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# Aligning Climate Governance with Urban Water Management: Insights from Transnational City Networks

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**Abstract:** A growing number of cities in different world regions are forming transnational networks in order to mitigate and adapt to climate change. In this study, we are interested in the nexus between climate change and urban water management. How do transnational city networks for climate action perceive urban water management? What kind of activities do they adopt for improving urban water management? How effective are these in practice? This study maps 17 transnational city networks that primarily work on climate governance, assesses whether they formally embrace urban water management as a field of activity, and analyzes the extent to which they influence local climate action regarding water-related issues. Our descriptive analysis reveals that the great majority of transnational city networks has embraced goals related to urban water management, mostly framed from the perspective of adaptation to climate change. However, our in-depth analysis of two frontrunner cities in Germany shows that membership in ICLEI (Local Governments for Sustainability) has only limited influence on the initiation and implementation of water-related policy measures.

**Keywords:** city networks; climate change; ICLEI; Sustainable Development Goals (SDGs); urban water management

## 1. Introduction

Climate change represents one of the fundamental global challenges of modern society and requires swift and coordinated action [1]. The Paris Agreement adopted in 2015, which builds on the United Nations Framework Convention on Climate Change (UNFCCC), represents the most recent commitment of all nations to undertake ambitious efforts to combat climate change and to adapt to its effects. Another feature of the Paris Agreement is its recognition that climate protection requires not only state actors (most importantly national governments) but also subnational and non-state actors to take action, which corresponds to the analytical concept of polycentrism [2–4]. Polycentrism perceives governance processes to involve multiple governing authorities at different scales, which are mostly or completely independent from each other [5–8]. By acting simultaneously at different levels, global challenges such as climate change can be addressed both more effectively and efficiently [7].

The growing body of research on polycentric climate governance ascribes cities and transnational city networks an important role in climate governance [9,10]; however, this does not mean that international and national policy-making bodies can be regarded as superfluous or unimportant [11]. On the one hand, cities are the main sources of greenhouse gas emissions since local policymakers

decide on industry-related questions as well as energy, housing, infrastructure, land use, and traffic policy [8]. On the other hand, cities are also affected considerably by climate change and must spend vast amounts on implementing the necessary adaptation and/or prevention measures [12]. The policy competences of cities also put them in a position, whereby they can engage in policy experiments and design climate policy inventions [13–17], which are likely to produce even better policy outcomes if they are coordinated with the national governments [18].

One set of challenges related to climate change is urban water management, which concerns providing water security as well as mitigating flood risk and damage. Water insecurity and urban floods are two of the most pressing water-related challenges presented by climate change [19]. The exceptionally hot and dry summer of 2018 has shown policymakers across northern and central Europe how vulnerable they are to water insecurity. For example, the water levels of the Rhine River in Germany were alarmingly low for around six months, which forced freight vessels to sail only partly loaded, and consequently increased the cost of delivering critical commodities such as mineral oil [20]. In response to the unusual weather conditions, many German local authorities restricted or even banned the withdrawal of surface water for irrigation and other purposes.

In this study, we examine the nexus between climate change and urban water management, which is also acknowledged by the Sustainable Development Goals (SDGs) adopted in 2015 [21]. More precisely, we are interested in how transnational city networks for climate action perceive urban water management, what kind of activities they adopt for improving urban water management, and how effective these are in practice. These three questions underlie this study. The latter of these three is particularly relevant as earlier studies (mostly focusing on cities in developing countries) have noted the difficulties of assessing the true impact of city networks on the initiation and implementation of climate-related policies, as well as the various local obstacles that have hindered positive outcomes of networking approaches [22,23]. We will assess this aspect for two frontrunner cities on climate action in Germany as a representative case of a developed country. For answering the first two questions, we rely on a content analysis of official documents published by the city networks. Turning to the third question, we provide two in-depth studies that complement the first analysis by revealing insights that could not be yielded from the descriptive content analysis.

Our analyses provide four intriguing insights. First, transnational city networks on climate action are indeed committed to goals related to urban water management. Second, measures related to urban water management are mostly framed from the perspective of adapting to climate change–a finding that concurs with the literature (see, e.g., [24]). Third, transnational city networks do not only make mere reference to urban water management but also commit themselves to specific targets. Fourth, we can show that participation in a network is not the primary motivation for adopting and implementing water-related policy measures.

While we believe this study provides some important preliminary and indicative insights, we are aware that it suffers from a number of limitations, of which four appear particularly pertinent. First, the number of networks scrutinized in this study is small and the analysis would have benefitted from increasing the sample size. Second, because of the small number of cases, we had to limit our analysis to very basic techniques for presenting and exploring the data. We invite scholars to build on our study in future research and to advance our knowledge by rectifying these flaws. Third, we could not offer a detailed analysis of policy integration, but we examined which city networks recognize water management as an area of climate action. We consider the mentioning of water management a necessary condition for determining whether climate policy and water policy are integrated. Yet, strictly speaking, we did not provide insights into how policy integration is achieved.

