furthermore, it also provided some experience in performing a baseline assessment, which has been useful in designing the GCAF. A short description of this work can be found in Appendix III.

There is no clear method to develop the GCAF, as this research is quite explorative and the field of urban water governance is still relatively novel. To be able to create the GCAF, a pragmatic approach is chosen that makes use of existing empirical and theoretical frameworks. Most studies, whether they focus on success factors (for example, Adger et al. 2005), barriers and limitations (e.g. Ekstrom et al. 2011), or capacity assessment (for example, Gupta et al. 2010), define the success factors, barriers or capacities through determining the most common concepts in literature. This study used a six step approach (Fig. 2.1):

1. **Literature orientation:** Gaining insight into the body of literature and theories;
2. **Concept GCAF:** Compiling the most reoccurring conditions used in existing frameworks and conceptualizing levels from very limiting (--) to very encouraging (++) integrated adaptive solutions;
3. **Testing:** Improving balance and inclusiveness of the framework by testing if the conceptual GCAF includes all relevant governance principles as identified by the OECD and UNDP;
4. **Condition refining:** Characteristics are developed based on an in-depth literature study for each governance condition separately. Each governance condition is therefore specified by their assigned characteristics;
5. **Expert review:** Feedback from experts will ensure that the GCAF will be communicative, widely accepted and in accordance with the prevailing scientific insights;
6. **Operationalization:** Explores methods of data collection and scoring.

This chapter describes considerations and actions in each phase. The research process proved to be highly iterative, as new literature, theories or insights emerge throughout the process. Moreover, the transition between the phases has been gradual and overlapping. The GCAF should contribute to governance science literature and needs to be applicable for policy- and decision-makers to address contemporary societal challenges. With this ambition in mind, scientific literature, grey literature (i.e. reports, studies and frameworks from (international) organizations) and applied (semi-) scientific literature are consulted.

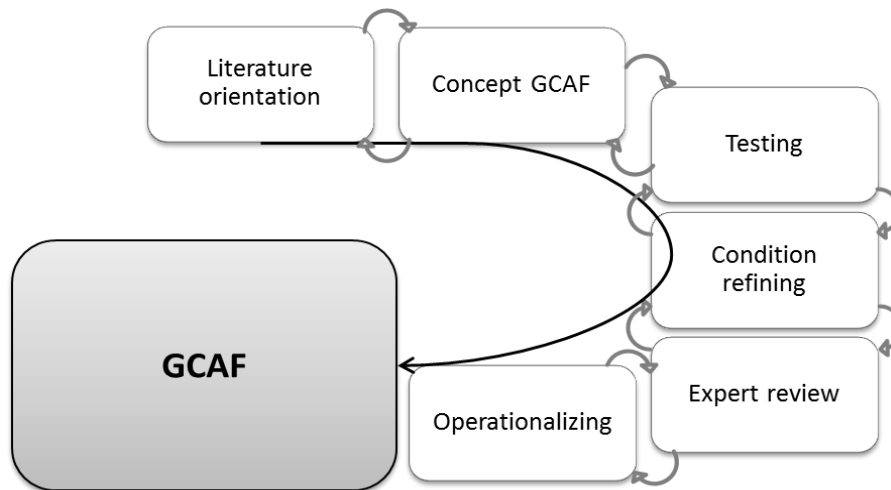


Figure 2.1 The phases in the development of the GCAF. Although the phases are shown sequentially, in fact the process may be iterative due to the ‘learning-by-doing’ nature of the study

2.2. Literature research

2.2.1. Literature orientation

The first phase of this study is an orientation of water governance literature to obtain insight into different, though related, fields of study that may provide valuable methodological approaches, theories and insights for developing the GCAF. The initial focus was on scientific literature identifying urban water governance capacities or institutional capacities, through both empirical and conceptual approaches. Furthermore, governance capacities on national and international scale were relevant, mainly from a conceptual perspective. As urban water issues strongly overlap with climate adaptation issues, adaptive governance capacity literature has substantially coincided with the scope of the GCAF.

Governance gaps are much more explored than governance capacities in relation to water governance. In principle, governance gaps can be defined as the factors limiting a desired situation. Therefore, governance gaps are important indicators for identifying (the absence of) governance capacities. Governance capacity is formulated as *key set of city-scale governance condition that should be present or developed to enable change that will be effective in solving long-term urban water issues of flooding, urban heat islands, water scarcity, water quality, and water quality and resource scarcity*. Therefore, theoretical frameworks regarding *transition management* (Loorbach 2010), *institutional change* (for example, Huitema et al. 2009) and *innovation studies* (see Moulaert et al. 2007) have been explored. This provides insight into underlying conditions which may evolve, and change the overall governance capacity. The literature has predominantly been found through suggestions of experts and peers, citations by other publications and internet searches. For the latter Scopus, Google Scholar and Google are used.

2.2.2. Concept GCAF

In this step, overlap and synergies between the conditions for good governance, as suggested in literature, have been analyzed. The most important conditions within governance processes are determined through this analysis, which together form the preliminary conditions for the GCAF. Table 2-1 shows the lay-out of a table through which the recurrent governance conditions have been sorted, while showing the various definitions by different authors.

Table 2-1 The preliminary governance conditions are determined by analysis of the most recurrent concepts in literature

	Authors, Studies, Reports and Frameworks									
Preliminary conditions										
	Descriptions									

On top of this, levels ranging from very limiting (--) to very encouraging (++) effective governance have been formulated for each condition using concepts of institutional change and transition management such as path-dependency, flexibility and redundancy. The development of the levels is adapted from the work of Alexander Ballard Ltd. (2008). Governance literature often describes a desired state or governance barriers, through which respectively a best case (++) and worst case (--) are defined. The concepts from the literature have been bundled in a coherent framework of governance conditions and levels (referring to the extent to which these conditions are present). The overall level of all governance conditions determines the governance capacity.

2.2.3. Testing

The concept GCAF comprises three defining focal points; (i) the focus on the urban scale; (ii) the focus on sustainable IWRM; and (iii) the focus on governance. The concept GCAF is, for the most part, an aggregation of concepts identified in similar frameworks, which may include one or some of the aforementioned focal points. However, the objectives and intended use of these frameworks differ from that of the GCAF.

In this step the GCAF was tested on overall balance and completeness using widely accepted governance principles. In this phase the governance conditions are further elaborated by studying prescriptive literature. The conditions are tested with valid concepts, principles and criteria for good governance. For this purpose, scientific works are studied and leading principles from international organizations used, such as the *OECD* (OECD 2011; OECD 2014; OECD 2015a; OECD 2015c; Corfee-Morlot et al. 2009), *UNDP* (Jacobsen et al. 2013; Cap-Net 2014; UNDP 2008) and *UNECE* (UNECE 2009). This phase results in the final definition of the governance conditions and ensured that the GCAF is comprehensive.

2.2.4. Condition refining

Characteristics have been developed based on an in-depth literature study for each governance condition separately. For example, studies, guidelines and frameworks focusing on stakeholder engagement are used to determine the most important characteristics regarding that aspect. The characteristics allow the governance conditions to capture the complementing varieties in the discovered definitions. Furthermore, it specifies the governance conditions to enable a more feasible operationalization of the framework. Moreover, the levels for each governance condition have been specified for the corresponding characteristic.

2.2.5. Expert review

One of the ambitions of the GCAF is to be widely applicable and understandable for non-experts. Therefore it is important that the GCAF is communicative through the use of accepted and understandable terminology. Publications by organizations such as the OECD and the UN, as well as a study of the glossary of terms of these organizations (and others, e.g. the World Bank) assisted in defining the governance conditions and corresponding characteristics. Good governance principles that are adopted by these organizations indicate the general acceptance of certain concepts and

prescriptions. Furthermore, the GCAF may be more accepted if it considers and builds upon the extensive work of acknowledged international organizations.

The progress of the development of the GCAF has been continuously reviewed by both experts and peers. The main expert reviewers are Prof. Dr. Peter Driessen², Dr. Carel Dieperink¹, Stijn Brouwer², who mainly provided substantive feedback; Prof. Dr. Kees van Leeuwen^{1,3} and Stef Koop², who additionally provided guidance on the applicability and strategy of the GCAF; and Alisa Doornhof¹, who, as a relative outsider, gave some insight into the understandability of the GCAF. Furthermore, a presentation has been given at KWR Watercycle Research Institute for colleagues from various disciplines through which insight on all the three aspects (i.e. substance, applicability and understandability) could be gained.

2.2.6. Operationalization

The previous phases ensured a solid scientific foundation for the GCAF that is acceptable and communicative. This phase intends to operationalize the GCAF, so that it may be applicable in urban areas around the globe. Existing empirical studies, as well as handbooks and practical guidelines, have been used to develop the operationalization of each characteristic. There are three main methods of data collection that are commonly used and deemed sufficient: questionnaires, in-depth interviews and desk research. Studies focusing on the use of these methods were included in this step, such as studies on developing questionnaires and interviews (e.g. Bird 2009).

The design of the assessment for each specific characteristic is based on related literature. For example, regarding stakeholder engagement reviews have been done of methods for, e.g., stakeholder analysis (e.g. Reed et al. 2009) and practical guidance for stakeholder engagement (Ridder et al. 2005). The operationalization is challenging as the specific characteristics of cities vary widely. Therefore a prerequisite of the operationalization is the support of local actors that can access the required information. This study provides some handholds for application of the GCAF. A more specific approach strongly depends on the objectives of the assessor and intended purposes of the outcomes (Bovaird and Löffler 2003).

The basis for the application of the GCAF will be the City Blueprint Baseline Assessment and Trends and Pressures Framework (TPF)⁴ (see Koop and van Leeuwen 2015). This assessment reveals the most pressing urban water issues, based on which the most relevant stakeholders can be identified. This study has developed handholds for performing an institutional mapping exercise that is based mainly on the work of the OECD (e.g. OECD 2014), guidelines for policy-makers (for example McFadden et al. 2010) and conceptual and empirical studies (Reed et al. 2009; Lienert et al. 2013). The institutional map can be useful to determine which people or organisations should be approached to perform the GCAF. After this the characteristics can be assessed through desk research, questionnaires, and/or in-depth interviews (Fig. 2.2).

² Utrecht University

³ KWR Watercycle Research Institute

⁴ For more information, please visit http://www.eip-water.eu/City_Blueprints

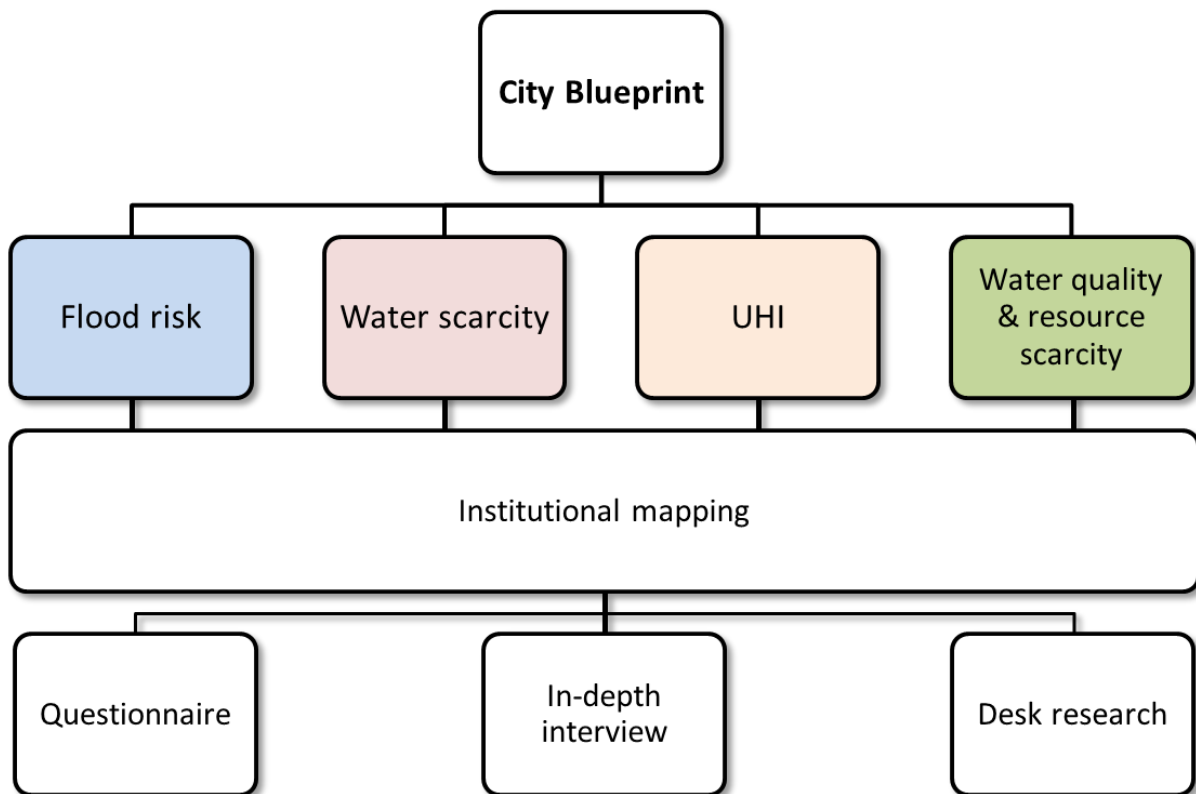


Figure 2.2 The basis for applying the GCAF is a City Blueprint Baseline Assessment and an institutional mapping exercise, followed by (a combination of) questionnaires, in-depth interviews and desk research

3. Stakeholder and network analysis

Urban water governance is an inherently complex process. Water issues are interconnected, particularly in the urban context, different temporal and spatial scales, with a multitude of actors, sectors and interests. This means that an intervention intended to solve one of the issues for one actor and scale could unintentionally reinforce or create new problems for other actors, scales and sectors (Stein et al. 2011). To prevent this, a thorough investigation must be conducted to (i) identify stakeholders, (ii) categorize them, and (iii) define their responsibilities, relations and interactions. The steps in this process can be considered gradual and iterative (Reed et al. 2009).

This chapter provides a theoretical background for stakeholder- and network analyses and handholds for the application in the context of the GCAF. This analysis provides a starting point with preliminary identified stakeholders, as it is likely that during the governance capacity assessment other stakeholders will become apparent, while others prove to be irrelevant. Hence, this work aims to produce a preliminary institutional map. However, the literature used in this chapter may be useful if further analysis is desirable.

Dealing with a large variety of uncertainties requires tailor-made, robust and adaptive solutions, which are best achieved at the local (i.e. decentralized) level (Termeer et al. 2015). Therefore, the focal point will be the city scale. The urban governance context can vary widely between cities. In order to investigate the governance capacity of cities consistently and objectively, an insight is required into the involved stakeholders and the respective network between actors. Consequently, an understanding of the existing governance structure will be developed. First the issue at hand should be determined, which will also assist the delineation of the analysis (da Silva et al. 2009, Reed et al. 2009, Pahl-Wostl et al. 2010). This study has identified four major urban water challenges, based on the categories of the City Blueprint and TPF (Koop and Van Leeuwen 2015):

1. Flood risk
2. Water scarcity
3. Urban heat island (UHI)
4. Water quality and resource scarcity

3.1. Stakeholder identification

The determination of the actors can be achieved by analyzing how the water issue affects and is affected by elements of the water system, society, ecosystem and technology (Pahl-Wostl et al. 2010; Reed et al. 2009). There is a wide range of methods available for identifying stakeholders. The appropriate method should be selected based on the objective of the analysis and available resources (Reed et al. 2009). The definition of 'actor' or 'stakeholder' herein is a vital step in the delineation. As the purpose of this analysis is to identify who may have the potential to develop the governance capacity that is required to achieve sustainable urban water management, those stakeholders that are most likely to affect urban water management given their interests, resources and influence are considered (Grimble and Chan 1995; Reed et al. 2009).

Through this will become clear which actors are relevant and required to change in the way they operate and how they perceive and interact with other actors (da Silva et al. 2009; Lienert et al. 2013). In short, it should be clear which actors have access to information and knowledge, power and funding to implement, the ability to create cooperations, and who are affected by policy decisions (da Silva et al. 2009; Stein et al. 2011; Lienert et al. 2013; OECD 2015b), while taking into account the interests of marginalized groups, the natural environment and future generations (Reed et al. 2009; OECD 2015b). This analysis tends to focus on formal stakeholders and organizations, because this supports the notion of transparency, accountability and responsibility (Lockwood et al. 2010; Graham et al. 2003; Jacobsen et al. 2013; Gupta et al. 2010) Furthermore, the power to influence the success or initiation of a management choice is often held in institutions (McFadden et al. 2010). Moreover, for practical purposes, it is not possible to identify, approach, and understand all individuals. Individuals with a high interest and limited power to influence the outcome can form alliances (Reed et al. 2009) or organizations which are assumed to be sufficiently representative social entities (Stein et al. 2011).

3.2. Categorization

As this assessment takes the perspective of the city, it should be clear how certain actors can influence the urban governance arena, i.e. which actors determine the integrated policies (i.e. national or regional policy), which actors supervise, regulate, co-ordinate, finance, develop specific local plans, manage, execute and operate (Lienert et al. 2013; OECD 2014). It is important to keep in mind that this assessment focusses on the capacities that are present within the urban governance network. Therefore it may be sufficient to consider sub-national actors if higher level governmental bodies are not directly involved in urban water governance (da Silva et al. 2009).

City-level decision making is often influenced by higher level decision making, which therefore could be taken into account. The actors can be classified by institutional layers (OECD 2014; Cap-Net 2014), but also can be determined which sectors should be included (Pahl-Wostl et al. 2010; Lienert et al. 2013; Ellis et al. 2009; Green 2007). The identified actors can be analyzed further regarding the water issue and their characteristics; e.g. their decisional level, sector, if it is private or public, their water interest and alleged interest (economic, technical, societal, environmental) (Lienert et al. 2013).

Besides the institutional and formal structures, there are actors that could be included in the policy-making process but have no formal political power. The notion of 'governance' encompasses modes of governing, where non-state and private corporate actors and networks participate in the design and implementation of public policy (Pahl-Wostl 2009). These actors can be important sources of knowledge and public-private partnership opportunities (Pahl-Wostl 2009; Lockwood et al. 2010; Van Rijswick et al. 2014), e.g. research and knowledge institutes, businesses, NGOs, one-issue pressure groups, local communities, etc. These actors can be grouped by their interest or stake in the water issue and in what way they tend to influence the decision-making process.

Furthermore, there are those who are affected by the water issue and corresponding plans, e.g. slum dwellers in urban areas in developing countries are most prone to flooding and the elderly who are susceptible to heat waves (Corfee-Morlot et al. 2009; UN-Habitat 2011; Van Staden 2014). These groups should be taken into account to improve public support and inclusion in the decision making process, through a well-designed stakeholder engagement strategy (see paragraph 4.3.4.)

3.3. Identifying relationships

There are numerous ways to investigate the relationships and interactions between different stakeholders. The level of elaboration depends on the purpose of the analysis. E.g. if the relationships and interactions are highly formalized and consistent throughout layers of governance (as is often the case in centralized governing systems), a study of protocols, and a scrutiny of a limited set of stakeholders may suffice. In a highly informal governing system with tacit rules and procedures, intrinsic knowledge of local customs and culture is required (Stein et al. 2011). In either case, the aim is to understand who has authority over who, who depend on or utilize certain facets of the water system, what are the financial flows and regulatory pathways (Lienert et al. 2013; Stein et al. 2011; McFadden et al. 2010).

There are three principal methods to analyze relationships; (i) Actor-linkage matrices; (ii) Social Network Analysis (SNA); and Knowledge Mapping. The actor-linkage matrices places stakeholders in rows and columns, creating a table where the nature of the relationships can be determined (e.g. complementary, co-operative or conflicting). This method is relatively easy and flexible to use. The SNA identifies ties between actors and the strength of the ties, through input from the actors themselves. Although this method gives a comprehensive representation of the ties within the actor arena, it is a rather labor-intensive and time consuming method, as it requires in-depth interviews with all actors (Reed et al. 2009; Stein et al. 2011). Knowledge mapping provides an insight into the content of information between the stakeholders. The SNA provides an answer to *who knows who*, where knowledge mapping answers the question of *who knows what*. Knowledge mapping could be incomprehensive, due to the unwillingness of actors to share information or the inability to access tacit knowledge (Reed et al. 2009).

Although the three methods are described separately, in practice often elements of these methods are used in conjunction, based on the aim of the analysis. For the purpose of this study it suffices to understand who should be included in the governance capacity assessment. To delve deep into the relationships of the actors at this stage would be ambiguous as this will also be investigated in the governance capacity assessment.

3.4. Practical handholds

The following steps assist to (i) identify the stakeholders; (ii) determine their interests and influence and; (iii) uncover their interdependencies (Romanelli et al. 2011; Reed et al. 2009). The order of the steps is flexible, for example, it is possible to first determine which interests are associated with the water issue and then allocate actors to these interests. Moreover, it should be emphasized that the process is iterative and the steps should be considered as strongly connected (Fig. 3.1).

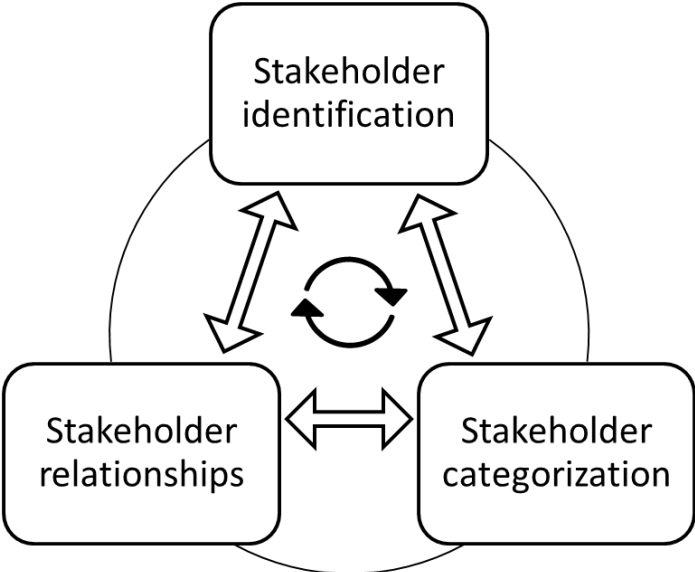


Figure 3.1 The three steps are interconnected and represent an iterative process

Step 1: Identify actors; a comprehensive identification of actors is a vital step in institutional mapping to prevent that some stakeholders are unintentionally omitted (Reed et al. 2009). Despite the wide variety in water governance settings, the OECD has compiled a list of recurrent stakeholders and water-functions (OECD 2015b, p.75). This can be a useful starting point for the analysis. However, the recurrent stakeholders and allocated roles and responsibilities, as well as the interactions between them are different for each specific context. A useful exercise to identify the relevant stakeholders is to construct simple diagrams based on questions regarding the policy issue, e.g. (McFadden et al. 2010):

Flood risk	<ul style="list-style-type: none"> → Allowed → → Control → → Incidents → 	<p>What is allowed or accepted? By whom?</p> <p>How is the standard controlled? Who performs this?</p> <p>What are the regulations? How are they controlled? Who is affected?</p>
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In addition, stakeholders can be found and sorted by investigating who is affecting (or influencing) and affected by the issue (Lienert et al. 2013; Reed et al. 2009). An example of a tool to perform this exercise is the “rainbow diagram” proposed by Chevalier and Buckles (2008), which classifies stakeholders according to the degree they can affect or be affected by a problem or action as shown in Fig. 3.2.

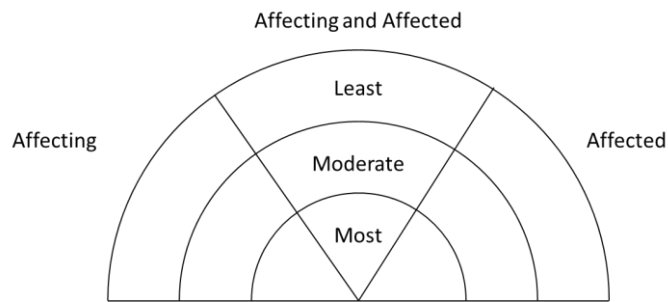


Figure 3.2 Rainbow diagram for classifying stakeholders according to the degree they can affect or be affected by a problem or action (Chevalier and Buckles 2008)

Step 1a: Formal actors: the formal actors can be identified with formal legal structures, regulatory frameworks and formalized rules of practice (Pahl-Wostl 2009). In other words, these are often the governmental bureaucracies that can affect and/or are affected by the water issue to some extent.

Step 1b: Assisting actors; besides the formal statutory actors, there is a plethora of other actors that assist policy making through information, knowledge, skills, services and financial resources. These could be data gathering and sharing organizations, research institutes, external financiers (e.g. the World Bank or investment agencies) and one-issue pressure groups, such as environmental groups, citizen organizations, NGOs, agricultural organizations, trade unions, businesses etc. Actors that have similar interests and influence on decision-making can be grouped. A distinction should be made between actors that have high interest and low interest in urban water policy. For example, knowledge and research institutes assist informed policy making, while real estate corporations could also assist, while having a direct interest in, policy implementation.

Step 1c: Interest groups: these actors have no formal influence on decision-making but have a high interest in urban water policy (Lienert et al. 2013), i.e. the marginalized groups that are affected by the water issue. Examples are local communities, farmers, users, etc. Public support, local wisdom and inclusion can be enhanced by taking their voice into account (Pahl-Wostl 2009).

Step 2: Categorization of stakeholders; this step will provide structure for the identified stakeholders. It can be approached by determining pre-set categories and grouping stakeholders accordingly or by taking a “bottom-up” approach, through which the goals and interests of different stakeholders are assessed after which they are grouped by searching for similarities. For the purpose of this analysis it is sufficient to study the organizational attributes; type of organization, level of formalization, activities that influence the water issue and scale of activity.

There are a number of possible classifications regarding the stakeholders (ODA 1995; Grimble and Wellard 1997; Reed et al. 2009): “Key players” (high interest and high influence), “Context setters” (low interest and high influence), “Subjects” (high interest and low influence) and “Crowd” (low interest and low influence). Similarly, the OECD (2014) has defined “Main actors” (who are directly involved with policy-making regarding the water issue), “Other actors” (who have statutory authority but are not directly involved in designing and implementing policy on the city level), “Advisory Groups” (who provide consultancy, expertise, data, information, etc.) and “Interest and Influential Groups” (who have an interest in or are affected by the water issue and corresponding policy). The previous steps should provide an understanding of the governance mode of the city.

