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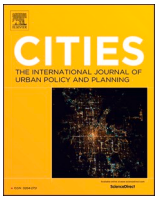

Governance assessment of a blue-green infrastructure project in a small size city in Belgium. The potential of Herentals for a leapfrog to water sensitive

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ABSTRACT

Climate change, population growth and land-use change have increased the risk of urban floods. Urban floods cause severe damages to cities and their inhabitants, and they are expected to increase over time. Consequently, urban adaptation is required to shift from traditional infrastructure to Blue-Green Infrastructure (BGI). Until recently, studies on BGI implementation have centred around large cities in developed countries. Meanwhile, medium and small size cities have received less attention. According to the Urban Water Management Transition Framework (UWMTF), cities can leapfrog towards more 'water sensitive' practices. Although leapfrogging is context-dependent, our understanding of how governance factors support leapfrogging remains embryonic. This paper contributes to the scholarly understanding of the governance factors that support and limit leapfrogging. By applying the Governance Assessment Tool (GAT) and considering three catalytic factors that underpin leapfrogging, this research assessed the process to implement the BGI project named Olympiadelaan in Herentals, Belgium. Overall, the governance context support was assessed as moderate. The regional and provincial governments play a key role in reaching this moderate level of support. This moderate support helps the city level to speed up its urban water management transition, but it is not enough to skip the states in the UWMTF.

1. Introduction

Urban floods have been increasing around the world due to factors such as climate change, changes in the use of land, population growth and aging infrastructure, among others (Bonasia & Lucatello, 2019). Climate change-induced floods cause billions of Euros of damage every year and their impact might increase (Ward et al., 2017). It is expected that floods become more frequent and severe with damages in Europe reaching the 23.5 billion Euros by 2050 (INTERREG 2 Seas Mers Zeeën, 2013). Therefore, climate change is making adaptation at the local, national and international levels a crucial need (Adger et al., 2005). The impact of climate change is expected to be experienced locally (Carter et al., 2015) and cities worldwide are among the areas where climate change impacts will be higher. The cost of climate change for cities could reach 10.9% of their GDP by 2100 (Estrada et al., 2017, p. 404).

Recent studies of the Organization for Economic Co-operation and Development (OECD) countries demonstrate that governance is key to reach the Sustainable Development Goals of the United Nations and to face climate challenges, including flood risks. Similarly, collaboration across different policy sectors and among the different governmental levels is key to accelerate adaptation processes (OECD, 2019a, 2019b). Against this background, our research focuses on the small city of Herentals in Flanders, Belgium. We believe our results are of interest for other OECD countries and more specifically for those countries where territorial planning competencies are entrusted to subnational entities, as they illustrate the relevance of subnational governments for coordinating and supporting climate adaptation policies. Additionally, our results are relevant for small or medium size cities interested in developing infrastructure to address water-related climate change risks. Medium and small size cities are very relevant in the European context. When stating that 70% of European population lives in cities, it is commonly overlooked that 56% live in small or medium size cities (Servillo et al., 2017).

Recent studies suggest that global temperature has increased 1.0° C when considering pre-industrial levels (OECD, 2019a). In Belgium, temperature could increase between 1.5 °C and 7 °C degrees by the end of the century due to climate change. This might increase precipitation up to 30% during winter by 2100 (OECD, 2013). Due to these projected changes, researchers have agreed that new solutions need to take into account uncertainty, flexibility and adaptability to enable urban water

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transition (Larsen et al., 2016). In the case of Belgian cities, pluvial floods have a dominant impact over fluvial floods (Cauwenberghs et al., 2018). Most of the floods have been caused by pluvial rather than tidal events, because high degree of land sealing has caused low infiltration capacity (Mees et al., 2016). The floods of 1998 and 2002–2003 in Flanders demonstrated the relevance of a new flood approach at city level. Therefore, different governmental levels started planning and developing infrastructure that could allow more room for water in cities or around them in order to be better prepared in the long-term (Mees et al., 2018).

Climate change adaptation requires strategic investments to deliver long-term sustainable solutions (Brown et al., 2008). Increasing adaptive capacities requires the ability of city governors, economic actors and residents as well as their associated structures and systems to be prepared to the potential harm of climate change and to take advantage of emerging opportunities to reduce vulnerability (Carter et al., 2015). It is considered that Blue-Green infrastructure (BGI) supports better adaptation of cities to the climate change effects (Brears, 2018). This adaptation means a shift from traditional infrastructure to a multifunctional infrastructure (BGI) (Casiano Flores, Crompvoets, et al., 2019). Hence, making cities more resilient to climate change requires a holistic approach that includes cross-organizational resilience and collaborative efforts (Marana et al., 2019).

BGI is seen as a strategic investment and a step forward from traditional infrastructure. Traditional infrastructure aims to send rainwater from the flooded area to the closest water body (Brears, 2018). Although this type of infrastructure has been effective, its negative effects include: a) changes to the local hydrological cycle, b) increases in peak flows, c) increases of risks downstream, d) changes to groundwater and surface water levels and e) inadequate infrastructure capacity due to the increase in extreme weather conditions. Consequently, BGI is currently considered a better approach to respond to flood risks (Brears, 2018) and is one of the actions recently proposed by the European Commission under the EU strategy on adaptation to climate change (European Commission, 2021). BGI is defined as a network of both strategic and planned infrastructure designed to protect bio-diversity, to deliver ecosystem services and to provide multiple social services. Examples of BGI include green buildings, parks or multi-functional facilities such as schools, museums, etc. (Brears, 2018). Multifunctional infrastructures are attractive for society and can combine urban ecology with safe and usable spaces (Hoyer et al., 2011). Cities such as Melbourne, Rotterdam or Portland have become an inspiration in this respect (Brown et al., 2016; Hoyer et al., 2011).

Until recently, studies of BGI have focused mainly on large cities, while less attention has been directed to medium or small size cities (Junghans et al., 2018; Özerol et al., 2020). Furthermore, studies tend to focus on leading cities and neglect middle and small size cities and towns (Kern, 2019). In particular, small size urban areas with a population between 5000 and 100,000 inhabitants are largely ignored by both academic literature and policy makers at national and European level (Servillo et al., 2017). Medium and small size cities face specific challenges: they have less autonomy than large cities when dealing with climate change adaptation and many measures taken in the water catchment are outside the boundaries of the city (Dolman et al., 2018). Additionally, when dealing with climate challenges, medium and small cities commonly lack expertise, human resources and a budget for large investments (Özerol et al., 2020). Literature on urban water transitions of small and medium size cities in Northern Europe, including Flanders, is scarce (Özerol et al., 2020). To fill this gap, we have selected the small city of Herentals in the province of Antwerp, which is part of the Flemish region.

Similar to medium and small size cities, research on leapfrog or leapfrogging in urban water transitions has received little attention. For example, a review of literature in the Scopus database with the support of ASReview program (van de Schoot et al., 2021)[1] identified 122 documents that related "leapfrog" concept with "city" studies. 68 out of these 122 documents focused on the topic of land, urban and growth development. In this context, "leapfrog" refers to urban development/growth that is discontinuous and dispersed (Shuvo, 2013). In contrast, in the topic of water only two articles were identified (Brodnik et al., 2018; Casiano Flores, Crompvoets, et al., 2019).

The concept of leapfrogging in relation to transitions developed in the 1980s (Sauter & Watson, 2008) and initially focused on the industry and technological sector (Binz et al., 2012; Goldemberg, 1998, 2011; Sauter & Watson, 2008). From a sustainability perspective, studies on leapfrogging are perceived as simplistic (Binz et al., 2012), having overoptimistic assumptions and underestimating the requirements for leapfrogging (Perkins, 2003). Leapfrogging has started to receive worldwide attention from international organisations and governments as part of the urban water transitions research as it is considered an efficient response to the water challenges caused by climate change (Casiano Flores, Crompvoets, et al., 2019). Its study can provide relevant insights into the limits of urban transitions and it is very relevant for both developing and developed cities. In fact, more than 50% of cities worldwide do not have an appropriate sewer or storm drainage systems and many developed cities have historically made important investments in single purpose systems, which require investments into their maintenance (Dolman & Ogunyoye, 2019).

Despite its relevance, few studies have been developed to understand leapfrogging in urban water transitions. In this regard, literature still has a "scarce" (Watson & Sauter, 2011) and "embrionic" understanding of the leapfrogging concept as well as a weak theoretical background (Binz et al., 2012). For example, a review of the literature with keywords "leapfrog", "water" and "governance" in the Scopus database and its further analysis employing the ASReview program resulted in the identification of 144 documents. From this total, only five were identified as relevant when analysed with ASReview (see Fig. A in the additional material). Three out of the five studies focus on the leapfrogging of cities to a water sensitive state, in Indonesia (Brodnik et al., 2018), specifically in Port Vila, Vanatu (Poustie et al., 2016) and the other study in the city of San Pedro Cholula, Mexico (Casiano Flores, Crompvoets, et al., 2019). The remaining two articles focus on environmental leapfrogging and sustainable water consumption (Evans et al., 2020) and water supply governance in Accra leapfrogging from government to governance (Suleiman & Cars, 2010). Some additional (non-Scopus) literature was identified for Port Vila, Indonesia (Brodnik et al., 2018; Poustie et al., 2016; The Australia-Indonesia Centre, 2018) and Addis Ababa, Ethiopia (Habtemariam et al., 2018).

Against this background, our research aims to contribute with empirical insights to the scholarly understanding of leapfrogging by assesing the governance factors that support or restrict the implementation of BGI in the small size city of Herentals, Belgium. The case of study is the Olympiadelaan project: the first BGI project in the city. Therefore, it implies a transition from traditional infrastructure to multifuctional infrastructure. This assement will employ the Governance Assessment Tool (GAT) to identify the governance context support for this transition; thus, the leapfrogging potential of the city from a governance perspective. The GAT assessment is based on semi-structured interviews and the revision of secondary data. The following section will explain in detail the urban transition framework on which we base our leapfrogging research. Then, we present the methodology used for our analysis. This is followed by the case of study

[1] ASReview uses Artificial Intelligence aided tools, it facilitates abstract screening, it categorizes the articles of the selected data base from the most to the least relevant and its result is reproducible.

description. The last sections present the results, the discussion and the conclusion of our study.