Fourth, our initial descriptive analysis relies exclusively on a multitude of materials that were published by the city networks themselves, and the information provided therein was not always satisfactory, which is also reflected in the empirical basis of this present analysis. The websites of the city networks often do not contain detailed information on how they function, how they are funded, and what their governance mechanisms are. The difficulties in obtaining this information make it

difficult to provide a scientifically sound assessment of the roles of city networks for governing the challenges of urban water management and climate change in a comparative fashion. Of course, good examples of disclosing organizational information also exist. On average, however, the information provided is superficial.

The remainder of this study unfolds as follows: first, we base this research in the context of the literature on policy integration. Second, we offer some theoretical considerations before moving on to the section on our materials and methods. We then turn to the presentation and discussion of our findings, which we summarize before coming to our conclusions.

## 2. Aligning Climate Action with Urban Water Management

We have learned from numerous studies that solving policy problems requires the integration of policies originating from different sectors [25], which is also recognized by the SDGs [21]. The literature on the nexus approach, for example, elaborates on this need to coordinate or integrate policies from different sectors, mostly concentrating on the energy–water nexus (e.g., [26]) or on the water–energy–food nexus (e.g., [27–29]).

A useful way of thinking about integration, especially in the context of the SDGs, was put forward by Nilsson and Persson [30], who differentiated between harmonization and coordination. Of these two, harmonization is the more demanding concept as it concerns bringing different policy objectives onto equal terms across sectoral policies. Coordination is the weaker form and is about "avoiding contradictory sectoral policies or mitigating adverse spill-over effects from sectoral policies" [30] (p. 37). Concentrating on the SDGs as well, Nilsson et al. [31] argued that the interactions between the different sectoral goals can be both negative and positive. Negative interactions refer to trade-offs between sectoral goals that require a different policy approach than positive interactions between individual SDGs, which produce co-benefits. While both Nilsson and Persson [30] and Nilsson et al. [31] concentrated on the SDGs, their overall judgment holds true for the feasibility of policy integration in general: in some instances, integration is easy to achieve since sectoral goals align naturally with each other; whereas, in other instances, it would be more challenging to attain integration. The nexus between water management and climate change in the urban context is one that is comparatively easier to address than other constellations [32] since many facets of water management are related to climate governance.

So far, the extensive literature on policy integration has consistently shown that policy integration tends to fall short, especially in terms of delivering the intended policy outcomes (e.g., [33,34]). The potential role of transnational city networks as facilitators of policy integration has not been a focus of the literature. Therefore, this study presents one of the first attempts to combine the study of policy integration with the study of transnational city networks. In doing so, it concentrates on the joint realization of water management with climate action in the urban context. Since some of the water-related issues are directly linked with climate change, whereas others are less so, the climate–water nexus provides an interesting source of variation for this analysis.

## 3. Theoretical Considerations

In this section, we outline our theoretical considerations for explaining under which conditions transnational city networks on climate governance embrace organizational goals related to urban water management. It should be noted that our analytical interest in transnational city networks is more specific than that of other studies in the pertinent body of literature (e.g., [35])

There is good reason to expect city governments to be more willing than central governments to engage in policy integration if the policy targets concern water and climate goals. For one, cities are affected by climate change and are also the setting in which climate-relevant activities take place (e.g., [8]). As both the source and potential victim of climate change, the incentive is strong for cities to become active in climate change. Cities can become active by themselves as well as form networks

able to lobby policymakers at the national and international levels, for example, by participating at the annual Conference of the Parties (COP) of the UNFCCC [8] (p. 81).

Why would transnational city networks commit themselves to integrating climate and water management concerns? Before turning to this question, we first need to clarify how this study conceives policy integration. We do not examine whether transnational city networks commit themselves to policy integration as defined above (i.e., in the sense of coordination or harmonization). Instead, we develop a simpler understanding of policy integration and analyze whether city networks recognize the need for action in multiple sectors, which we consider a necessary condition for policy integration. Therefore, we examine whether transnational city networks on climate action mention urban water management as a field of activity. In doing so, we concentrate on three dimensions:

- First, whether transnational city networks mention urban water management as one of their organizational goals;
- Second, the framing of urban water management as an activity related to climate change mitigation, adaptation, or both;
- Third, the number and type of specific fields of activity related to urban water management.

