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ORIGINAL ARTICLE

Obstacles to the diffusion of adaptation in the Rhein-Neckar region in Germany

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Abstract

Because the impacts of climate change are felt at the local level, we assess adaptation diffusion mechanisms (i.e., learning, competition, and emulation) among smaller big cities and medium-sized towns. Since the diffusion of adaptation has immediate spatial implications, we argue that local conditions play an important role in the diffusion process. The densely populated Rhein-Neckar Metropolitan Region in Germany is an ideal case for studying diffusion mechanisms with regard to adaptation. Using a rich data set of 28 interviews, we unpack the views of local actors such as mayors, city council politicians, city administration representatives, and representatives from regional agencies and identify factors influencing the diffusion of adaptation. We find limited or compromised diffusion due to insufficient knowledge about adaptation, competition between municipalities, and cooperation with cities outside the region. In addition, we find some (albeit limited) political will for adaptation. While some of the interviewed politicians considered making long-term investments in adaptation, most highlighted competing local issues and viewed adaptation with caution, illustrating adaptation's lack of salience and social legitimacy. Indeed, one crucial finding was that housing and mobility are more important to a wide range of politicians and bureaucrats alike. By examining diffusion mechanisms at the subnational level, we combine theoretical perspectives from political science and geography to show how local decision-makers—in particular, politicians—influence the diffusion mechanisms of adaptation.

Keywords Policy diffusion · Mechanisms · Adaptation · Mitigation · Metropolitan region · Municipality

Introduction

In 2015, the United Nations (UN) Sustainable Development Summit adopted 17 Sustainable Development Goals (SDGs), of which SDG 11 emphasizes "sustainable cities and communities". As extreme weather events are becoming more frequent and intense due to complex processes in the global climate system, cities are directly impacted and must respond to these accumulating emergencies (AG6 WG II 2022; Araos et al. 2016; Lesnikowski et al. 2021; Kern 2019). However, few empirical studies have analyzed the policy diffusion mechanisms of adaptation among smaller big cities and medium-sized towns[1] in metropolitan regions.[2]

Therefore, the Rhein-Neckar Metropolitan Region in Germany provides a suitable platform for studying decision-makers' responses, gaining insights into the preferences of local actors, and examining how adaptation decisions shape growing urban regions. This paper unpacks the views of

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[1] Smaller big cities can be defined as cities between 100,000 and 500,000 inhabitants, while medium-sized towns have between 20,000 and 100,000 inhabitants (BBSR, n.d.).

[2] So far, there is no generally accepted definition of metropolitan regions. In a functional way, they represent agglomerations that bundle different functions and are defined as engines of development. Spatially, one (monocentral region) or several closely located large cities (polycentric region) form the center of a metropolitan region, which is enclosed by a surrounding area characterized by strong functional interdependencies with the centers (Growe 2018).

mayors, city council politicians, city administration representatives, and regional agencies within and across cities through a very rich data set of 28 interviews. Using this data set, it aims to identify which factors facilitate or hinder the diffusion of adaptation. We thus pay particular attention to the internal political determinants of adaptation policy diffusion mechanisms across various levels of government.

It is important to highlight that attaining adaptation in urban regions effectively means re-using or providing more green and open spaces, which is particularly difficult in growing metropolitan regions with high population density (Kramer and Wagner 2020). The current adaptation diffusion literature does not sufficiently address this, as it does not recognize that spatial factors may hamper the pace and scale of adaptation. With our study of the Rhein-Neckar Metropolitan Region, we aim to fill this gap in the literature and shed light on the specific spatial and political drivers that may create obstacles to the more widespread diffusion of adaptation. While we focus on one particular region in Germany, the results may be of great value to other (metropolitan) regions that experience similar adaptation diffusion–related challenges.

The paper proceeds as follows: first, we provide an overview of the theoretical considerations of adaptation policy diffusion and its underlying mechanisms. This is followed by presenting the particularities of the Rhein-Neckar Metropolitan Region and outlining the methods used in this study. Then, we present our empirical interview results and discuss three different diffusion mechanisms present in the Rhein-Neckar Metropolitan Region. We end by discussing and reflecting on the results of our multidisciplinary approach.