Step 2a: Institutional layers; this will yield a hierarchical overview of authorities based on their geographical boundaries (Ellis et al. 2009). A distinction between the main actors (those who have a direct interest and influence in city-level strategy) and context setters (actors who influence city-level policy making, but have low interest, e.g. national and supranational bureaucracies) should be made (ODA 1995; Grimble and Wellard 1997; Reed et al. 2009). The authorities who have a statutory involvement in policy making on the city level are included. This information should be available

through government websites, contact with local water professionals or scrutiny of policy documents and statutory instruments. Fig. 3.3 shows the proposed administrative levels (OECD 2014);



Figure 3.3 Proposed administrative levels of formal bureaucracies (adjusted from OECD 2014)

Step 3: Relationships, Interactions and Interdependencies; an important part of the network analysis is to understand the interdependencies between the identified actors (Lienert et al. 2013). When assessing governance conditions within a network, it may be possible that certain conditions only exist through multi-actor interactions or that capacities of individual actors are not accessible without (the right) interactions. Moreover, the interdependencies will reveal a more detailed picture of the governance structure. The relationships and interactions can be consultation, information sharing, funding, representation, deconcentrated body (e.g. an executive branch of a ministry) (OECD 2013).

Step 4: Aggregation; There are three basic governance modes (Thompson et al. 1991):

- *Bureaucratic hierarchies*; regulatory processes are mainly based on formal institutions and governmental actors play the dominant role;
- *Markets*; are based on a combination of formal and informal institutions and non-state actors dominate;
- *Networks*; are mainly governed by informal institutions and both state and non-state actors can be included.

Driessen et al. (2012) elaborate further on possible governance modes, where multi-layer governance is included in addition to the role of formal and non-formal actors (Fig. 3.4). In a centralized governance system, market actors and civil society adhere to the directions of the national or high level government body. In a decentralized governance system, the national government body is represented through local governments who have a certain degree of autonomy. The public-private governance includes market actors in decision-making. Often market parties co-fund water management interventions in exchange for a higher inclusion in decision making. In an interactive governance scheme, civil society, market actors and government have an equal voice in decision making. In a self-governance context, the role of the government is relatively small.

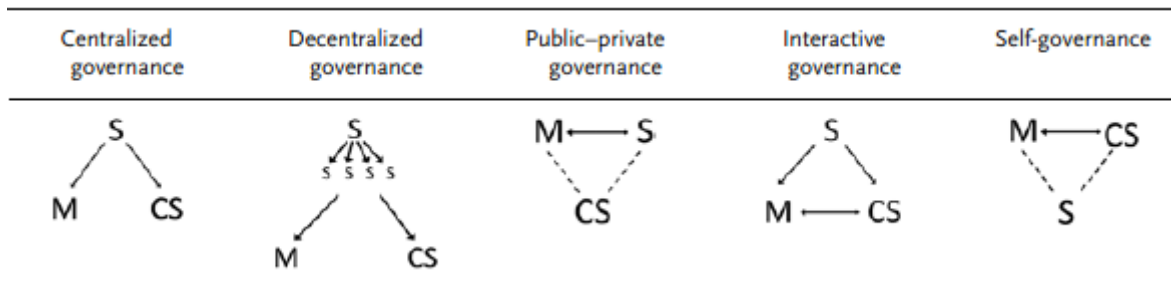


Figure 3.4 Conceptual framework for environmental governance. It depicts the relations and roles of state (S), market (M) and civil society (CS) actors (Driessen et al. 2012)

Based on the aforementioned work, the following institutional map is proposed (Figure 3.5), where;

- The inner circle includes governmental and corporate organizations that have high influence and interest in urban water policy;
- The context setters are organizations that impose guidelines, overarching visions and objectives, but are not directly involved in urban policy making;
- The supporting groups consist of actors that can be included in policy- and decision making, but have no formal political power;

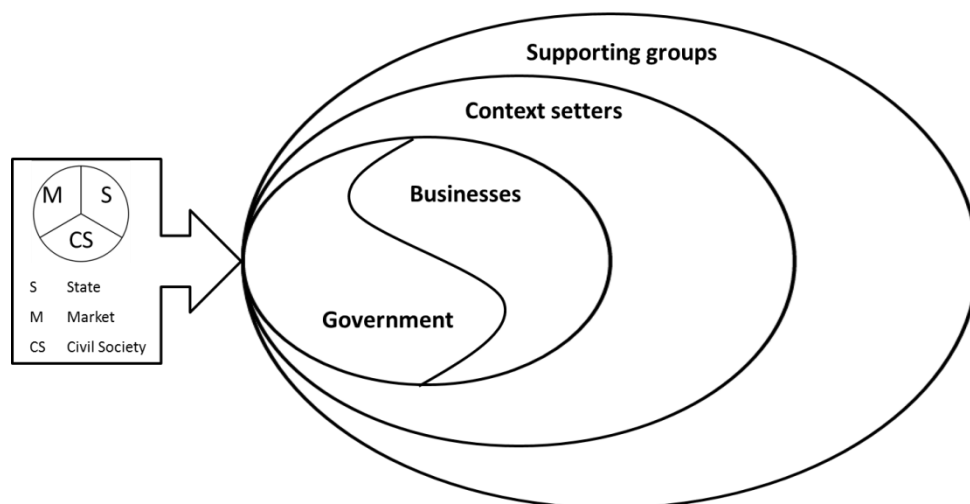


Figure 3.5 Proposed institutional map, adjusted from OECD (2014)

The institutional map should allow for an indication of the dominant governance mode. While a comprehensive and in-depth institutional mapping exercise is difficult and time-consuming, it is expected that a 'snapshot' of the governance setting should suffice to identify the relevant actors that should be included in the governance capacity assessment framework. Furthermore, developing an institutional map is an iterative process and during the execution of an assessment it is most likely that unforeseen actors, roles and relations will be discovered.

4. Constructing the Governance Capacity Assessment Framework

4.1. Governance Capacities literature

This chapter presents the Governance Capacity Assessment Framework (GCAF) that assesses the most important city-scale governance conditions (GCs) which either impede (--) or encourage (++) sustainable governance, IWRM and climate adaptation. The determination of the most important GCs for stirring the transformation towards water-wise cities is complex and is interdependent by definition. The term governance capacity is derived from the concepts of water governance and adaptive capacity. Water governance is considered as the range of political, institutional and administrative rules, practices and processes – formal and informal – through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management (OECD 2015a).

The definition of adaptive capacity, in relation to climate change, is often adopted from the IPCC; “*the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences*” (IPCC 2007a). Pahl-Wostl (2009) defines the concept to include other changes that may influence resource governance systems in particular; “*the ability of a governance system to first alter processes and if required convert structural elements as response to experienced or expected changes in the societal or natural environment*”.

Hence, the term ‘governance capacity’ in light of the GCAF is defined as: *key set of city-scale governance condition that should be present or developed to enable change that will be effective in solving long-term urban water issues of flooding, urban heat islands, water scarcity, water quality, and water quality and resource scarcity*. This definition emphasizes the perspective of water issues in the urban context. Although most literature uses the term ‘capacity’ instead of ‘condition’, this definition emphasizes that the actual capacity to deal with water issues is only present when all of the necessary GCs are developed.

The body of literature on governance regarding water issues and climate change has substantially increased, much like the political attention for the subject. The 6th World Water Forum (12-17 March 2012, Marseille, France) emphasized again that the global “water crisis” is predominantly a governance crisis (OECD 2015a). Works that assist the comprehension of water governance and the transition towards sustainable water management are emerging. Nonetheless, a comprehensive, consistent and comparable method to assess urban water governance is lacking. The GCAF aims to contribute to fill this void. This will foster city-to-city learning and provide some insight on which aspects are relevant to improve the city’s overall governance capacity. Ultimately, the GCAF can contribute to the development and realization of water-wise cities. This chapter will elaborate on and substantiate the GCAF. First, the consulted literature is described. Second, the most important GCs that typically have much consensus in literature are identified and used to construct the GCAF. The GCs will be described in the next section.

4.1.1. Approach for developing the Governance Capacity Framework

Socio-economic development, globalization, and climate change create highly complex challenges that are imbued with uncertainty for decision makers. The basis of the conditions lies in descriptive, conceptual and prescriptive literature and frameworks on *organizational-, institutional-, governance-, adaptation-, and transition and change management*, all related to Natural Resource Management (NRM), IWRM, societal change, climate change or spatial planning. There is no “hard” delineation between conceptualizing literature, prescriptive literature and frameworks; in fact some works include elements of two or three of these literature groups. In order to develop the GCAF we (i) consulted conceptual literature to gain insight into typical structures of governance and identify reoccurring and wicked problems; (ii) prescriptive literature that provides principles and approaches to deal with typical governance problems; (iii) practical approaches and frameworks regarding the assessment and design of policy processes (Fig. 4.1).

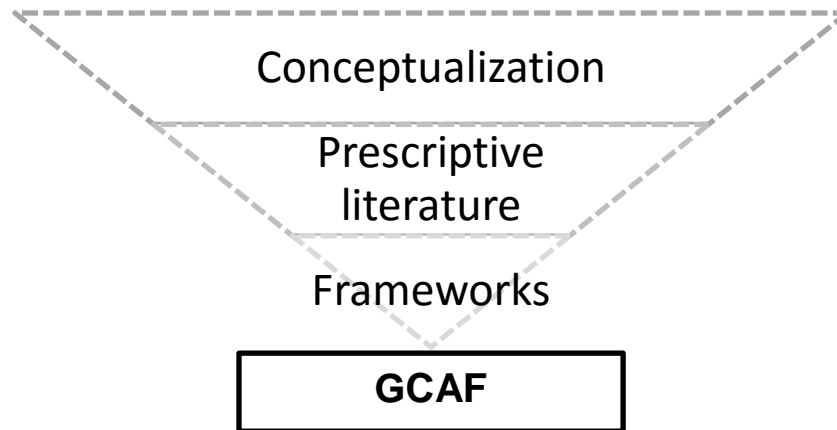


Figure 4.1 The approach used to develop the Governance Capacity Assessment Framework (GCAF) consisting of three consecutive steps; (i) conceptual literature, to understand wicked governance issues; (ii) prescriptive literature, to obtain insight into principles or approaches to deal with the issues; (iii) evaluation of practical frameworks regarding the assessment and design of policy processes, leading to the proposed GCAF

In addition to principles for efficient and effective governance, e.g. resources, knowledge, skills, communication etc., good governance also includes moral principles; legitimacy, transparency, accountability, inclusiveness and fairness (Rogers and Hall 2003; Duit and Galaz 2008; UNDP 2008; Corfee-Morlot et al. 2009; Lockwood et al. 2010; OECD 2011; Jacobsen et al. 2013). Additionally, there are frameworks that assist in developing- or assessing governance regimes, or identifying barriers to adaptation ranging from the intra-organizational to the supranational level. In general, all frameworks address the assessment of governance dealing with wicked problems (see Table 4-1).

The need for a Governance Capacity Assessment Framework for urban water issues

The body of literature can greatly contribute to the design of sustainable governance. Nonetheless, their origins and approaches are scattered, despite their commonalities. The GCAF specifically focusses on the city level, since wicked IWRM and adaptation issues are most pressing there and, at the same time, city-level solutions may be most effective to improve quality of life and reduce environmental pressure (Tyndall Centre 2004). The literature provides an extensive number of detailed governance analyses and case studies. However, a concise and comprehensive framework which is understandable for its target group, i.e., decisions-makers, politicians, non-experts and the general public, and allows for coherent comparisons is limited and for urban water issues almost non-existing. This work aims to address this lacuna.

Table 4-1 The conceptual and prescriptive literature and frameworks used for this study

Conceptual literature		
Author & year	Title	
(Folke et al. 2002)	Resilience and sustainable development: building adaptive capacity in a world of transformations	
(Folke et al. 2005)	Adaptive Governance of Social-Ecological Systems	
(Armitage 2005)	Adaptive Capacity and Community-Based Natural Resource Management	
(Bulkeley 2005)	Reconfiguring environmental governance: Towards a politics of scales and networks	
(Moulaert et al. 2007)	Introduction: Social Innovation and Governance in European Cities	
(Duit and Galaz 2008)	Governance and Complexity—Emerging Issues for Governance Theory	
(Driessen et al. 2012)	Towards a Conceptual Framework for The Study of Shifts in Modes of Environmental Governance - Experiences From The Netherlands	
(Fröhlich and Knieling 2013)	Conceptualizing Climate Change Governance	
Prescriptive literature		
Author & year	Title	
(Rogers and Hall 2003)	Effective Water Governance	
(Graham et al. 2003)	Principles for Good Governance in the 21st Century	
(Adger et al. 2005)	Successful adaptation to climate change across scales	
(Fussler 2007)	Adaptation planning for climate change: concepts, assessment approaches, and key lessons	
(Brown and Farrelly 2009)	Delivering sustainable urban water management: a review of the hurdles we face	
(Huiteima et al. 2009)	Adaptive Water Governance: Assessing the Institutional Prescriptions of Adaptive (Co-)Management from a Governance Perspective and Defining a Research Agenda	
(Lockwood et al. 2010)	Governance Principles for Natural Resource Management	
(Loorbach 2010)	Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework	
(OECD 2015a)	OECD Principles on Water Governance	
Frameworks		
Author & year	Title	Scale
(Alexander Ballard Ltd 2008)	Adaptive Capacity Benchmarking: A Handbook and Toolkit	Organization
(UNDP 2008)	Capacity Assessment Methodology	Local-national
(UNECE 2009)	Guidance on Water and Adaptation to Climate Change	National
(Corfee-Morlot et al. 2009)	Cities, Climate Change and Multilevel Governance	Local-national
(Ribeiro et al. 2009)	Design of guidelines for the elaboration of Regional Climate Change Adaptations Strategies	Regional
(Gupta et al. 2010)	The Adaptive Capacity Wheel: a method to assess the inherent characteristics of institutions to enable the adaptive capacity of society.	Local-national
(Pahl-Wostl et al. 2010)	Analyzing complex water governance regimes: the Management and Transition Framework	River basin
(Ekstrom et al. 2011)	Barriers to climate change adaptation: A diagnostic framework	Local-supranational
(Van Rijswijk et al. 2014)	Ten building blocks for sustainable water governance: an integrated method to assess the governance of water	Water system
(Ford and King 2015)	A framework for examining adaptation readiness	Local-national
(Bressers et al. 2015)	Benefit of Governance in Drought Adaptation – Governance Assessment Guide	Local-water system

4.2. Characteristic levels

One of the ambitions of the GCAF is to promote city-to-city learning and to assist cities to understand which GCs should be improved to increase their governance capacity. Each GC has been further specified in three characteristics. For each characteristic, a heuristic ordinal classification of five levels has been developed to enable scoring; the Characteristic Levels (CLs). Hereby it may be clear to what extent a certain characteristic is developed.

The CLs have been determined using a wide range of literature. The relevancy of certain study fields in the assessment of a certain city strongly depends on the extent to which sustainable water governance is developed in the city. The cities that have no or poor water governance will gain more from good governance principles (for example, UNDP 2008), while fragmented and path dependent governance networks would gain more from transition management (Loorbach 2010; Van der Brugge and Van Raak 2007; Van der Brugge and Rotmans 2007), social learning (Pahl-Wostl et al. 2007) and innovation studies (Moulaert et al. 2007).

Five levels have been defined for each characteristic. As only the highest level (++) relates to a city that has fully developed the governance capacity to sustainably manage its water resources; all other levels require a transition. The basis of the description of the CLs therefore lies in transition management. Transition management and innovation studies as such are more process-oriented. Fig. 4.2. shows the general phases described in transition scholarship (Van der Brugge and Rotmans 2007). The system state on the vertical axis corresponds more or less to the CL of a city. A city with a moderate CL (0) will be described as fragmented and in a path-dependent lock-in. Cities with a very encouraging CL (++) seek to stabilize the state of sustainable governance.

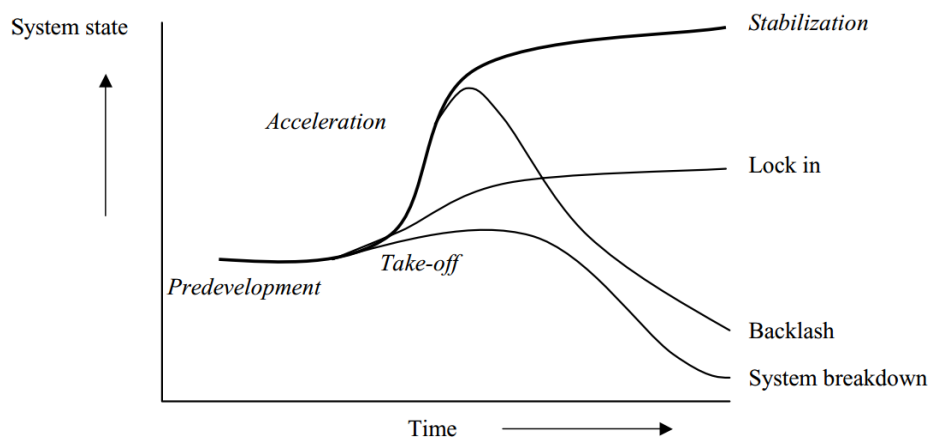


Figure 4.2 The four phases of transition including less desired pathways that evolve as a result of complexity of the interaction processes (Van der Brugge and Rotmans 2007).

The CLs for each condition have been described through narratives. Often, the most relevant limiting factors or prerequisites for sustainable governance have been described in literature, which can be seen as worst case and best case scenarios (i.e. all limiting factors- or prerequisites are present). The intermediate levels have been described based on the phases described in transition management and different study fields, such as innovation studies (including path-dependency, see Moulaert et al. 2007), and social learning (the concept of multiple-loop learning, e.g. Pahl-Wostl 2009). It is the nature of wicked problems to constantly change due to altered perspectives, inclusion of a variety of stakeholders and alterations from previous attempts to solve it. Hence transitions are continuously required, as wicked problems can be tamed, but never truly solved (Head and Alford 2013). Table 4-2 briefly describes the relation of the CLs to the stages of transition management. The CLs for each characteristic can be found in Appendix I. As governance capacity is assumed to be achieved only when all conditions are met, the lowest scoring GC should be the focus of cities looking to improve their governance.

Table 4-2 The CLs are generally based on the descriptions given below, which have been derived from the stages of transition and which include elements of innovation

Level	Description	Stage of transition
--	The characteristic is not present or inhibited	Predevelopment
-	The characteristic is hardly present	Predevelopment
0	Highly fragmented, lock-in on conventional practices, growing awareness in small groups	Take-off
+	Ambition to support innovation. Due to uncertainty, innovation is promoted, creating redundancy and reconsideration of basic assumptions	Acceleration
++	Sustainable practices, with regular learning and adapting to changing conditions	Stabilization

4.3. Identifying the most important conditions for governance capacity

Based on an iterative literature study, a GCAF of nine GCs has been composed. These are prerequisite ‘ingredients’ that together provide the capacity for urban stakeholders to practice sustainable water governance. Each of the nine GCs consists of three characteristics which will be assessed separately, which determines the score of each condition. This section will describe the identified GCs with their characteristics and discuss the relevancy of each GC and their relation to the overall coherency of the GCAF. The proposed GCAF consists of the following GCs, sequenced as shown below:

Knowing	GC1 Awareness	GC1.1 Community knowledge GC1.2 Local support GC1.3 Internalization
	GC2 Useful knowledge	GC2.1 Information availability GC2.2 Accessibility GC2.3 Cohesion
Wanting	GC3 Continuous learning	GC3.1 Smart monitoring GC3.2 Evaluation GC3.3 Cross-stakeholder capacity building
	GC4 Stakeholder engagement process	GC4.1 Inclusiveness GC4.2 Protection of core values GC4.3 Progress and choice variety
	GC5 Policy ambition	GC5.1 Ambitious and realistic goals GC5.2 Discourse embedding GC5.3 Cohesive policy
	GC6 Agents of change	GC6.1 Entrepreneurial GC6.2 Collaborative GC6.3 Visionary
Enabling	GC7 Multi-level network potential	GC7.3 Room to maneuver GC7.3 Clear division of responsibilities GC7.3 Authority
	GC8 Financial viability	GC8.3 Affordability GC8.3 Willingness to pay GC8.3 Financial continuation
	GC9 Implementing capacity	GC9.1 Policy instruments GC9.2 Legal compliance GC9.3 Preparedness

4.3.1. Awareness

Awareness of the relevant issues is a prerequisite for (the transition to) sustainable governance. Awareness refers to the knowledge of the occurrence, causes, and consequences of the issue hand, perceptions, interpretations and experiences leading to patterns of behavior (Alexander Ballard Ltd 2008; Raaijmakers et al. 2008). Awareness is not mentioned explicitly in most sources of information (or references), as it is self-evident that awareness of the current and future water challenges is needed to establish sustainable policy. However, it is a prerequisite for public support, informed decisions and engagement of stakeholders in decision making concerning climate adaptation and IWRM. Marshall et al. (2013) studied if climate change awareness of primary producers, i.e. understanding of the effects of climate change on their operations, relates to the adaptive capacity, and carefully suggests that other industries, sectors and stakeholders can increase adaptive capacity by increasing both public and individual awareness and consciousness. Similarly, Alexander Ballard Ltd (2008) defines awareness as something that is cognitively and emotionally developed within organizations that are aware of the causes, impact, scale and urgency of climate change for their core business. Awareness of the problem will then lead to assessment, communication and recognition of climate and water vulnerabilities and in turn increase the willingness to act (Fussel 2007; Raaijmakers et al. 2008).

Raaijmakers et al. (2008) explored how flood risk perceptions can contribute to assist policy-makers and bridge the gap between public perception and expert risk assessment. They based their work on the *psychometric paradigm*⁵ (Slovic 1987) and defined three ordinal elements of risk perception; (i) *worry*, which refers to dread or fear of a certain hazard; (ii) *awareness*, meaning knowledge of the risk among those who are exposed; and (iii) *preparedness*, referring to the control over the risk. This determines the dynamics of consciousness as awareness may increase worry, which will increase the demand to take action and thus increase preparedness. On the other hand, a higher level of preparedness may decrease worry, which results in lower awareness over time (see Fig. 4.3). In accordance, Adger et al. (2009) argues that the limit of adaptation is endogenous and based on goals, values, risks perception and social choice. Increasing awareness of water issues and climate adaptation can lead to recognition of actual risks, more ambitious goals and to better informed decisions. GC1 (*Awareness*) consists of three characteristics, i.e., *community knowledge, public support and stakeholder internalization*.

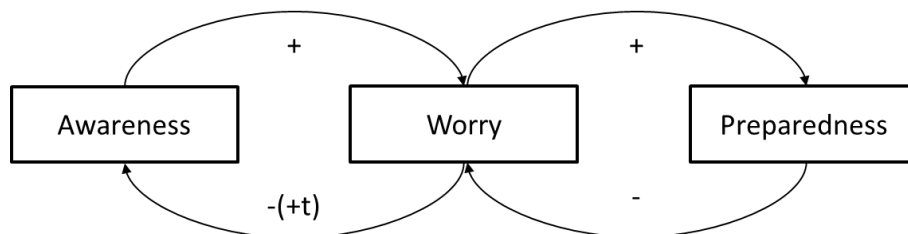


Figure 4.3 Awareness of the issue increases worry and demand for action, which will increase preparedness. However, a higher preparedness will reduce worry and, over time, may cause a decline in awareness (adopted from Raaijmakers et al. 2008)

Community knowledge

Knowledge of an issue is necessary to cultivate awareness. An understanding is necessary of the causes, impact, scale and urgency of the issue (Alexander Ballard Ltd 2008) in particular related to the activities of a community (Costas et al. 2015). Provision of information to-, or education of the public usually increases awareness (Raaijmakers et al. 2008). In the past decades the role of the state has steadily declined, giving rise to new actors, decision-makers and partnerships (Agrawal and Lemos 2007, Berkes 2009). Hence, to be able to design the right approach the level of knowledge within the urban governance network, including both formal and informal actors, will greatly determine the

⁵ The psychometric paradigm is a research approach in risk perception. It states that laypeople use qualitative information rather than statistical information, e.g. if a certain practice has high benefits, risk perception of a certain hazard tends to be lower (Siegrist 2010).

outcome of the decision-making process. *Community knowledge* assesses the knowledge that is generally present within the community regarding the issue.

Local support

Cultivating awareness amongst actors will ultimately increase the adaptive capacity (Marshall et al. 2013; Ford and King 2015) and the willingness to take action and invest resources (Alexander Ballard Ltd 2008; Raaijmakers et al. 2008). Public opinion and perception of risk play a key role in the effectiveness and scope of decision making as well as implementation of IWRM and may open new “policy windows” through increasing public support (Moser and Ekstrom 2010; Ribeiro et al. 2009; Brown and Farrelly 2009). Furthermore, businesses, communities and individuals can significantly influence both the causes of- and approaches to deal with wicked problems (UNEP 2006; Agrawal and Lemos 2007). Depending on the (perceived) severity of the adverse effects from an issue and the frequency of occurrence, more or less people will worry about it. Often people will not worry about what they perceive as infrequent events, decreasing the demand to take action and thus public support (Raaijmakers et al. 2008). The coverage of issues in the (local) media is an indicative proxy for public local perception (Sampei and Aoyagi-Usui 2009) and can strongly influence the political agenda (McCombs 2004). *Local support* aims to measure to what extent the general public supports the transition towards more adaptive governance.

Internalization

This characteristic means that a certain idea, value or belief is made an integral part in one’s activities and identity by learning or (unconscious) assimilation and action (Alexander Ballard Ltd 2008). Individuals, organizations, institutions or even the entire urban network can, to a certain level, internalize principles of IWRM, the necessity of climate adaptation and long-term strategies. The process of internalization is an iterative one, where awareness leads to understanding and perception of the issue, which in turn increases the awareness (Moser and Ekstrom 2010; Ekstrom et al. 2011). Importantly, internalization is here not necessarily measured at the individual level. *Internalization* assesses to what extent the local institutions and organizations involved in IWRM internalize issues of water and climate change in their policy, actions and communication.