The first dimension refers to the literature on the role of cities in climate governance [8,12–17,36]. The dual role of cities as the actors both causing and being affected by climate change puts them in a position, whereby they will push for designing and implementing effective means of dealing with climate change when they are participating in transnational networks. From this perspective, it is reasonable to expect that transnational city networks will support measures that adopt a holistic understanding of the causes and consequences of climate change and therefore commit themselves to policies that cut across policy domains. For networks that focus on climate change in all its facets, this expectation is even more plausible as climate change policies span numerous policy domains and include urban water management as well. Therefore, we expect that transnational city networks committed to mitigating and/or adapting to climate change are likely to embrace measures related to urban water management as a rational decision for lowering the anticipated or actual costs that incur from climate change (**Expectation 1**).

Considering the differences in climate change mitigation and adaptation policies, it is reasonable to expect that the latter will dominate the way in which measures related to urban water management are framed. Adaptation policies consist of concrete measures to inhibit the adverse effects of climate change [37], for which cities tend to have the necessary formal competences. In this context, Massey and Huitema [38] (p. 347), for example, showed that local governments in England have become increasingly aware of the need for committing to adaptation. Of course, cities are also effective in mitigating climate change, but, given their (limited) resources as well as their knowledge and experience with planning, we expect that transnational city networks are more likely to frame measures related to urban water management from the perspective of adaptation (**Expectation 2**).

Lastly, we expect that if transnational city networks commit themselves to urban water management, they are likely to support actions in multiple fields rather than in only one [26,32], since climate change has several implications for the management of water resources (**Expectation 3**).

## 4. Materials and Methods

In order to analyze the accuracy of our three expectations, first, we carried out a descriptive analysis of the transnational city networks' acknowledgment of urban water management. The descriptive nature of the analysis resulted from a very small number of cases and the limited availability of comparative data. More precisely, we analyzed 17 of 24 networks identified by Lee and Jung, which defined transnational city networks for climate change as institution-led or decentralized and multilateral platforms that enable cities and local entities to promote local climate action by performing at least one of the following functions: information sharing, networking, research, target setting, funding, lobbying, planning, and monitoring [17]. In doing so, we applied a broad definition

of transnational city networks. However, the analyzed networks varied to a considerable degree; some of the cases included members other than local authorities (e.g., the CDP included private sector businesses; see, e.g., [39]).

As the focus of our analysis was on functions rather than the institutional designs of the networks, the case selection put forward by [17] seemed justified for the sake of our argument. We limited ourselves to those networks that demonstrated activity in 2018; this was determined by the presence or absence of an up-to-date website (see Table 1). We consulted every resource accessible on the networks' websites to derive information on their goals and activities. As Acuto and Rayner [40] showed, reports were the most frequent outputs of transnational city networks and therefore provided a good—albeit not ideal—empirical basis for this analysis. The material consulted was appropriate since our analytical interest was in the official acknowledgment of goals related to urban water management. The diverse set of documents included annual or periodical reports, project descriptions, online presentations (prepared for conferences and workshops), statements, and press releases. We used graphs and tables to illustrate the plausibility of our theoretical considerations as set out in the previous section.

**Table 1.** Transnational city networks included in the analysis.

| **City Networks** | |
|---|---|
| **1. Asian Cities Climate Change Resilience Network (ACCRN):** 2328 individuals in Bangladesh, India, Indonesia, Thailand, and Vietnam | **10. ICLEI—Local Governments for Sustainability:** More than 1500 cities in 124 countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America |
| **2. C40 Cities:** 94 cities in various countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America | **11. Renewable Energy and Energy Efficiency Partnership (REEEP):** 359 governments, international and multilateral organizations, non-governmental institutions, foundations and private sector actors in various countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America |
| **3. CDP (formerly: Carbon Disclosure Project):** more than 620 cities (and more than 7000 companies) in various countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America | **12. Sustainable Cities International:** Projects in cities in Bolivia, Canada, Cuba, Indonesia, Mexico, Philippines, Senegal, South Africa, Sri Lanka, Tanzania, and Thailand |
| **4. Clean Air Asia:** more than 1000 cities in Asia | **13. The Climate Group:** Projects in regions in various countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America |
| **5. Climate Alliance of European Cities with Indigenous Peoples:** 1739 cities in 26 countries in Europe | **14. The Climate Registry:** 300 organizations in Canada and the United States of America |
| **6. Connecting Delta Cities:** Eight cities in China, Indonesia, Japan, The Netherlands, United Kingdom, United States of America, and Vietnam | **15. United Cities and Local Governments (UCLG):** More than 240000 cities in 140 countries in Africa, Asia, Australia/Oceania, Europe, North America, and South America |
| **7. Covenant of Mayors:** 7755 cities in 53 countries in Europe and Asia | **16. The US Mayors Climate Protection Agreement:** 1060 mayors in the United States of America |
| **8. Energy Cities:** More than 1000 cities and local authorities in 30 countries in Europe and Asia | **17. Western Climate Initiative:** Various cities in **Québec** and Nova Scotia (Canada), and the state of California (United States of America) |
| **9. EUROCITIES Declaration on Climate Change:** More than 140 largest cities and more than 45 partner cities in 39 countries in Europe and Asia | |

Notes: Case selection based on [17] (pp. 102–103).