Theoretical considerations about local adaptation and diffusion

Policy diffusion is primarily concerned with how policies diffuse across jurisdictions—that is, how the policies of a particular government unit (e.g., nation states or subnational units) are influenced by those of other units (Dobbin et al. 2007). It is a prominent and widely used theoretical concept in political science and policy studies, especially because studying the adoption of policies can be applied to a range of topics; the latter range from social issues (Givan et al. 2010) to environmental and climate-related causes such as mitigation (Kammerer and Namhata 2018), adaptation (Schoenefeld et al. 2022), and biodiversity (Tosun and Koch 2022). However, one of the key shortcomings in the diffusion literature is that it generally fails to elaborate on existing theory (Knill and Tosun 2015; Schoenefeld et al. 2022).

Typically, scholars revert to the four widely accepted mechanisms of policy diffusion—learning, competition, emulation, and coercion—to explain how and why policymaking processes and subsequent policies are influenced by those in other government units (Gilardi 2010; Gilardi and Wasserfallen 2019; Shipan and Volden 2008). However, some do not consider coercion to be a diffusion mechanism due to the involuntary nature of adoption by pressure (Gilardi and Wasserfallen 2019). Therefore, we exclude it from the present study.

Theoretically, we contribute to the literature on policy diffusion. In particular, we examine the underlying mechanisms of learning, competition, and emulation in the diffusion of adaptation within the subnational unit of the Rhein-Neckar Metropolitan Region in Germany, paying particular attention to barriers to adaptation. Blatter et al. (2022) have argued that diffusion studies often lose their explanatory power by working inductively when analyzing different sets of diffusion mechanisms. Therefore, we inform our set of diffusion mechanisms by following the framework of Blatter et al. (2022). This approach draws more equally on rationalist and social constructivist elements from international relations and policy studies, thereby leading to greater theoretical coherence. This means that while "learning" and "competition" are predominantly conceptualized by rationalist ideas, such as gaining new information or competing for finances, they are also subject to constructivist accounts, such as previously held belief systems, jointly acquired knowledge, or the incentive to create global standards together rather than engaging in competition (Blatter et al. 2022). With regard to emulation, studies already emphasize the constructivist account by placing importance on norms and appropriateness (Gilardi and Wasserfallen 2019), presuming that these factors create shared beliefs about what works well and what does not. While most studies assume a symmetric relationship in all three mechanisms between the involved polities, this is not necessarily the case, particularly for emulation (Blatter et al. 2022).

In the following, we operationalize the three mechanisms—learning, competition, and emulation—in greater detail.

Learning focuses on cognitive processes, such as drawing lessons from innovative policies; accordingly, studies of this mechanism highlight the role of experts or epistemic communities (Dunlop et al. 2018). Climate change is undeniably an issue that demands a certain level of expertise; for instance, expertise is necessary in order to find solutions and understand the difference between mitigation and adaptation. Assuming that information about a particular adaptation policy has relevant consequences for existing policies and even other governance units (Gilardi 2010), we examine the knowledge of local policymakers with regard to climate change and adaptation in particular. However, our focus is not just on how policymakers gain new information and their corresponding willingness to address adaptation but also on their agency, motivation, and underlying beliefs.

Competition is more concerned with analyzing how governance units adjust their policies due to externalities in other units (Blatter et al. 2022). With regard to competition, it is not only the battle for resources and human capital but also the level of cooperative action displayed by relevant actors which can affect diffusion processes (Braun and Gilardi 2006). For example, the Rhein-Neckar Metropolitan Region has an "upper-tier" Rhein-Neckar association that actively fosters interaction between local and regional levels and even advises local authorities concerning climate change, thereby boosting cooperation (Wagner et al. 2019). This association appears to act as a boundary-spanning diffusion actor, not only because it is external to governance units in the metropolitan region but also because it actively fosters common standards across cities.

With regard to *emulation*, studies emphasize the importance of norms and appropriateness (Gilardi and Wasserfallen 2019). It is therefore necessary to consider policymakers' perceptions of adaptation's appropriateness and effectiveness, especially at the local level. Adaptation does contain specific presumptions about climate change and the legitimacy of relevant policies. For example, policymakers must agree about the appropriate course and scale of action, such as whether to prioritize mitigation over adaptation and how urgently to act, as well as what issues will have to be deprioritized as a result. Thus, one can expect that the diffusion of adaptation will be influenced by whether local decision-makers believe that climate change is an important political issue that deserves attention in the form of, for example, fostering adaptation as the appropriate course of action.