2. The Urban Water Management Transitions Framework and its relation to leapfrogging

The framework proposed by Brown et al. (2008) - Urban Water Management Transitions Framework (UWMTF) - conceptualizes the evolution of the urban water infrastructure. The UWMTF helps to identify key features of more sustainable urban water practices. It allows benchmarking at the macro-scale by establishing a typology of six city states where the final aim is to reach a "water sensitive city" (WSC) state. In this state, the city has an integrated water management cycle, it is resilient to climate change, and it has multi-fuctional infrastructure and an urban design that reinforces water sensitive behaviours (Brodnik et al., 2018). The WSC concept was developed on a premise that the largest part of the population lives in cities and therefore a more sustainable water management is required (Brown et al., 2008).

Cities are complex systems where various actors and processes interact through geographic, institutional and governance scales (Bai et al., 2016). The type of adaptation depends on the cultural, technological, economic and governance contexts (Adger et al., 2005). Consequently, adaptation to increase flood resilience capacity can be considered more a governance issue than a technological one (Rijke et al., 2013). Water management challenges in cities highlight the relevance of solving governance challenges, such as fragmented scopes, viewpoints, and responsibilities (Koop et al., 2017). Reaching a WSC state involves the interaction of different disciplines such as water sciences, urban planning, urban design and engineering, among others (Salinas Rodriguez et al., 2014). At the same time, it requires institutional changes that reinforce shifts within the institutional practices (Brown et al., 2008). An assumption of the UWMTF is that cities can skip some stages to reach a WSC state faster, without having the need of a linear process (Salinas Rodriguez et al., 2014). This non-linear process is called leapfrogging.

Leapfrogging provides an alternative route for cities where they can skip stages of transition pathway to introduce a more sustainable infrastructure directly (Brown et al., 2016). This transition requires a more decentralized approach and depends on policy and organizational structures, meaning the institutional context (Binz et al., 2012). Institutions provide a key framework that can support or limit the innovations required for leapfrogging. Due to their relevance, the role of policy processes and institutions for leapfrogging needs to be understood better considering a governance perspective (Sauter & Watson, 2008). Hence, the governance context plays a key role since governance arrangements can support adaptation strategies (Carter et al., 2015). "Whether and under which conditions such a leapfrogging would be possible is [still] highly contested" (Binz et al., 2012, p. 155). Research has found that cases of leapfrogging vary from country to country (Sauter & Watson, 2008).

Dolman and Ogunyoye (2019) developed the UWMTF further to provide a more detailed understanding of cities' urban water management transition when considering water infrastructure projects and leapfrogging possibilities. Fig. 1 shows how cities with single purpose infrastructure correspond to an early state in the transition process and how leapfrogging in developing cities can help to skip more states than in developed cities and how multi-functional infrastructure corresponds to more advanced water management stages. They also consider that a Waterway state has three sub states. The first one, infrastructural network, corresponds to BGI which is still very engineer driven, such as city squares that catch rainwater, have few trees and provide social services. The second sub state is when the project affects the urban network such as an elevated park. Finally, the last sub state, natural network, is focused on nature-based solutions and the development of natural networks.

We will base this research on the contribution from Dolman and Ogunyoye (2019) to the UWMTF and the work of Casiano Flores, Crompvoets, et al. (2019) using the GAT to assess in a systematic manner the governance context for leapfrogging, which requires a transition from mono- to multi-fuctional infrastructure. The following section will explain our methodology and the use of the GAT.

3. Methodology: the Governance Assessment Tool and its application

This research employs the Governance Assessment Tool (GAT) to assess how the governance context supports or restricts the implementation of the BGI project. This assessment will help to identify the leapfrogging potential of the city of Herentals from a governance perspective. The GAT belongs to the frameworks that consider contextual factors when implementing a policy (Ansell & Gash, 2008; Bressers & Kuks, 2013; Knieper et al., 2010; Ostrom et al., 2007; Pahl-Wostl, 2009; Thiel & Egerton, 2011; Van Rijswick et al., 2014). Contextual consideration requires context-specific answers, rather than "panaceas" or "universal remedies"(Gupta et al., 2013; Ostrom et al., 2007; Pahl-Wostl, 2015). The GAT is based on the Contextual Interaction Theory (CIT) (Boer de, 2012; Bressers, 2009; Bressers et al., 2015; Bressers & Kuks, 2004; de Boer & Bressers, 2011). It is a framework that can be applied when there is a multi-level setting with interdependency among the actors (Casiano Flores et al., 2017; Casiano Flores, Özerol, et al., 2019). This interdependence must at least be classified as a "legislatively initiated coordination" (Gage et al., 1990) even if it is not fully implemented.

The GAT has been applied to assess the water governance context in

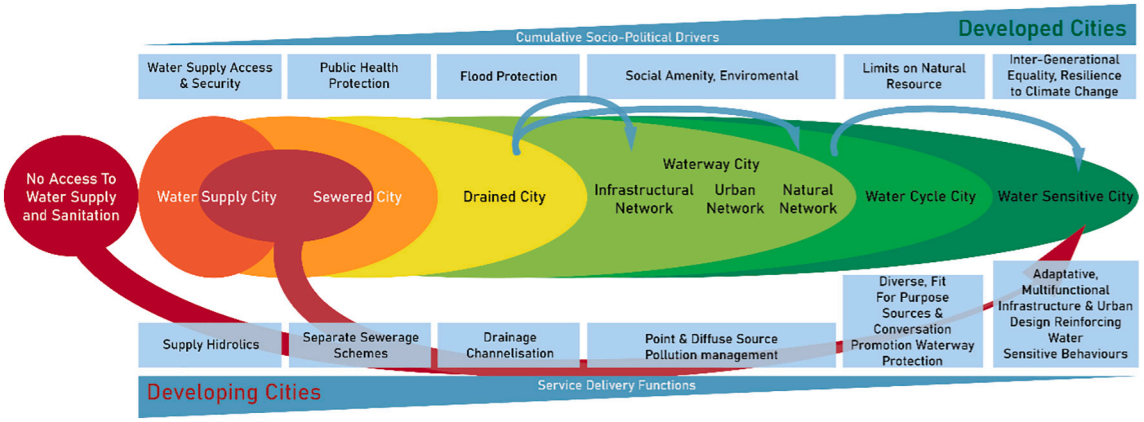

Fig. 1. Adaptation of the Urban Water Management Transitions Framework for leapfrogging of developing and developed cities (Dolman & Ogunyoye, 2019).

different European countries (Bressers et al., 2016; Vikolainen et al., 2017; Vinke-de Kruijf et al., 2015) and to assess the leapfrogging capacity in a medium size city in Mexico (Casiano Flores, Crompvoets, et al., 2019). The GAT considers governance as "beyond merely government", it is a context for decision-making and implementation, which can be either supportive or restrictive for those processes. GAT divides the governance context into the descriptive-analytical elements and the semi-normative qualities (Casiano & Boer de, 2015). The five descriptive-analytical elements are called the "dimensions of governance", which are multi-level, multi-actor, multi-faceted, multi-instrument and multi-resourced based. These five dimensions describe the governance regime (Bressers & Kuks, 2013) and they are attributes upon which the governance quality is assessed. The "semi-normative" characteristic implies that the normative contents of the qualities are derived and dependent on the policies under assessment. The four semi-normative qualities are: extent, coherence, flexibility and intensity. Together, the dimensions and the qualities assess how supportive the context is for the implementation of the policies under study. The four criteria are defined by the questions they pose (Bressers et al., 2016):

Extent: are all elements in the five dimensions, which are relevant being addressed, taken into account?
Coherence: are the elements in the dimensions of governance supporting, rather than contradicting, each other?
Flexibility: are multiple roads to the goals, depending on opportunities and threats as they arise, permitted and supported?
Intensity: how strongly do the elements in the dimensions of governance urge changes in the status quo?

The questions around each dimension allow a systematic analysis of the governance context. The combination of the five dimensions of governance and the four qualities conform the GAT 'matrix' model (Bressers et al., 2015). This GAT matrix is available in the additional material as Table A.

Considering that leapfrogging is context-dependent and that our understanding of factors that support leapfrogging remains embryonic, this research applies the GAT through semi-structured interviews and the review of secondary data in an in-depth case analysis. This type of analysis allows focusing on details overviewed by statistical analyses (Lijphart, 1975). Case studies complement theory and allow generalisations of theoretical prepositions (Yin, 2009). In depth case studies of urban water transitions can increase our understanding of the dynamics of water transitions. They are considered a pillar of transition studies since they can enhance the explanatory capacity of transition frameworks (de Haan et al., 2015).

The GAT has an institutional perspective with contextual considerations (Bressers et al., 2016) and enables a systematic analysis of the governance context by assessing to what extent the governance context restricts or supports policy implementation. Therefore, interviews with policy implementers are a key aspect. The interviews for this research were conducted with all the steering committee members of the Olympiadelaan project. There were two rounds of interviews, eight interviews each. Each interview was conducted in an individual manner with semi-structured questions. This type of questions allow the actors to explain both their role and point of view as well as to obtain relevant information (van Rij, 2008). The questionnaire was based on the GAT matrix and was divided into 6 sections. The first section focused on the general context of the project, meanwhile the second section focused on the collaboration of the different governmental levels. The third section had its focus on the collaboration between governmental and non-governmental actors. The fourth section focused on the agreements and disagreements between the different actors, considering their perceptions and goals. The fifth section focused on the availability and use of the different policy instruments that could support or hinder the implementation of the project and finally, the sixth section focused on the responsibilities and instruments available and employed by the different actors to support the project.

The first round took place in September 2018 and each interview lasted 1 h. The second round was from November 2019 to March 2020. In this case the interviews lasted between one and 2 h. Table 1 shows the affiliation of the interviewees.