4.3.2. Useful knowledge

Knowledge management literature distinguishes between data, information and knowledge. Data in itself is not necessarily informative, only through interpretation and analysis can meaning be given to the data. Knowledge refers to the information that enables informed decision-making and –action (Rowley 2007). This hierarchical relationship is often depicted as a ‘knowledge pyramid’ as shown in Fig. 4.4. Therefore, a lack of data, information or knowledge can inhibit informed decision-making, which is mentioned in virtually all literature on adaptive governance. Moreover, in practice many cities recognize the lack of useful local knowledge of how future trends, such as urbanization and climate change, will affect their local situation (Amundsen et al. 2010; Brown and Farrelly 2009). Knowledge of social developments and the urban water system as well as how future developments may impact urban water management are all crucial to enable informed decision-making (Van Rijswick et al. 2014; Ribeiro et al. 2009). Information should be of good quality as well as understandable and accessible for non-experts in order to prevent miscommunication, knowledge gaps and fragmented policy (e.g. Alexander Ballard Ltd 2008; Corfee-Morlot et al. 2009; Fussel 2007; Rogers and Hall 2003).

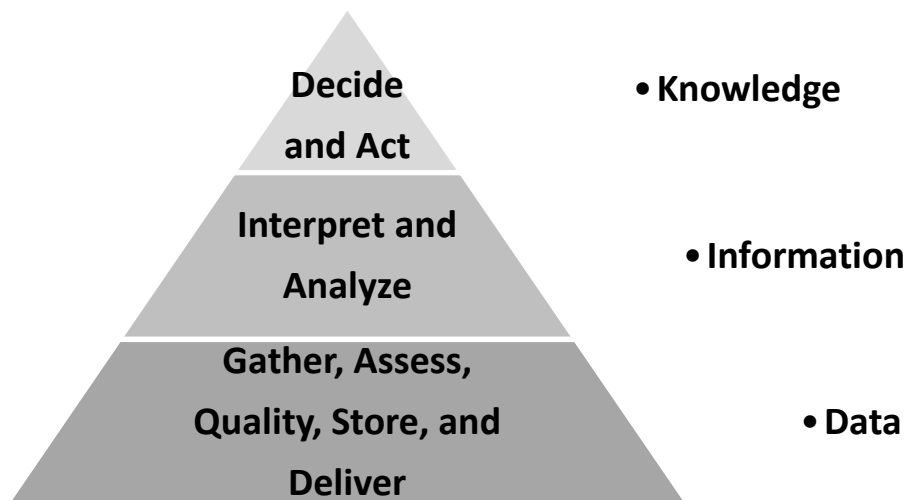


Figure 4.4 The Knowledge Pyramid, adjusted from Van Leeuwen and Vermeire (2007)

As cities deal with uncertainties, it is therefore not just the availability of scientific research but it also needs to be useful and applicable in the local context. Moreover, practical knowledge that is shared, accessible or co-created by all relevant local stakeholders strongly contributes to effective decision making and implementation (Hanger et al. 2013; Lemos et al. 2012). Knowledge, as developed throughout the governance capacity trajectory via learning-by-doing, is a vital part of the decision and implementation process (Folke et al. 2002). GC2 (*Useful knowledge*) consists of three characteristics, i.e., *information availability, accessibility and cohesion*.

Information availability

The availability of information enables knowledge that covers all relevant sectors, ranging from community knowledge to scientific knowledge (Lockwood et al. 2010), short-term and long-term predictions, and extensive and applicable knowledge regarding alternative solutions (Ford and King 2015; Van Rijswick et al. 2014). Information of and from different policy fields and sectors should be available to enable well-informed decisions (Head and Alford 2013; Lonsdale et al. 2010; OECD 2011), as a limited problem investigation can lead to ill-defined problems and over-focus on a limited set of incomplete solutions (Ekstrom et al. 2011). Furthermore, scientific analysis, future risk estimations, including worst-case scenarios, cost of inaction and a variety of possible alternatives should be specified to tackle relevant issues in their local context (Fussel 2007; Van Rijswick et al. 2014). *Information availability* assesses the extent to which both tacit and tangible information is of sufficient quantity.

Accessibility

Information should be accessible and understandable for all interested and relevant stakeholders (Lockwood et al. 2010; OECD 2015c; Jacobsen et al. 2013). The flow of data, information and knowledge between actors will enhance effective decision making and implementation (Engle and Lemos 2009). Moreover, open sharing of information will prevent miscommunication and unintended interpretations (Moser and Ekstrom 2010) as transparency is ensured (Lockwood et al. 2010; Lonsdale et al. 2010). Hence, by sharing the available information, understanding by all relevant stakeholders, civil society and organizations will increase across the entire decision-making and implementation process. *Accessibility* refers to the sharing of knowledge to all interested stakeholders.

Cohesion

Information of a variety of disciplines should be bundled to gain insight in the city's future risks, and to deal with complexity and uncertainty (OECD 2015c; Van Rijswick et al. 2014; Folke et al. 2005; Ford and King 2015). Information should be useful and timely regarding the policy- and decision-making process (Ford and King 2015), thus meeting the requirements of current and future data demands (Van Rijswick et al. 2014; OECD 2015c; Lonsdale et al. 2010). However, information that is produced, but not perceived by the relevant actors has little value (Ekstrom et al. 2011; Lonsdale et al. 2010). Information of and from different policy fields and sectors is required to be able to deal with wicked problems, therefore this information should be cohesive and compatible (Head and Alford 2013; Lonsdale et al. 2010; OECD 2015a). This will contribute to shared recognition of interdependencies, allowing actors to jointly address and co-create knowledge and formulation of solutions for wicked problems (Lockwood et al. 2010). *Cohesion* assesses the conformity of information across actors, sectors and administrative layers.

4.3.3. Continuous learning

Deliberate and continuous learning-by-doing should be employed, with the understanding that wicked problems entail uncertainties, complexities and unknowns. Crucial to learning in a public policy context is the interaction amongst actors, to understand different perspectives and achieve a more comprehensive, if not consensual, problem evaluation (Muro and Jeffrey 2008; Pahl-Wostl 2009; Pahl-Wostl et al. 2007). Furthermore, this can prevent an overly limited scope to deal with urban water issues (Termeer et al. 2015), due to conventional technocratic path dependencies (Brown and Farrelly 2009). In an attempt to conceptualize the process of learning, the theory of multiple loops learning is introduced, see Fig. 4.5 (Pahl-Wostl 2009; Gupta et al. 2010; Medema et al. 2014). Multiple loop learning consists of three loops, where in the single loop incremental learning occurs, questioning whether the current paradigm is executed right. This is consistent to the idea of path dependency, as every change reinforces the current paradigm. Double loop learning refers to the questioning of assumptions and key relationships on which policy is based. Triple loop learning questions world views and underlying norms and values (Pahl-Wostl 2009).

Regular monitoring, evaluation and diagnosis are required for continuous learning and creating preparedness for uncertain and unexpected situations (Pahl-Wostl 2009). Active promotion of interaction within the urban governance network will increase the capacity to reduce risks, deal with uncertainties and unstable future developments. GC3 (*Continuous learning*) consists of three characteristics, i.e., *smart monitoring*, *evaluation* and *cross-stakeholder capacity building*.

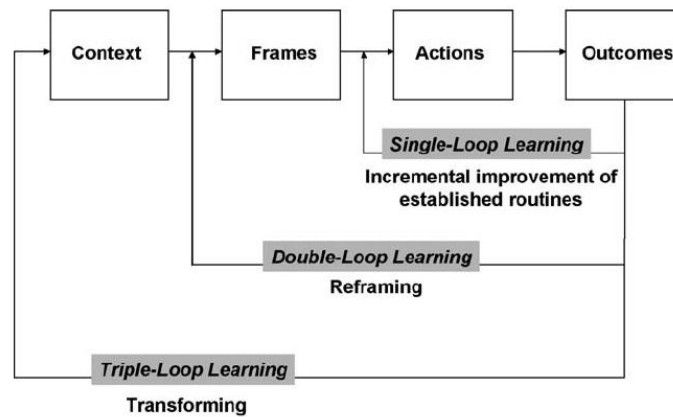


Figure 4.5 Multi-loop learning: Single-loop learning occurs when established routines are improved; Double-loop learning occurs when underlying assumptions are challenged; Triple-loop learning occurs when world-views, underlying values and beliefs are being questioned (Pahl-Wostl 2009)

Smart monitoring

The actual state of urban systems, actions, interactions and results should be monitored, in order to better understand both social and natural (water) system behavior, needed to continuously improve current policy and management (Alexander Ballard Ltd 2008; Loorbach 2010; Ribeiro et al. 2009; Brown and Farrelly 2009). It may facilitate single loop learning; actors ask the question “are we doing things right” (Pahl-Wostl 2009). Next, smart monitoring may facilitate double loop learning by recognizing underlying processes from a smartly developed monitoring network. Interesting developments are for example the use of information gathered by citizens, known as citizen science. This method uses civil society to collect data, e.g. Middleton et al. (2014) monitored social media activity during disasters to construct real time crisis maps. This is beneficial in two ways, as vast amounts of sometimes unique data can be gathered rather cheaply and it will raise (public) awareness (Silvertown 2009; Adger et al. 2013). *Smart monitoring* assesses to what extent actions, interactions and outcomes are monitored using a wide range of monitoring methods.

Evaluation

Learning is a diagnostic effort. Actors should consciously and continuously question whether they are “doing the right thing” (Pahl-Wostl 2009). This is the concept of double-loop learning and can only be achieved by constant and critical evaluation, not only of data and outputs, but also by challenging their underlying assumptions, norms and objectives (Pahl-Wostl et al. 2007; Pahl-Wostl 2009; Gupta et al. 2010). This will alter the problem definition and thus may lead to radically different potential solutions (Kim 1993). As such, it is important to appreciate uncertainties and possibilities to prevent lock-in on an unsustainable path (Pahl-Wostl 2009; Brown and Farrelly 2009). The transition to a new paradigm must be evaluated with regard to the rate of progress, barriers and points of improvement (Loorbach 2010). Additionally, by evaluating past and current governance arrangements, identification of trends with predicting value can provide information to estimate the impact of future changes. *Evaluation* assesses whether progress and barriers are evaluated so that trends, processes and future challenges can be identified and understood.

Cross-stakeholder capacity building

The basis of social learning is interaction amongst actors. Also the mode of stakeholder involvement through which learning occurs can be distinguished (CIS Working Group 2.9 2003; see Fig. 4.6): (i) information supply (i.e., learning of new facts through social interaction); (ii) consultation (referring to dialogue and exchange of arguments); and (iii) active involvement (social learning-by-doing). Stakeholders may create and maintain strong ties during creation and implementation of policy by continuous joint evaluation. This can enhance mutual learning, and open sharing of resources, advice and ensures continuous effectiveness of policy (Reed et al. 2009; Pahl-Wostl 2009). By promoting mutual trust and respect between actors, a more open mind and willingness to learn or adapt can be achieved (Gupta et al. 2010). This will also facilitate multiple loop learning, as actors will appreciate

alternative perspectives which can evolve their underlying norms, values and assumptions (Pahl-Wostl 2009). *Cross-stakeholder capacity building* assesses to what extent interactions between actors occur which facilitate learning.

4.3.4. Stakeholder engagement process

The importance of engaging stakeholders is widely noted in literature (e.g. Adger et al. 2005; UNDP 2008; Pahl-Wostl 2008; Ekstrom et al. 2011). Most works reason that stakeholders should be engaged for normative reasons, i.e. as a criterion for good governance (Jacobsen et al. 2013; Ford and King 2015; OECD 2015b; Van Rijswick et al. 2014; UNECE 2009), and for instrumental reasons, because a wider range of resources and knowledge becomes available, a more complete problem framing can be developed, and more comprehensive solutions can be discovered (Lockwood et al. 2010; Pahl-Wostl 2009; Van Rijswick et al. 2014; Ridder et al. 2005). Engagement has two basic dimensions: inclusiveness, referring to the opportunity for stakeholders to be involved, and empowerment, referring to the extent to which stakeholders can influence the outcome of a decision-making process (Ford and King 2015; Van Rijswick et al. 2014; Brown and Farrelly 2009).

The interaction between the decision-makers and other stakeholders can be conceptualized in three layers, as is shown in Fig. 4.6. The first layer (information supply) indicates one-way communication (co-knowledge), the second layer (consultation) indicates a dialogue where other stakeholders can provide input for the decision-making process (co-thinking), where in the third layer (active involvement) stakeholders are actively involved throughout the phases of the policy-making and implementation process (co-operation) (CIS Working Group 2.9 2003). Furthermore, trust, respect and fairness are also mentioned in particular for public engagement (Lockwood et al. 2010; Ridder et al. 2005).

Active involvement of stakeholders in decision-making processes often is much more time consuming than unilateral decision-making. However, as illustrated in Fig. 4.7, this is usually more than compensated by time gains in the implementation phase (Ridder et al. 2005). Additionally, through continuous cross-actor interactions especially after initial decision making, different viewpoints and expectations can be used to evaluate existing policy on a regular basis, thereby increasing policy support, effectiveness and mutual learning (Pahl-Wostl 2008; Armitage 2005). GC5 (*Stakeholder engagement process*) consists of three characteristics, i.e., *inclusiveness, protection of core values and progress and choice variety.*

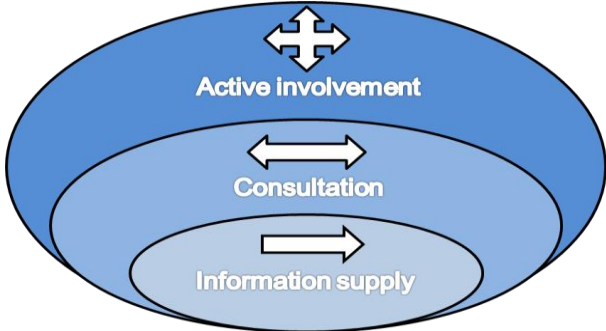


Figure 4.6 Three layers of stakeholder engagement (CIS Working Group 2.9 2003)

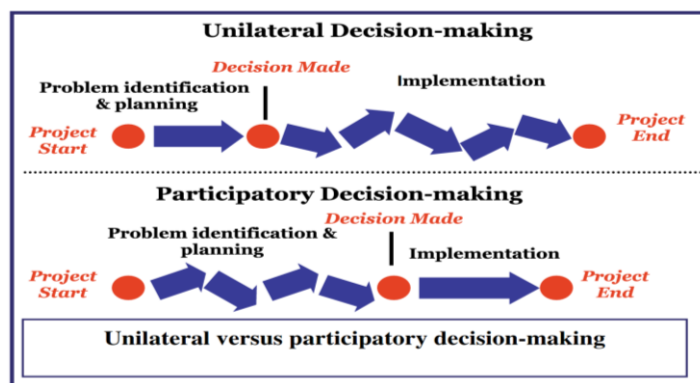


Figure 4.7 Participatory decision-making often takes much more time compared to unilateral decision-making. However, the time gain in the implementation phase often compensates this initial time loss (Ridder et al. 2005)

Inclusiveness

Inclusiveness refers to the opportunity for interested stakeholders to be included in the policy-making process as well as the transparency of decision-making. Inclusiveness will support fairness, equity and diversity (Lockwood et al. 2010; Van Rijswijk et al. 2014; Jacobsen et al. 2013) and will increase legitimacy and trust in the decision-making process (for example, Jacobsen et al. 2013; Gupta et al. 2010; OECD 2011; Ridder et al. 2005). *Inclusiveness* measures the level to which relevant stakeholders are able to be part of the decision-making process, decide or speak on behalf of the group they represent.

Protection of core values

This characteristic refers to respecting stakeholders. Stakeholders should be committed to the process, rather than to a predetermined outcome (Ridder et al. 2005). If stakeholders feel threatened they will distrust, not participate in, delay or step out of the decision-making process (Ridder et al. 2005; Pahl-Wostl 2009; Ellis et al. 2009). A clear exit strategy on predetermined points in the process should also be defined, as stakeholders are more likely to enter if they have the possibility to exit (Ridder et al. 2005). *Protection of core values* measures the extent to which stakeholders feel confident that their core values will not be harmed by assessing if commitment is focused on the process instead of the results and if stakeholders have exit possibilities at given moments.

Progress and choice variety

Speed and progression need to be ensured by clear and realistic procedures. Stakeholders should produce and then select from a variety of alternatives to ensure learning and get authoritative and legitimate decisions (Ford and King 2015; Lockwood et al. 2010; Van Rijswijk et al. 2014; OECD 2015a). Progress of the process and inclusiveness is needed, as stakeholders are discouraged if it appears that their input is neither heard nor considered. A transparent process is therefore needed where stakeholders can clearly see how their input is considered. The selection of a policy or approach should be at the end of the process to secure continued prospect of gain and thereby cooperative behavior (Ridder et al. 2005). *Progress and choice variety* assesses if the engagement process is transparent and if stakeholders are given the opportunity to co-create options and commit to a possible outcome at the end of the process.

4.3.5. Policy ambition

Policy ambitions are related to the dominant policy discourses regarding urban water management. In practice, several discourses compete for dominance. Policy that does not match the local values, discourses, and principles will often not be successful (Van Rijswijk et al. 2014). Hence, the degree to which integrated policy and approaches that address water and climate issues are embedded in the dominant policy discourse, largely determines the effectiveness and policy ambitions. Often the over-fragmentation of roles and responsibilities mean that no single agency is in charge of water policy (OECD 2011). Policy should be integrated throughout and across governance levels and between organizations (OECD 2011; OECD 2015a; Lockwood et al. 2010; Corfee-Morlot et al. 2009). The

objectives should be long-term, with short- and mid-term measurable targets (Lockwood et al. 2010; OECD 2015c; Brown and Farrelly 2009). Policy designers should aim at creating a shared narrative and at resolving conflicts through dialogue and inclusion (Van Rijswijk et al. 2014; Head and Alford 2013). GC5 (*Policy ambition*) consists of three characteristics, i.e., *ambitions and realistic goals*, *discourse embedding* and *cohesive policy*.

Ambitious and realistic goals

Urban water challenges require a long-term vision to guide short-term goals (OECD 2015c; Lockwood et al. 2010), the lack of which has been identified as a major barrier to adaptation (Ford and King 2015; Brown and Farrelly 2009). Different aspects of wicked problems are felt at different time scales. Short-term goals should not interfere with long-term objectives, but instead contribute to it (UNECE 2009; Adger et al. 2005). A common and agreed upon vision is necessary to coordinate the agendas of different sectors and stakeholders. Furthermore, creating a vision encourages looking forward and anticipating the future (Philip et al. 2011). *Ambitious and realistic goals* measure: (i) if goals are ambitious; (ii) city policy has a long-term vision; (iii) if this long-term vision is put effectively into practice by a cohesive package of short-term and intermittent targets.

Discourse embedding

Most scholars stress the importance of the local culture, history, values, beliefs, traditions, etc. that shape the institutional setting (Rogers and Hall 2003; Pahl-Wostl et al. 2008; Klein Woolthuis et al. 2005). The level to which sustainable policy is interwoven within the historical, cultural, normative and political context largely determines the effective implementation of ambition, goals and targets with regard to IWRM and climate adaptation (Adger et al. 2013). *Discourse embedding* therefore assesses the extent to which sustainable policy is included in historical and current policy and most important institutions.

Cohesive policy

Unclear division of roles and responsibilities across organizations and throughout governance levels contribute to poor water governance (e.g. OECD 2015c; Loorbach 2010; Lockwood et al. 2010). Water governance transcends sectorial boundaries as it affects and is affected by other sectors (OECD 2011; Havekes et al. 2013; Fröhlich and Knieling 2013). Hence, effective and ambitious water governance and management is only possible if policies are cohesive on the horizontal and vertical levels (Lockwood et al. 2010; OECD 2011; UNECE 2009; Havekes et al. 2013; Ribeiro et al. 2009). Cohesive policy is particularly important to prevent fragmentation between policy fields, which can even result in contradictory policy objectives (Lockwood et al. 2010; Adger et al. 2005). *Cohesive policy* assesses the cohesiveness of policy that shape urban water management which are the water policies itself and with respect to other related sectors, such as the energy-, transport- and ICT sectors (Koop and Van Leeuwen 2016).

4.3.6. Agents of change

The concept of agents of change is often described in organizational change-, adaptive capacity- and innovation literature (Alexander Ballard Ltd 2008; Pahl-Wostl et al. 2011; Scholten 2009), although different terminology may be used (e.g. leaders, agents of change, policy entrepreneurs, institutional entrepreneurs, etc.). For this governance condition, the concepts of leadership and agents of change have been combined, as strong leadership can either steer towards or away from sustainable transitions (Schultz and Fazey 2009; Marion and Uhl-Bien 2001) and agents of change without support from authoritative actors will have little effect (Alexander Ballard Ltd 2008). However, the actual drivers behind change are the agents of change.

Agents of change and leadership are recurrent requisites in literature for the transition towards sustainable governance (Adger et al. 2005; Head and Alford 2013; Alexander Ballard Ltd 2008; Moser and Ekstrom 2010). Every context requires different types of agents, however for transition management the following three types can be identified that can promote sustainable practices (Ford and King 2015; Gupta et al. 2010; Head and Alford 2013; Schultz and Fazey 2009; Termeer et al. 2012): (i) *Entrepreneurial*: to gain access to resources, seek opportunities and manage risks; (ii) *Collaborative*: to build bridges and coalitions between actors; (iii) *Visionary*: who supports long-term

visions and is able to communicate it. Agents of change in this sense does not only refer to formal leaders, but instead to those that engage the intrinsic motivation of people, rather than the more traditional means of coercion or monetary incentives (Head and Alford 2013; Schultz and Fazey 2009). GC6 (*Agents of change*) consists of: *entrepreneurial*-, *collaborative*- and *visionary agents of change*.

Entrepreneurial

Entrepreneurial agents of change are necessary to gain access to resources (Termeer et al. 2012). They lead by example and, much like entrepreneurs, they spot opportunities, take measured risks and enable action (Gupta et al. 2010). *Entrepreneurial* therefore assesses to what extent entrepreneurial agents of change enable action towards sustainable urban water management and governance.

Collaborative

In the context of urban water management and governance, collaborative agents of change are needed to build coalitions and bridge policy- and disciplinary boundaries (Termeer et al. 2012; Gupta et al. 2010). This type of agents of change encompasses trust building, seeking win-win cooperations, recognizing particular expertise and generally engages in diplomacy (Head and Alford 2013). *Collaborative* assesses the extent to which collaborative agents of change set up coalition forming which is necessary to enable effective solutions that have the support of all relevant stakeholders.

Visionary

Visionary or directional agents of change link time scales and sectors, i.e. comprehend the bigger picture and have the ability to steer activities and results (Schultz and Fazey 2009; Termeer et al. 2012). Furthermore, they have the ability to convey their vision convincingly and create support (Gupta et al. 2010; Head and Alford 2013; Ribeiro et al. 2009). *Visionary* assesses the extent to which there are agents of change that envision long-term solutions and steer activities towards results promoting local solutions for water issues and addressing climate adaptation.

4.3.7. Multi-level network potential

Tackling water challenges under increasing pressure of climate change and urbanization requires cooperation between many stakeholders and institutions with different interests, perspectives and which act on different levels (Gupta et al. 2010; Moser and Ekstrom 2010). Flexible and dynamic networks are important to deal with wicked problems with high uncertainties and complex relations (Pahl-Wostl 2009). It also requires some autonomy of actors at different levels within the network to create a variety of approaches, and cooperate in different groups. These different types of cooperations and approaches create some degree of redundancy that is often considered as an important precondition for dealing with new situations and challenges (Gupta et al. 2010; Loorbach 2010; Folke et al. 2005). Furthermore, urban water issues also need to be perceived as important and embedded in the institutional and political system. GC4 (*Multi-level network potential*) consists of three characteristics, i.e., *room to maneuver*, *clear division of responsibilities*, and *authority*.

Room to maneuver

By providing the means and information for actors to experiment with solutions, a more comprehensive portfolio of approaches will be compiled (Gupta et al. 2010). The consequent redundancy provides more flexibility in dealing with challenges by providing options and back-up systems on the short term, while giving insight for long-term governance (Folke et al. 2002; Loorbach 2010; Pahl-Wostl 2009). *Room to maneuver* assesses the extent to which actors in the urban water network have the freedom and opportunity to develop a variety of approaches necessary to effectively address wicked problems.

Clear division of responsibilities

A cooperative network of actors is required to deal with the variety and uncertainty inherent to wicked problems (Folke et al. 2005; Armitage 2005). Wicked problems transcend administrative and sectoral boundaries and horizontal and vertical cooperation is required (Pahl-Wostl et al. 2007; Folke et al. 2005; Ribeiro et al. 2009). To enable effective cooperations, a clear division of responsibilities is required (UNDP 2008; OECD 2011). *Clear division of responsibilities* assesses the extent to which wicked water challenges are or can be addressed by more fit-for-purpose division of responsibilities.

Authority

Most scholars mention a ‘balancing act’ between stabilizing- and change supporting elements of a governance system (Pahl-Wostl et al. 2008; Adger et al. 2005). Regulatory frameworks and common values provide direction and long-term stability and delineate the autonomy of local actors (e.g. Gupta et al. 2010; Armitage 2005; Lockwood et al. 2010). Research indicates that adaptation is more effective if there is an authoritative group that takes the lead or oversees activities (Ford and King 2015). The overarching regulatory framework should enhance transparency and accountability, while still keeping local issues in consideration (Gupta et al. 2010; Loorbach 2010). *Authority* assesses to what extent authoritative actors are included in cooperations to address urban water issues and climate adaptation in existing institutional structures and implemented policy.

4.3.8. Financial viability

Addressing urban water challenges requires a continuity of financial support (e.g. OECD 2015c; Rogers and Hall 2003; UNECE 2009; Van Rijswick et al. 2014), as short budgetary cycles prevent long-term thinking (Ford and King 2015) and will most likely substantially increase overall cost (UNEP 2013). An important aspect of financial viability is the costs and benefits of measures, e.g. who is affected, who benefits and, therefore, who should pay (Lockwood et al. 2010; UNECE 2009; Adger et al. 2005). For financial continuation, support for current policy is necessary to ensure the willingness to pay amongst stakeholders and civilians. Water resources and services are basic human needs and therefore there should be a fair balance between revenue and affordability for the poorest in society (OECD 2011; Havekes et al. 2013). GC8 (*Financial viability*) consists of three characteristics, i.e., *affordability*, *willingness to pay* and *financial continuation*.

Affordability

The UN’s Millennium Development Goals (MDGs) include sustainable access to water services such as potable water and proper sanitation for all, including the poorest (UN 2015, MDG 7.C). Therefore, providers of water services should find a balance between financial revenue and affordability for the poor (Jacobsen et al. 2013; OECD 2011; Havekes et al. 2013). Financing water resources and services strongly depends on the local context, e.g. federal, with strong involvement of the central government, or unitary institutions, with higher local autonomy (Ford and King 2015; OECD 2011). In developed countries, the user- and polluter pays principle is often employed, while in developing countries, the solidarity principle (paid by tax) is often more appropriate (UNECE 2009; OECD 2011; Van Rijswick et al. 2014). *Affordability* assesses if the water services and climate change adaptation measures are affordable for all relevant stakeholders and interests.