To systematize the materials collected, we concentrated on three aspects. To gain a basic understanding of the networks' general approaches, we first used the materials to determine whether a given network indicated commitment to urban water management. To this end, we searched the materials for specifications of the networks' main objectives. We constructed a measurement that assigned a value of 1 in either of the following cases: first, if a network stated that it had in place one organizational goal related to water management; second, if it presented on its website concrete projects related to urban water management. In all other cases, the variable was coded 0.

Second, we examined whether the networks' objectives related to urban water management were framed as measures to mitigate climate change, to adapt to it, or both. We differentiated between mitigation and adaptation activities for two reasons: first, this distinction was frequently made in the literature on climate policy (e.g., [41]); second, it was instructive to see whether different perceptions across the networks existed regarding these two approaches to climate action. In a nutshell, adaptation covers all measures that are taken to reduce the negative consequences of climate change on the environment, such as the hydration of drained areas (e.g., [37]). Mitigation, in contrast, means taking steps against the causes of climate change and, therefore, attempting to inhibit further deterioration (e.g., [42]). In the context of urban water management, mitigation policies can consist, for example, of measures for increasing the efficiency of water use or energy generation from water resources. For this purpose, we constructed a variable that assigned a value of 1 if the identified objectives or projects on the networks' homepages referred to adaptation strategies only. In cases where all the projects and objectives could be subsumed under mitigation strategies exclusively, the variable was coded 2, and when they referred to both adaptation and mitigation, the variable was coded 3.

In a third step, we employed an even more nuanced coding scheme and differentiated between the five most important fields of activity in urban water management as indicated by the transnational city networks. These included the following categories:

- Water supply and access to drinking water
- Water quality and hygiene
- Efficient water use
- Flood resilience
- Electricity generation from water

The coding categories generated inductively from the analysis of the materials provided by the networks corresponded to categories identified in the relevant literature. For a network to be assigned to any of these categories, we looked for an explicit acknowledgment or a pertinent project. We were aware that the types of targets mentioned would vary according to the vulnerability of the cities that participated in the respective network as well as the cities' economic and organizational capacities. A source of bias we were confident to be able to control was that the commitment to (different activity fields of) water management resulted merely from local and/or temporary circumstances in the member cities [43]. We examined the networks' collective commitments only, which meant that defining water management as an area of action was the outcome of a collective deliberation process, and it was unlikely to be changed based on local or temporary conditions.

After assessing the aims of the city networks, as derived from the analyzed materials, we complemented our descriptive analysis of 17 transnational city networks with two in-depth studies on how effective these networking approaches were in reality. Therefore, we concentrated on how ICLEI membership had helped launch and implement water-related adaptation measures in the German cities of Hamburg and Heidelberg. We decided to focus on the effects of membership in ICLEI since that network was committed to the comparatively broad incorporation of water management in climate action (see Table 2). We concentrated on Germany as a developed state in order to afford a hard test of the potential on-the-ground effects of membership in transnational city networks.

Since both cities were in Germany, they acted in the same political context. This helped us to rule out contextual factors that may have affected the results to be obtained from the analysis. Although both Heidelberg and Hamburg are situated in the same polity and are strongly committed to fighting climate change, these cities differed in several significant ways, which made them insightful for a comparative, in-depth analysis. While Hamburg is a city located in a coastal region, Heidelberg is an inland city located along the Neckar River. Furthermore, Hamburg, unlike Heidelberg, is a port city, which makes water management vital for the city's economy and represents an important task for the future. Hamburg also has a long history of storm surges and flooding along the Elbe River, with one extreme example in 1962 still remembered today, whereas Heidelberg has been spared from

major flood catastrophes. Hamburg has a population of around 1.8 million and is more than 11-fold the size of Heidelberg; the population size makes the preservation of water supply in times of drought an even more pressing issue. Lastly, Hamburg represents a state of its own and benefits from the legal competence to adopt and implement policy measures, whereas Heidelberg is part of the state of Baden-Württemberg and is constrained in policy-making by state rules.