Only recently, political parties and their representatives have been assigned more fundamental roles in policy diffusion processes (Wolkenstein et al. 2020). Research suggests that there is little incentive for politicians to address long-term policy problems like climate change because the political gains of doing so are distant and uncertain (Pahl et al. 2014). Politicians' reluctance mainly stems from the fact that their actions are driven by "electoral survival" (Victor 2011: 66), meaning that they prefer short-term actions over cost-intensive measures that do not benefit them within the electoral cycle (Jacobs 2011, but see Schulze 2021). However, internal values could also drive political commitment, either reflecting parties' political views or the "aim to be perceived as 'responsible' problem solvers" (Blatter et al. 2022: 815), thus facilitating diffusion. This is why politicians may aim to prioritize adaptation in urban areas even though they are aware that it will likely cause conflicts with other issues, especially in growing regions such as Rhein-Neckar. However, it is important to point out that such diffusion mechanisms do not necessarily play out symmetrically across cities; they can also display variations both within and between cities (Blatter et al. 2022).

In addition to the way in which political scientists view diffusion mechanisms, geographers who study policy mobility—a theoretical concept related to policy diffusion (Peck 2011; Pojani 2020)—have long argued that more attention should be paid to how adaptation or mitigation influence "the mobility of policies between contexts" (Fricke 2020: 76, but see also Peck 2011). Especially at the local level, spatially relevant interventions such as adaptation can necessitate cooperation between individual municipalities (Biesbroek et al. 2009). Therefore, space is a relevant factor in the study of policy diffusion and adaptation (Fricke 2020; Maggetti and Gilardi 2016) and can subsequently lead to policymaking processes involving horizontal diffusion (Schoenefeld et al. 2022). However, this does not mean that policies must diffuse such that they are identical to the policies in other jurisdictions. Prince argues that policies can look different in different places but are nonetheless "connected [and] muta[ting] across space and time" (2012: 319).

This assumption is based on an extension of the concept of *relational space*. Here, cities are not only seen as part of networks but also represent networks themselves. According to Jones's (2019) concept of *phase space*, both relational and territorial perspectives play an important role. Thus, it is not only relevant what already exists but also what possibilities the current state of space entails in the future (Prince 2012). Freeman (2012) extends this idea and speaks of "policy-making as occurring in wave form" (Prince 2012: 320). Here, the direct and communicative exchange is in the first line of tacit knowledge between individual actors, through which the mobility of policies in *fluid space* can be explained and ultimately codified. In our view, the governance mechanisms of metropolitan regions can make an important contribution to facilitating exchange processes and enabling the spatial concepts presented above, primarily by creating a *fluid space* of exchange between different networks between and within cities. Therefore, we do not examine one existing adaptation policy per se but present information to local policymakers across cities within a single region about different adaptation policies. This way, we can uncover individual-level considerations for the policies' adoption.

We apply the framework of Blatter et al. (2022), which was developed for the national level, to diffusion mechanisms at the subnational level. In the diffusion literature, internal political determinants and political economic explanations of adaptation are rarely tested at the individual level (but see Gilardi and Wasserfallen 2016). In our study, we thus go beyond the structural, environmental level that is usually the concern of diffusion studies by integrating the three causal diffusion mechanisms for (non-)adoption in the specific case of the Rhein-Neckar Metropolitan Region. This allows us to study these causal mechanisms in greater depth, which Starke (2013) argues is particularly well-suited for understanding *why* policies diffuse and through which mechanisms this diffusion occurs. Indeed, most papers

use quantitative approaches that frame adoption as binary (i.e., diffused or not), but this "does not allow for a nuanced assessment of the outcome of the diffusion process" (Tosun and Koch 2022: 514).