Willingness to pay

Financial resources are only available if those who have the ability to pay are also willing to pay (Paavola and Adger 2002). The willingness to pay will generally be higher when a community is confronted with recent damage from calamities and disasters (Fussel 2007; Raaijmakers et al. 2008). However, as this is not under the control of decision-makers, informing and engaging actors will increase risk perception and (financial) support for action (Costas et al. 2015). More accurate projections of future risks, based on socio-economic and climate change scenarios, will enable the estimation of costs for different adaptation strategies as well as the cost of inaction. Inaction, or maintaining business-as-usual, may result in higher (future) costs in terms of damages or implementing reactive measures (Leonardsen 2012). Trust in the local authorities that the money is well spent is also essential. Transparency and accountability are prerequisites for trust (Lockwood et al. 2010) and therefore willingness to pay is strongly related to good governance and communication. *Willingness to pay* assesses how expenditures on water and climate adaptation are perceived without any statements about the cases of this perception.

Financial continuation

Financial resources are a crucial necessity for developing and implementing sustainable solutions in the urban water cycle. Policy focused on solving long-term problems requires long-term thinking but, equally important, long-term financial support and security (Lockwood et al. 2010; Fussel 2007; Ford and King 2015). Policy is most effective if this long-term financial support is guaranteed on forehand

(Gupta et al. 2010; Van Rijswick et al. 2014). Thus, *financial continuation* assesses if water services are financially secured for the long term.

4.3.9. Implementing capacity

Implementation is somewhat neglected in adaptation scholarship. This is partly because there are few adaptation efforts that have reached this stage (Ekstrom et al. 2011). However, most studies mention it as a crucial phase in adaptation (Adger et al. 2005; Ekstrom et al. 2011; Van Rijswick et al. 2014). Governance condition 9 (*Implementing power*) is substantiated through (i) policy instruments to incentivize sustainable action by the use of steering instruments; (ii) legal compliance, referring to the enforceability of agreements and regulations; and (iii) the development of action plans, which allows stakeholders to contribute to the policy objectives (Müller and Siebenhüner 2007). An intelligent mixture, appropriate for the local context, will contribute to the successful implementation of policy (Van Rijswick et al. 2014). Urban water issues have a trans-boundary nature of, hence communication, education, and sometimes persuasion is necessary, as implementation depends on the cooperation of several actors (Ekstrom et al. 2011). GC9 (*Implementing power*) consists of three characteristics, i.e., *policy instruments*, *legal compliance* and *preparedness*.

Policy instruments

The agency of actors themselves is addressed in this characteristic, thus not interfering directly with their decisions but rather change the conditions of decisions (Müller and Siebenhüner 2007). Emission charges, for example, allow polluters to consider whether it is more profitable to reduce emissions or to maintain current practices and pay the additional charges (Bemelmans-Videc et al. 2011). Conversely, subsidies incentivize sustainable actions, where benchmarking and ratings will increase public pressure on actors to contribute to sustainable management (Müller and Siebenhüner 2007). Principles such as polluter-pays principles, full cost recovery or recognition of ecosystem services can all determine how financial resources are generated and at the same time discourage certain practices (OECD 2011; Van Rijswick et al. 2014). These instruments are employed on a relatively short term and allows for some creativity by the stakeholders. This contributes to organizational learning (e.g. actors will reconsider their operations to avoid charges or to qualify for subsidies), diversity in approaches and redundant solutions (Müller and Siebenhüner 2007; Gupta et al. 2010; OECD 2015c).

Legal compliance

This characteristic refers to the opportunity for parties to enforce agreements. Regulations and agreements that cannot be enforced sometimes lose credibility and eventually legitimacy (Van Rijswick et al. 2014). Legal instruments could be permits, bans and technical standards which directly influence decision making of stakeholders. While the prescription of precise targets and means limit social learning and innovation (Müller and Siebenhüner 2007), it may be necessary to enhance the effectiveness of water governance (Van Rijswick et al. 2014; Jacobsen et al. 2013; Lockwood et al. 2010). *Legal compliance* assesses the extent to which actors comply with agreements, targets, standards and norms.

Preparedness

The challenges that cities (will) face are imbued with uncertainty. To be able to respond appropriately to these challenges requires taking into account different long-term and short-term scenarios and preparing accordingly. Raaijmakers et al. (2008) subdivide preparedness in a social- and institutional dimension. The social dimension refers to the proactive and reactive actions taken by an individual respectively before and during a calamity, as well as dealing with the consequences. Local authorities should have proper emergency response schemes, supplies and volunteers. The institutional dimension includes the design and communication of an action plan. Successful implementation of such plans depends on the right balance between autonomy and control, providing a structured but flexible approach to deal with uncertainties and unknowns (Müller and Siebenhüner 2007). Moreover it is important to have the ability to act according to plan (Gupta et al. 2010). This will also provide a more comprehensive understanding of what resources are required, create awareness and provide clarity and specificity on what to do (Ekstrom et al. 2011). *Preparedness* assesses the existence and adequacy of action plans and (emergency) protocols.

5. Operationalization

5.1. Introduction

The GCAF aims to be comprehensive, consistent and comparable. These criteria have strong implications for the operationalization as the assessment method needs to measure what it intends to measure, and outcomes should be reproducible and comparable between cities with a wide range of traditions, cultures and geophysical contexts. The determination of specific (combinations of) methods strongly depends on the eventual application of the GCAF, as this determines the resources and network of contacts that are available. This chapter will provide some handholds for the operationalization of the GCAF. There are three main methods for the application of the GCAF. First, the questionnaire will shortly be described, second, the in-depth interview and third, desk research. An overview of the strengths and weaknesses of each of these methods is provided in relation to the GCAF. Finally, some suggestions will be made to gather data for each characteristic specifically.

The methods described next are an indication of how to approach the application of the GCAF and are not strictly defined. For this part of the study integrated governance assessments (although applied in other fields of study, scales or with deviating purposes), indicator specific methods (related to the characteristics) and general guidelines for data collection have been researched.

5.2. Methods and considerations

There are numerous approaches for the assessment of governance. All of these approaches have their strengths and weaknesses, particularly regarding the abstract nature of governance. Assessing governance is often qualitative and depends on the choices and interpretations made by the assessor, the considerations in the methodology and the method of data production and transfer. However, three main methods have been identified: (i) questionnaire survey; (ii) in-depth interview, and; (iii) desk research.

5.2.1. Questionnaire

The questionnaire is a common and well established method in the social scientist's toolbox for acquiring information on participants' social characteristics, past and present behavior, norms, values, beliefs and motivations with respect to the topic of the research (Bulmer 2004). Proper questionnaire design is crucial to generate information conducive to the objectives of the research (Bulmer 2004, Bird 2009). The design includes the format, sequence and wording, classifications, type of questions, length and output (Bird 2009).

A key requirement of a questionnaire format is that the order of the questions should be logically sequenced. This fosters a smooth transition between questions and topics (Sarantakos 2005) and will assist the understanding of the participants of the research's objectives and also help them to remain concentrated and involved in providing answers (McGuirk and O'Neill 2005), particularly if it concerns a self-administered questionnaire. The GCAF covers a wide range of topics, therefore the questionnaire should be constructed in such a way that similar topics are clustered (e.g. in the order of knowing, wanting, enabling).

Closed questions are, in principle, difficult to construct but relatively easy to analyze and are often used in quantitative research. Closed questions are also easy to administer, easily coded and analyzed, allow comparisons and quantification, and will probably yield less irrelevant responses (Sarantakos 2005). Open-ended questions allow more freedom for the participant, yield more spontaneous answers and are more suited to test hypotheses or awareness (Oppenheim 1992). However, due to the wide variety of possible answers, analysis of the results can be challenging. For the GCAF a combination of closed and open questions provides a questionnaire that is quantifiable with a degree of depth to the answers. This is particularly useful as the GCAF also aims to gain insight into, e.g., awareness, perceptions and relations of actors, which are better suited for ordinal or open-ended questions.

Despite the practical and substantial benefits of a questionnaire, there are some challenges to be considered. Bird (2009) has stated the following issues. Firstly and most important, the design of the questions can significantly influence the results. The format, sequence and wording, classifications, and type of questions need to be considered to improve reliability, validity and sustained engagement. Secondly, the questions should be unambiguous to prevent misinterpretation by the participants. Also, a questionnaire has limited complexity as the questions should be brief and self-explanatory. Furthermore, the response of a participant may be influenced by others (e.g. the participant might answer a knowledge question with the help of others). The response rate, mainly for self-administered questionnaires, may be poor (Bird 2009, p. 1312-1313).

There are numerous examples of researches in the field of (urban) water management that use questionnaires to produce results. Koop and Van Leeuwen (2015) use a questionnaire to assess the performance of urban water management. This questionnaire can also be used as a guideline for desk research. Raaijmakers et al. (2008) used questionnaires in combination with GIS computations to explore the spatial analysis of risk perception. The questionnaire proved useful to quantify the level of awareness (knowledge of risk), worry about the risk and preparedness. Marshall et al. (2013) used questionnaires to gain insight into the awareness to climate change and adaptive capacity of the respondents. The OECD's Program on Water Governance used self-administered surveys to provide evidence on the relationship between governance structures for managing water in selected cities and water policy outcomes (OECD 2016a).

5.2.2. In-depth interview

In-depth interviews (i.e. semi-structured interviews) can be used for qualitative research that involves conducting intensive individual interviews with a small number of respondents. The researcher follows a guideline, but is able to deviate from the guide when it seems appropriate (Davis-Case 1990). These interviews are useful when detailed information about a person's thoughts and behaviors are required or to explore new issues in depth (Boyce and Neale 2006; Barriball and While 1994; Davis-Case 1990). Furthermore, it has the potential to overcome poor response rates of a questionnaire survey (Austin 1981).

As in-depth interviews are often conducted face-to-face (or through a medium such as the telephone or internet), the exact wording of the (written) questions is not as important, because the researcher has the opportunity to clarify the questions for the interviewee (Barriball and While 1994; Bird 2009; Boyce and Neale 2006). In-depth interviews also allow the interviewees to more freely express themselves and they may be more comfortable to address sensitive issues (Keller and Conradin n.d.; Barriball and While 1994; Boyce and Neale 2006). As such, in-depth interviews encourage two-way communication where those being interviewed can ask questions of their own (Davis-Case 1990; Keller and Conradin n.d.). Therefore the interviewer may not only find out about the perception of an individual, but also the underlying reasons (Davis-Case 1990). Additionally, the interviewer can support the interviewee to retrieve memories (Barriball and While 1994), and observe non-verbal responses (Bird 2009). The in-depth interview is often used to validate other indicators that have been measured (Keller and Conradin n.d.).

In-depth interviews can be very valuable to gain insight into the intrinsic perspectives of individuals. However, the interviews can be time-consuming and costly (Bird 2009) and requires skilled interviewers who can balance between open-ended and focused interviewing (Davis-Case 1990; Boyce and Neale 2006; Keller and Conradin n.d.). It is also prone to bias as interviewees may want to emphasize either positive or negative aspects of the issue under investigation (Boyce and Neale 2006), for example, a community member who is personally affected by a policy will try to convince the researcher that the policy is ineffective. The presence of the researcher may also be intimidating, resulting in vague or untruthful answers (Bird 2009). Therefore, trust is a crucial aspect in the interview and the interviewee's response should be handled discreetly according to the consent of the interviewee (Keller and Conradin n.d.; Davis-Case 1990).

In the field of (urban) water management, in-depth interviews are a common approach to gain insight into the motivation and perceptions of participants. Van der Meene et al. (2009) performed an

assessment for the institutional capacity required to enable sustainable urban water management in Sidney, Australia. Experts and professionals were interviewed to explore in-depth experiential knowledge of the water practitioners. Costas et al. (2015) used in-depth interviews to analyze the motivations of several stakeholders to live at the coast, despite the threats of natural hazards and the impact of climate change. In both examples, the reason for certain actions, decisions and behavior is investigated.

5.2.3. Desk research

Desk research, or secondary research, is the re-analysis of data for the purpose of answering the original research question with better techniques, or answering new questions with old data (Glass 1976). Desk research is a common step in almost any research, to prepare the ground for primary data collection or to offer general background information (Do sd). It provides an understanding of what is already researched and which data is missing, thus narrowing the focus of the research (The Wallace Foundation 2009). Desk research can often be conducted relatively fast and at no or low cost. Furthermore, it can generally be conducted by persons with limited research background or specific expertise in the issue (The Wallace Foundation 2009; University of Surrey n.d.). Often, desk research consists of the following steps: identifying sources of information, gathering existing data, normalizing data, and data analysis (The Wallace Foundation 2009).

The usefulness of desk research strongly depends on existing information and the objective of the research. Often, specific, local information may not be available or not up to date. Combining data is also common for desk research, which must be approached with great caution to ensure that they can be combined and indeed measure the same things (The Wallace Foundation 2009). Furthermore, tacit information is often not documented or presented for the purpose of new studies.

There is a myriad of examples of desk research being used in studies, also with relation to water management. Commonly, desk research is used to delineate the research and determine which data should still be produced. Van der Meene and Brown (2007) constructed a literature assessment method through which they aimed to determine the institutional capacity to enable sustainable urban water management. Similarly, Ford and King (2015) used a systematic literature review protocol to identify documents containing information relevant for adaptation readiness.

5.2.4. Complementary approach

The previously described methods for research are complementary and in the application of the GCAF, it is most likely that all three methods are required. As stated by Bird (2009): *'a combination of closed and open questions provides the survey write-up with quantifiable and in-depth results'*. Van der Meene et al. (2009) combined desk research with in-depth semi-structured interviews, where the interviews provided more in-depth information on specific issues, but also on the linkages between the issues. Gupta et al. (2010) mention that for comparing institutions, in-depth interviews should be supported by desk research and the results should be scored accordingly.

The broad scope of the GCAF in combination with the distinctive context of cities will induce that the degree to which each of the methods is employed depends on the availability and specificity of local information. The GCAF aims to take a 'snapshot' of the governance capacity of a city, to give policy- and decision-makers an indication of which governance conditions should be further investigated and improved. The characteristics of the governance conditions are elaborated into levels through narratives (see Appendix I). Questionnaires, in-depth interviews and desk research should contribute to develop a description which can be attributed to one of the levels through the narratives. Through this, despite different data and information sources, an overall and comparable score can still be produced. Appendix II includes some examples of possible data collection methods and questions for surveys or interviews.

6. Discussion and recommendations

6.1. Synopsis

The objective of this research is to develop a framework to assess the governance capacity of cities to deal with urban water issues, which is consistently applicable, comprehensive, and allows for comparison between cities. Therefore, the Governance Capacity Assessment Framework (GCAF) has been developed. As cities may face a potentially infinite number of issues, some delineation had to be made. The City Blueprint management assessment allowed insight into the most threatening issues, resulting in four themes: flood risk, water scarcity, Urban Heat Island (UHI), and water quality and resource scarcity. The problem-oriented GCAF approach therefore suits well within the City Blueprint Framework. The problem-oriented approach is also useful in selecting the relevant actors and stakeholders for the GCAF assessment. Literature, practical guides and empirical work on stakeholder analysis have been consulted. This resulted in the stakeholder and network analysis, which can yield a preliminary overview of possible stakeholders and actors.

Through a reiterative process, including expert reviews, governance conditions (GCs) were added, altered or rejected. Grey literature (from the OECD, UN and other organizations) and scientific literature provided both theoretical and practical input for this research. Due to the wide body of literature, some concepts reflect different perspectives. To accurately define the conditions, characteristics have been determined. This has been done by delving deeper into more specific study fields related to the corresponding condition which makes the assessment more comprehensive and embedded in scientific literature.

There is a wide variety in urban water management. Some cities still need to develop most water-related infrastructure and basic services, others require a transition to more sustainable practices, while a few aim to consolidate sustainability (Koop and Van Leeuwen 2016). Characteristic Levels (CLs) have been defined to enable the inclusion of all relevant governance concepts for the different development stages of cities. The levels are narratives, describing a certain state of governance regarding the characteristics. In general, the literature provided worst case scenarios, through governance gaps or barriers on the one hand (Brown and Farrelly 2009; Moser and Ekstrom 2010; OECD 2011), and best case scenarios, through principles of good governance or governance capacities on the other hand (Berkhout et al. 2006; OECD 2015a; UNDP 2011; Ford and King 2015). In order to define different stages of the transition process towards sustainable urban water governance, best and worst case scenarios have been combined and assimilated with concepts of transition management (Van der Brugge and Van Raak 2007; Loorbach 2010), (climate adaptive) capacity (Smit and Wandel 2006; Armitage 2005; Adger 2006), resource governance (Lockwood et al. 2010), and organizational theory (Alexander Ballard Ltd 2008; Kim 1993). In this way, the transition process steps or levels have been constructed for each of the 27 characteristics (Appendix I).

The operationalization of the GCAF is based predominantly on empirical governance literature, existing governance assessments and literature on surveys and questionnaires. These methods can be used to develop a descriptive investigation of cities after which an assessment can be determined. Appendix II provides examples of questions and methods to gather data.

6.2. Discussion

The identification and definition of GCs and characteristics have been done through an extensive literature review. This approach has been used by most other works regarding governance principles, criteria, limitations or assessments. The literature study revealed that the field of urban water governance is relatively new, but emerging. Moreover, there is growing awareness of the importance of city scale governance to deal with climate change and urbanization. Herein the GCAF can be a valuable contribution to increase empirical research to convert science into practice. For example, the frameworks with similar aims as the GCAF often lack empirical application or have only been

experimented with (Ford and King 2015). There are some empirical works, e.g. Engle and Lemos (2009), but their work is difficult to reproduce in other areas. Gupta et al. (2010), Alexander Ballard Ltd (2008) and Van Rijswick et al. (2014) have assessed adaptive capacity and water governance respectively. Their work, as they intended, is applied to a variety of spatial scales or with varying in-depth analysis, which makes comparison difficult. A city scale assessment, that is consistent and comparable, is needed. The GCAF contributes to fulfill this requirement.

This research aimed to identify the most 'important' GCs that enable the transition towards sustainable urban water governance. The importance of the GCs has mainly been based on its recurrence in scientific- and grey literature. Concepts mentioned by large, international organizations, such as the OECD and the UN, have been perceived highly relevant as it is often widely supported and validated by empirical research. In particular, the OECD has conducted extensive empirical research to find governance gaps (which could be seen as the opposite of governance capacity). Nonetheless, every city is unique and has its own history, culture, political-, socioeconomic-, and physical context. The GCAF should be approached with this in mind, and careful consideration of the city's specificity should always be made.

This study refers to governance 'conditions', where most works define them as capacities. The decision to define them as conditions is based on the conviction that only when all governance conditions are met, the full potential of sustainable water governance can be developed. As such, capacity refers to the potential to achieve sustainable water governance. This perspective also has implications for scoring the characteristics in the assessment. For example, a city that has a relatively high score on average, but scores very poorly on one or two characteristics, does not have the governance capacity to enable sustainable transition to deal with wicked problems. In this sense, the strength of a city's governance capacity depends on its 'weakest link'.

As this study combines a variety of study fields, there are seemingly conflicting concepts and identified GCs. Redundancy, for example, is appropriate for cities that desire sustainable transition, as this will provide multiple options and back-ups, while preventing lock-in and path dependency (Folke et al. 2005; Gupta et al. 2010). However, for a city that has already developed several sustainable approaches, redundancy is less relevant or even harmful and will in fact reduce efficiency. As Folke et al. (2005) emphasize, concepts such as redundancy needs to be combined with social learning and institutional memory and is most relevant in times of turbulent change. Similarly, most works mention clear roles and responsibility (OECD 2016b), while dynamic cooperations, autonomy and flexibility are also often mentioned (Gupta et al. 2010). Ford and King (2015) suggest that adaptation is most effective if a single organization takes the lead, while inclusion and empowerment of a variety of stakeholders is commonly promoted. Furthermore, entrepreneurial agents of change seek short-term wins and spot opportunities quickly, while visionary agents of change promote long-term thinking and a shared vision (Schultz and Fazey 2009).

The conflicts arise from the different backgrounds, perspectives, objectives, etc. of the literature. To be able to include these concepts, the Characteristic Levels (CLs) have been defined based on transition management scholarship. Concepts that may seem conflicting are often relevant for cities in different stages of development. Cities with a lower level and in an environment of turbulent change should focus more on the transition, while higher level cities should focus on consolidating sustainable practices. Furthermore, a shift in focus from predetermined outcomes to the focus on process is mentioned as a means to reconcile conflicting concepts (Loorbach 2010, Pahl-Wostl et al. 2010), for example, a single organization can take the lead in the process, while still including and empowering all relevant stakeholders.

The range of concepts indicates that the scholarship regarding urban water governance capacity is fragmented. After all, urban water governance includes aspects from transition management, adaptive capacity, stakeholder engagement, sustainability, environmental governance, good governance, and innovation studies. All these study fields are relevant to water governance in cities, as cities are dealing with multi-level decision-making, a plethora of interests, actors and sectors, and wicked problems. Other works related to (urban) water governance often focus on gaps or limitations (e.g. the

OECD; Moser and Ekstrom 2010; Amundsen et al. 2010), while others explored principles and success criteria (e.g. Adger et al. 2005; OECD 2015a; Fussel 2007). This research has pioneered in reconciling these fields of study and as such attempts to contribute to water governance scholarship, as well as promoting empirical work related to urban water governance.

The literature used in this study and the feedback from experts has resulted in a comprehensive, 'universal' set of GCs for the GCAF. Hence, a solid conceptual base of the GCAF has been developed. The challenge in dealing with this variety is to place them in the right context for the purpose of this study. There are concepts that have been mentioned in literature, but have not been included in the GCAF. The reasons for this are that they may be too specific, which would inhibit the ambition of consistent application and comparable assessments (e.g. specific approaches to finance water services), more related to water management than governance (e.g. infrastructure- and asset management) or if the administrative scale does not match (e.g. human resource development and management applies to the intra-organizational level).

For the purpose of this study and the GCAF, the method proposed in the stakeholder and network analysis is relatively inexpensive and easy to apply. Its focus lies on formal stakeholders and registered organizations as their perspectives, relations and actions are often documented. This does not mean that informal stakeholders should be excluded. Its aim is to provide a preliminary institutional map, as the application of the GCAF may also yield (unforeseen) stakeholders. As the proposed method is largely based on practical guidelines and empirical work, it can be assumed that the application of the stakeholder and network analysis is feasible.

Similarly, the operationalization also includes empirical work. However, this part of the research is much more exploratory as its appropriateness relies more on the GCAF's objectives. It should measure what it intends to measure. The operationalization therefore calls for a more learning-by-doing approach. This exploratory operationalization can provide useful handholds and could yield some preliminary results. Moreover, the GCAF intends to provide a snapshot of the current urban governance capacity and as such has a more diagnostic nature. It does not directly provide practical tools to improve a city's performance.

6.3. Next steps

The GCAF is part of the City Blueprint Framework developed by KWR. The City Blueprint baseline assessment of urban water management is already applied in 45 municipalities and regions in 27 different countries. The importance of water governance has become apparent through the experiences of the City Blueprint, literature and feedback from cities. Sufficient governance capacity is an essential prerequisite to continuously improve urban water management. The City Blueprint Trends and Pressure Framework (TPF), water management performance framework and GCAF are baseline assessments facilitating the decision making process and assisting cities to prioritize and set objectives and targets for long-term planning (Fig. 6.1). KWR is currently developing methods for scenario modeling which combine hydrodynamics and societal trends in a trans-disciplinary setting. The combination of these research areas can greatly assist cities to continuously assess, improve and evaluate their transition towards sustainable IWRM.

The comprehensiveness of the GCAF could be further verified by review from decision-makers, governance practitioners and scientists. The next step in development would be to improve its operationalization through a case study. The results of the case study will allow further insights in the application of the GCAF. A possible way forward is to assess the governance of a small number of cities, who score best in managing one of the four wicked water issues, hereby improving the comparability of the GCAF and facilitating city-to-city learning. The City Blueprint framework shows that Rotterdam (the Netherlands) and Copenhagen (Denmark) are proficient in flood risk management, Hamburg (Germany) scores high dealing with water quality and resource scarcity, Jerusalem (Israel) deals well with water scarcity, and Melbourne (Australia) is well on the way to reduce the UHI (see Fig. 6.2).

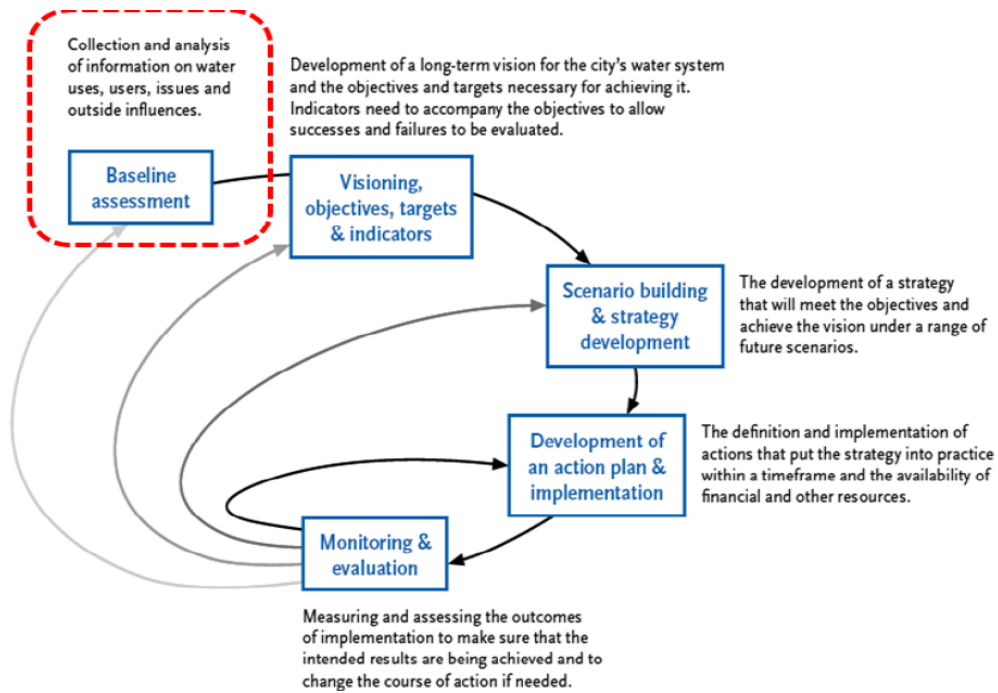


Figure 6.1 These are the phases to develop sustainable IRWM. The GCAF can contribute to this transition, particularly in combination with the City Blueprint baseline assessment and future scenario development (Philip et al. 2011)



Figure 6.2 Best practices in; *flood risk*: Rotterdam (The Netherlands) and Copenhagen (Denmark); *water quality and resource scarcity*: Hamburg (Germany); *water scarcity*: Jerusalem (Israel); and *UHI*: Melbourne (Australia)

Another approach is to select a sample of cities covering the whole range of performance scores, which will provide valuable insight into the width of the GCAF's applicability. Furthermore, additional research is required to be able to code the questionnaires and score the responses and results from data collection efforts. It should determine if the score of the assessment indeed reflects the actual governance capacity of a city. This research by itself can be useful for policy- and decision-makers in the sense that it compiles the relevant conditions to develop urban water governance capacity. In fact, Waternet (Amsterdam) intends to use the GCAF as their 'partner scan' to start cooperations with other cities such as Sao Paulo.