**Table 2.** Fields of activity of the city networks.

| Fields of activity | Supply | Quality | Efficiency | Flood Resilience | Electricity | Number |
|---|---|---|---|---|---|---|
| Energy Cities | - | - | - | - | - | 0 |
| The US Mayor Climate Protection Agreement | - | - | X | - | - | 1 |
| The Climate Registry | - | - | X | - | - | 1 |
| C40 Cities | X | - | X | - | - | 2 |
| CDP | - | X | X | - | - | 2 |
| Connecting Delta Cities | X | - | - | X | - | 2 |
| Renewable Energy and Energy Efficiency Partnership | X | - | - | - | X | 2 |
| The Climate Group | X | - | X | - | - | 2 |
| United Cities and Local Governments | X | - | - | X | - | 2 |
| Asian Cities Climate Change Resilience Network | X | X | - | X | - | 3 |
| ICLEI-Local Governments for Sustainability | X | - | X | X | - | 3 |
| Sustainable Cities International | X | X | X | - | - | 3 |
| Climate Alliance of European Cities with Indigenous Peoples | X | X | X | X | - | 4 |
| EUROCITIES Declaration on Climate Change | X | X | X | X | - | 4 |

For the purpose of data generation, we conducted interviews with experts of both city administrations, who either acted as intermediaries for the transnational networks or worked in the planning department where the formulation of climate-related targets took place. The interview-based approach provided us with interesting insights, which cannot be drawn from studying written documents only.

## 5. Transnational City Networks' Commitment to Water Management

We begin the presentation of our results by differentiating between transnational city networks on climate action that acknowledged water management as one of their organizational goals and those that abstained from doing so. Of the 17 networks analyzed, 14 mentioned water management, which supported Expectation 1. The networks that did not mention urban water management as one of their organizational goals were Clean Air Asia, the Covenant of Mayors for Climate and Energy, and the Western Climate Initiative. In the case of Clean Air Asia, the lack of recognition was unsurprising given the regional network's narrow focus on improving air quality. The same held true for the Western Climate Initiative, a network comprised of representatives from the Canadian provinces of Québec and Nova Scotia as well as the state of California, which provided administrative and technical services to support the implementation of subnational greenhouse gas emission trading programs. The Covenant of Mayors for Climate and Energy was founded in 2008 when the European Commission introduced

the Climate and Energy Package 2020 [44]. Membership is open to all local authorities in Europe and Asia, which are democratically constituted. Considering that the participating entities were committed to adopting and implementing an integrated approach to climate change mitigation and adaptation, it was surprising that water management did not constitute one of this network's organizational goals. We considered this a first important finding.

Turning to the second dimension of our descriptive analysis, Table 3 shows which networks framed water management from the perspective of mitigation, adaptation, or both. Of the 14 networks that mentioned water management as an organizational goal, eight networks framed it in the context of adaptation to climate change, four as an issue related to mitigation, and two—C40 Cities and The Climate Group—used both frames. Under the maxim of "Cities get the job done", the C40 network promotes the crucial role of municipal climate action, and for this purpose it unites cities from all around the globe, representing 25% of the global economy and more than 650 million people. The relatively high capacity of the participating cities might be a driving force in the adoption of broader climate change approaches and increased policy integration. The same goes for the cities, which work under the guidance of The Climate Group.

**Table 3.** Assignment of city networks to different types of climate action.

| Types of climate action | Adaptation | Mitigation | Both |
|---|---|---|---|
| Asian Cities Climate Change Resilience Network | ■ | | |
| Climate Alliance of European Cities with Indigenous Peoples | ■ | | |
| Connecting Delta Cities | ■ | | |
| Energy Cities | ■ | | |
| EUROCITIES Declaration on Climate Change | ■ | | |
| ICLEI - Local Governments for Sustainability | ■ | | |
| Sustainable Cities International | ■ | | |
| United Cities and Local Governments | ■ | | |
| CDP | | ■ | |
| Renewable Energy and Energy Efficiency Partnership | | ■ | |
| The Climate Registry | | ■ | |
| The US Mayor Climate Protection Agreement | | ■ | |
| C40 Cities | | | ■ |
| The Climate Group | | | ■ |

Notes: Illustration is based on original data from the networks' websites and our own coding.

When inspecting Table 3, we can see that the majority of transnational city networks framed the embracement of water management from the perspective of adaptation to climate change, as postulated by Expectation 2.

Table 2 presents the five main fields of activity related to urban water management. The greatest number of networks adopted goals related to water supply and access, which was plausible given the importance of this issue for adapting to climate change. The second greatest number of networks mentioned the efficient use of water, followed by measures to protect cities against flooding. Less attention was paid to issues related to water quality and the generation of electricity from water resources.

The fields of activity of the individual networks varied as shown in Table 2, which also revealed that one network—Energy Cities—did not mention any specific fields related to urban water management. On the one hand, it was surprising that Energy Cities did not mention water management since the network demonstrated a great level of commitment to climate action in the past and is consisted of many high-capacity cities, which are mostly based in Europe. On the other hand, the main focus of Energy Cities was to mitigate climate change by realizing the energy transition at the local level. From that perspective, it was plausible that this network was committed to water management as an adaptation strategy, but without specifying fields of action. After all, water management is not closely related to energy transition.