We also make a point to look at diffusion processes from a multidisciplinary perspective and combine insights from political science, geography, and spatial planning. This approach allows us to better understand the various challenges and framework conditions associated with adaptation diffusion in a local urban context. By combining these theoretical perspectives, we further contribute to the diffusion literature by showing how local decision-makers—in particular, politicians—influence the diffusion of adaptation. This, in turn, sheds light on the role of politics in policy diffusion (Gilardi and Wasserfallen 2019).

Study area and selection of case study region: Rhein-Neckar Metropolitan Region

The Rhein-Neckar Metropolitan Region is situated in southwestern Germany and is often valued for its excellent infrastructure. It spans three federal states—namely Baden-Wuerttemberg, Rhineland-Palatinate, and Hessen—and thus has administrative as well as political differences. Since 2005, a joint state treaty has regulated uniform regional planning and policy across the state borders and the region; this treaty "is [..] regarded as a pioneer of cooperative federalism in Germany" (Yan and Growe 2022: 9). The creation of a uniform regional plan aims to standardize the various federal (i.e., sub-national) state-specific laws, regulations, and planning cultures, including in the context of spatially relevant climate projects (King 2022). However, there is no uniform climate action strategy for the metropolitan region; instead, reference is made to individual strategies in the independent cities and municipal districts. In addition to the planning association, metropolitan governance is shaped by the association "Zukunft Metropolregion Rhein-Neckar" ("Future Rhein-Neckar Metropolitan Region"), which emphasizes the importance of economic actors in the region, and the "Metropolregion Rhein-Neckar GmbH," a public–private partnership (for a detailed description, see Yan and Growe 2022).

Another special feature of the Rhein-Neckar Metropolitan Region is that 18 municipalities in the Baden-Wuerttemberg part of the region form a neighborhood association. This association's central goal is to develop a common spatial and settlement structure. In addition to cooperation efforts, it is also responsible for land use planning and thus has legally binding planning structures (Nachbarschaftsverband n.d.).

By perceiving "metropolitan regions as a political concept […] [m]etropolitan policies are not […] isolated systems, but rather […] more general shifts in political fields dealing with territorial changes" (Fricke 2017: 303). The region has agency as an entity and carries out regional development projects under its own auspices, supports and coordinates the work of existing regional networks, and engages in regional marketing (Galland and Harrison 2020). In relation to regional governance in Europe, Albrechts et al. (2003) argue that urban planning theory and practice also have incentives, for instance, "to articulate a more coherent spatial logic for land use regulations" (113). Nevertheless, in all European Metropolitan regions, there is a continuing struggle to negotiate and integrate the views of different actors (network logic versus territorial logic; Harrison and Growe 2014) and a corresponding advance in "agreement-based policy styles and the rise of a new 'contractualism' in planning and governing metropolitan regions" (Galland and Harrison 2020: 13). It follows that ongoing processes of negotiation and coordination must take place at different spatial levels, which can either support or hamper diffusion processes.

The Rhein-Neckar Metropolitan Region includes three smaller big cities (100,000–500,000 inhabitants; BBSR n.d.)—Heidelberg, Mannheim, and Ludwigshafen am Rhein—as well as smaller but economically strong cities, such as Walldorf and Weinheim. Together, these provide good employment opportunities and a high standard of living for the region's 2.4 million inhabitants (Growe 2018). For our study, we selected the following case study cities: Heidelberg and Mannheim as two smaller big cities, Worms and Speyer as two larger medium-sized towns (50,000–100,000 inhabitants; BBSR n.d.), Weinheim and Leimen as two smaller medium-sized towns (20,000–50,000 inhabitants; BBSR n.d.), and Walldorf as a larger small town (10,000–20,000 inhabitants; BBSR n.d.) (Fig. 1).

Furthermore, these cities also fulfill different functions in the spatial planning sense according to the central place concept, which is intended to create equal living conditions across the region (§ 1 (2) ROG[3]). The concentration of infrastructure and settlements and the provision of services of general interest in central places are considered principles of German spatial planning (§ 2 ROG). Indeed, the central place concept has been an important cornerstone for supra-local, sustainable planning and the formation of development axes since about 1950 (Blotevogel 1996). In the new spatial planning guidelines of 2016, the concept of central places continues to play a major role in planning, especially with regard to the provision of "public services by creating the basis for the obligation under public law to provide public services and civic engagement to complement each other" (MKRO 2016: 17).