The GAT matrix, Table A (Bressers et al., 2015) and its operationalization, Table B (Casiano Flores, Crompvoets, et al., 2019) available in additional material, were used to interview the steering committee members and to evaluate the governance context. Table B (additional material) is an evaluation matrix that was developed based on the previous research that identified three catalysts for leapfrogging a) Trans-disciplinary science, b) Cross-sector partnership and c) Innovation experiments (Brodnik et al., 2018). Trans-disciplinary science considers that solutions need to include an integral perspective with a shared vision and knowledge from the different stakeholders and not be based on a mono-disciplinary approach. Cross-sectoral collaboration points out the relevance of collaboration between the different sectors such as academia, business, government and civil society. Lastly, innovation experiments provide the opportunity to learn by doing and to do by learning as well as sharing knowledge to adapt the proposed solutions to local contexts (Brodnik et al., 2018). In other words, leapfrogging requires experimentation with innovative technologies and their adaptation to the local context (Brown et al., 2016). Consequently, Table B includes the three catalysts for leapfrogging to assess the leapfrogging potential. By including the three catalyst factors in the GAT, we are providing systemization to the assessment. Systematization is a way of sorting through complexity, allowing a framework for practitioners to consider the context and dynamics of their particular settings (O'Toole, 2004). This evaluation matrix has already been applied to assess the leapfrogging potential of a medium size city in Mexico, San Pedro Cholula (Casiano Flores, Crompvoets, et al., 2019).

Each evaluative quality is assessed based on the interviewees' answers. To assess each cell of the matrix, each interviewee response is analysed individually and then compared with the rest of the stakeholders' answers to reach a general conclusion. This analysis is complemented or contrasted with data from secondary sources. The results are considered reliable because most of the interviewees consistently reported in similar and complementary ways. As in previous GAT applications, the degree of the quality in each dimension is compared with the other dimensions to determine a general assessment per quality (Casiano Flores, 2017; Casiano Flores, Crompvoets, et al., 2019; Casiano Flores, Özerol, et al., 2019; Vikolainen et al., 2017). Table B (additional material) presents the range of the conditions within each cell to be assessed as low, moderate or high. The final assessment of each quality can be assessed as: High support, Moderate support, Moderate-low support and Low support. High support is when most of the dimensions are assessed from Moderate-high to high. Moderate support is when most of the categories are between moderate and high. Moderate-low is when most of the categories are assessed between moderate-low and low and it is low when there is an overwhelming majority of low degree in each governance dimension of the quality. In order to understand the governance context support for leapfrogging, we have selected the city of Herentals. The next section will explain the background of our selected case.

Table 1
Affiliation of the actors interviewed.

City government	Provincial government	Regional government
Spatial Planning Department Municipality of Herentals Municipal Commission of Spatial Planning	Antwerp Spatial Planning Agency	Flanders Environmental Agency Flanders Heritage Agency Flanders Nature and Forest Agency

4. Case study: the Flemish flood management evolution and the city of Herentals

Flood governance is fragmented in Belgium. The three Belgian regions (Brussels, Wallonia and Flanders) are in charge of water management and spatial planning, while emergency planning and insurance are the responsibility of the federal government, creating a high number of actors and legal frameworks at the four Belgian governmental levels: municipal, provincial, regional and national (Mees et al., 2018). The Northern region, Flanders, is highly populated and vulnerable to floods (Verbeke & Devroede, 2017). In Flanders, water management competences are also highly fragmented. The management of watercourses and spatial planning are addressed at the three governmental levels (regional, provincial and municipal) (Mees et al., 2018). According to the legal framework, Flanders is in charge of risk prevention and flood mitigation. It also monitors non-navigable rivers and population warning systems, while the federal government is in charge of disaster planning and evacuation plans (STAR FLOOD, 2016).

Until the 1980s, the Flemish approach to water management was sectorial and technical, based on technical flood defense measures (Davids et al., 2019). The institutional reforms that took place between 1980 and 1988 transferred the responsibilities for spatial planning and water management to the regions and within the regions, internal reforms also took place (Mees et al., 2018). Since 2013, in order to improve the flood protection policy, the Flemish Environmental Agency has stimulated a multi-layered flood prevention and safety policy, protection and preparedness with shared responsibilities between managers and other actors (Liefferink et al., 2018). Additionally, the Flemish Environmental Agency launched the concept of Multi-Layer Water Safety in 2013, which includes flood prevention, protection and preparedness measures. This approach shared the responsibilities among various actors such as water managers, actors from different policy domains and society in general (Mees et al., 2018).

Since the 1980s, water management and planning in Flanders have become more interconnected due to new instruments such as the flood risk maps and the water assessments (Davids et al., 2019). The water assessment was introduced by the 2013 reform to the 2003 Decree on Integrated Water Policy. The assessment requires an advice from the water manager on the impact of a permit, plan or program on the water system (Mees et al., 2018). In 2014, the Sixth State Reform allowed municipalities to transfer competences for their watercourses to the provinces. In this sense, the flood policy has experienced a recentralization at the regional level, which overtook the steering role of the federal level, becoming the main policy entrepreneur (Mees et al., 2018). Furthermore, an institutional body, the Coordination Commission on Integrated Water Policy, was established to better coordinate water management and spatial planning. The Commission is the key actor for flood risk management in the region of Flanders and it plays an important role for the integration of the water policy in Flanders. It drafts and coordinates risk management plans which are integrated in a legal manner in the river basin management plans (Verbeke & Devroede, 2017).

Important changes also took place in water management between 1995 and 2015. The nature-based solutions in water management as well as coordination between the governmental actors became more commonplace (Mees et al., 2018). After the floods of 1998 and 2002–2003, there was a shift from a flood policy based on rapid water drainage to a policy that considers room for water (Mees et al., 2018). There has been an increasing attention to nature-based and spatial planning flood solutions (Mees et al., 2018). In addition, the legal alignment between the flood risk objectives, the implementation of the flood risk management plans, which are integrated to the river basin management plan, generates a useful framework to reduce flood risk in Flanders (Verbeke & Devroede, 2017).

According to the 2011 census, Herentals has a population of 27,2179 inhabitants and covers the area of 48.6 km^2 (City Population, 2020). The case of study is the BGI Olympiadelaan project in the city of Herentals. Herentals is part of a group of cities where pilots are being implemented as part of the EU Interreg project "Water Sensitive Cities: the Answer To CHallenges of extreme weather events" (CATCH). Herentals has been classified as a city in the Drained city state by the CATCH experts. The cities of the CATCH project are located in areas that are already suffering the climate change effects such as heavy rains, increasing frequency of rains and intensity of floods (Dolman et al., 2018; Özerol et al., 2020). The objective of the CATCH project is to accelerate the process of climate resilience by redesigning urban water management of the cities (Dolman et al., 2018). The Olympiadelaan project is described by local actors as unprecedented. It allows to understand the "new complexity" that local actors are experiencing and how the different actors are dealing with it. This project permits us to study the water management transition from mono-functional to multi-functional infrastructure and how the local actors are changing their implementation practices to adapt to the requirements of BGI projects. At the same time, our governance approach helps us to understand the support of the governance context in a systematic manner. In other words, the choice of our case allows us to understand the governance network that local governments are developing to work on climate change adaptation (Aylett, 2015). The objective of the project and its impact on the urban water management in the city of Herentals makes the Olympiadelaan project an appropriate case of study.

The Olympiadelaan project is located between the Olympiadelaan road and the railway line. It is part of the larger Kleine Nete valley plan. Fig. 2 shows the location of the project. The idea is to design a project that combines different functions: recreation, nature, heritage and a more sustainable water management. The Flemish government organized a public consultation in June 2019 where it presented the future of the valley where the project is located. This valley is called the Kleine Nete (Provincie Antwerpen, 2019a). Among all the catchments in the Flemish region, the Nete catchment is the one where flood risk is less acceptable and requires measures to improve its status (Verbeke & Devroede, 2017). The citizen consultation revealed concerns about the access to green areas and mobility. The intention of the Flemish government is to design and manage this valley in a way that it can absorb climate change-induced shocks and at the same time contribute to food, water and energy supply, preservation of biodiversity, heritage and landscape quality (Provincie Antwerpen, 2019b).

The following section will present the results of our assessment.

5. Results of the governance assessment for the Olympiadelaan project in Herentals

This section presents the results of our case of study. The matrix in Table 2 summarizes the results obtained from the governance assessment. These results are explained in a systematic manner below. They are presented considering the order of each governance dimension: a) Levels & Scales, b) Problem perspectives & Networks, c) Problem perspectives and Goal ambitions, d) Strategies and Instruments and e) Responsibilities & Resources.

6. Levels & scales

6.1. *Extent: high*

The government levels involved in the project are: European, regional, provincial and the city. The European level is participating through the Interreg project, which supports experience exchange with other small and medium size cities in the Northern region (Özerol et al., 2020). The Flemish government is involved through the Water, Nature and Heritage Agencies. It has an overview of other nature and water projects in the region and their connection with the Olympiadelaan project. The province is the coordinator of the project through the Spatial Planning Agency with the support and involvement of the Spatial