Two networks were active in one field, but most addressed two fields. While this empirical pattern supported Expectation 3, we would have expected more networks to flag three or more fields of activity. EUROCITIES and Climate Alliance of European Cities with Indigenous Peoples were the two networks that showed the broadest range of fields of activity. The EUROCITIES Declaration on Climate Change was one of several joint letters of intent agreed on by the members of the EUROCITIES network. After being founded in 1986 by six ambitious European cities, it has now grown to include the mayors of more than 140 local entities. In addition to the network's general climate action approach, EUROCITIES had (jointly with ICLEI) been selected by the EU Commission for assuming co-leadership in the development of the Urban Water Agenda 2030. This process gave birth to the Porto Declaration on the Urban Water Agenda 2030, which addresses a wide variety of challenges, such as water scarcity, the combatting of water pollution, and flood resilience. In contrast to EUROCITIES, the Climate Alliance of European Cities follows a slightly different path by not only setting targets that concern the climate performance at home but also abroad. In addition to limiting their own carbon emissions, the European members agreed to abstain from the use of tropical timber in order to preserve the rainforests and to support the indigenous communities living inside them.

## 6. Effects of ICLEI (Local Governments for Sustainability) Membership on Water Management

What are the effects of membership in city networks on the initiation and implementation of water-related adaptation measures? To address this question, we examined the local policies adopted by Hamburg and Heidelberg. In addition to adaptation, both cities were strongly committed to climate change mitigation, with Hamburg aiming at a long-term reduction of carbon emissions by 80% and Heidelberg by 95% [45,46]. Of the different networks in which these two cities were active, we focused on the effects of their membership in ICLEI—a network that was particularly committed to water-related policy goals in climate actions (more generally on ICLEI, see [47]).

### *6.1. Case Study 1: Hamburg*

Coastal flood protection, a measure made necessary by the accelerated rising of sea levels, is a central challenge Hamburg faces in the context of climate change [45]. Since the city's economy relies heavily on direct and indirect port-related activities (of which the production value was as high as 7.6 billion EUR in 2010 [48] (p. 26)), improving resilience against storm surges is a top priority. A comprehensive resilience strategy also includes the protection of inland areas from floods. The city has already experienced severe floods. In the future, climate change is likely to bring heavy rainfalls, which are expected to increase the risk of floods. Yet the competent authorities do not only concentrate on the potential damages caused by large amounts of water but also prepare for more intense and more frequent drought periods. Consequently, another key policy goal concerns the securing of water supply.

As a response to these threats, the Senate of Hamburg adopted the Hamburg Climate Plan in 2015, which contains the long-term vision for both adaptation and mitigation to be reached by 2050 with interim milestones set for 2020 and 2030. The Hamburg Climate Plan replaced the Climate Action Master Plan and the Adaptation to Climate Change Action Plan, which had been in place since 2013. Central mitigation targets of the plan include the 80% reduction of carbon emissions by 2050 as well as making the city administration carbon-neutral by 2030 through increasing energy efficiency and reducing energy consumption. Water-related adaptation strategies are comprised of:

- the strengthening of public flood protection measures
- designating building plots in light of flood risks
- improved risk communication
- rainwater retention, and
- improved drainage.

Furthermore, the adaptation strategy relies on a climate impact monitoring scheme, whose indicators measure changes in the city's climate resilience over time. The so-called IMPACT indicators capture, among other variables, the run-off characteristics of the Elbe River and its tidal range at a checkpoint in the borough of Hamburg-St. Pauli [49] as well as data on the frequency and intensity of storm surges [50]. The funding of the climate impact monitoring was increased immediately following the adoption of the Climate Plan, totaling 320,000 EUR in 2016. The mean financial expenditure was only as high as ca. 67,000 EUR per annum between 2013 and 2015 [45].

The impact of ICLEI membership becomes manifest in the CLEVER Cities project, which is currently being implemented in the borough of Hamburg-Harburg and is funded by Horizon 2020, an initiative of the European Union which aims to make nearly € 80 billion available for research and innovation projects between 2014 and 2020 [51]. Alongside Hamburg, the project is being implemented in several ICLEI member cities, such as London and Milan, to pursue the goal of urban regeneration with nature-based solutions, that is, implementing measures inspired by processes that can be found in natural ecosystems [52]. Among others, the activity in Hamburg-Harburg focuses on the management of rainwater, which shall be utilized in irrigation systems for planting areas, thereby increasing the efficiency of rainwater re-use.