Urban water governance is increasingly being recognized as one of the biggest challenges society will face in this century. Both the UN and the OECD state that “*the water crisis is essentially a crisis of governance*” (UNDP 2003; OECD 2011). In light of the emerging relevancy of urban water governance, this research aims to contribute to the transition towards sustainable urban water management by integrating fragmented scientific knowledge and summarizing and operationalizing it to inform local decision-makers. The GCAF can strongly contribute to this ambition as it has a comprehensive theoretical foundation, includes a variety of empirical studies, and provides practical handholds. On this base, the following management or policy implications can be identified, guided by the principles of transparency, accountability and participation:

- The GCAF has combined a variety of knowledge fields, concepts and approaches, which reflect the complexity of urban water governance. The GCAF allows a city to assess the extent to which certain governance conditions are present. This is the first step in managing the transition towards sustainable IWRM. Through the GCAF cities can design their water governance based on transition management theory, while maintaining an overview of the governance conditions related to the water issue;
- The GCAF enables comparison between cities and can thus facilitate city-to-city learning. Furthermore, the CLs describe different states of GCs, and as such can be used, complementary to the assessment, as a conceptual best practice;
- The appropriateness of certain GCs can be less or greater regarding the context of each city. Therefore, in practice, it may be difficult to achieve a high level for each condition. The GCAF is a good baseline evaluation that enables cities to prioritize as well as efficiently and effectively build governance capacity to be able to accelerate transitions towards sustainable IWRM.

7. Conclusion

This research answers the following research questions:

What are the most important conditions required for the governance capacity to enable (the transition towards) sustainable urban Integrated Water Resources Management and how can they be measured?

In order to answer this question, a Governance Capacity Assessment Framework (GCAF) has been developed that aims to include all essential governance conditions (GCs). Furthermore, the GCAF is designed to be repeatedly applied as a tool to assess urban governance capacity. First must be determined who should be assessed, i.e., the identification of the most relevant actors. Stakeholders have been delineated by focusing on the most recurring water challenges identified by the City Blueprint management assessment framework. These issues are: (i) *flood risk*; (ii) *water scarcity*; (iii) *urban heat island (UHI)*; and (iv) *water quality and resource scarcity*. The proposed stakeholder and network analysis, based on empirical literature and guidebooks, provides handholds to produce a quick-scan institutional map.

Secondly, a study of various scholarships such as transition management, adaptive capacity, sustainability, good governance, and innovation has yielded a set of the most relevant and recurrent GCs. The GCs are considered prerequisites for the governance capacity to deal with wicked water issues. The following GCs have been identified: 1) *Awareness*; 2) *Useful knowledge*; 3) *Continuous learning*; 4) *Stakeholder engagement process*; 5) *Policy ambition*; 6) *Agents of change*; 7) *Multi-level network potential*; 8) *Financial viability*; and 9) *Implementing capacity*. Each GC is accurately defined by three characteristics and for all of the 27 characteristics a heuristic ordinal classification of five levels has been developed by combining general concepts of transition management and characteristic features. This has resulted in an innovative, cohesive and solid conceptual basis for assessing urban water governance. Moreover, this approach made the inclusion of seemingly conflicting concepts possible.

Thirdly, an explorative operationalization study provides useful insights for application of the GCAF. The GCAF can be empirically validated via a learning-by-doing approach. Cities that successfully deal with one of the wicked water issues could be assessed as in extension of this research. Through this, city-to-city learning is enhanced and more insight in the governance processes leading to best practices is gained.

This study has pioneered in integrating the fragmented scholarship that is relevant for urban water governance and climate adaptation. Moreover, the GCAF has explored bridging theory and practice, by developing a practice-oriented framework that will be used to gather much needed empirical data. As the water crisis is essentially a crisis of governance, this study provides a valuable contribution to the study field of urban water governance and climate adaptation. The rapidly evolving challenges of climate change and urbanization make this increasingly urgent and, therefore, this research aims to put forth a plea to further empirically investigate urban water governance.

“The fate of the Earth’s climate and the vulnerability of human society to climate change are intrinsically linked to the way the cities develop over the coming decades and century”

(Tyndall Centre 2004)

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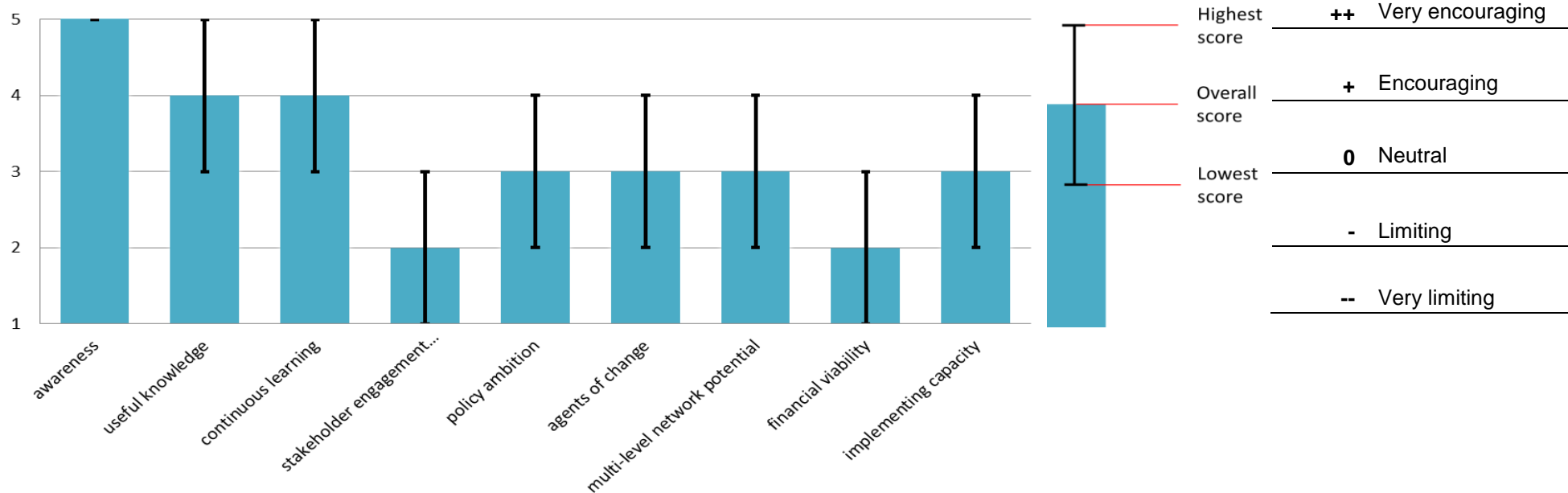
Appendix I Constructing the Characteristic Levels

This appendix describes the Characteristic Levels (CLs) specified for each characteristic into (--) very limiting, (-) limiting, (0) neutral, (+) encouraging and (++) very encouraging, regarding the transition towards water-wise and climate adaptive cities. These levels allow inclusion of different concepts corresponding to different 'states' of urban governance. E.g. redundancy is a precondition that is relevant for cities that are exploring sustainable approaches, as it provides back-ups and alternatives which reduces vulnerability. For cities that seek to maintain sustainable approaches, this is less relevant.

The theories used to develop the CLs strongly depend on transition management. As only the highest level (++) indicates sustainable practice, which only a few cities will have reached, most cities in the lower levels need transitions. The levels are narratives that describe a certain state of that specific characteristic and have been developed by using limitations, principles and success criteria described in literature. As such a worst case scenario and best case scenario could be developed, with the intermediate levels based on transition management-, innovation-, and path dependency literature.

All nine governance conditions consist of three characteristics. For each characteristic, a level is assigned and the average of these characteristics determines the overall score of the condition. It is chosen to show the lowest and highest characteristic in the score as shown in the bar chart on the next page, so that policy-makers can see at one glance how the score is established. The defined CLs of each characteristic form the basis for the questionnaire and the scoring of the Governance Capacity Assessment Framework. The next page shows an overview of the governance conditions and characteristics and a fictional example of what the results of the GCAF could look like.

Governance conditions



Objective: The Governance Capacity Assessment Framework (GCAF) for cities and urban areas that is *comprehensive, consistent and comparable*.

<u>Governance condition</u>	Characteristics	<u>Governance condition</u>	Characteristics
GC1 Awareness	GC1.1 Community knowledge GC1.2 Local support GC1.3 Internalization	GC6 Agents of change	GC6.1 Entrepreneurial GC6.2 Collaborative GC6.3 Visionary
GC2 Useful knowledge	GC2.1 Information availability GC2.2 Accessibility GC2.3 Cohesion	GC7 Multi-level network potential	GC7.1 Room to maneuver GC7.2 Clear division of responsibilities GC7.3 Authority
GC3 Continuous learning	GC3.1 Smart monitoring GC3.2 Evaluation GC3.3 Cross-stakeholder capacity building	GC8 Financial Viability	GC8.1 Affordability GC8.2 Willingness to pay GC8.3 Financial continuation
GC4 Stakeholder engagement process	GC4.1 Inclusiveness GC4.2 Protection of core values GC4.3 Progress and choice variety	GC9 Implementing capacity	GC9.1 Policy instruments GC9.2 Legal compliance GC9.3 Preparedness
GC5 Policy ambition	GC5.1 Ambitious and realistic goals GC5.2 Discourse embedding GC5.3 Cohesive policy		

GC1 Awareness

Description: Awareness is a prerequisite that can be fostered and developed to enable more action. It refers to a more profound understanding of the causes, impact, scale and urgency of wicked problems on daily operations. It forms the base for which understanding, communication, learning and action can be developed to deal with wicked problems. It is something that is cognitively and emotionally felt within individuals, the organizations and society, resulting in different degrees of adaptive capacity. Hence, the limit of adaptation is endogenous in society. This determines the formulation of goals, values, risk perception and social choice.

In this framework three dimensions of awareness will be assessed; *community knowledge*, *local support* and *internalization*. Community knowledge refers to extent to which different stakeholders possess relevant knowledge regarding the issue. This is the first step in achieving full conscious behavior regarding the issue. Next, public support reflects the local awareness of the issue. In any functioning democracy the public opinion will influence governance; therefore this dimension is important to foster. Finally, internalization encompasses the extent in which awareness of the urban water issue is incorporated in the perception and behavior of relevant stakeholders. This ultimately will affect their goals, values and perceptions, their problem framing and thus their encouragement or opposition towards climate adaptive approaches. These three characteristics are prerequisites for sufficient awareness necessary to tackle the issues.

Description literature: Fussel 2007; Alexander Ballard Ltd 2008; Raaijmakers et al. 2008; Adger et al. 2009; Marshall et al. 2013.

GC1.1: Community knowledge		In the past decades the role of the state has steadily declined and a plethora of actors, decision-makers and partnerships have since emerged. To be able to come to the right decision, knowledge must be dispersed throughout the community. This characteristic assesses the public's knowledge regarding the issue
		<i>Agrawal and Lemos 2007; Alexander Ballard Ltd 2008; Raaijmakers et al. 2008; Berkes 2009; Costas et al. 2015</i>
--	Ignorance	The community and decision-makers are unaware of the issue at hand. This results in resistance to any measures to address the issue, as they have no understanding of the risks
-	Fragmented knowledge	Only a small part of the community recognizes the risks related to the issue. However, those who have the most influence and those most likely to be affected, i.e. the most relevant stakeholders, have very limited understanding of the issue, which results in a low support for action
0	Underestimation	Though most of the community understands that the issue entails risks and threats to the socio-economic and natural environment, they underestimate the impacts and (future) frequency of occurrence. Consequently, only small actions are accepted
+	Overestimation	The community is knowledgeable but also recognizes that there are uncertainties. Consequently, they overestimate the impact and probability of occurrence with regard to the issue to be safe
++	Expert awareness	Knowledge of risk assessment with the least uncertainties about probabilities and consequences of the issue. This enables accepted and sustainable action as nearly all members of the community are aware of- and understand the actual risks

GC1.2: Local support		As urban water issues involve a network of stakeholders, public awareness is a requirement for enabling action. Moreover, public opinion, (media) attention, worries and risk perception, play a key role in the effectiveness and scope of decision and implementation processes
		<i>McCombs 2004; UNEP 2006; Agrawal and Lemos 2007; Alexander Ballard Ltd 2008; Raaijmakers et al. 2008; Brown and Farrelly 2009; Ribeiro et al. 2009; Sampei and</i>

		<i>Aoyagi-Usui 2009; Moser and Ekstrom 2010; Marshall et al. 2013; Ford and King 2015</i>
--	Public resistance	There is generally no public support and sometimes resistance to spend resources on the issues. The water issue is not on the political agenda, as is evident in the lack of (media-) attention
-	Public unaware, support by small groups	A marginalized group of the public (e.g. the most vulnerable, environmentalists, NGOs) express their concerns, but these are not adopted by the general public. There is no notable (media-)attention to raise public awareness
0	Moderate support for small changes	There is growing public awareness and increasing worries regarding the issue. However, the causes, impact, scale and urgency are not widely known or acknowledged. There is support for incremental changes. There is growing (local) media attention for the issue
+	General support for long-term sustainability goals	There is increasing public understanding of the causes, impacts, scale and urgency of the issue. There is moderate support for long-term sustainability, although awareness is raised mainly in parties that are directly involved in decision-making. There are also some parties that express serious worries regarding the issue. Furthermore, measures requiring considerable efforts or substantial change are not supported
++	Active support and demand for action	There is a general sense of importance regarding the issue. There is active public support and demand to undertake action and invest in innovative, groundbreaking solutions. This is also evident, since the issue receives much media attention

GC1.3: Internalization		Extent to which sustainable behavior regarding the issue is part of the organizational and institutional urban network by learning or (unconscious) assimilation and action
		<i>Alexander Ballard Ltd 2008; Moser and Ekstrom 2010; Ekstrom et al. 2011</i>
--	Unaware	The decision-makers and their organizations are unaware of the existence of future impacts of the issue. Even when problems occur there is no understanding of causes and actual effects or how current practices impact the issue. Also those who contribute to the problem (e.g. polluters, project developers, etc.) are often not fully aware of their contribution or ignore it. "Invisible" effects such as groundwater depletion, declining biodiversity, etc. go often unnoticed by most stakeholders
-	Recognition mainly by external pressure	Actors are starting to recognize the issues, although it is not because of intrinsic motivation. They are urged to do so by superiors, clients or external pressures. Some actors will concede that there are (looming) issues, but there is often no support to proceed to action or change current (unsustainable) practices. Actors do not want to change their own actions, rather they feel like others are responsible for solving the issue
0	Exploration	There is a growing awareness that the issue is and/or will affect the business-as-usual. Actors are starting to investigate if and to what extent they can contribute to solving the issue and try to understand what the implications are for the long term. This often starts with informal actors
+	Partly internalized	There are incentives for actors to start internalizing the issue with regards to IWRM, climate adaptation and sustainable behavior into their core business and behavior. However, a full long-term strategy embedded in everyday practice, policies or in joint strategies with other actors is not yet fully developed
++	Fully internalized	Full awareness of the causes, impacts, scale and urgency of the issue. Most actors have internalized sustainable behavior and, as a result, the urban network as a whole strongly internalizes a shared long-term strategy to tackle water wicked problems of urban water and climate change

GC2 Useful knowledge

Description: This condition consists of three characteristics, i.e., *information availability*, *accessibility* and *cohesion*. *Information availability* refers more to the quantity of knowledge, both tacit and tangible. *Accessibility* refers to the sharing of knowledge to all interested stakeholders. Finally, *cohesion* refers to the conformity of knowledge across actors, sectors and administrative layers.

Description literature: Folke et al. 2002; Rogers and Hall 2003; Fussel 2007; Alexander Ballard Ltd 2008; Brown and Farrelly 2009; Corfee-Morlot et al. 2009; Amundsen et al. 2010; Lemos et al. 2012; Hanger et al. 2013; Van Rijswick et al. 2014.

GC2.1: Information availability		Information provision needs to meet the requirements of current and future information demands. The availability of reliable information enhances well-informed decision making and reveals if there are information gaps. Scientific knowledge is complemented with local, tacit knowledge
		<i>Fussel 2007; Ribeiro et al. 2009; Lockwood et al. 2010; Lonsdale et al. 2010; Ekstrom et al. 2011; OECD 2011; Ford and King 2015; Head and Alford 2013; Van Rijswick et al. 2014</i>
--	Lack of information	Available information is scarce and of poor quality which limits everyday operations. The information limitations may contribute to misperception of the issue at hand
-	Information scarcity and limited quality	Reliable information does not cover all relevant requirements to address the wicked issue. Often, not all information is of sufficient quality to generate a comprehensive approach. The information may be sufficient for basic operations
0	Information meets short-term requirements, limited exploratory research	Existing information gaps are hardly identified. Effects of long-term processes are often not considered and exploration of new approaches is seldom researched. Information is often produced in a structured way
+	Information enhancing integrated long-term thinking	Relevant information from a wide range of sources. Information gaps are identified and efforts are initiated to bridge these gaps. Local wisdom is also included as citizens co-produce knowledge, for example through citizen science
++	Comprehensive information enabling long-term integrated policy	Information provision regarding the issue is complete and reliable. Tacit information is a vital part, enhancing the comprehensiveness of the information availability as well as improving effective implementation. Abundant information assimilation results in unforeseen extra benefits

GC2.2: Accessibility		Degree to which knowledge is accessible and understandable for all interested actors including decision makers. Co-creation of practical knowledge e.g. pilots
		<i>Engle and Lemos 2009; Lockwood et al. 2010; Lonsdale et al. 2010; Moser and Ekstrom 2010; Jacobsen et al. 2013; OECD 2015c</i>
--	Not transparent and inaccessible knowledge	There is little data available and sharing of information is limited or discouraged. Furthermore, information that is available, is often difficult to understand for non-experts
-	Low sharing of fragmented knowledge	Data is sometimes shared with other stakeholders. Most of the data is inaccessible for most stakeholders. Furthermore, knowledge is often technical and difficult to understand for non-experts
0	Sharing of non-communicative specialized knowledge	There are protocols for accessing information; however, it is not readily available. Although data is openly available, it is difficult to access due to the specialized character

+	Sharing of partly cohesive knowledge	All interested stakeholders can access data. Although knowledge is increasingly understandable, it requires a time-consuming search through a maze of organizations, protocols and databases to abstract cohesive knowledge and insights
++	Sharing of cohesive knowledge enabling active citizen engagement	Data is easily available on open source information platforms. There are multiple ways of accessing and sharing information. This will enhance active stakeholder involvement and co-creation of knowledge

GC2.3: Cohesion		Dealing with water issues in the urban environment requires different kinds of knowledge, which is produced and shared by different policy fields and stakeholders. Therefore, information needs to be cohesive <i>Folke et al. 2005; Lockwood et al. 2010; Lonsdale et al. 2010; Ekstrom et al. 2011; Ford and King 2015; Head and Alford 2013; Van Rijswijk et al. 2014; OECD 2015a; OECD 2015c</i>
--	Non-cohesive and contradicting knowledge	Lack of data strongly limits the cohesion between (policy) sectors, leading to low usefulness for policy making
-	Low-cohesive knowledge within sectors	Data within sectors is non-cohesive and therefore hampers non-complex decision making. The data is inconsistent within and between sectors
0	Insufficient cohesion between sectors	Data collection is consistent and the knowledge base is growing to meet sectorial policy needs. However, knowledge is fragmented leading to limited knowledge exchange. Hence, policy sectors have sometimes conflicting goals, inefficient and overlapping management regarding the issue
+	Substantial cohesive knowledge	Risks, insights and predictions of different trends are specified in the local context by bundling sectorial knowledge. Different alternatives, cost-benefit analysis, including cost of inaction, are often calculated to support informed, integrated and long-term decision making. However, knowledge about effective implementation together with relevant stakeholders is still rather limited
++	Implementation of cohesive knowledge	There is useful knowledge and experience for the implementation of cohesive, long-term and integrated strategies. This may include knowledge co-creation with all relevant stakeholders

GC3 Continuous Learning

Description: Continuous learning is strongly based on the multiple-loop learning theory. Single-loop learning refers to assessing and improving current practices; double-loop learning refers to questioning and changing basic assumptions on which actions are based; triple-loop learning refers to changing fundamental beliefs and world views. Continuous learning consists of three characteristics, i.e., smart monitoring, evaluation and cross-stakeholder capacity building. Smart monitoring is needed to be able to monitor process, progress and policy outcome. Evaluation is a prerequisite for learning and cross-stakeholder capacity building will assist in problem framing and gaining insight in other perspectives.

Description literature: Pahl-Wostl et al. 2007; Pahl-Wostl 2009; Muro and Jeffrey 2008; Brown and Farrelly 2009; Gupta et al. 2010; Medema et al. 2014; Termeer et al. 2015.

GC3.1: Smart Monitoring		The extent and detail to which technical and policy measures are (smartly) monitored in order to adequately measure effectiveness of policy and implementation. Smart monitoring results serve as tool to recognize trends, predict future developments, recognize or clarify underlying processes and quickly recognize alarming situations
		<i>Alexander Ballard Ltd 2008; Brown and Farrelly 2009; Pahl-Wostl 2009; Ribeiro et al. 2009; Silvertown 2009; Loorbach 2010; Adger et al. 2013; Middleton 2014</i>
--	Irregular, poor quality or absent	Monitoring is rarely done. As a result ineffective and inefficient policies are repeated. Hence, alarming situations may not be recognized adequately and evaluation is hardly possible
-	Reliable data but limited coverage	Monitoring is improved as progress, processes and policy outcomes are regularly registered. However, only a few aspects are monitored and this leads to an incomplete or even wrong understanding of current affairs. As a result, policy-makers are often incompletely informed, which can hinder learning
0	Quick recognition of alarming situations	Monitoring covers most relevant aspects to assess the business as usual and enables identification of alarming situations. This improves current practices, i.e. single-loop learning, which may lead to a lock-in effect of insufficient strategies. For example, flood defense monitoring often only measures water levels, disregarding (long-term) aspects, such as ecological, esthetical and societal aspects
+	Useful to recognize underlying processes	Abundant monitoring allows for adequate evaluation. This abundance uncovers underlying trends, processes and relationships that, in turn, urges for revision of existing assumptions and approaches, i.e. double-loop learning
++	Useful to predict future developments	Monitoring system is adequate in recognizing alarming situations, identifying underlying processes and provides useful information for identifying future developments. Monitoring of transition progress is done as well as the process itself

GC3.2: Evaluation		The extent to which current policy and implementation are continuously assessed and improved
		<i>Kim 1993; Pahl-Wostl et al. 2007; Pahl-Wostl 2009; Brown and Farrelly 2009; Gupta et al. 2010</i>
--	Insufficient evaluation	Evaluation of policy results and decision making process is lacking. As a result ineffective and inefficient policies are repeated
-	Non-directional evaluation	There is limited evaluation with inconsistent and random criteria. The evaluation is poorly performed, without taking into account all relevant aspects. The evaluation has low legitimacy and results may be biased
0	Improving routines	The identified problems and solutions are evaluated based on conventional (technical) criteria. Current practices are improved, leading to a lock-in on dominant paradigms. This corresponds to single-loop learning; the last action is assessed based on existing criteria, leading to small changes and a short-term perspective

+	Double-loop evaluation	Evaluation is based on a range of innovative criteria. Hence, a better understanding results in continuous improvements of policy and implementation, including adoption of innovative approaches
++	Changing assumptions	Double loop evaluation questions the basis of all actions and explicitly communicates uncertainties. Policy assumptions have changed by the full recognition of long-term processes such as climate change

GC3.3: Cross-stakeholder capacity building		Extent to which stakeholders have the opportunity and are open to interaction and deliberately chose to learn from each other, i.e., level of social learning
		<i>CIS Working Group 2.9 2003; Pahl-Wostl 2009; Reed et al. 2009; Gupta et al. 2010</i>
--	Closed attitude towards cross-stakeholder learning	Contact with other parties is non-existent or even discouraged. There is no trust in each other and therefore very limited sharing of experience, knowledge and skills occurs. This results in repetition of similar mistakes and stakeholders acting out of self-interest
-	Small coalitions of stakeholders with shared interest	Cross-stakeholder learning occurs only in small groups that strongly dependent on each other or share common interests. These small coalitions may be more resistant to other opinions as they encourage each other to put forward their shared point of view
0	Open attitude towards stakeholder interaction	Stakeholders and institutions are willing to interact. Learning from these interactions is rather limited due to informative character or because stakeholders are not always incorporated early on in the decision-making process
+	Open for cross-stakeholder learning	Stakeholders and institutions experience the interactions as valuable and useful for improving policy and implementation. However, it appears difficult to put this learning experience into practice. There are many cross-stakeholder capacity building programs encouraging learning and improving the capacity to learn from each other
++	Putting cross-stakeholder learning into practice	Based on cross-stakeholder learning, policy and implementation is improved and this is broadly supported. There is recognition that the issue is complex and that cross-stakeholder learning is a precondition for adequate solutions and successful implementation. Continuous capacity building programs ensure continuous cross-stakeholder learning

GC4 Stakeholder engagement process

Description: Stakeholder engagement is required for common problem framing, gaining access to a wide variety of resources and improving implementation of policy. Stakeholder engagement consists of three characteristics, i.e., inclusiveness, referring to the transparency of the engagement process and the opportunity to get involved; protection of core values, referring to respecting stakeholders and allowing them to commit to the process rather than a predetermined outcome; and progress and choice variety; which refers more to the process, where progress is important to encourage stakeholders and where they can co-create and co-decide on a variety of choices.