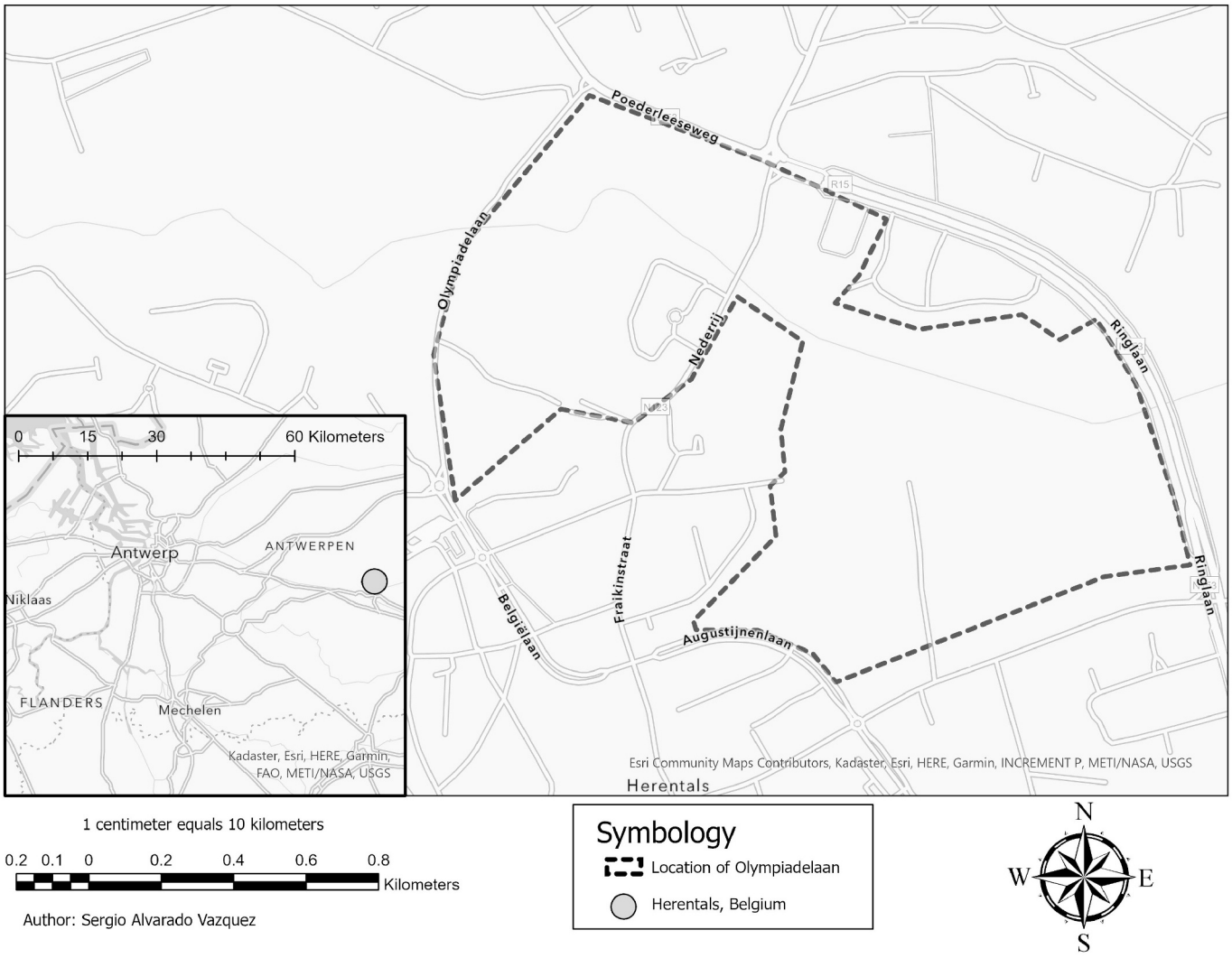

Fig. 2. Location of the Olympiadelaan project and the location of Herentals (Provincie Antwerpen, 2019c).

Table 2
Results of the governance assessment, the Olympiadelaan project.

Governance dimensions	Qualities of the governance regime			
	Extent	Coherence	Flexibility	Intensity
Levels & Scales	High	Moderate-high	Moderate	Moderate-High
Actors & Networks	Moderate	Moderate	Moderate-low	Moderate
Problem perspectives & Goal ambitions	Moderate-high	Moderate-high	Moderate	Moderate
Strategies & Instruments	Moderate	Moderate	Moderate	Moderate
Responsibilities & Resources	Moderate	Moderate	Moderate-high	Moderate
Final Assessment	**Moderately Supportive**	**Moderately Supportive**	**Moderately Supportive**	**Moderately Supportive**

Planning Agency at the city level.

6.2. Coherence: moderate-high

The different government actors work together in a collaborative manner, but it has been a long and complex process. The discussions and agreements among governmental actors have been a key part of the Olympiadelaan project since the beginning. The steering group of the project meets on a regular basis (between 8 and 10 times per year). The interviewed government actors participate in these meetings. For the Flemish government it is clear that nothing will be done if the city does not support it. In general, this type of meetings is sometimes perceived as having a limited scope (e.g. one or two specific projects). However, they have allowed the introduction of new concepts such as 'water sensitive' or 'blue-green infrastructure' to actors who were unfamiliar with them. One element that has helped to facilitate teamwork was the initiative of the province to include a designer that could make some drawings of the Olympiadelaan project considering the different visions that the stakeholders have, to visualize the problems and to work them out together.

6.3. Flexibility: moderate

It is not possible to move up and down the levels for leadership, but the structure allows the levels to complement and respect each other in order to support the implementation of the project. In general, the Flemish approach is described by the interviewed actors as mainly top-down with each government level having its own planning and agenda. The process implies constant negotiations to create a common vision. When projects are brought to the table by the regional or provincial governments, the different governmental actors engage in negotiations.

In the case of the Olympiadelaan, it took three legislatures to start working on the project. The project is part of the bigger, longer-term Kleine Nete project. The Kleine Nete is a natural river in Flanders with good water quality, rich in nature and animal species. It spreads over 15 municipalities in Antwerp and Limburg provinces and is part of an EU Natura 2000 Network (VLANDEREN.be, 2019). The city government is a key actor but does not have the leader position. The dynamic of the actors follows and respects the governance structure and the capacity of the agencies. An agency with low resources and capacity in the process is aware that they cannot lead the project.

6.4. Intensity: moderate-high

The European Union, the Flemish and provincial governments are supporting the development of the Olympiadelaan project with the help and participation of the city of Herentals. This type of BGI projects are the result of the accumulated experience by the Flemish government. Examples of BGI projects where the Environmental Agency worked together with cities are the Dijle river project in the city of Leuven, which took place in the 2000s and the reopening of the Deme river in the city center of Diest in 2007 (VLAAMSE MILIEUMAATSCHAPPIJ, 2015). One way for the regional government to promote the implementation of such projects is by facilitating tools that can be used by local governments. In recent years, the Flemish government has launched and started promoting pluvial flood risk maps with climate change scenarios (Casiano Flores & Crompvoets, 2020). The municipal level considers that it is important to be open and to support the implementation of upper levels' proposals. In this sense, upper levels are taking the main lead. For example, the provincial government created the development plan that Herentals is part of and it expects that the Olympiadelaan can be a leverage project for other similar projects in the region.

7. Actors & networks

7.1. Extent: moderate

While governmental actors' network are fully involved in the project, social participation is limited. This hinders cross-sectoral collaboration. There is a local advisory group at the city level and there are some NGOs working in the area such as Natuurpunt. However, they do not take part in the regular meetings of the governmental actors where they discuss the project. Some governmental actors do not see this lack of participation as a problem since they prefer to reach agreements among themselves before presenting the projects to social actors. The governmental actors consider that public presentations are enough and direct communication with social actors only needs to take place when the project starts officially, and not when it is still in the planning phase.

7.2. Coherence: moderate

Cross-sectoral collaboration is limited to the governmental actors' network. The institutional relationship among governmental actors has improved with time and some level of trust has been built. However, this trust is limited to the actors who participate in the process and not necessarily to the agencies that they represent. To create trust with citizens, the governmental actors who participate in the implementation of the project consider that they need to be careful and confident when they present the project. They acknowledge that their collaboration with the social actors tends to be top down. The regional level finds it challenging to communicate with citizens. Based on their experience, people react better when governmental actors already have a clear plan of what they intend to do. However, this is also changing, and governmental actors are getting more used to discussing their project ideas with people. Nonetheless, governmental actors find it difficult to reach out to people who are not interested. For example, several interviewees feel that people who are against the projects have a lot of media attention, while people who are in favor are more difficult to mobilize. Therefore, they have learned that in many cases it is important to enable as much support as possible since the beginning. It took ten years to reach agreements among the governmental actors to start working on the Olympiadelaan project. Direct social participation in the BGI projects is still not fully institutionalized in Flanders.

7.3. Flexibility: moderate-low

There is no shift in leadership and social capital is very limited. It is possible to include new actors depending on the necessary project changes. However, this is only considered when the members of the steering group agree that this is really needed, since the negotiations take time and it is important to know how the new actor can really contribute to the project. Otherwise, there are concerns that the agreements could take longer. As mentioned before, the governmental actors start the consultation with social actors when the members of the steering group have reached an agreement. Yet, interviewed actors agree that social support is very important, some projects have been stopped due to lack of social acceptance. In this sense, it seems that no social capital is being created during the process and strong disagreement of societal actors can affect the projects considerably.

7.4. Intensity: moderate

Collaboration is still fragmented and limited to governmental actors to continue supporting the changes in favor of BGI projects. Different governmental actors acknowledge that the provincial and the regional government try to support such changes. The province is even trying to change the mentality of citizens by supporting the organization Kamp C, which helps local governments. This organization is located in the province of Antwerp and was created to speed up sustainable social transition, focusing on two main factors: sustainability and innovation (Kamp, 2020). The province has created the plan that includes Herentals project and BGI has become part of the infrastructure strategies of the Flemish government. Yet, there is ample room for collaboration when it comes to the inclusion of social actors.

8. Problem perspectives and goal ambitions

8.1. Extent: moderate-high

Most cross sectorial and trans-disciplinary perspectives are considered by the actors involved in the Olympiadelaan project. The following perspectives are brought forward by the four governmental levels: as a park, the project includes recreational facilities; as a natural area, it is expected to contribute to the implementation of the European Birds and Habitat directives; as a heritage site it ensures historical preservation; and as a water retention area it decreases flood risks. However, social perspective is limited to consultations such as the one on December 12, 2018 (Stad Herentals, 2018) or the one in June, 2019. The perspectives of social actors and those directly affected by the project (the football team, the hospital and a store located in the project area) are subject to one-on-one negotiations with the governmental actors.

8.2. Coherence: moderate-high

Most of the cross-sectorial and trans-disciplinary perspectives are considered. The key actors that are engaged in the Olympiadelaan project have managed to create common goals and visions. The regular meetings among the governmental actors have supported this process, even in the absence of a specific plan for climate adaptation. The department of spatial planning at the municipal level wants to go further and is working on a vision for Herentals on topics such as rainwater. However, in some cases an engineering perspective still dominates the issue. The municipal level still lacks ideas to retain water in the city. The

municipal government encourages the citizens to capture the water, use it and then discard the rest.

8.3. Flexibility: moderate

Goals are agreed upon beforehand and are difficult to reassess during the implementation. Yet, there are regular meetings and annual governmental evaluations that help to monitor the projects and the goals. Most of the changes must be agreed on before the implementation of the project. The changes are expected to be in line with the previous agreements and to reach the established goal.