According to one interviewee from the Coordination Centre for Climate Issues of the City of Hamburg, however, the actual impact of membership with ICLEI in particular and city networks in general on policy initiation and implementation is rather limited. The main reason for this is that the city administration is already active in climate action; another is that climate action has become a necessity, given the city's vulnerability to climate change. The main impact of ICLEI membership concerns networking events as their ideas are exchanged and discussed among network partners, including the implementation of specific collaborative projects such as CLEVER Cities. ICLEI membership does not bring new policies to the political agenda, and the formulation of policy targets is also not affected directly. The city network does not demand specific policy action and, therefore, competent authorities in the city are swifter in realizing the need for action and designing corresponding policies and measures. Yet, exchange with other cities within the ICLEI context is helpful for validating the measures and objectives adopted by local authorities. Thus, a central input provided by ICLEI is its effectiveness in expanding the capacity for learning from others and for optimizing the policies and measures that are in place in the individual cities.

The network's impact on the actual advances towards becoming a climate-resilient city is even more limited. Network-driven projects like CLEVER Cities are helpful for the implementation of the city's adaptation targets, but participation in such collaborative projects is often not feasible due to a lack of organizational capacity as well as the limited number of funding opportunities. The overall number of realized projects, thus, remains relatively low.

Nevertheless, the membership in city networks does help foster Hamburg's image as a frontrunner and reliable partner in transnational climate action. According to our interviewee, this offers a strategic advantage. In the interviewee's opinion, having a strong reputation as a frontrunner in climate governance provides a wide range of indirect benefits. Most notably, it reduces the costs of getting in touch with other relevant actors, such as other cities, private businesses, or academic institutions. This became remarkably apparent when Energy Cities, a network in which Hamburg has never been a member, reached out to our interviewee's authority and requested an opportunity to benefit from Hamburg's experience with specific policies.

### *6.2. Case Study 2: Heidelberg*

The Office of Environmental Protection, Trade Supervision and Energy of the City of Heidelberg explained that its main water-related adaptation challenge is the protection against floods caused by heavy precipitation. The city expects such events to occur more frequently in the future due to rising temperatures. In May 2016, this threat became apparent when the Neckar River was flooded after approximately 90 liters of rain per square meter hit the city area within just a couple of hours,

causing approximately 1 million EUR worth of damage to property [53]. This event helped the authorities realize that the need for appropriate management approaches was urgent, which resulted in action being taken by the city government and administration. As a direct consequence, the city council of Heidelberg adopted a resolution that initiated an encompassing heavy rain management analysis. The resulting technical report contained risk maps for different flood scenarios and identified vulnerable areas, which are given priority in management efforts. To prepare for the management of heavy rain incidents, regular workshops are held for responsible agencies, such as the fire departments and the Office for Landscape and Forestry. The involvement of different agencies also sought to develop an integrated management approach. At the time of writing, the city authorities were in the process of developing a risk communication concept. Despite the city's own initiatives and efforts, the specific design of the risk management is shaped by the provisions of the state of Baden-Württemberg and is dependent upon eligible funding. Compared to the influence of the state level, the impact of city networks is limited.

The city's membership in ICLEI has inspired activities related to water management. ICLEI has made an impact by facilitating occasional contact between the network and city administration to discuss Heidelberg's participation in specific projects. In late 2018, Heidelberg was asked to join the Climate Resilient Cities and Infrastructures (RESIN) initiative funded by Horizon 2020. One of the components of RESIN was to connect cities and the Fraunhofer Institute for Intelligent Analysis and Information Systems. Its aim was to carry out vulnerability assessments of water-related climate issues according to a novel methodology and to share knowledge on adaptation strategies. Apart from city governments, the RESIN partners are comprised of private sector businesses and several academic institutions. The role of ICLEI was to identify cities that were still in the early stages of water management preparation and to induce them to participate in RESIN. Heidelberg's participation in the project was finally called off because of the city's high level of existing preparations, which had been established after the city council's resolution. Therefore, Heidelberg no longer corresponded to the category of cities 'still in [the] early stages' of implementing resilience measures and so did not qualify for project participation. Besides, according to our interviewee, Heidelberg did not want to 'over-academize' its adaptation strategies, for this could have impeded the broader participation of the general public. The exchange of ideas and communication among the network partners was appreciated nonetheless and provided valuable indirect benefits to the city of Heidelberg. As in the case of Hamburg, these indirect benefits are, above all, rooted in the validation of the city's climate-related objectives through communication with other network members, as well as in the establishing of its reputation as a forerunner in adaptation and mitigation—a status which makes it easier for the city to find partners in climate governance.

Overall, the direct impact of ICLEI membership can be considered limited: it neither contributed new themes to the political agenda nor shaped adaptation strategies at the local level. Similar to Hamburg, Heidelberg by itself is already active in mitigating and adapting to climate change.

### 6.3. Summary

Despite the differences between Hamburg and Heidelberg, the two case studies revealed that the impact of city networks in general and ICLEI in particular was limited, at least in terms of initiating new policies and policy implementation. The city governments and agencies are the ones who identify water-related issues and place them on the political agenda. They are also the ones who design and implement the corresponding measures. In this context, ICLEI matters for validating the approaches selected and exploring possibilities for collaborative implementation projects. From that perspective, ICLEI offers the benefit of exchanging knowledge and expertise as well as increasing the reputation of the participating cities.