Description literature: *CIS Working Group 2.9 2003; Armitage 2005; Adger et al. 2005; Ridder et al. 2005; Pahl-Wostl 2008; Pahl-Wostl 2009; UNDP 2008; Brown and Farrelly 2009; UNECE 2009; Lockwood et al. 2010; Ekstrom et al. 2011; Ford and King 2015; Jacobsen et al. 2013; Van Rijswick et al. 2014; OECD 2015b.*

GC4.1: Inclusiveness		The level to which relevant stakeholders are able to be part of the decision-making process, decide or speak on behalf of the group they represent and the stakeholder engagement process should be clear and transparent
		<i>Ridder et al. 2005; Gupta et al. 2010; Lockwood et al. 2010; OECD 2011; Jacobsen et al. 2013; Van Rijswick et al. 2014</i>
--	Limited information supply	There is hardly any stakeholder engagement with insufficient information supply. Stakeholder engagement is sometimes actively discouraged
-	Non-inclusive information supply	Stakeholders are informed or sometimes consultation takes place but there is a lack of transparent procedures for stakeholder participation. However, not all relevant stakeholders are recognized or approached and stakeholders hardly have influence on the results of decision-making
0	Untimely consultation and low influence	Stakeholders are mostly consulted, but not actively involved. Consultation is often not timely, as plans and decisions are already made prior to engaging stakeholders. Therefore stakeholders have low influence on the outcome of decision-making
+	Timely, over-inclusive and active involvement	Stakeholders are actively involved in the decision-making process. It may be unclear how decisions are made and who should be involved at what stage. Moreover, some stakeholders are not able to decide on behalf of their group or organization
++	Transparent involvement of committed partners	Active involvement of all relevant stakeholders where all participants have the power to engage, represent or advise during the process. It is fully clear how decisions will be reached and who will be involved a which stage

GC4.2: Protection of core values		Extend to which stakeholders feel confident that their core values will not be harmed. This is ensured by if commitment is focused on the process instead of the results and stakeholders have the possibilities to exit at given moments
		<i>Ridder et al. 2005; Ellis et al. 2009; Pahl-Wostl 2009</i>
--	Insufficient protection of core values	Stakeholders are hardly engaged, leading to stakeholders core values seriously being harmed as the influence on the final results is very limited
-	Non-inclusive and low influence on results	Stakeholders are informed or sometimes consulted at a late stage of the decision-making process. Not all relevant stakeholders are approached and influence on result is limited. This leads to limited influence on the end result and core values being harmed, especially for affected groups that have limited means
0	Suboptimal protection of core values	Stakeholders are often engaged via consultation or short periods of active involvement. This limits the influence on results as well as time and opportunities to find the most optimal solutions in which the core values of all stakeholders are maximally protected

+	Requisite early commitment to output	Stakeholders are actively involved, but are expected to commit themselves to the outcomes early in the process. Stakeholders are reluctant to commit themselves as they are concerned that their core values will be harmed. There are limited possibilities to exit the process. This discourages some stakeholders to get involved, leading to suboptimal solutions
++	Core values are maximally protected	Stakeholders are asked to commit to the process instead of the outcome. There are clear exit possibilities at certain stages in the process and stakeholders do not have to commit themselves to sub-decisions but have large influence on the end-result as they are actively involved

GC4.3: Progress and choice variety		Speed and choice variety needs to be ensured by clear and realistic procedures. Stakeholders should produce and then select from a variety of alternatives to ensure learning and get authoritative decisions. The selection should be at the end of the process to secure continued prospect of gain and thereby cooperative behavior
		<i>Ridder et al. 2005; Lockwood et al. 2010; Ford and King 2015; Van Rijswijk et al. 2014; OECD 2015a</i>
--	Lack of procedures limit engagement and progress	There is a lack of clear procedures to engage stakeholders. There is very limited choice variety hampering widely supported decision-making. As decisions lack support they may result in conflicting situations. This significantly limits progress and effectiveness of decision-making and implementation
-	Rigid procedures limit the scope	Informative and consultative approaches have a limited predetermined scope with rigid procedures and low flexibility. This may lead to quick decision making but slow an ineffective implementation that lack support
0	Consultation or short active involvement	Consultation or short active involvement of stakeholders results in limited choice variety. This can lead to unresolved conflicting interests and suboptimal solutions which often leads to unilateral decisions
+	Active involvement with abundant choice variety	Stakeholders are actively involved and extensive choice variety is created. However, the procedures, deadlines and agreements are unclear, leading to inertia and indecisiveness. This limits continued cooperative behavior, learning, optimization of interests or not fully supported end results
++	Active engagement with choice selection at the end of the cooperation	Clear procedures and realistic deadlines enable active engagement. The process of increasing choice variety is fully explored and selection of the best alternatives is done at the end of the process. This encourages stakeholders to engage throughout the whole process

GC5 Policy ambition

Description: The extent of shared problem framing, cohesive goal setting in multi-level governance regulation, across sectors and with stakeholders. Rules and agreements that are based on shared values and principles which make them easier to enforce because parties have the strong conviction that they should behave in conformity with the rules. Goals are feasible regarding the executive authorities' available means and capacity. Goals are set that exploit the potential to tackle water-related issues at hand as well as sustainability objectives such as long-term climate adaptation, reducing resource scarcity and maintaining ecosystem services. Long-term goals are achieved through short- to mid-term goals that are at the appropriate scale.

Description literature: *Brown and Farrelly 2009; Corfee-Morlot et al. 2009; Lockwood et al. 2010; OECD 2011; OECD 2015a; Head and Alford 2013; Van Rijswijk et al. 2014.*

GC5.1: Ambitious and realistic goals		Sustainable development is developed with a long-term vision with short-term intermittent targets. Important is the level to which concepts such as cost recovery and ecosystem services are operationalized and used to continuously assess existing and new techniques, projects and regulation
		<i>Adger et al. 2005; Brown and Farrelly 2009; UNECE 2009; Lockwood et al. 2010; Ford and King 2015; OECD 2015c</i>
--	Short-term, conflicting goals	There is a lack of sustainability objectives, leading to arbitrary and sometimes conflicting actions. These actions may cause negative side-effects and inhibit adaptation
-	Short-term goals	Short-term actions and goals are coordinated, but a comprehensive long-term vision is lacking. Policy is reactive and is focused on 'quick fixes'. This results in ineffectiveness and inefficiency
0	Confined realistic goals	There is a confined vision regarding the issue. Its ambition is predominantly focused on improving the current situation, where predictability and certainties are assumed
+	Long-term ambitious goals	There is a long-term vision that incorporates uncertainty. There is a clear long-term vision, but it is not supported by a comprehensive set of short-term targets. It is therefore unclear if and how the long-term vision is realistically achievable
++	Realistic, ambitious strategy	Ambitious policy objectives are set for the long term. The objectives are specified with a comprehensive set of intermittent targets, which provide a clear and flexible pathway. Scenarios are used to provide valuable insights to maintain adaptability of strategies

GC5.2: Discourse embedding		The extent to which sustainable policy is interwoven with historical, cultural, normative and political context. This can be measured by assessing the sustainability ambitions within the institutional setting and implemented policy
		<i>Rogers and Hall 2003; Klein Woolthuis et al. 2005; Pahl-Wostl et al. 2008; Adger et al. 2013</i>
--	Unsuitable policy and implementation	The cultural, historical and political context is largely ignored, leading to arduous implementation. A possible reason is the improvident replication of policies from cities that strongly differ
-	Persistent reluctance and poor embedding	There is a persistent degree of reluctance, as the local context is not entirely considered. This may lead to ineffective implementation, inefficient use of resources and distrust between actors. There is friction between societal demand and the political values, ambitions and objectives
0	Problem framing and embedding	Conventional policies fit the local context, but do not improve the city's adaptability to the issue. It assists lock-in onto current practices, but does not embrace uncertainty or the necessity to adapt. The issue is increasingly interwoven and framed into the cultural, historical and political context

+	Consensus for sustainable actions	There is a consensus that adaptation may be required, but substantial effort is necessary to overcome opposing interests. Changes that fit the local context are proposed and mostly accepted, however an overall strategy is not established
++	Embedding of sustainable implementations	Cultural, historical and political values are considered in policy-making and are used smartly to accelerate policy implementation. Innovations are subdivided into suitable phases which are more acceptable and effectively enables sustainable practices

GC5.3: Cohesive policy		Extent to which existing regulation block sustainable innovations. Take into account administrative boundaries, alignment across government levels and technical possibilities. Integration of different sectoral policies and strategies to create co-benefits <i>Adger et al. 2005; Ribeiro et al. 2009; UNECE 2009; Lockwood et al. 2010; Loorbach 2010; OECD 2011; OECD 2015c; Fröhlich and Knieling 2013; Havekes et al. 2013</i>
--	Incompatible policy	There is high fragmentation between policies from different sectors, resulting in conflicting and incompatible objectives. This makes most policies difficult to implement. Different sectors compete for resources and hamper the ability of other policy fields to reach their objectives
-	Opposing sectoral policy	There are some dominant policy fields that are prioritized. For example, urban development objectives are achieved, while decreasing the ecological value and limiting the city's ability to drain stormwater. This practice leads to imbalanced policy
0	Fragmented policy	Policy is fragmented but not yet conflicting. The policy objectives are based on the sector's specific scope and opportunities for co-benefits are not explored
+	Overlapping comprehensive policy	There is cross-boundary coordination between policy fields to address wicked problems. Although the policies are comprehensive, they overlap because integration is not fully established and efforts to harmonize different sectors, policies and overall implementation are required
++	Cohesive synergetic policy	The urban water policy is coherent with policies in other sectors. There is an overarching vision which ensures effective coordination of policy fields. Goals are continuously evaluated and revised to adapt to new challenges

GC6 Agents of change

Description: In order to drive change, agents of change are required to show direction, motivate others to follow and mobilize the resources required. Agents of change consists of visionary agents, to promote a sustainable vision and convince others of the need to act; collaborative agents, to build bridges and coalitions between actors, and; entrepreneurial agents, to gain access to resources, seek opportunities and manage risks.

Description literature: Marion and Uhl-Bien 2001; Adger et al. 2005; Alexander Ballard Ltd 2008; Schultz and Fazey 2009; Gupta et al. 2010; Moser and Ekstrom 2010; Termeer et al. 2012; Ford and King 2015; Head and Alford 2013.

GC6.1: Entrepreneurial		Entrepreneurial agents of change have the authority, persuasiveness and ability to identify opportunities and subsequently act by initiating new projects. Entrepreneurial agents of change are skilled in accessing the necessary resources and networks
		<i>Gupta et al. 2010; Termeer et al. 2012</i>
--	Insufficient entrepreneurship	Lack of agents of change result in failing risks management and squanders of resources in ineffective measures. This results in distrust by other actors and potential investors, leading to diminishing access to resources
-	Static and short-sighted entrepreneurship	Agents of change struggle to gain sufficient resources for dealing with common and immediate aspects regarding the issues. Entrepreneurial agents of change fail to make use of windows of opportunity such as increased awareness after a calamity. At these moments opportunities to address stakeholders with potential access to resources are rarely seized
0	Conventional and risk-averse entrepreneurship	Entrepreneurial agents of change are better able to seize low-risk opportunities. Therefore, opportunities for innovative approaches and synergies, that by definition include risk, are not pursued
+	Tentative experimental entrepreneurship	As there is growing understanding that the (wicked) problems entail uncertainty and complexity, there is an increased understanding that innovative approaches are needed. Entrepreneurial agents of change are enabled to do tentative experimental projects often within the existing pool of resources. Novel (financial) resources are increasingly recognized and actors are stimulated to pursue new opportunities
++	Measured and enabling entrepreneurship	Entrepreneurial agents of change are enabled to experiment, as it is widely recognized that opportunities for improvement need to be explored. Measured risk taking is encouraged, which, besides increased benefits, also provides new insights and encourages creativity of actors. They are able to recognize and access a variety of resources through, e.g., public-private partnerships

GC6.2: Collaborative		Agents of change that understand and have the network to access and abstract valuable resources. Because of their 'soft skills' they are able to engage, collaborate with and connect the business, government and social sectors. Moreover they often initiate coalition forming
		<i>Gupta et al. 2010; Termeer et al. 2012; Head and Alford 2013</i>
--	Lack of collaborative agents	Collaborative agents of change are strongly discouraged, as there is a one-sided perspective of the issue due to personal interest or nepotism of leaders. It may lead to distrust between stakeholders and reduces the willingness to cooperate. Talented cooperative agents of change do not have the opportunity to use their skills
-	Low influence of collaborative agents leads to insufficient stakeholder	There is limited collaboration whereas existing visions mainly aims to deal with current and common issues, including only a small group of actors. It is not recognize that the existing collaborations are insufficient and that other actors need to be included

	inclusion	
0	Agent enhance conventional collaboration to preserve status quo	Agents promote current coalitions which aim to maintain the business as usual. There is limited effort to create innovative collaborations with conventional actors. There is trust within the existing collaborations, but the agents do not build trust with other important stakeholders that is necessary for long-term integrated solutions
+	Agents of change push for exploratory collaboration with new stakeholders	Most agents of change understand that the (wicked) problems require more wide-spread collaborations between different sectors and stakeholders. Agents of change are investigating opportunities to collaborate with new unconventional actors. Although this is not always successful, it does result in valuable new insights, trust relationships and improvements towards more adaptive and sustainable collaborations
++	Agents of change strongly enhances wide-spread synergetic collaboration	Agents of change are fully using their network and skills to connect different sectors and stakeholders in order to build productive and synergetic collaborations. They successfully mediate where there are conflicting interests and have the authority to provide satisfying compromises. Furthermore, they are aware of who should be included in the collaboration at what time

GC6.3: Visionary		Visionary agents of change drive change by promoting a comprehensive and integrated vision and strategy on water and climate change issues as well as enhancing organizational skills and knowledge. They have the capacity to manage change and communicate effectively <i>Ribeiro et al. 2009; Schultz and Fazey 2009; Gupta et al. 2010; Termeer et al. 2012; Head and Alford 2013</i>
--	Deficient sustainability vision and short-term thinking	There is a lack of visionary agents of change that promotes a long-term, sustainable vision regarding the issue at hand. This contributes to fragmented expectations and objectives by different stakeholders and sectors regarding the issues, resulting in conflict and indecisiveness. It may even be that there are strong visionary agents of change that block long-term and integrative initiatives regarding the issues
-	Unilateral and short-term vision	Visionary agents of change successfully promote a unilateral vision, which benefits only a limited group of stakeholders which often has a short-term focus. This inhibits long-term and sustainable development
0	Agents of change defend status quo	At this level, most visionary agents of change adjust their vision in order to promote the business as usual. They do not opposed but also not promote long-term and integrated visions addressing the issue
+	Long-term vision with flawed dissemination	Agents of change develop a clear long-term vision that considers the interests of most sectors and stakeholders. There is still some dissension between short-term targets and implementation strategies on the one hands and the long-term vision from visionary agents of change on the other hand
++	Long-term vision supported by short-term implementation receiving much approval	Visionary agents of change in different positions and from different backgrounds actively and successfully promote a sustainable and long-term vision regarding the issue and make sure that it comes up in important meetings, political debates or important events. They have the ability to overcome contradicting objectives and formulate an integrative vision. Their communicative skills are well-developed and they are well-informed by a wide range of knowledge sources. This enables the development of short-term objectives, which contribute to the vision

GC7 Multi-level network potential

Description: Urban governance involves a plethora of actors and interests. For sustainable governance, working in networks is inevitable. Multi-level network potential consists of three characteristics, i.e., *room to maneuver*, that refers to the opportunity to develop a variety of alternatives. This results in some redundancy preventing the reliance on a single approach and subsequent lock-in. This characteristic also includes the opportunity to create the necessary ad hoc fit-for purpose collaborations to accomplish this variety; a *clear division of responsibilities* necessary to deal with wicked water challenges. In new and changing situations fit-for-purpose cooperative partnerships with a clear division of roles and responsibilities need to be established. Finally, legitimate presence of *authority*, that puts forward the necessity to address the issues, is also a prerequisite of successful policy development and implementation.

Description literature: Folke et al. 2005; Pahl-Wostl 2009; Gupta et al. 2010; Loorbach 2010; Moser and Ekstrom 2010.

GC7.1: Room to maneuver		Room to maneuver assesses the extent to which actors in the urban water network have the freedom and opportunity to develop a variety of alternatives and approaches, creating redundancy necessary to effectively address complex water issues. This also involves the possibility to form ad hoc fit-for-purpose partnerships that are able to address existing or emerging water problems or sub-problems
		<i>Folke et al. 2002; Pahl-Wostl 2009; Gupta et al. 2010; Loorbach 2010</i>
--	Strictly imposed obligations	The actions of stakeholders are strictly controlled. The objectives and actions are stringent to meet rigid short-term targets. Actors have insufficient freedom to effectively achieve targets and goals. Moreover, freedom to form fit-for purpose partnerships to address the issue is strongly limited
-	Limited autonomy	Only a few actors receive some degree of autonomy. There are limited opportunities for actors to develop alternative approaches. The unilateral approach increases vulnerability, as back-up systems or plans are not established. There is hardly any opportunity to form partnerships with unconventional actors
0	Limited room for innovation and collaboration	Actors are given the means to perform predefined tasks for dealing with the present issue. The targets are well-defined, but the possibility to deviate from the prescribed tasks is limited. Therefore, room to innovate is hampered and fit-for-purpose partnerships are often lacking
+	Redundancy to address uncertainty	Actors recognize that current approaches are insufficient to deal with complex situations. Therefore, a high degree of freedom is provided to experiment and create a redundant set of solutions. This is done in a dynamic mix of cooperative partnerships between stakeholders with a variety of interest and expertise lacking clear overall vision
++	Freedom to develop innovative solutions	There is a common and accepted vision for dealing sustainably with the issue. Within the boundaries of this vision, actors are given the freedom to develop novel and diverse approaches and partnerships. This leads to continuous improvements and the search for alternatives necessary to deal with a complex future

GC7.2: Clear division of responsibilities		A clear division of responsibilities is important to address wicked water challenges. In unclear or new situations fit-for-purpose cooperative partnerships with a clear division of roles and responsibilities need to be established
		<i>Armitage 2005; Folke et al. 2005; Pahl-Wostl et al. 2007; Ribeiro et al. 2009</i>
--	Unclear division of responsibilities	Unclear division of responsibilities or over-hierarchical relationships lead to passive behavior where trust relationships can hardly be established
-	Barriers for effective cooperation	Lack of interest or highly fragmented authorities erect high barriers for effective governance or management of the issue. As a result

		miscommunication often leads to a lack of sufficient trust between actors
0	Inflexible division of responsibilities	Possibilities to cooperate often only involve a limited set of conventional actors. Fragmented policy mostly reinforces current strategies and approaches. Hence, most opportunities for fruitful cooperation structures are not seized or discovered. The division of responsibilities is based on dealing with past practices limiting effective cooperation for current problems
+	Innovative cooperative strategies	Actors recognize that knowledge and experience are scattered within the local network. Therefore, effective overall solutions require bundling of knowledge and clear roles and responsibilities. Due to the inadequate extent of cooperative networks that address complex issues, extra effort is made to bundle the scattered expertise and to reach fit-for-purpose division of responsibilities
++	Dynamic, fit-for-purpose cooperation	There are many synergetic cooperations within the urban water network that can provide solutions for the issue. The roles and responsibilities are clearly divided amongst actors. These cooperations are dynamic and result in fit-for-purpose problem solving necessary to solve complex, multi-level and unknown challenges

GC7.3: Authority		Presence of legitimate forms of authority (e.g. embedded in policy or law) that put forward the necessity to address water issues <i>Adger et al. 2005; Armitage 2005; Pahl-Wostl et al. 2008; Gupta et al. 2010; Lockwood et al. 2010; Loorbach 2010; Ford and King 2015</i>
--	Powerless	By far most attempts to put forward water and climate aspects regarding the issues fail due to contradicting and competing interests that overrule them. The issue is hardly included in policy, regulation or any administrative principles
-	Unfruitful attempts	Attempt to put forward the issue is fragile and has low chances of being accepted or acted upon. This could be due to poor embedding of sustainability principles in current policy, opposing interests, financial constraints, etc.
0	Restricted authority	The issue is not on the top of the political agenda. There is not a strong opposition against the adoption of regulation, policy and sustainable arguments in general as long as it does not considerably change the status quo. Hence, long-term policy is limited and new policy mainly needs to build upon existing fragmented policy
+	Stirring authority	Political and public support leads to declarations of intent, sustainability principles and recognition of the need for long-term and integrated approaches. As a consequence, new policies, regulation and projects are introduced and legitimate authorities are assigned that promote long-term integrated policy and ensures its implementation
++	Strong well-embedded authority	Long-term and integrated approaches regarding the issue are well embedded in policy, regulations, authority and receive much support both politically and societal

GC8 Financial viability

Description: Financial resources and management are crucial for good water governance. This condition includes financial continuation, which refers to the financial arrangements for the long term; willingness to pay, which is important to create collaborative investments, and; affordability, which allows the whole population to gain access to water services and enable climate adaptation.

Description literature: *Rogers and Hall 2003; Adger et al. 2005; UNECE 2009; Lockwood et al. 2010; OECD 2011; OECD 2015c; Ford and King 2015; Havekes et al. 2013; Van Rijswick et al. 2014.*

GC8.1: Affordability		Water services and climate adaptation measures should be available and affordable for all citizens including the poorest <i>UNECE 2009; OECD 2011; Ford and King 2015; Havekes et al. 2013; Jacobsen et al. 2013; Van Rijswick et al. 2014; United Nations 2015</i>
--	Unaffordable basic water services	Water services are not affordable for a substantial part of the population. This may be due to inefficient or obsolete infrastructure, mismanagement, extreme poverty or unsuitable financial principles
-	Limited affordability of basic water services	A share of the population has serious difficulty to pay for basic water services, e.g. low-income or marginalized groups
0	Unaffordable climate adaptation	Basic water services are affordable for the vast majority of the population. However, extreme heat, flooding and water scarcity mainly affect poor people and marginalized communities as they cannot afford adaptation. For example, they cannot afford house insulation or often live in flood prone areas where house prices are lowest
+	Limited affordable climate adaptation	There is recognition that poor and marginalized communities are disproportionately affected by the effects of climate change. Serious efforts are made to support climate adaptation for everyone, including vulnerable groups
++	Climate adaptation affordable for all	Strong solidarity has resulted in programs and policy that ensures climate adaptation for everyone. This includes both public infrastructure as well as protecting private property

GC8.2: Willingness to pay		Willingness to pay assesses how expenditures and risks regarding water and climate adaptation are perceived. Often, trust in local authorities and sense of urgency or worry regarding the issue enhances the willingness to pay <i>Paavola and Adger 2002; Fussel 2007; Raaijmakers et al. 2008; Lockwood et al. 2010</i>
--	Mistrust and resistance to financial decisions	There is a high level of mistrust in decision making regarding resource allocation. At this level financial decisions are based on prestige projects, projects that benefit a small group of actors or assist limited interests. They often do not address the actual urban water issues. Hence, there is a high degree of resistance regarding resource allocation
-	Fragmented willingness to pay	The willingness to pay for measures addressing water related issues is fragmented and insufficient. There is a gap between the perceived importance of the issues between stakeholders. Furthermore, the perceived required investments to address the issues is substantially lower than the actual cost. This may be due to low trust in local authorities
0	Willingness to pay for business as usual	There is support for the allocation of resources for conventional tasks. Most people are unwilling to financially support novel policies regarding climate change or a transition towards more adaptive governance regarding the issue. There is limited awareness or worries on the actual issues or most important future threats whereas trust in local authorities is often sufficient
+	Willingness to pay for provisional adaptation	Due to growing worries about challenges, there are windows of opportunity to increase funding for certain aspects regarding the issues. However, the perception of risk is not entirely in accordance with actual risk. Civil society and

		decision makers do not fully comprehend the situation and there is confusion about the magnitude of the issues amongst different actors
++	Willingness to pay for present and future risk implementation	The actual issues are perceived as relevant and there is political and public support to allocate substantial financial resources to address it. Furthermore, expenditure for non-economic benefits (e.g. ecology, esthetic value, knowledge creation, etc.) is perceived as important. There is clear agreement on- and support for financial principles, such as the polluter-pays-, user-pays- or the solidarity principle

GC8.3: Financial continuation		Financial resources are a necessity for developing and implementing sustainable solutions in the urban water cycle. Policy focused on solving long-term problems requires long-term thinking but, more importantly, long-term financial support and security. Policy is most effective if this long-term financial support is guaranteed on beforehand <i>Fussel 2007; Gupta et al. 2010; Lockwood et al. 2010; Ford and King 2015; Van Rijswijk et al. 2014</i>
--	Lack of financial resources	There are insufficient financial resources available to perform even the most basic tasks regarding the issue. Financing is irregular and unpredictable leading to poor policy continuation
-	Inequitable financial resources	There are potential resources available to perform basic management tasks regarding the issue, but they are difficult to access, fairly randomly distributed and lack continuation
0	Financial continuation for basic services	Financial resources are available to perform fragmented and singular functions in managing the issue. The allocation of financial resources is based on past trends, current costs of maintenance and incremental path-dependent development. Costs for short-term action to deal with long-term future challenges are not incorporated into baseline funding
+	Abundant financial support with limited continuation	Financial resources are made available for project based endeavors. Due to limited prospect of financial continuation, the transition from development to long-term implementation is uncertain
++	Long-term financial continuation	There is secured continuous financial support for long-term adaptation policy, measures and research regarding the issue. Funding of adaptation includes capital costs of interventions throughout their life-cycle and the costs of research projects and programs. These costs are included into baseline funding for management of the issue, while both economic and non-economic benefits are considered

GC9 Implementing capacity

Description: Policy instruments are the means to achieve behavioral change. This includes the so called sticks and carrots, or compliance and incentives. This condition consists of policy instruments, referring to incentives for sustainable behavior; legal compliance, which refers to the ability to ensure compliance to agreements, laws, targets, etc.; and preparedness, which allows actors to know how to reach objectives and how to respond to calamities.

Description literature: Adger et al. 2005; Müller and Siebenhüner 2007; Ekstrom et al. 2011; Van Rijswick et al. 2014.