8.4. Intensity: moderate

Currently, the perspectives of the actors are aligned with the main project goal. However, there are still some differences among the governmental actors when it comes to the details of the project. To address this situation, various scenarios have been drafted to show the different ways the project can be developed to facilitate discussion among the actors. Each scenario requires a different budget. It appears that the most appealing scenario is also the most expensive. This scenario requires the acquisition of a recent commercial construction, which would be costly. Therefore, negotiations are still taking place to find a less costly solution.

9. Strategies & instruments

9.1. Extent: moderate

Innovative strategies are limited to governmental actors. The strategies are based on current legislation and the legal mandate that each governmental actor has. The upper governmental levels agree that in the last 20 years the vision has changed from an engineering perspective towards a more integral one. The fact that the topic of climate change has become more common and that some of its effects have been felt, has helped to increase awareness. The Flemish and the provincial governments have promoted and implemented different pilot projects that increased their understanding of BGI project implementation processes. Among the first ones was the Leuven project in the 2000s. It is important to highlight that while for the municipal government the Olympiadelaan project is first of its kind, the upper governmental levels have already gained experience from previous pilots and projects. This experience is being applied in the Olympiadelaan project.

9.2. Coherence: moderate

Due to the 2013 reform, the strategies and instruments that have supported BGI have been institutionalized and policy fragmentation among governmental actors has decreased. Nevertheless, there are some important issues, for example between the Flemish Heritage legislation that oversees historical protected areas and the BGI projects. In the case of Herentals, there have been complications since the restrictions for new projects in heritage areas are high, which makes it difficult to agree on a final project. In this case, the Heritage Agency considers that legal restrictions are a handicap for the Olympiadelaan project, since the Agency perceives that the other governmental actors are not trying to overlook them but to find pragmatic solutions.

9.3. Flexibility: moderate

There is an opportunity to combine different instruments and strategies under the current legislation. On one hand, many governmental actors already know each other thanks to other projects where they have participated. On the other hand, the meetings that the different governmental actors have, allow to combine different instruments and strategies to favor the project. In this sense the actors agree that with time, there have been changes in the project that they want to implement. Yet, there are some important challenges regarding the flexibility of the governance context. For example, if the Olympiadelaan was a Flemish project instead of a provincial project, the Heritage Agency could be more flexible and could adjust the restrictions of the area. For the city, the Olympiadelaan project is the first of its kind, which has allowed local actors to familiarise with this type of projects that require the involvement of multiple agencies.

9.4. Intensity: moderate

According to the interviewed actors, some changes in the strategies and instruments are still required. One of the most important changes that could facilitate the implementation of BGI projects is the creation of comprehensive legislation that would cover BGI projects. Currently, there is no legislation in this regard and governmental actors have adapted themselves to make use of the existing legislation to implement these infrastructure projects. There is a number of potential changes that could facilitate project implementation. For example, reforms to the processes related to land use change and land compensation, in order to make them more flexible and efficient. Another way to improve the implementation of the project is to strengthen the coordination role, “the engine”. Some actors would like more involvement in terms of coordination by having a person whose full-time job was the project. Furthermore, the negotiations are still taking place with the football team, the hospital and the store that are affected by the project. In general, the city is undergoing changes to continue increasing its resilience capacity. One of the most important changes is related to the drainage. When the drainage needs to be replaced, it is being separated: one line for residual water and another for rainwater. However, this is a lengthy process.

10. Responsibilities & resources

10.1. Extent: moderate

Overall, the actors consider that the resources are limited. There is no collaboration or partnerships between public and private actors to increase the resources. The resources come from the governmental actors. Yet, after the budget cuts carried out by the Flemish government, the Kleine Nete projects have not been really affected since they are considered as one of the priority areas. The actor facing main budgetary constraints due to its mandate is the Flemish Heritage Agency. For example, the Heritage Agency can agree on the construction of a project such as a historical wall that would be beneficial for the BGI project. However, they cannot finance such construction since they are only in charge of the maintenance of existing structures. When considering the different scenarios for the project, the one considered as the best choice by the different actors is constrained by the budget. Therefore, negotiations on this issue are still ongoing.

10.2. Coherence: moderate

The responsibilities are clearly assigned, every actor knows his/her role in the project and represents the interests of its agency. While transdisciplinary implementation is well supported, cross-sectoral is limited. Spatial development involves the different government levels, important agreements need to be made among them, in order to allocate specific actions and responsibilities. This requires multi-level coordination. Nevertheless, the city of Herentals considers that the provincial level helps to have a larger vision, while the provincial government obtains a more detailed picture at the municipal level through the involvement of the local government. The most experienced are the upper levels.

10.3. Flexibility: moderate-high

The steering group is an example of the mechanisms that have been developed to support the participation of different agencies in BGI projects. However, in some cases the actors involved still find it complicated to navigate. This is the case of European subsidies for urban green areas, which require agreements and partnerships to be prepared in much shorter time than they usually take in Flanders. One important aspect that is outside the stakeholders' control, is the legal compensation system in cases of land use change. The provincial government can change the status of the land, but the compensation price is set in the court of law. This situation complicates the planning of resources since the provincial government cannot calculate the exact costs of this procedure for the project.

10.4. Intensity: moderate

The resources vary from agency to agency and the actors consider that they are insufficient. The collaboration makes it possible to pool the resources that can facilitate the implementation of BGI projects. For example, the provincial government does not have enough financial and legal resources to implement BGI by itself, so coordination and collaboration is required. An important barrier for the BGI projects is the multitude of landowners potentially affected by the project. In this sense, some of the interviewed actors consider that instead of legislation changes, changes in the procedures could be more effective. These changes should aim at facilitating the paperwork inside the agencies and the interaction with the social actors.

11. Discussions of results

The operationalization and application of the GAT allowed a systematic understanding of how the governance context supports the implementation of BGI in Herentals. These results increase our understanding of the leapfrogging potential of the city by identifying the status of the three catalyst factors for leapfrogging (trans-disciplinary science, cross-sector partnership and the implementation of innovation experiments). To do so, we used four governance qualities. These qualities were all assessed as moderately supportive, although some of them tend to support some governance dimensions more than others. Extent and coherence were identified as the qualities that support more governance dimensions. In this sense, our results confirm the increasing integration of the governmental levels in Flanders (Casiano Flores & Crompvoets, 2020).

In terms of extent and coherence, there is still room for improvement: the creation of legislation that considers BGI, implementation of projects that belong to more advanced stages such as decentralized rainwater catchment systems, a circular perspective for water management and a higher inclusion of social actors could take this integration further. Social participation is still very limited. Different governmental actors consider that agreeing among themselves first is very important. In the words of a regional actor: “agreements among governmental actors is one of the key aspects, before involving social actors… people expect clear plans from the government”. Otherwise, people feel that the government does not know what they want to do and this increases distrust in the Flemish context. “It is not easy to work together and create trust when there are many different interests over a small piece of land”. This situation could also be hindering more direct social participation. Urban climate resilience policies and strategies require the participation of public, private and social sectors (Özerol et al., 2020). The lack of social participation limits the creation of social capital but favors governmental control over the implementation process and shows the citizens that the government is certain about what they are doing. Yet, it is important to mention that some changes are starting to take place, in words of an interviewed city actor “People already expect plans from the government, but now they are also getting used to discuss ideas”.

The qualities of flexibility and intensity relate to the “quest for control” dilemma, which focuses on distrust or uncertainty versus trust and understanding (Boer de, 2012). From the GAT perspective, our results demonstrate that the Flemish governance context is “on a quest for control transition”. Therefore, in terms of flexibility, the implementation process is still perceived as top-down. It seems that governmental actors are familiar with and respect this type of process. In this sense, the Flemish governance context can be characterized as a hierarchical governance style, where “steering is based on authority and powers derives from the position in a formal hierarchy” (Pahl-Wostl, 2019, p. 8). These results are aligned with recent studies that found that the Flemish context still responds mainly to a hierarchical and top-down approach (Casiano Flores & Crompvoets, 2020; Chantillon et al., 2017). The following statement from a regional governmental actor summarizes the opinion of governmental actors from different levels: “the obligations are distributed according to the level of government and they are respected”. In the same line, a local actor stated: “Flanders will not do anything the municipality does not support”. Various actors mentioned that “the higher the governmental level is, the more top-down tends to be its approach”.

Regarding intensity, the interviewed actors consider that some important changes need to take place to improve the implementation of BGI projects. Budget constraints complicate negotiations among the actors and hinder coordination efforts. As a provincial actor put it: “The provincial government by itself does not have the financial and legal resources to implement this specific BGI project. We depend on others”. Previous research on Flanders has identified that more economic resources could facilitate the implementation of climate change projects in Flanders (Casiano Flores & Crompvoets, 2020). In case of this specific project, changes in administrative processes related to land-use change and compensation are also deemed necessary.

When using the governance qualities to analyze the three catalyst factors of leapfrogging, we can see that trans-disciplinary science is present. The regional government has experience (since the 2000s) in this type of projects, in contrast to the experience at the city level, which is mainly mono-disciplinary. Therefore, the regional actors observe an important difference between small/medium and large cities. Since large cities tend to have more data or information, more resources and capacity in terms of personnel or budgets, they can also hire consultants, or they have even developed their trans-disciplinary projects on their own. For example, the city of Antwerp is currently running pilots using artificial intelligence to develop new tools to prevent urban floods. They have also developed flood models, which in some cases are considered more accurate than those developed by the regional government. This result is aligned with research that has identified that medium and small size cities tend to depend on subnational governments in terms of climate governance (Casiano Flores & Crompvoets, 2020; Kern, 2019).

In contrast, as most small and medium size cities in Europe (Kern, 2019), the city of Herentals does not even have a climate change adaptation strategy (Özerol et al., 2020). For Herentals, the Olympiadelaan project is one of a kind, while upper levels see it as part of a bigger project they are working on (VLANDEREN.be, 2019). Consequently, both subnational governments (the Flemish and provincial government) are supporters of a more advanced water management approach of small size cities. For Herentals this could mean a leap from a Drained city state to the Natural network sub state of the Waterway state (See Fig. 1). Upper governments also acknowledge that the shift of approach from mono-disciplinary to trans-disciplinary science has been recent. An interesting example in this respect is the Nature and Forest Agency, which has had important organizational transformations in the last five years, shifting from a vertical organization to a more horizontal one. This shift, according to the interviewed actors, has allowed them to have a more transversal approach to meet goals that require a trans-disciplinary focus, such as creating green areas that include water and protect different species.