ICLEI might exert a more direct impact on cities that are less active and possess lower financial and/or organizational capacity. However, given our empirical focus on two cities that are both committed to fighting climate change and which have the financial and organizational means for doing

so, we cannot make any strong claims. Therefore, we invite future research to concentrate on cities that do not consider themselves frontrunners and that are limited in their capacities.

## 7. Discussion of the Findings

In Section 3, we formulated a number of expectations, which we can now revisit in light of the findings presented in the previous sections. Our first expectation postulated that transnational city networks on climate action regard urban water management as one component of their organizational goals. Considering that only three networks did not mention urban water management, we interpreted our findings as indicative support of this expectation. In our second expectation, we postulated that transnational city networks framed water management from the perspective of adaptation. Our findings were certainly in line with our initial reasoning, as a clear imbalance in favor of adaptation efforts was identified. Even though other studies found that the distinction between these two frames was becoming increasingly elusive (e.g., [41]), the specific knowledge and capabilities developed in local communities indeed seemed to favor the adoption of adaptation strategies in polycentric systems, as forecasted by the literature on adaptive (co-)management [54]. The third expectation postulated that transnational city networks supported actions in multiple fields rather than in only one. As put forth by this expectation, we were able to show that the majority of networks was active in two or more fields related to urban water management, which we found plausible since water problems related to climate change were unlikely to be limited to one aspect only (e.g., [55]).

What conclusions can we draw from this analysis with regard to the potential of transnational city networks to promote policy integration? As explained previously, we did not analyze the willingness of transnational city networks to engage in the integration of policies that originated from different sectors in the sense of coordination or harmonization (see [30]). Rather, we examined the recognition of the urban water sector in the networks' approaches to climate action, which is a first indication of the willingness to promote policy integration, though it requires a more refined analysis. At any rate, with the exception of three networks, there seems to exist a common understanding that climate governance requires multi-sectoral action—an observation that reveals the potential for attaining policy integration. Of course, the formal commitment to multi-sectoral action and the actual behavior of the network members are two different things and again need to be investigated in detail.

How effective are city networks in initiation and implementation of policies that align climate action with water management? By analyzing two cities in Germany (Hamburg and Heidelberg) and concentrating on one particular network (ICLEI), we could show that the city network concerned was not decisive in putting new policies on the agenda or for the implementation of policies that combined goals related to climate change with water management. However, this does not mean that network membership does not have any effects. Indeed, the communication processes that take place within such networks help to assess the design of the policies adopted. Further, network membership facilitates the implementation of integrative policies through the possibility of forming collaborative implementation regimes. In addition, membership in city networks increases the profile and reputation of the cities and makes them more attractive for collaboration. All these points can be conducive to developing strategies for better aligning climate governance with water management. Of course, we expect the effects of membership in transnational city networks to vary across developed and developing countries. We expect to encounter more impeding factors in the latter than the former [22,23,27,29,56].

## 8. Conclusions

Many academic observers (e.g., [4]) argue that climate governance has moved from being state-centric to a form labeled as polycentric [5–7]. In this study, we took polycentricism as a starting point to argue that, with the growing relevance of such arrangements, we need to broaden our analytical perspective on the actors that can help to promote policy integration. Among the set of 'new' transnational actors in climate governance, we decided to concentrate on transnational city networks

since they provide particularly instructive insights regarding the implementation of SDGs 6, 11 and 13, which lie at the heart of this special issue. Our descriptive findings revealed that, in an increasingly polycentric world, transnational city networks indeed have the potential to formally promote the integration of water management with climate change in the urban context. In practice, however, we found the actual impacts of city networks on the climate agendas and progresses in water-related adaptation to be rather limited, at least in cities and communities with high administrational capacity and strong, long-standing commitments to climate change mitigation and adaptation. The main impact of city networks is to provide a forum for validating and optimizing the design of policies and measures and to exchange experiences regarding their implementation. Concerning the crucial role of the validation of policy initiatives on the local level, it becomes apparent that transnational city networks provide a form of "normative incentives" to the participating cities, which are not connected with economic appeals (see, e.g., [57]). Investigating the constituents of these kinds of incentives and their implications for policy success in participating cities could provide an interesting foundation for further studies on polycentric governance.

It remains unclear whether the impact of such networks is greater on cities that are less equipped with administrational capabilities. Our in-depth analysis only focused on two cities in Germany and, therefore, only applies to countries with similar economic advancement. We invite further research to focus more on cities in developing regions. It could prove fruitful to examine whether the lack of administrational capacity is limited by hampered networking activities, or whether it is higher because of lower levels of preparation in the field of water-related adaptation and its potential for improvement.

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