GC9.1: Policy instruments		Effective use of policy instruments to stimulate desired behavior and discourage undesired activities and choices. Continuous monitoring, evaluation and adjustments are needed to check and improve the effectiveness of applied policy instruments
		<i>Müller and Siebenhüner 2007; Gupta et al. 2010; Bemelmans-Videc et al. 2011; OECD 2011; OECD 2015c; Van Rijswick et al. 2014</i>
--	Instruments enhance unsustainable behavior	Policy instruments at place enhance unwanted or even damaging behavior that opposes the envisioned sustainability goals. For example, discount for higher water use stimulates spilling and inefficiency. There is hardly any monitoring that can be used to evaluate or reveal the counterproductive effects of the used policy instruments. Moreover, it is also possible that instruments have the intention to enhance unsustainable behavior, e.g. for short-term gains
-	Unknown impacts of policy instruments	There is little understanding and awareness of unwanted effects of the used policy instruments. Instruments are being used without knowing or properly investigating their impacts on forehand. The set of instruments actually leads to imbalanced development and inefficiencies. During the implementation, a persistent belief in the effectiveness of the instruments blocks learning or the recognition that the instruments do not have the intended results. Furthermore, the instruments, especially subsidies, are prone to misuse, due to unclear preconditions and unverifiable implementation
0	Fragmented instrumental use	Often, instruments are not coherently used for different policy fields or sectors whereas the goals are very similar. The result is a poor overall instrumental effectiveness and sometimes contradicting stimuli. The scattered instruments, each with a limited sphere of influence, only achieve temporary behavioral changes. Sufficient monitoring results and much knowledge and insight in how current instruments work and perform. Therefore, actors are open to look for improvements in the use of policy instruments
+	Profound exploration of sustainability instruments	There is strong realization that the use of instruments may be a powerful tool to effectuate sustainable transitions. It is argued that instruments, such as full cost recovery and polluters pays principles, make actors aware of how their behavior affects the issue and serve as an incentive to internalize sustainable behavior. The use of various instruments is mainly being explored and therefore not yet optimized and efficient. Extensive monitoring and evaluation ensures quick learning to deal with uncertainty
++	Effective instruments enhance sustainable transitions	There is much experience with the use of instruments to promote long-term, comprehensive and substantial change in actors' behavior. Monitoring results show that the current use of instruments proves to be effective in achieving sustainable behavior amongst almost all actors. Still continuous evaluations ensures flexibility, adaptive capacity and fit-for-purpose use of policy instruments

GC9.2: Legal compliance		Legal compliance ensures that stakeholders respect agreements, objectives, legislation, etc.
		<i>Müller and Siebenhüner 2007; Lockwood et al. 2010; Jacobsen et al. 2013; Van Rijswick et al. 2014</i>
--	Poor compliance due to unclear legislation	Legislation and responsibilities are unclear, incomplete or inaccessible leading to poor legal compliance by most actors. Actors are often unable to comply with legislation irrespective of their willingness to comply. If there is powerful

		enforcement of the unclear legislation, it often leads to poor legitimacy and the loss of credibility. Furthermore, unclear legislation is susceptible to misuse and misinterpretation
-	Moderate compliance to incomplete legislation	Legislation is incomplete meaning that certain gaps can be (mis-)used to ensure legal compliance. In practice, enforcement of unbalanced policy may lead to discontent and the loss of trust in local authorities. There is no clear division of responsibilities of executive and controlling tasks. Inspections, legal enforcement and sanctions may be inconsistent
0	Strict compliance to fragmentized legislation	There is strict compliance to well-defined, fragmentized policies, regulations and agreements. However, the prescription of precise targets and means limit flexibility, innovations and realization of ambitious goals. Furthermore, an activity may be penalized multiple times in different direct and indirect ways due to poor coordination
+	Flexible compliance to ambitious explorations	New ambitious policies, agreements and legislations are being explored. Most actors are willing to comply and there is also voluntary compliance to more ambitious goals and agreements. The ambitious and explorative character sometimes leads to unrealistic targets that demand for some flexibility. Hence, not all targets have to be strictly accomplished since a 'learning-by-doing' approach is used to realize ambitious goals
++	Good compliance to effective sustainable legislation	Legislation is ambitious and effective. There is much experience with developing and implementing sustainable policy. Short-term and long-term targets are well integrated leading to realistic implementation. Moreover, compliance is high

GC9.3: Preparedness		Implementation capacity is strongly increased due to existence of procedures and scripts for action that support policy and prepares the city for both gradual and sudden uncertain changes and events <i>Müller and Siebenhüner 2007; Raaijmakers et al. 2008; Gupta et al. 2010; Ekstrom et al. 2011</i>
--	Poor preparedness	There are hardly any action plans for dealing with (future) calamities, uncertainties and existing risks. Therefore, the division of executive tasks is unclear leading to low (disaster) preparedness and high vulnerability
-	Limited preparedness	Development of action plans is ad hoc and responds to recently experienced calamities. The actual probabilities and impacts are not well understood, whereas future risks are unknown. Furthermore, the division of resources, roles, tasks and responsibilities are unclear
0	Low awareness of preparation strategies	As a result of past experiences, there is a more complete set of action plans. However, they are ineffective as tasks are not clearly assigned and possibly affected people do not know what to do. The set of plans, allocated resources and preparations are not sufficient to deal with imminent calamities and gradually increasing pressures due to climate change
+	Over-abundant preparedness	There are abundant plans for dealing with a wide range of short- and long-term threats. Policymakers follow the precautionary principle and create a set of proactive action plans. However, they are scattered and non-cohesive. Allocation of resources, staff and training may be ambiguous. There is high awareness of possible threats, however, an overall action plan combining all threats and their interactions is missing
++	Comprehensive preparedness	Long-term plans are flexible by bundling different risks, impacts and worst case scenarios. The action plans for calamities are clearly communicated, co-created and regularly rehearsed by all relevant stakeholders. The required materials and staff are available on short-term notice to be able to respond adequately

Appendix II Example of data collection for the GCAF

The first step prior to the application of the GCAF is to determine which urban water- or climate change issues are the most threatening. The issues are: (i) flood risk, (ii) water scarcity, (iii) urban heat island and (iv) water quality and resource scarcity. These are based on the work of the City Blueprint and can be considered the most relevant water issues (Koop and Van Leeuwen 2015). The assessment of the governance capacity requires a variety of information sources and stakeholder arena compositions. Therefore the questionnaire, in-depth interview design and desk research strategy may be issue-specific for certain governance conditions (Table 0-1). This section will give examples of questions that could be included and possible sources of information. This can then be used to specify the assessment set-up depending on the distinct context of the city under investigation. Practical frameworks (Alexander Ballard Ltd 2008; Lockwood et al. 2008; Ridder et al. 2005) have contributed greatly to this.

Table 0-1 Some governance conditions and characteristics can be assessed with a general questionnaire, while others require a theme specific customization

Governance condition		Theme	General
GC1	Awareness		
GC1.1	Community knowledge	x	
GC1.2	Local support	x	
GC1.3	Internalization	x	
GC2	Useful Knowledge		
GC2.1	Information availability	x	
GC2.2	Accessibility	x	
GC2.3	Cohesion		x
GC3	Continuous learning		
GC3.1	Smart monitoring	x	
GC3.2	Evaluation	x	
GC3.3	Cross-stakeholder capacity building		x
GC4	Stakeholder engagement		
GC4.1	Inclusiveness		x
GC4.2	Protection of core values		x
GC4.3	Progress and choice variety		x
GC5	Policy ambition		
GC5.1	Ambitious and realistic goals	x	
GC5.2	Discourse embedding		x
GC5.3	Cohesive policy		x
GC6	Agents of change		
GC6.1	Entrepreneurial		x
GC6.2	Collaborative		x
GC6.3	Visionary		x
GC7	Multi-level network potential		
GC7.1	Room to maneuver		x
GC7.2	Clear division of responsibilities		x
GC7.3	Authority		x
GC8	Financial viability		
GC8.1	Affordability		x
GC8.2	Willingness to pay	x	
GC8.3	Financial continuation		x
GC9	Implementing power		
GC9.1	Policy instruments	x	
GC9.2	Legal compliance	x	
GC9.3	Preparedness	x	

GC1 Awareness

Community knowledge

As this condition aims to assess the level of general knowledge regarding water management functions regarding the issue at hand, theme specific (i.e. related to the issue) questions are required. The design of the questions is similar. For open questions, use of keywords related to the issue can indicate the level of community knowledge, and for closed questions could be asked with true or false answers or ordinal scale provided. Desk research could focus on historical data, existing data bases, Environmental Impact Assessments, etc.

Questions	
Issue	Flood
Questions	How often do floods occur? What was the flood depth? What is the flood duration? How do these floods come to be?
Indicator	Key words related to causes (e.g. rainfall, inadequate infrastructure capacity), impact (proximity of answers to empirical data, e.g. flood duration, depth, damages), and probability of occurrence (use key-words or ordinal scale, e.g. [1-2 years; 2-5 years; 5-10 years; 10-20 years; 20-100 years])
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	UHI
Questions	Have you ever heard of UHI? Can you explain the phenomenon? What are the causes, impacts, mechanisms, and possible measures?
Indicator	Key words related to causes (e.g. surface sealing, concrete structures, scarce green/blue areas, anthropogenic heat release), impact (increased night time temperatures, health risks, changing micro-climate), mechanisms (heating of hard surfaces, heat storage, greenhouse effect due to fine-particulate air pollution), and measures (green roofs, green/blue areas, increase albedo, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	Water scarcity
Questions	Are you aware of water scarcity? Do you know if water sources are depleting? If so, at what rate? What are the causes and impacts?
Indicator	Key words related to causes (e.g. over-extraction, droughts, poor environmental flow management, pollution, salinization, etc.) and impact (rationing of water use, socio-economic and environmental effects of water resource depletion, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	Water quality and resource scarcity
Questions	Do you know the current state of the water quality? What processes affect the water quality? What are the causes? What are the socio-economic/environmental impacts? How is wastewater/sludge/residual waste processed?
Indicator	Key words, true/false questions or ordinal scale [very poor ↔ very good] related to causes (diffuse/point pollution, CSOs, exotic species, stagnant water, etc.), impacts (eutrophication, poor ecological value, stench, sedimentation, algae, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups

Local support

Questions related to local support aim to assess to what extent the issues at hand are considered priority. For local support ordinal scales [very low \leftrightarrow very high] can be used, or knowledge of measures currently taken or considered necessary could be investigated. Desk research could include records of correspondence, media reports, advisory committee feedback, and existing action groups.

Questions	
Issue	Flood
Questions	How concerned are you with floods? Do you think current measures are adequate? Do you think action is necessary?
Indicator	Ordinal scale regarding concern [not concerned \leftrightarrow very concerned]; current measures [not at all adequate \leftrightarrow very adequate], temporal aspect [very urgent \leftrightarrow never necessary]
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	UHI
Questions	How concerned are you with the UHI? Do you think current measures are adequate? Do you think action is necessary?
Indicator	Ordinal scale regarding concern [not concerned \leftrightarrow very concerned]; current measures [not at all adequate \leftrightarrow very adequate], temporal aspect [very urgent \leftrightarrow never necessary]
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups, vulnerable groups (elderly)
Issue	Water scarcity
Questions	How concerned are you with water scarcity? Do you think current measures are adequate? Do you think action is necessary? Would you change your water demand?
Indicator	Ordinal scale regarding concern [not concerned \leftrightarrow very concerned]; current measures [not at all adequate \leftrightarrow very adequate], temporal aspect [very urgent \leftrightarrow never necessary], list of responses sorted by water demand reduction (e.g. shorter showers, rain water harvesting, water saving faucets, shower, appliances, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	Water quality and resource scarcity
Questions	How concerned are you with water quality? Do you think current measures are adequate? Do you think action is necessary? What aspects of water quality worry you most?
Indicator	Ordinal scale regarding concern [not concerned \leftrightarrow very concerned]; current measures [not at all adequate \leftrightarrow very adequate], temporal aspect [very urgent \leftrightarrow never necessary], list of responses sorted by water quality aspects (e.g. recreation, ecology, stench, aesthetic value, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups

Internalization

This characteristic aims to assess to what extent the issue is consciously or subconsciously included in the behavior of stakeholders. The questions are related to specific actions to mitigate or adapt to the issue and how actors would respond to the occurrence of the issues. Desk research may focus on policies, company strategies, declarations in intent, tender criteria for projects regarding the issue, water usage data, transgression of laws regarding the issue, etc.

Questions	
Issue	Flood
Questions	Do you take any measures to prevent floods? Or reduce the effects? Are there sustainability strategies?
Indicator	List of measures for flood prevention sorted by effectiveness and impact reduction (e.g. place valuable or vulnerable properties higher, avoid building in flood plains, water retention on property, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	UHI
Questions	Do you take any measures to mitigate UHI? Or reduce the effects? Are strategies to deal with the UHI?
Indicator	List of measures to mitigate UHI (green roof/garden, increase albedo, reduce energy consumption, motorized transport in the city, etc.), measures to deal with UHI (light clothes, take enough water with you, seek shade)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	Water scarcity
Questions	Do you take any measures to regarding droughts? Did you ever experience governmental decrees that ration water use? Did you think it was necessary? Did you, or others, abide by it?
Indicator	List of measures to deal with droughts (water storage, water reuse, green garden, etc.), yes/no answers whether or not the community abides by water rations
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups
Issue	Water quality and resource scarcity
Questions	Do you take any measures to prevent pollution/increase water quality? Do you know of measures that improve water quality? Do you know what substances cannot be flushed in the sewer?
Indicator	List of measures to deal with water quality (helophytes, natural banks, filtration tanks, stormwater separation, etc.)
Respondent	(Affected) community members (N=30), mayor, city councilor, communication official of municipality, local action groups

GC2 Useful knowledge

Information availability

The existence of information related to the issue under investigation. The questions here refer to the extent to which actors perceive the adequacy of the information for their activities and objectives, and related to certain aspects of information, e.g. databases, reports, published works, future scenarios, etc. The latter will be an important focus for the desk research. Other aspects to consider are references in policies, strategies and official documents and the sufficiency and currency of the information, and documented examples of obtaining, local, traditional and expert knowledge.

Questions	
Issue	Flood
Questions	Do you feel you have sufficient information to achieve your objectives regarding floods? What data is collected regarding flooding? How have floods been recorded in the past? How is that data managed? Do flood models exist?
Indicator	Ordinal scale for information sufficiency [not at all \leftrightarrow very sufficient]; list number of flood-related features and processes (duration, depth, flow paths and velocities, run-off, infrastructure, etc.) and check them accordingly
Respondent	Responsible stakeholder (private or public), knowledge institutes, affected community members
Issue	UHI
Questions	Do you feel you have sufficient information to achieve your objectives regarding UHI? What data is collected regarding UHI? How have extreme heat events been recorded in the past? How is that data managed? Do UHI models exist?
Indicator	List number of UHI-related features and processes (blue/green space, evapo-transpiration, albedo, temperature, winds, humidity, air pollution, etc.) and check them accordingly
Respondent	Responsible stakeholder (private or public), knowledge institutes, affected community members, real estate owners
Issue	Water scarcity
Questions	Do you feel you have sufficient information to achieve your objectives regarding water scarcity? Is water extraction and usage known and monitored regularly? What definition of water scarcity is used and how is this measured?
Indicator	Use of Falkenmark indicator or water stress index, critical ratio. Ordinal scale for information sufficiency [not at all \leftrightarrow very sufficient], regarding definition (e.g. renewable freshwater sources, water resource accessibility, production plants (desalination, water reuse), water demand, etc.)
Respondent	Responsible stakeholder (private or public), knowledge institutes, affected community members, water users
Issue	Water quality and resource scarcity
Questions	Do you feel you have sufficient information to achieve your objectives regarding water quality? Is water quality known and monitored regularly? What definition of water quality is used and how is this measured? Are new technologies and emerging substances researched?
Indicator	Ordinal scale for information sufficiency [not at all \leftrightarrow very sufficient], regarding definition (e.g. ecologic, chemical, aesthetic quality)
Respondent	Responsible stakeholder (private or public), knowledge institutes, action groups, water users (fishermen, recreationists)

Accessibility

This characteristic assesses to what extent information can be accessed freely. The questions can be answered through an ordinal scale or if the answer approximates certain terms, such as open-access, freely available online, etc. The desk research should be focused on websites and archives of the responsible organizations, determining its accessibility, but also its presentation. For example, documents presented in an uncommon or incomprehensible format can be considered inaccessible.

Questions	
Issue	Flood
Questions	How can one access flood data? Is it understandable?
Indicator	Ordinal scale for information accessibility [<i>impossible</i> \leftrightarrow <i>difficult</i> (on request, physical archives, bureaucratic procedures) \leftrightarrow <i>moderate</i> (on request, data delivered within a week) \leftrightarrow <i>easy</i> (online, small fee, incomplete data) \leftrightarrow <i>very accessible</i> (online electronic data, open access and complete)]; What is the format of the file type, is there an (interactive) interface, are there maps, etc.
Respondent	Interested parties, past experiences of stakeholders involved in projects, communication expert
Issue	UHI
Questions	How can one access UHI data? Is it understandable?
Indicator	Ordinal scale for information accessibility [<i>impossible</i> \leftrightarrow <i>difficult</i> (on request, physical archives, bureaucratic procedures) \leftrightarrow <i>moderate</i> (on request, data delivered within a week) \leftrightarrow <i>easy</i> (online, small fee, incomplete data) \leftrightarrow <i>very accessible</i> (online electronic data, open access and complete)]; What is the format of the file type, is there an (interactive) interface, are there maps, etc.
Respondent	Interested parties, past experiences of stakeholders involved in projects, communication expert
Issue	Water scarcity
Questions	How can one access water scarcity data? Is it understandable?
Indicator	Ordinal scale for information accessibility [<i>impossible</i> \leftrightarrow <i>difficult</i> (on request, physical archives, bureaucratic procedures) \leftrightarrow <i>moderate</i> (on request, data delivered within a week) \leftrightarrow <i>easy</i> (online, small fee, incomplete data) \leftrightarrow <i>very accessible</i> (online electronic data, open access and complete)]; What is the format of the file type, is there an (interactive) interface, are there maps, etc.
Respondent	Interested parties, past experiences of stakeholders involved in projects, communication expert
Issue	Water quality and resource scarcity
Questions	How can one access water quality data? Is it understandable?
Indicator	Ordinal scale for information accessibility [<i>impossible</i> \leftrightarrow <i>difficult</i> (on request, physical archives, bureaucratic procedures) \leftrightarrow <i>moderate</i> (on request, data delivered within a week) \leftrightarrow <i>easy</i> (online, small fee, incomplete data) \leftrightarrow <i>very accessible</i> (online electronic data, open access and complete)]; What is the format of the file type, is there an (interactive) interface, are there maps, etc.
Respondent	Interested parties, past experiences of stakeholders involved in projects, communication expert

Cohesion

This characteristic is not theme specific, as it assesses the cohesion of information across actors and policy fields. Often actors can improve efficiency and effectiveness, if they share information that is useful and meets the demand of the actors. Desk research can focus on documented use of knowledge networks, partnerships with knowledge providers (knowledge- and research institutes), service agreements, sharing protocols with knowledge holders and committee memberships. The governing body uses an ICT system that provides effective intra- and inter-organizational data management.

Questions	
Questions	How do you perceive knowledge exchange with other organizations?
Indicator	Ordinal scale for cohesion [<i>not at all cohesive</i> (no exchange) \leftrightarrow <i>limited cohesion</i> (very limited exchange of incomplete/poor information) \leftrightarrow <i>moderate</i> (basic information exchange) \leftrightarrow <i>cohesive</i> (information in several formats) \leftrightarrow <i>very cohesive</i> (common data production and knowledge platform, with interactive interface to enable fit-for-purpose knowledge exchange)];
Respondent	Interested parties, past experiences of stakeholders involved in projects, communication expert

GC3 Continuous learning

Smart monitoring

Smart monitoring refers to the monitoring methods regarding features of the relevant issues, e.g. water levels, precipitation, etc. It also includes how policy progress is monitored. How are targets assessed? Furthermore, smart monitoring should foster interaction between centers of knowledge. The questions are focused on how relevant actors monitor their progress and the issues. Desk research will focus on how data is created and whether the data is reliable (combining multiple sources).

Questions	
Issue	Flood
Questions	Questions related to response from GC2.2; what flood features are monitored and how are they monitored? How are service level agreements (SLAs) monitored? How is flood policy monitored?
Indicator	Labor-intensive monitoring vs. digitized monitoring system. Monitoring frequency and spatial distribution (e.g. upstream monitoring for adequate warning and time to respond). Use of redundant data sources
Respondent	Representative of executive organization, knowledge institutes, NGOs
Issue	UHI
Questions	Questions related to response from GC2.2; what UHI are monitored and how are they monitored? How are service level agreements (SLAs) monitored? How is UHI policy monitored?
Indicator	Labor-intensive monitoring vs. digitized monitoring system. Monitoring frequency and spatial distribution (e.g. heat gradient between different areas, and to map the UHI). Use of redundant data sources (temperature, humidity, wind, etc. but also heat perception)
Respondent	Representative of executive organization, knowledge institutes, NGOs, owners of e.g. green roofs
Issue	Water scarcity
Questions	Questions related to response from GC2.2; what features related to water scarcity are monitored and how are they monitored? How are service level agreements (SLAs) monitored? How is drought policy monitored?
Indicator	Labor-intensive monitoring vs. digitized monitoring system. Monitoring frequency and spatial distribution (e.g. upstream monitoring for adequate environmental flow management). Monitoring related to water resource availability, water demand/resource extraction, and ecological impacts. Use of redundant data sources
Respondent	Representative of executive organization, knowledge institutes, NGOs, water users
Issue	Water quality
Questions	Questions related to response from GC2.2; what water quality features are monitored and how are they monitored? How are service level agreements (SLAs) monitored? How is water quality policy monitored (ecological, chemical, etc.)? How is wastewater monitored?
Indicator	Labor-intensive monitoring vs. digitized monitoring system. Monitoring frequency and spatial distribution (e.g. sewage system monitoring, surface water monitoring (to identify pollution sources). How is treatment monitored (e.g. effluent quality, efficiency and effectiveness). Use of redundant data sources
Respondent	Representative of executive organization, knowledge institutes, NGOs

Evaluation

This characteristic aims to assess to what extent monitoring data is evaluated, in order to facilitate learning. It aims to determine if only current practices are improved, or that underlying assumptions are also challenged. Desk research can focus on the monitoring, evaluation, review and improvement (MERI) strategy, documented reviews of plans, projects and policies, and changes based on reviews.

Questions	
Issue	Flood
Questions	What is consider (un)acceptable? How is performance of infrastructure evaluated? How often are processes/policies evaluated? Which actors perform an evaluation and is that in turn reviewed also? How is flood data used to develop policy?
Indicator	Acceptability: statements (flood depth, duration, frequency, etc.) and ordinal scale [not at all acceptable \leftrightarrow acceptable]. Evaluation: not limited to performance (ecological, socio-economic effects), frequency of evaluation
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders
Issue	UHI
Questions	What is (un)acceptable? How is performance of the UHI measures evaluated? How often are processes and policies evaluated? Which actors perform an evaluation and is that in turn reviewed also? How is UHI data used to develop policy?
Indicator	Acceptability: statements (temperature, perceived heat, frequency, humidity etc.) and ordinal scale [not at all acceptable \leftrightarrow acceptable]. Evaluation: not limited to performance (include ecological, socio-economic effects), frequency of evaluation
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders, real estate owners (e.g. with green roofs)
Issue	Water scarcity
Questions	What is (un)acceptable (what is 'water scarcity')? How is performance of measures evaluated? How often are processes/policies evaluated? Which actors perform an evaluation and is that in turn reviewed also? How is water resource data used to develop policy? Are assumptions challenged (e.g. water demand for certain sectors)
Indicator	Acceptability: statements (drought duration, resource availability, frequency, etc.) and ordinal scale [not at all acceptable \leftrightarrow acceptable]. Evaluation: not limited to performance (include ecological, socio-economic effects), frequency of evaluation
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders, water users (or sectors with high water demand)
Issue	Water quality
Questions	What is consider (un)acceptable? How is performance of infrastructure evaluated? How often are processes/policies evaluated? Which actors perform an evaluation and is that in turn reviewed also? How is flood data used to develop policy?
Indicator	Acceptability: statements (ecological/chemical, effluent, efficiency, etc.) and ordinal scale [not at all acceptable \leftrightarrow acceptable]. Evaluation: not limited to performance (ecological, socio-economic effects), frequency of evaluation
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders, wastewater treatment

Cross-stakeholder capacity building

This characteristic aims to assess to what extent stakeholders learn from each other in order to consider different perspectives, approaches and solutions. The questions relate mostly to whether or not there is a ‘constructive critical’ cooperation between actors. This will inhibit multiple-loop learning. Desk research could focus on community of practice, documented changes as a result of reviews by other actors, and are there knowledge creating cooperations?

Questions	
Issue	
Questions	What stakeholders are involved in evaluation? How do you process cross-stakeholder feedback? Do you feel that other actors value your perspectives? Can you give an example of when evaluation has led to changing assumptions and approaches?
Indicator	“double-checking” (evaluation is done by several actors with different perspectives), ordinal scale regarding the perceived understanding of one’s feedback to another actor and vice-versa
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders

GC4 Stakeholder engagement process

Inclusiveness

This characteristic refers to the level to which relevant stakeholders are able to be part of the decision-making process and decide or speak on behalf of the group they represent. The stakeholder engagement process should be clear and transparent. The questions relate to whether or not stakeholders feel that they can easily enter or are engaged in the decision-making process and if this process is clear. The desk research can focus on past engagement or decision-making processes; with a focus on inclusion and legitimacy of the involved stakeholders (i.e. can they speak on behalf of their constituents?).

Questions	
Issue	
Questions	[to affected stakeholders] Have you been involved in the decision-making process regarding recent projects? Did you think it was relevant? Do you feel all relevant perspectives and interests have been included?
Indicator	Open question to find out how stakeholders perceive the inclusiveness of the process. Ordinal scale: regarding interests: [not at all \leftrightarrow all perspectives included]
Respondent	Members of community of practices, policy-makers, responsible authority, affected stakeholders

Protection of core values

Extent to which stakeholders feel confident that their core values will not be harmed. Commitment should be focused on the process instead of the results and stakeholders should have the possibilities to exit at predetermined moments. The questions should focus on the process of stakeholder engagement. The perception of stakeholders is vital regarding their point of view regarding the issue, the commitment to the outcome or process and exit possibilities. Desk research may be focused on documented examples of social cost-benefit analyses, complaints registers and dispute resolution procedures.