The cross-sector partnership is less developed when it comes to social

actors whose participation is still limited. The governmental actors have managed to build an important partnership among themselves. In this sense, the role of the provincial government as a coordinator is valued by the other two governmental levels. They share the larger picture of the province and they promote integrated projects. The fact that there is no BGI legislation, but BGI projects are being implemented, confirms that innovation in Flanders comes from civil servants and administrative bodies (Mees et al., 2018). It appears that both subnational agencies have made considerable efforts to develop partnerships together with local governments. However, this case of study shows that cross-sector partnerships are still facing many limitations. There is no direct social participation in the project. Although cross-sector participation is challenging, when achieved, it can open opportunities to increase resources and connect capacities. Innovations tend to be driven by networks that are not limited to hierarchical governmental structures, but include different social actors (Pahl-Wostl, 2019). This less developed catalyst factor shows that certain traditional visions or practices are not easy to overcome. Governmental actors are still trying to adapt to be more inclusive towards social actors. They acknowledge that this is a process that can take time. However, they have already proven that structural changes are possible, as they did shift from a monodisciplinary to a transdisciplinary approach.

Innovation experiments also known as pilot cases are relatively common in Flanders. Actually, the interviewed subnational actors consider the BGI they developed more than 10 years ago as their pilot projects. Nowadays, they consider they gained considerable experience and they believe that in some cases city governments are interested in those projects because they have seen the positive results the pilot projects have had. Nevertheless, the implementation of BGI projects faces many challenges. In this sense, the CATCH Interreg project is a very good example of the value that these innovative experiments have. CATCH partners have had positive exchange of experience regarding BGI projects in small and medium size cities. Actually, it is important to acknowledge that the city of Herentals has also shown openness to participate in these innovative projects.

Overall, we can see that BGI faces considerable institutional challenges such as lock-in to traditional practices, lack of long-term planning, insufficient policy coherence and lack of resources (Brears, 2018). Our case study shows that governmental actors have been capable of overcoming traditional practices and they have increased policy integration. This result is in line with previous research that identified that subnational governments play an important role in the European Union climate governance system (Jänicke & Wurzel, 2019). They act as policy coordinators, taking over responsibilities from federal and local governments in the area of environment, including flood policies (Happaerts et al., 2012). Authority is shifting to subnational governments in both upwards and downwards direction (Kern, 2019). In fact, the cities involved in the CATCH project, including Herentals, are dependent on higher governmental levels for their urban water management and climate change adaptation (Özerol et al., 2020). Our findings support the statement that limited participation of subnational governments can hinder the transition possibilities of small and medium size cities (Casiano Flores & Crompvoets, 2020; Casiano Flores, Crompvoets, et al., 2019).

At the city level, municipal actors consider the Olympiadelaan a pilot that can help them to build experience with this type of projects. They have acknowledged that bigger cities have already done similar projects, such as the Park Spoor Noord in Antwerp, where the train tracks were moved underground due to the expansion of the Antwerp terminal. This resulted in 17 ha that were used to develop a park that combines different BGI projects (City of Antwerp, n.d.). They also appreciate the more comprehensive vision of the region that upper governmental levels have. The Herentals' actors also pointed out that the experience gained in this project has been applied to other projects. Still, they consider that the processes in water management are accelerating, rather than skipping stages. In words of a municipal actor: “it is very difficult to skip states, you follow a process”. Then the interviewed actor added that seeing a presentation about Ghent water management, made him realize that Herentals was in the early stages. Hence, we can state that even when the governance context favors the implementation of BGI under current circumstances, leapfrogging still seems challenging. The moderately supportive governance context does not facilitate a leap from a Drained city to a Water cycle city. This would require a higher level of support that could include more financial resources and a higher degree of participation that could enhance the creation of social capital.

12. Conclusion

The aforementioned results provide the empirical insights into the scholarly understanding of leapfrogging from a governance perspective. We can conclude that the governance context moderately supports the urban water management transition process of the city of Herentals, due to the support that the subnational governments provide to the city. This moderate assessment is mainly the result of the subnational government experience in BGI projects and the integration of urban planning with water management at the subnational level. This conclusion strengthens the results of recent research that has demonstrated that integrated or water sensitive approach is supportive of BGI (Dolman, 2021; Gleason & Casiano Flores, 2021) and in this case, we show that small size cities are also likely to benefit from it. Hence, this case study might be of interest for other European countries, such as Spain, Italy or France where territorial planning competencies are entrusted to subnational entities (Durà et al., 2018), as well as countries where subnational governments have been adjusting guidelines for floods in different climate change scenarios at the subnational level such as Germany (Madsen et al., 2014). In the same vein, the results demonstrated that the integration of water management and urban planning at the subnational level could help to deal with complexity by decreasing policy fragmentation and supporting collaboration. Therefore, we invite policymakers and practitioners to consider our study as an example of how changes in the legislation and in the operation of programs at the subnational level can support coherence between water management and urban development in favor of BGI projects at city level. The integration of water management and urban development has already proved its relevance to mitigate flood risks (Ran & Nedovic-Budic, 2016; Saunders & Kilvington, 2016).

The moderate support also means that there is still room to improve governance support. Considering the current water management of the city and the current governance conditions, the leapfrogging potential for this Drained city (Herentals) is limited to sub-states of a Waterway city state. These results support the conclusion that leapfrogging is a complex process that takes time and requires cross sectoral and multilevel collaborations. Furthermore, when comparing these results with similar studies we identify that, while in a less developed water management context leapfrogging seems unrealistic (Casiano Flores, Crompvoets, et al., 2019), in a more supportive context, such as Herentals, leapfrogging is perceived more as an acceleration of the transition process.

From a broader perspective, this conclusion aligns with recent research that shows that success in European Union climate governance depends not only on the member states, but on cities and subnational actions, meaning a shift towards a polycentric network (Kern, 2019). In this regard, it is important to highlight the openness and interest of city actors in the implementation of BGI projects, their participation and the existence of European projects such as Interreg. These projects enable sharing and learning experiences. Furthermore, we can conclude that the exchange of experience with upper governmental levels can work as a source of inspiration. As mentioned before, the urban planning department has started working closer with water managers to implement other projects in the city based on the Herentals pilot experience. Therefore, we believe that our case illustrates the role of governmental actors from a multi-level governance perspective and the benefits that

participation in European and regional projects can have for practitioners in terms of a learning experience. Interreg projects have proved to facilitate learning and networking among local authorities engaged in climate topics (Collovà et al., 2020).

Considering these conclusions, we would like to invite researchers to conduct similar assessments in more supportive governance contexts where the governance structure is less hierarchical and more polycentric,[2] such as The Netherlands (Pahl-Wostl, 2019) or where pilot projects have taken place with the support of various national and international actors to compensate for the lack of capacity of cities and subnational governments. Assessments of such contextual variations could strengthen our understanding of how much leapfrogging depends on institutional developments. Our current findings still question whether leapfrogging is realistic for urban water management systems located in the three early states of the UWMTF. It appears that leapfrogging might be more realistic where formal institutions are more effective and where there is a polycentric governance system. Yet this needs to be scientifically verified. Finally, we also consider that further research needs to be conducted to understand better how new tools such as flood risk maps and water assessments developed by subnational governments can support urban water transitions and leapfrogging.

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CRediT authorship contribution statement

Casiano Flores, Cesar	Conceptualization, Methodology and Writing - Original Draft
Vikolainen, Vera	Writing - Review & Editing
Crompvoets, Joep	Writing - Review & Editing

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change, 15*(2), 77–86. https://doi.org/10.1016/j.gloenvcha.2004.12.005.

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory, 18*(4), 543–571. https://doi.org/10.1093/jopart/mum032.

Aylett, A. (2015). Institutionalizing the urban governance of climate change adaptation: Results of an international survey. *Urban Climate, 14*, 4–16. https://doi.org/10.1016/j.uclim.2015.06.005.

Bai, X., Surveyer, A., Elmqvist, T., Gatzweiler, F. W., Güneralp, B., Parnell, S., … Webb, R. (2016). Defining and advancing a systems approach for sustainable cities. *Current Opinion in Environmental Sustainability, 23*, 69–78. https://doi.org/10.1016/j.cosust.2016.11.010.

Binz, C., Truffer, B., Li, L., Shi, Y., & Lu, Y. (2012). Conceptualizing leapfrogging with spatially coupled innovation systems: The case of onsite wastewater treatment in China. *Technological Forecasting and Social Change, 79*(1), 155–171. https://doi.org/10.1016/j.techfore.2011.08.016.

Boer de, C. (2012). Contextual water management: A study of governance and implementation processes in local stream restoration projects. In *CSTM*. Universiteit Twente.

Bonasia, R., & Lucatello, S. (2019). Linking flood susceptibility mapping and governance in Mexico for flood mitigation: A participatory approach model. *Atmosphere, 10*(8), 424. https://doi.org/10.3390/atmos10080424.

Brears, R. C. (2018). Blue and green cities: The role of blue-green infrastructure in managing urban water resources. In *Blue and green cities: The role of blue-green infrastructure in managing urban water resources*. https://doi.org/10.1057/978-1-137-59258-3.

Bressers, H. (2009). From public administration to policy networks: Contextual interaction analysis. In S. Narath & F. Varone (Eds.), Rediscovering public law and public administration in comparative policy analysis: A tribute to Peter Knoepfel (pp. 123–142). Presses polytechniques.

Bressers, H., Bressers, N., Browne, A., Furusho, C., Lajeunesse, I., Larrue, C., Özerol, G., Ramos, M.-H., Stein, U., Tröltzsch, J., & Vidaurre, R. (2015). Benefit of governance in drought adaptation: Governance assessment guide. In H. Bressers, & N. Bressers (Eds.), *DROP project European Union*. http://doc.utwente.nl/97103/.

Bressers, H., Bressers, N., Kuks, S., & Larrue, C. (2016). The governance assessment tool and its use. In H. Bressers, N. Bressers, & C. Larrue (Eds.), *Governance for drought resilience*. Springer International Publishing.

Bressers, H., & Kuks, S. (2004). *Integrated governance and water basin management: Conditions for regime change towards sustainability*. Kluwer Academic Publishers. http://doc.utwente.nl/48981/.

Bressers, H., & Kuks, S. (2013). Water governance regimes: Dimensions and dynamics. *International Journal of Water Governance, 1*(1), 133–156. https://doi.org/10.7564/12-IJWG1.

Brodnik, C., Holden, J., Marino, R., Wright, A., Copa, V., Rogers, B., … Yuliantoro, D. (2018). Jumping to the top: Catalysts for leapfrogging to a water sensitive city. In , *Vol. 179. IOP conference series: Earth and environmental science* (p. 012034). https://doi.org/10.1088/1755-1315/179/1/012034.

Brown, R., Keath, N., & Wong, T. (2008). Transitioning to water sensitive cities: Historical, current and future transition states. In *11th international conference on urban drainage, Edinburgh, Scotland, UK, 2008* (pp. 1–10).

Brown, R., Rogers, B., & Werbeloff, L. (2016). *Moving toward water sensitive cities a guidance manual for strategists and policy makers*. Cooperative Research Centre for Water Sensitive Cities.

Carter, J. G., Cavan, G., Connelly, A., Guy, S., Handley, J., & Kazmierczak, A. (2015). Climate change and the city: Building capacity for urban adaptation. *Progress in Planning, 95*, 1–66. https://doi.org/10.1016/j.progress.2013.08.001.

Casiano, C., & Boer de, C. (2015). Symbolic implementation: Governance assessment of the water treatment plant policy in the Puebla's Alto Atoyac sub-basin. *International Journal of Water Governance, 3*(4), 1–24. https://doi.org/10.7564/14-IJWG79.

Casiano Flores, C. (2017). Context matters: Water governance assessment of the wastewater treatment plant policy in Central Mexico [University of Twente]. In *CSTM: Vol. Ph.D.* https://doi.org/10.3990/1.9789036543224.

Casiano Flores, C., & Crompvoets, J. (2020). Assessing the governance context support for creating a pluvial flood risk map with climate change scenarios: The Flemish subnational case. *ISPRS International Journal of Geo-Information, 9*(7), 460. https://doi.org/10.3390/ijgi9070460.

Casiano Flores, C., Crompvoets, J., Ibarraran Viniegra, M. E., & Farrelly, M. (2019). Governance assessment of the flood's infrastructure policy in San Pedro Cholula, Mexico: Potential for a leapfrog to water sensitive. *Sustainability, 11*(24), 7144. https://doi.org/10.3390/su11247144.

Casiano Flores, C., Özerol, G., & Bressers, H. (2017). "Governance restricts": A contextual assessment of the wastewater treatment policy in the Guadalupe River basin, Mexico. *Utilities Policy*. https://doi.org/10.1016/j.jup.2017.06.006.

Casiano Flores, C., Özerol, G., Bressers, H., Kuks, S., Edelenbos, J., & Gleason, A. (2019). The state as a stimulator of wastewater treatment policy: A comparative assessment of three subnational cases in central Mexico. *Journal of Environmental Policy and Planning*. https://doi.org/10.1080/1523908X.2019.1566060.

Cauwenberghs, K., Feyaerts, T., Hunter, N., Dewelde, J., Vansteenkiste, T., Huybrighs, M., Vaes, G., & Berry, R. (2018). Collaborative development of high resolution pluvial flood maps for Flanders. In G. La Loggia, G. Freni, V. Puleo, & M. de Marchis (Eds.), HIC 2018. 13th international conference on Hydroinformatics (pp. 381–372). doi:10.29007/nxqj.

Chantillon, M., Crompvoets, J., & Peristeras, V. (2017). The governance landscape of geospatial E-services—The Belgian case. *ISPRS International Journal of Geo-Information, 6*(9), 282. https://doi.org/10.3390/ijgi6090282.

City of Antwerp. (n.d.). *Park Spoor Noord*. 2020. Retrieved August 12, 2020, from https://www.antwerpen.be/nl/info/52d5052439d8a6ec798b4a41/park-spoor-noord.

City Population. (2020). Herentals (Belgium). https://www.citypopulation.de/php/belgium-census.php?cityid=13011.

Collovà, C., Vikolainen, V., Habib, E., & Väisänen, A. (2020). European climate pact: Pre-legislative synthesis of national, regional and local positions on the European

[2] Polycentric means that the governance system combines decentralization with coordination among large autonomous governance units (Pahl-Wostl, 2019).