Questions	
Issue	
Questions	Do you feel that your perspectives are respected? Do you feel that you were expected to commit to the outcome or the process? Why did you engage or not engage in previous engagement processes?
Indicator	Ordinal scale: perspective: [not at all \leftrightarrow very respected] Open question to find out how stakeholders perceive the process itself; is the outcome predetermined? What were the barriers or incentives to engage?
Respondent	Members of community of practices, policy-makers, responsible authority, affected stakeholders

Progress and choice variety

Progress and choice variety needs to be ensured by clear and realistic procedures. Stakeholders should produce and select from a variety of alternatives to ensure learning and get legitimate decisions. The selection should be at the end of the process to secure continued prospect of gain and thereby cooperative behavior. Questions relate to the perceived progress of the process, the possible alternatives and gains throughout the process.

Questions	
Issue	
Questions	Experiences of previous engagement efforts by both initiator and affected. Did you feel like there was progress in the process? How was stakeholder input managed? Were you informed about how your input affected the outcome? Did you feel like you could co-create and co-decide alternatives? At what point did stakeholders receive gain from participating in the process? Would you participate in subsequent stages?
Indicator	Ordinal scale: progress: [not at all \leftrightarrow very well] input [not at all included \leftrightarrow clearly included]. Open question to find out how stakeholders perceive their contribution to the decision-making. When were the gains? Did they feel that they had ample choices?
Respondent	Members of community of practices, policy-makers, responsible authority, affected stakeholders

GC5 Policy ambition

Ambitious and realistic goals

A long-term vision with short-term intermittent targets is needed for sustainable development. Important is the level to which visions are expressed in objectives, which have been translated into targets. Questions should assess to what extent this coherency exists, if they allow enough flexibility, and if they are ambitious, but realistic. Desk research can focus on policy documents, visions, and SLAs regarding the issue.

Questions	
Issue	Flood
Questions	How are the goals regarding flood risk policy defined? Is there a long-term vision? Are 'alternative' futures considered, e.g. through scenarios? How supportive are short-term targets to long-term objectives?
Indicator	Open questions to find out how the vision is designed: through credible models? Scenarios? Ordinal scale for short-long term [not at all ←→ very supportive]
Respondent	Policy-makers, executive governmental agencies
Issue	UHI
Questions	How are the goals regarding the UHI defined? Is there a long-term vision? Are 'alternative' futures considered, e.g. through scenarios? How supportive are short-term targets to long-term objectives?
Indicator	Open questions to find out how the vision is designed: through credible models? Scenarios? Ordinal scale for short-long term [not at all ←→ very supportive]
Respondent	Policy-makers, executive governmental agencies, real estate owners
Issue	Water scarcity
Questions	How are the goals regarding water scarcity policy defined? Is there a long-term vision? Are 'alternative' futures considered, e.g. through scenarios? How supportive are short-term targets to long-term objectives?
Indicator	Open questions to find out how the vision is designed: through credible models? Scenarios? Ordinal scale for short-long term [not at all ←→ very supportive]
Respondent	Policy-makers, executive governmental agencies
Issue	Water quality and resource scarcity
Questions	How are the goals regarding water quality and resource scarcity/recovery policy defined? Is there a long-term vision? Are 'alternative' futures considered, e.g. through scenarios? How supportive are short-term targets to long-term objectives?
Indicator	Open questions to find out how the vision is designed: through credible models? Scenarios? Ordinal scale for short-long term [not at all ←→ very supportive]
Respondent	Policy-makers, executive governmental agencies

Discourse embedding

The extent to which sustainable policy is interwoven with historical, cultural, normative and political context. This can be measured by assessing the sustainability ambitions within the institutional setting and implemented policy. Questions aim to assess whether or not policy is perceived as suitable for the local context. Desk research can focus on whether or not there has been social resistance to recent policy, if local cultural values, traditions and history have been explicitly considered in policy documents or if communication experts have been employed in the policy-making process.

Questions	
Issue	
Questions	Ordinal scale; Do you think the policy fits the local context? How are local values and beliefs incorporated in policy?
Indicator	Ordinal scale: [not suitable \leftrightarrow very suitable]; open questions to find out if and how local culture is incorporated into the policy, or even used to implement and improve it.
Respondent	Policy-makers, local community/affected people

Cohesive policy

Refers to the extent to which existing regulation support or hinder sustainable innovations. It takes into account administrative boundaries, alignment across government levels and technical possibilities. Key is the integration of different sectoral policies and strategies to create co-benefits. The questions are aimed at determining to what extent different policies are aligned, horizontally and vertically. Desk research can focus on existing policies across government levels and policy fields. The research should determine the complementariness, overlap and conflict. Is there a cross-sectoral committee?

Questions	
Issue	
Questions	Ordinal scale; Are other policy fields taken into account, approached or included in policy-making? What do you feel about the cohesiveness between policies? True/false statements: e.g. water policy is aligned with energy, -infrastructure, -urban planning, etc.
Indicator	Ordinal scale: [very conflicting \leftrightarrow very complementary]; Ask several policy fields about the linkage between their respective policies (true/false statements)
Respondent	Policy-makers across sectors, decision-makers across levels

GC6 Agents of change

Entrepreneurial

Entrepreneurial agents of change have the authority, passion and ability to identify opportunities and initiate new projects. They are skilled in accessing the necessary resources. Questions relate to current and past practices where innovations are developed. Desk study could focus on who recognized opportunities to create (co-)benefits in recent projects, from idea to implementation.

Questions	
Issue	
Questions	Regarding recent/successful projects: is there a team or individual that recognized opportunities at some point in the project? Are there actors that have the ability to access resources and create extra benefits to guide a project from idea to implementation?
Indicator	Open question to find out whether or not agents of change are recognized and enabled to seek opportunities and persuade others to collaborate
Respondent	Members of community of practices, policy-makers, project members, decision-makers

Collaborative

Agents of change that understand and have the network to access and abstract valuable resources. Because of their 'soft skills' they are able to engage, collaborate with and connect the business, government and social sectors where they often initiate coalition forming. Questions relate to current and past practices where an individual or team sought collaborations. Desk study could focus on who enabled collaborations to create (co-)benefits in recent projects, from idea to implementation.

Questions	
Issue	
Questions	Regarding recent/successful projects: is there a team or individual that created collaborations at some point in the project? Are there actors that have the ability to access networks and create extra benefits to guide a project from idea to implementation?
Indicator	Open question to find out whether or not agents of change are recognized and enabled to seek collaborations and create or access the necessary network
Respondent	Community of practices, policy-makers, project members, decision-makers

Visionary

Visionary agents of change drive change by promoting a comprehensive and integrated vision and strategy as well as enhancing organizational skills and knowledge. They have the capacity to manage change and communicate effectively. Questions relate to practices where an individual or team promoted a vision. Desk study could focus on who passionately promoted a sustainable vision.

Questions	
Issue	
Questions	Regarding recent/successful projects: is there a team or individual that the projects vision? Are there actors that have the ability to produce and communicate a sustainable vision?
Indicator	Open question to find out whether or not agents of change are recognized and enabled to create visions and communicate it effectively?
Respondent	Members of community of practices, policy-makers, project members, decision-makers

GC7 Multi-level network potential

Room to maneuver

People resist increasing awareness unless they think they can act in a meaningful way (Alexander Ballard Ltd 2008), i.e. unless they have the room to maneuver. For this questions relate to the extent to which actors can develop a variety of approaches, and the possibility to form ad-hoc, fit-for-purpose cooperations. Desk research can focus on mandates, guidelines, protocols, previous successful cooperations, how solutions to problems have been developed and if unconventional actors therein are included.

Questions	
Issue	
Questions	Do you feel that you have adequate time and resources to develop new ideas? Regarding the (emerging) issue, to what extent can you (or organization) deal with it? To what extent can you act on spotted opportunities?
Indicator	Ordinal scale: time and resources: [no time and resources at all \leftrightarrow ample time and resources], dealing with issue [not at all \leftrightarrow very well], opportunities [not at all \leftrightarrow ad-hoc and fit-for-purpose]. Open questions can determine more in-depth what the room to maneuver is of an organization
Respondent	Representative of executive organization, knowledge institutes, NGOs, local community leaders

Clear division of responsibilities

In collaboration, clear responsibilities improve accountability, efficiency and effectiveness. The questions aim to assess whether actors perceive the responsibilities of their own and others as clear and if it makes sense. Also if they think, within the cooperation, the division of responsibilities is fair. Desk research can focus on records of inter-organizational meetings, service level agreements, policy documents, and governmental websites. The perspective of the issue can be taken: who does what regarding the issue?

Questions	
Issue	
Questions	Do you feel that responsibilities are clearly defined? Do you feel that the responsibilities are clearly divided? Are you aware of the responsibility of others? Do you feel that, regarding some aspects of the issue, responsibilities are ambiguous?
Indicator	Ordinal scale: definition: [not at all \leftrightarrow very clear], division [not at all \leftrightarrow very well], Open questions can determine more in-depth where there may be ambiguity in the division of the responsibilities
Respondent	Members of community of practices, policy-makers, responsible authority

Authority

Collaborations without legitimate authority will have difficulty to further develop their approaches. This characteristic aims to assess whether there is authority to overcome contradicting interests. The questions focus on the approachability of large organizations (governmental organizations, large knowledge institutes, large NGOs, etc.). Desk research can focus on previous projects where an organization with legitimate authority exercised leadership regarding the issue.

Questions	
Issue	
Questions	Are large parties approachable and prepared to join collaborations? Have past collaborations been decisive? Do you think the current collaboration has enough authority to overcome conflicting interest?
Indicator	Ordinal scale: approachable: [not at all \leftrightarrow very approachable], decisiveness [not at all \leftrightarrow very decisive], Open questions can determine more in-depth where authority may be. Respondents can also list a number of actors that they would like to include in their collaboration to gain more momentum and legitimacy
Respondent	Members of community of practices, policy-makers, responsible authority

GC8 Financial viability

Affordability

Water services and climate adaptation measures should be available and affordable for all citizens including the poorest. Questions relate to the perceived affordability of water services and adaptation measures, for both users as well as responsible organizations. Desk research can focus on actual pricing of services. Coding may be possible with a % of public expenditure or % of average income.

Questions	
Issue	
Questions	Ordinal scale; Do you feel like the water service/adaptation measure is affordable?
Indicator	Ordinal scale: [very expensive \leftrightarrow very cheap]; both for users as policy makers (e.g. insufficient budget)
Respondent	Users, decision-makers, real estate owners, affected groups

Willingness to pay

Willingness to pay assesses how expenditures and risks regarding water and climate adaptation are perceived. Often, trust in local authorities and sense of urgency or worry regarding the issue enhances the willingness to pay. Questions are related to these issues. Desk research could focus on debates on budget allocation, if there had been resistance, etc.

Questions	
Issue	Flood
Questions	Would you accept a price increase if that means that additional benefits are created? Ordinal scale; Do you consider taxes regarding flooding fair? Do you think current expenditure is adequate? Nominal: Are you satisfied with current pricing of the service?
Indicator	List of benefits (ecological, recreation, etc.). Ordinal scales: benefits [fairness of taxation [very unfair \leftrightarrow very fair]; expenditure [very insufficient \leftrightarrow very sufficient]; nominal: [totally disagree \leftrightarrow totally agree]
Respondent	Policy-makers, executive governmental agencies, users, affected groups
Issue	UHI
Questions	Would you invest in measures to reduce the UHI? Do you think the UHI should be addressed? Who should pay for the measures?
Indicator	Ordinal scale: [will not invest \leftrightarrow will invest]. Open questions regarding the perceived problem holders and willingness to pay
Respondent	Policy-makers, executive agencies, real estate owners, affected groups
Issue	Water scarcity
Questions	Do you think water scarcity should be addressed? Would you invest in more water-efficient technologies? Or (rain) water storage/reuse?
Indicator	Ordinal scale: [will not invest \leftrightarrow will invest]. Open questions regarding the perceived problem holders and willingness to pay
Respondent	Policy-makers, executive agencies, real estate owners, affected groups
Issue	Water quality and resource scarcity
Questions	Do you think water quality should be addressed? Would you contribute to measures to increase water quality (natural banks, helophytes, less/other fertilizer)? Would you invest in new technologies for resource recovery?
Indicator	Ordinal scale: [will not invest \leftrightarrow will invest]. Open questions regarding the perceived problem holders and willingness to pay

Respondent	Policy-makers, executive agencies, users
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Financial continuation

Financial resources are a necessity for developing and implementing sustainable solutions in the urban water cycle. Policy focused on solving long-term problems requires long-term thinking but, more importantly, long-term financial support and security. Policy is most effective if long-term financial support is guaranteed on forehand. Questions relate to the perceived financial security for service providers. Desk research can focus on documentation of financial arrangements.

Questions	
Issue	
Questions	Is financial continuation guaranteed? Do you feel that the organization has adequate financial security to maintain a long-term perspective?
Indicator	Ordinal scale: [very insecure \leftrightarrow very secure]; For which term (scoring could be based on the number of years of guaranteed resources and if it is sufficient for dealing with the issue)
Respondent	Policy-makers, executive governmental agencies, NGOs

GC9 Implementing capacity

Policy instruments

Effective use of policy instruments to stimulate desired behavior and discourage undesired activities and choices. Continuous monitoring, evaluation and adjustments are needed to check and improve the effectiveness of applied policy instruments. Questions relate to the existence of incentives for (sustainable) behavioral change. Desk research can focus on existing policies regarding subsidies, campaigns and if its effectiveness is documented.

Questions	
Issue	Flood
Questions	Do you feel that there are sufficient subsidies/incentives for flood risk reduction? Why did you apply for the subsidy?
Indicator	Ordinal: subsidies [no subsidies that I know off ↔ sufficient subsidies and incentives]; open question to discover the reason for applying for subsidies and if it has changed the perspective.
Respondent	Policy-makers, executive governmental agencies, users, affected groups
Issue	UHI
Questions	Do you feel that there are sufficient subsidies/incentives to promote green roofs, green and blue areas and other UHI reducing measures? Why did you apply for the subsidy?
Indicator	Ordinal: subsidies [no subsidies that I know off ↔ sufficient subsidies and incentives]; open question to discover the reason for applying for subsidies and if it has changed the perspective.
Respondent	Policy-makers, executive governmental agencies, users, affected groups
Issue	Water scarcity
Questions	Do you feel that there sufficient subsidies/incentives to reduce water usage, increase water saving measures or promote use of alternative water sources (reuse, rainwater collection)?
Indicator	Ordinal: subsidies [no subsidies that I know off ↔ sufficient subsidies and incentives]; open question to discover the reason for applying for subsidies and if it has changed the perspective
Respondent	Policy-makers, executive agencies, real estate owners, affected groups
Issue	Water quality and resource scarcity
Questions	Are there incentives to reduce pollution or increase water quality? For example, are industries encouraged to use or search for alternative materials or methods that would improve the effluent water quality? Or resource recovery techniques?
Indicator	Ordinal: subsidies [no subsidies that I know off ↔ sufficient subsidies and incentives]; open question to discover the reason for applying for subsidies and if it has changed the perspective
Respondent	Policy-makers, executive agencies, users

Legal compliance

This characteristic refers to the legal compliance, which ensures that stakeholders respect agreements, objectives, legislation, etc. Questions regarding this characteristic aim to assess the legitimacy of legislation and if it can be enforced. The desk research should focus on targets, agreements and laws. What are the enforcement instruments? Can they be adapted to innovations or future circumstances?

Questions	
Issue	Flood
Questions	Are there legal restrictions or obligations regarding flood risk (e.g. ban on building in flood plains)? How are they monitored and are they enforced regularly? If violations are common, how could that be?
Indicator	Open questions to gain insight into the legitimacy of legislation, agreements and targets
Respondent	Policy-makers, users, affected groups
Issue	UHI
Questions	Are there legal restrictions or obligations regarding the UHI (e.g. imposed ratio of green and paved surface area)? Or power rations (Tokyo for example) to reduce emissions in terms of particulate matter and heat?
Indicator	Open questions to gain insight into the legitimacy of legislation, agreements and targets
Respondent	Policy-makers, users, affected groups
Issue	Water scarcity
Questions	Are there legal restrictions or obligations regarding water scarcity (e.g. imposed limitation of water usage or restriction for water resource extraction)? If violations are common, how could that be?
Indicator	Open questions to gain insight into the legitimacy of legislation, agreements and targets
Respondent	Policy-makers, users, affected groups
Issue	Water quality and resource scarcity
Questions	Are there legal restrictions or obligations regarding water quality and water treatment? Does legislation promote or perhaps inhibit transition to sustainable management (e.g. ban on reusing sewage sludge or recovery of resources)?
Indicator	Open questions to gain insight into the legitimacy of legislation, agreements and targets
Respondent	Policy-makers, executive agencies, users, affected groups

Preparedness

Implementation capacity is strongly increased due to existence of procedures, scripts for action that support policy and prepares the city both gradual and sudden unknown changes and events. The questions refer to both the existence of plans, and the awareness of these plans. The desk research could focus on the existence of action plans, how they are communicated, if they are rehearsed, if staff, volunteers and equipment are appointed.

Questions	
Issue	Flood
Questions	What are the recent experiences with flooding? What was the response and what are the lessons to be learned? Do you know what to do prior, during and after a flood event? Are long-term projects regarding floods adequately planned?
Indicator	Open questions to gain insight into the preparedness to calamities. Ordinal scale: [no plan ←→ detailed, adaptive plan]
Respondent	Policy-makers, affected groups, executive agencies
Issue	UHI
Questions	What are the recent experiences with UHI? What was the response and what are the lessons to be learned? Do you know what measures you can take to deal with UHI, prior (green roofs, blue and green areas) and during a calamity (drinking water, wear light clothes)? Are there implementation plans for long-term projects regarding UHI?
Indicator	Open questions to gain insight into the preparedness to calamities. Ordinal scale: [no plan ←→ detailed, adaptive plan]
Respondent	Policy-makers, real estate owners, executive agencies
Issue	Water scarcity
Questions	What are the recent experiences with calamities regarding the issue? What was the response and what are the lessons to be learned? Do you know what you should do during a drought? Are there plans to reduce water resource depletion?
Indicator	Open questions to gain insight into the preparedness to calamities. Ordinal scale: [no plan ←→ detailed, adaptive plan]
Respondent	Policy-makers, users, affected groups
Issue	Water quality and resource scarcity
Questions	What are the recent experiences regarding water quality? What was the response and what are the lessons to be learned? What actions can you take to prevent or improve poor water quality? Are there implementation plans for long-term projects regarding water quality and resource recovery??
Indicator	Open questions to gain insight into the legitimacy of legislation, agreements and targets
Respondent	Policy-makers, executive agencies, users, affected groups

Appendix III City Blueprint baseline assessment of the City of Leicester (UK)

The City of Leicester is located in the East Midlands of England (Fig. 0.1). The river Soar passes through the city. The responsible water service provider in Leicester is Severn Trent Water, which provides drinking water and wastewater collection and -treatment. The baseline assessment has been conducted using the City Blueprint Questionnaire which is available online at http://www.eip-water.eu/City_Blueprints.



Figure 0.1 The location of Leicester (UK). Source: Google

The City of Leicester has relatively low concerns, as is expected for a city in the developed world. However, there are some trends and pressures that require further elaboration. Indicator 4 (political instability) scores as a medium concern. However, this number represents the national political (in)stability and is out of the influential reach of local governance. Indicator 6 (flood risk) yields a relatively low score. It underestimates the actual risk because it also takes into account marine flooding, which is no threat as the city lies in-land. Nonetheless, the city is prone to fluvial flooding, resulting in occasional floods (Leicester City Council 2011). The water quality is calculated with the sub-indicator 7.1 Water Quality Index (WQI), which is a national statistic. The sub-indicator 7.2 Biodiversity is determined based on the classification in the Water Framework Directive (WFD) on national scale. Within the Humber river basin (which includes the Soar river) only 9% of the water bodies have a 'good' ecological status or potential (Environment Agency 2009). Therefore, the actual water quality within the Soar River basin can be assumed to be lower than the national average. Finally, the unemployment rate of the City of Leicester is 7.7%, which is 2% higher than the national average (Nomis 2015). From the global perspective this is relatively low, however, from a national perspective this indicator can be considered a concern (see Fig. 0.2).

The baseline assessment reveals that there could be improvement in treatment of wastewater and resource- and energy recovery from wastewater and solid waste. Leicester had expanded mostly in the industrial revolution. Parts of the sewer system still date from Victorian times and the actual capacity and condition of the sewer is unknown. This also means that there is a predominantly combined sewer system. The city is exploring possibilities to develop the water front. This indicates that currently water is not seen as something attractive. The city scores well with access to sanitation and drinking water, which is of high quality. Furthermore, the city council and Severn Trent Water are aware of possible climate change impacts and have expressed and shown the ambition to take measures (see Fig. 0.3). For the complete assessment, please contact the author or the City Blueprint Action group.

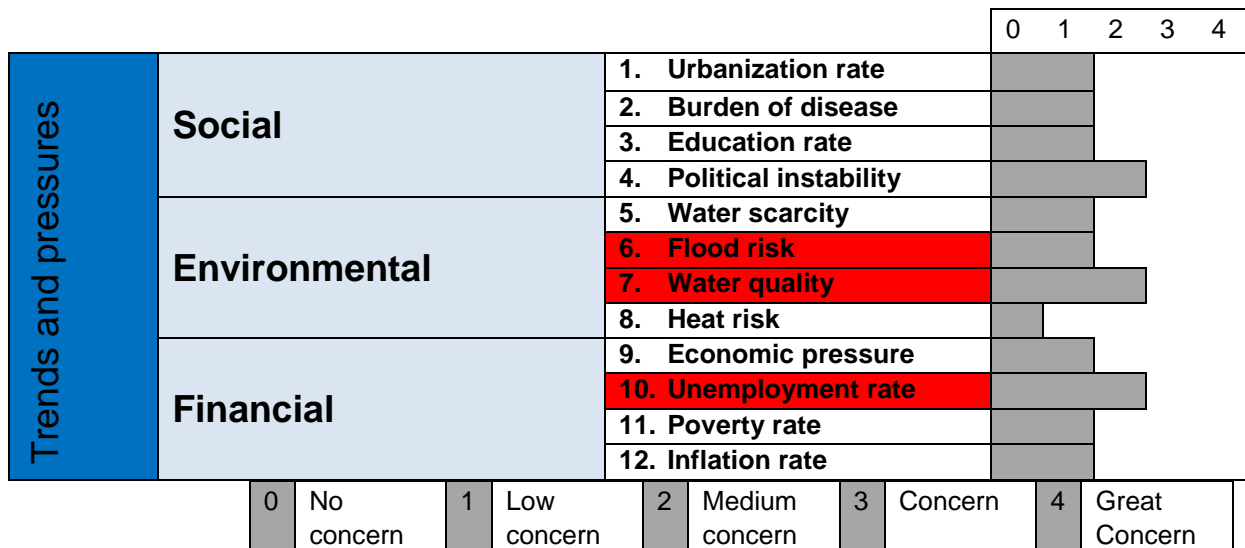


Figure 0.2 The Trends and Pressures Framework of Leicester

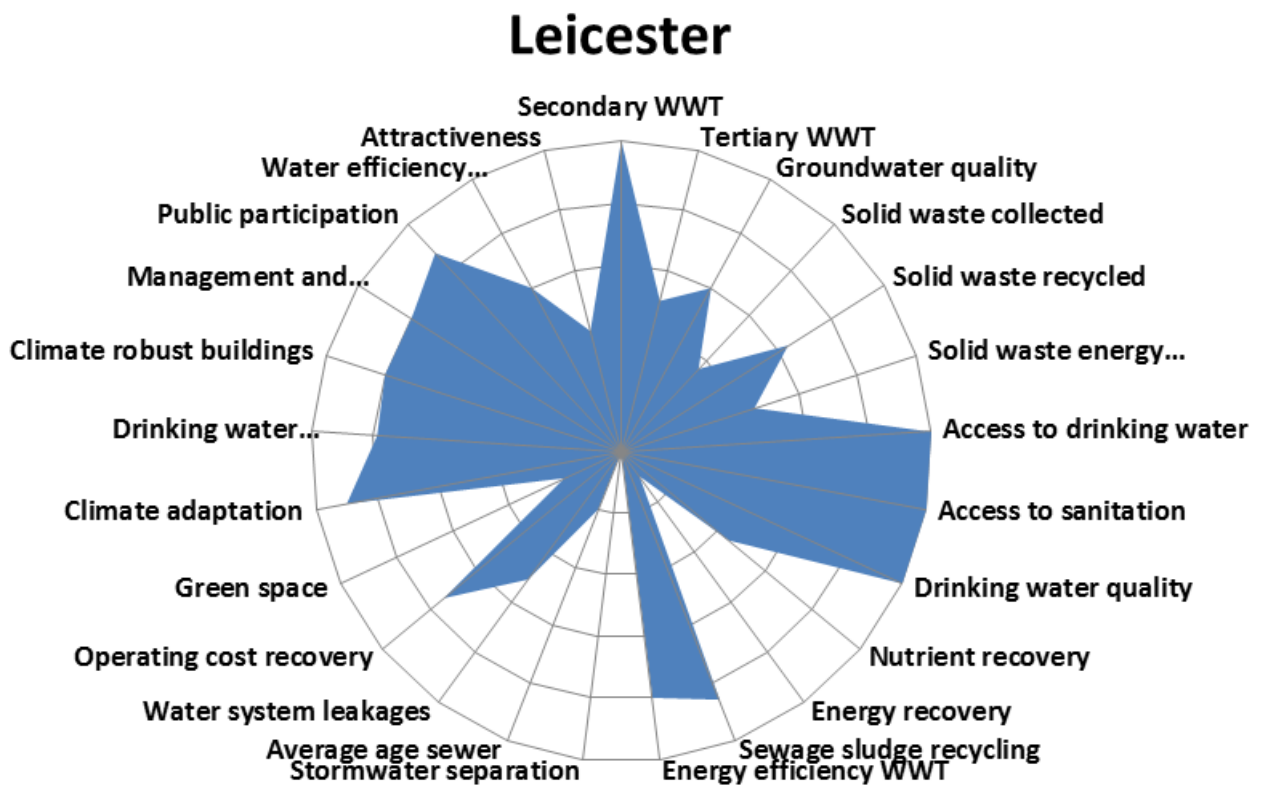


Figure 0.3 The City Blueprint of Leicester