Commission's initiative. https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659303/EPRS_BRI(2020)659303_EN.pdf.
Davids, P., Boelens, L., & Tempels, B. (2019). The effects of tailor-made flood risk advice for homeowners in Flanders, Belgium. *Water International, 44*(5), 539–553. https://doi.org/10.1080/02508060.2019.1614251.
de Boer, C., & Bressers, H. (2011). *Complex and dynamic implementation processes: The renaturalization of the Dutch Regge River*. Universiteit Twente in collaboration with the Dutch Water Governance Centre.
de Haan, F. J., Rogers, B. C., Frantzeskaki, N., & Brown, R. R. (2015). Transitions through a lens of urban water. *Environmental Innovation and Societal Transitions, 15*, 1–10. https://doi.org/10.1016/j.eist.2014.11.005.
Dolman, N. (2021). Merging blue-green infrastructure with urban design. *Mark and Focus, 4*(1), 19–21.
Dolman, N., Lijzenga, S., Özerol, G., Bressers, H., Bormann, H., & Böge, M. (2018). *Applying the Water Sensitive City framework for climate adaptation in the north sea region: First impressions from the CATCH project*. International Water Week.
Dolman, N., & Ogunyoye, F. (2019). How water challenges can shape tomorrow's cities. *Proceedings of the Institution of Civil Engineers: Civil Engineering, 172*(1), 13–15. https://doi.org/10.1680/jcien.2019.172.1.13.
Durà, A., Camonita, F., Berzi, M., & Noferini, A. (2018). Euroregions, excellence and innovation across EU borders a catalogue of good practices. UAB. doi: 978–84–947903-8-6.
Estrada, F., Botzen, W. J. W., & Tol, R. S. J. (2017). A global economic assessment of city policies to reduce climate change impacts. *Nature Climate Change, 7*(6), 403–406. https://doi.org/10.1038/nclimate3301.
European Commission. (2021). Forging a climate-resilient Europe - the new EU strategy on adaptation to climate change. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0082.
Evans, D. M., Browne, A. L., & Gortemaker, I. A. (2020). Environmental leapfrogging and everyday climate cultures: Sustainable water consumption in the global south. *Climatic Change, 163*(1), 83–97. https://doi.org/10.1007/s10584-018-2331-y.
Gage, R., Mandell, M., Gage, R., & Mandell, M. (1990). *Strategies for managing intergovernmental policies and networks*. Praeger.
Gleason, J. A., & Casiano Flores, C. (2021). Challenges of water sensitive cities in Mexico: The case of the metropolitan area of Guadalajara. *Water, 13*(5), 601. https://doi.org/10.3390/w13050601.
Goldemberg, J. (1998). Leapfrog energy technologies. *Energy Policy, 26*(10), 729–741. https://doi.org/10.1016/S0301-4215(98)00025-1.
Goldemberg, J. (2011). Technological leapfrogging in the developing world. *Science and Technology*, 35–42.
Gupta, J., Pahl-Wostl, C., & Zondervan, R. (2013). "Glocal" water governance: A multi-level challenge in the anthropocene. *Current Opinion in Environmental Sustainability, 5*(6). https://doi.org/10.1016/j.cosust.2013.09.003.
Habtemariam, L. W., Tufa, K., Herslund, L. B., & Mguni, P. (2018). Taking a livelihood perspective to building urban water resilience: Potential and challenges in Addis Ababa. *Progress in Development Studies, 18*(4), 235–251. https://doi.org/10.1177/1464993418786775.
Happaerts, S., Bruyninckx, H., & Van den Brande, K. (2012). Introduction. In H. Bruyninckx, S. Happaerts, & K. van den Brande (Eds.), *Sustainable development and subnational governments policy-making and multi-level interactions* (pp. 1–24). Palgrave Macmillan UK.
Hoyer, J., Dickhaut, W., Kronawitter, L., & Weber, B. (2011). Water sensitive urban design principles and inspiration for sustainable Stormwater management in the city of the future. doi:978-3-86859-106-4.
INTERREG 2 Seas Mers Zeeën. (2013). Short term adaptation for long term resilience to climate change. https://www.interreg2seas.eu/en/star2cs.
Jänicke, M., & Wurzel, R. K. W. (2019). Leadership and lesson-drawing in the European Union's multilevel climate governance system. *Environmental Politics, 28*(1), 22–42. https://doi.org/10.1080/09644016.2019.1522019.
Junghans, L., Kreft, S., & Welp, M. (2018). Inclusive visions for urban transitions: Lessons from stakeholder dialogues in Asian medium sized cities. *Sustainable Cities and Society, 42*, 512–520. https://doi.org/10.1016/j.scs.2018.08.003.
Kamp, C. (2020). Kamp C. https://www.kampc.be/.
Kern, K. (2019). Cities as leaders in EU multilevel climate governance: Embedded upscaling of local experiments in Europe. *Environmental Politics, 28*(1), 125–145. https://doi.org/10.1080/09644016.2019.1521979.
Knieper, C., Holtz, G., Kastens, B., & Pahl-Wostl, C. (2010). Analysing water governance in heterogeneous case studies—Experiences with a database approach. *Environmental Science & Policy, 13*(7), 592–603. https://doi.org/10.1016/j.envsci.2010.09.002.
Koop, S. H. A., Koetsier, L., Doornhof, A., Reinstra, O., Van Leeuwen, C. J., Brouwer, S., … Driessen, P. P. J. (2017). Assessing the governance capacity of cities to address challenges of water, waste, and climate change. *Water Resources Management, 31*(11), 3427–3443. https://doi.org/10.1007/s11269-017-1677-7.
Larsen, T. A., Hoffmann, S., Luthi, C., Truffer, B., & Maurer, M. (2016). Emerging solutions to the water challenges of an urbanizing world. *Science, 352*(6288), 928–933. https://doi.org/10.1126/science.aad8641.
Liefferink, D., Wiering, M., Crabbé, A., & Hegger, D. (2018). Explaining stability and change. Comparing flood risk governance in Belgium, France, the Netherlands, and Poland. *Journal of Flood Risk Management, 11*(3). https://doi.org/10.1111/jfr3.12325.
Lijphart, A. (1975). The comparable-cases strategy in comparative research. *Comparative Political Studies, 8*(2), 158–177.
Madsen, H., Lawrence, D., Lang, M., Martinkova, M., & Kjeldsen, T. R. (2014). Review of trend analysis and climate change projections of extreme precipitation and floods in Europe. *Journal of Hydrology, 519*, 3634–3650. https://doi.org/10.1016/j.jhydrol.2014.11.003.
Marana, P., Eden, C., Eriksson, H., Grimes, C., Hernantes, J., Howick, S., … Serrano, N. (2019). Towards a resilience management guideline — Cities as a starting point for societal resilience. *Sustainable Cities and Society, 48*, Article 101531. https://doi.org/10.1016/j.scs.2019.101531.
Mees, H., Crabbé, A., & Suykens, C. (2018). Belgian flood risk governance: Explaining the dynamics within a fragmented governance arrangement. *Journal of Flood Risk Management, 11*(3), 271–280. https://doi.org/10.1111/jfr3.12330.
Mees, H., Suykens, C., Beyers, J.-C., Crabbé, A., Delvaux, B., & Deketelaere, K. (2016). Analysing and evaluating flood risk governance in Belgium. Dealing with flood risks in an urbanised and institutionally complex country. http://www.starflood.eu/documents/2016/03/wp3-be-final-webversion.pdf.
OECD. (2013). *Water and climate change adaptation: Policies to navigate uncharted waters*.
OECD. (2019a). *Policy coherence for sustainable development 2019*. OECD Publishing. https://doi.org/10.1787/a90f851f-en.
OECD. (2019b). *Governance as an SDG accelerator*. OECD Publishing. https://doi.org/10.1787/0666b085-en.
Ostrom, E., Janssen, M., & Anderies, J. (2007). Going beyond panaceas. *PNAS, 104*(39), 15176–15178. https://doi.org/10.1073/pnas.0701886104.
O'Toole, L. J. (2004). The theory–practice issue in policy implementation research. *Public Administration, 82*(2), 309–329. https://doi.org/10.1111/j.0033-3298.2004.00396.x.
Özerol, G., Dolman, N., Bormann, H., Bressers, H., Lulofs, K., & Böge, M. (2020). Urban water management and climate change adaptation: A self-assessment study by seven midsize cities in the North Sea region. *Sustainable Cities and Society.* , Article 102066. https://doi.org/10.1016/j.scs.2020.102066.
Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change, 19*(3), 354–365. https://doi.org/10.1016/j.gloenvcha.2009.06.001.
Pahl-Wostl, C. (2015). *Water governance in the face of global change: From understanding to transformation*. Springer.
Pahl-Wostl, C. (2019). The role of governance modes and meta-governance in the transformation towards sustainable water governance. *Environmental Science & Policy, 91*, 6–16. https://doi.org/10.1016/j.envsci.2018.10.008.
Perkins, R. (2003). Environmental leapfrogging in developing countries: A critical assessment and reconstruction. *Natural Resources Forum, 27*(3), 177–188. https://doi.org/10.1111/1477-8947.00053.
Poustie, M. S., Frantzeskaki, N., & Brown, R. R. (2016). A transition scenario for leapfrogging to a sustainable urban water future in Port Vila, Vanuatu. *Technological Forecasting and Social Change, 105*, 129–139. https://doi.org/10.1016/j.techfore.2015.12.008.
Provincie Antwerpen. (2019a). Olympiadelaan Herentals. https://www.provincieantwerpen.be/aanbod/drem/dienst-ruimtelijke-planning/lopende-projecten/olympiadelaan-herentals1.html.
Provincie Antwerpen. (2019b). *Olympiadelaan Herentals*.
Provincie Antwerpen. (2019c). *Olympiadelaan en omgeving Tweede info- en inspraakmoment 12/12/2018*. Retrieved June 17, 2021, from https://www.provincieantwerpen.be/content/dam/provant/drem/dienst-ruimtelijke-planning/prups-kleinstedelijke-gebieden/20181212_Presentatie DRP provincie Antwerpen_PRUP Olympiadelaan.pdf.
Ran, J., & Nedovic-Budic, Z. (2016). Integrating spatial planning and flood risk management: A new conceptual framework for the spatially integrated policy infrastructure. *Computers, Environment and Urban Systems, 57*, 68–79. https://doi.org/10.1016/j.compenvurbsys.2016.01.008.
Rijke, J., Farrelly, M., Brown, R., & Zevenbergen, C. (2013). Configuring transformative governance to enhance resilient urban water systems. *Environmental Science & Policy, 25*, 62–72. https://doi.org/10.1016/j.envsci.2012.09.012.
Salinas Rodriguez, C. N. A., Ashley, R., Gersonius, B., Rijke, J., Pathirana, A., & Zevenbergen, C. (2014). Incorporation and application of resilience in the context of water-sensitive urban design: Linking European and Australian perspectives. *Wiley Interdisciplinary Reviews Water, 1*(2), 173–186. https://doi.org/10.1002/wat2.1017.
Saunders, W., & Kilvington, M. (2016). Innovative land use planning for natural hazard risk reduction: A consequence-driven approach from New Zealand. *International Journal of Disaster Risk Reduction, 18*. https://doi.org/10.1016/j.ijdrr.2016.07.002.
Sauter, R., & Watson, J. (2008). Technology leapfrogging: A review of the evidence: A report for DFID. In *Tyndal Center for Climate Change Report, October*.
Servillo, L., Atkinson, R., & Hamdouch, A. (2017). Small and medium-sized towns in Europe: Conceptual, methodological and policy issues. *Tijdschrift voor Economische en Sociale Geografie, 108*(4), 365–379. https://doi.org/10.1111/tesg.12252.
Shuvo, F. K. (2013). Modelling informal settlements using a hybrid automata approach. In *Semantic scholar*. https://www.semanticscholar.org/paper/Modelling-Informal-Settlements-Using-a-Hybrid-Shuvo/515dd5a5018bbdab8e3abd65300791010656f524#citing-papers.
Stad Herentals. (2018). *Samen naar herbestemming voor Olympiadelaan en omgeving*.
STAR FLOOD. (2016). BELGIUM. https://www.starflood.eu/countries/belgium/.
Suleiman, L., & Cars, G. (2010). Water supply governance in Accra: "authentic" or "symbolic.". *Water Policy, 12*(2), 272–289. https://doi.org/10.2166/wp.2009.162.
The Australia-Indonesia Centre. (2018). Leapfrogging towards a water sensitive city. Exploring pathways for Bogor. https://www.monash.edu/__data/assets/pdf_file/0007/1602772/UWC_full_Eng_181218v4_singlepage-optimised.pdf.
Thiel, A., & Egerton, C. (2011). Re-scaling of resource governance as institutional change: The case of water governance in Portugal. *Journal of Environmental Planning and Management, 54*(3), 383–402. https://doi.org/10.1080/09640568.2010.507936.
van de Schoot, R., de Bruin, J., Schram, R., Zahedi, P., de Boer, J., Weijdema, F., … Oberski, D. L. (2021). An open source machine learning framework for efficient and

transparent systematic reviews. *Nature Machine Intelligence, 3*(2), 125–133. https://doi.org/10.1038/s42256-020-00287-7.

van Rij, E. (2008). *Improving institutions for green landscapes in metropolitan areas*. Delft University of Technology. https://books.google.nl/books/about/Improving_Institutions_for_Green_Landsca.html?id=adFv_I0bRVgC&printsec=frontcover&source=kp_read_button&redir_esc=y#v=onepage&q&f=false.

Van Rijswick, M., Edelenbos, J., Hellegers, P., Kok, M., & Kuks, S. (2014). Ten building blocks for sustainable water governance: An integrated method to assess the governance of water. *Water International, 39*(5), 725–742. https://doi.org/10.1080/02508060.2014.951828.

Verbeke, S., & Devroede, N. (2017). Flood risk management in Flanders: From flood risk objectives to appropriate measures through state assessment. *La Houille Blanche*, (4), 20–25. https://doi.org/10.1051/lhb/2017027.

Vikolainen, V., Flikweert, J., Bressers, H., & Lulofs, K. (2017). Governance context for coastal innovations in England: The case of Sandscaping in North Norfolk. *Ocean and Coastal Management, 145*, 82–93. https://doi.org/10.1016/j.ocecoaman.2017.05.012.

Vinke-de Kruijf, J., Kuks, S., & Augustijn, D. (2015). Governance in support of integrated flood risk management? The case of Romania. *Environment and Development, 16* (December), 104–118. https://doi.org/10.1016/j.envdev.2015.04.003.

VLAAMSE MILIEUMAATSCHAPPIJ. (2015). *Water in de stad: De Vlaamse Milieumaatschapppij en lokale besturen slaan de handen in elkaar*.

VLANDEREN.be. (2019). Kleine Nete. https://www.natura2000.vlaanderen.be/gebied/kleine-nete.

Ward, P. J., Jongman, B., Aerts, J. C. J. H., Bates, P. D., Botzen, W. J. W., DIaz Loaiza, A., … Winsemius, H. C. (2017). A global framework for future costs and benefits of river-flood protection in urban areas. *Nature Climate Change, 7*(9), 642–646. https://doi.org/10.1038/nclimate3350.

Watson, J., & Sauter, R. (2011). Sustainable innovation through leapfrogging: a review of the evidence. *International Journal of Technology and Globalisation, 5*(3/4), 170. https://doi.org/10.1504/IJTG.2011.039763.

Yin, R. (2009). *Case study research: Design and methods* (4th ed.). Sage Publications.