[3] Spatial Planning Act (Raumordnungsgesetz (ROG)) of 22 December 2008 (BGBl. I p. 2986), as last amended by Article 3 of the Act of 20 July 2022 (BGBl. I p. 1353).

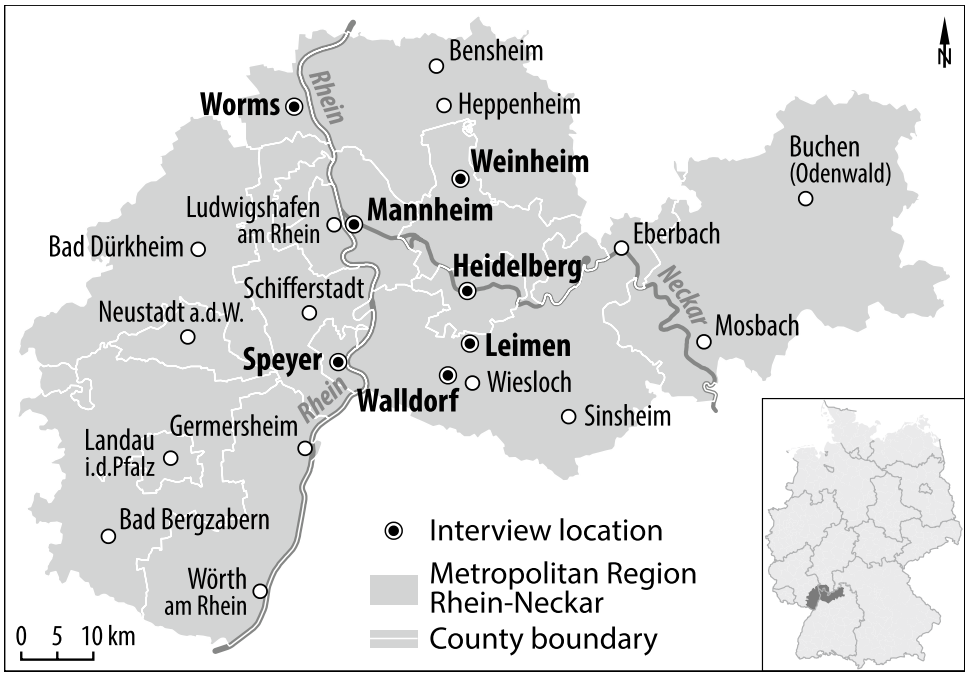

Fig. 1 Overview of interview locations in the Rhein-Neckar Metropolitan Region. Own illustration, based on Geodata: GeoBasis-DE/BKG 2016; cartography: Volker Schniepp

Heidelberg and Mannheim are high-order centers; Worms, Speyer, Walldorf, and Weinheim are middle-order centers; and Leimen is a low-order center. According to BBSR (2021), low-order centers serve the basic needs of the local population, middle-order centers supply the surrounding areas and cover higher periodic needs, and high-order centers cover the most specialized needs. Middle-order centers are particularly important for the complete and easily accessible supply of the population. Although a paradigm shift from hierarchical structures to network models is already being discussed (Meijers 2007), central places continue to have far-reaching significance for both the surrounding area and the other cities in the region through urban–rural linkages (Fricke 2020). In the context of the present study, such linkages can promote diffusion processes of adaptation.

Data and methods

Semi-structured elite interviews (Aberbach and Rockman 2002) with relevant local and regional stakeholders were deemed the most appropriate method for studying policymakers' motivations and diffusion mechanisms in the Rhein-Neckar Metropolitan Region. A total of 28 face-to-face interviews were conducted with 14 local politicians and 14 administrative bureaucrats between June 2017 and June 2018. The sample is very diverse and consists of current and former lord and first mayors, different political party members of environmental committees and district councils, senior members of local planning and administration offices, and representatives from the regional metropolitan association. The local politicians were difficult to reach; only 14 local politicians of the 53 contacted agreed to be interviewed for this study (see Appendix).

The interviews were conducted in German and translated into English for this paper. They lasted between 25 and 90 min. All except one of the interviewees gave permission for the recorded audio files to be transcribed (using the transcript software f5). The transcriptions were analyzed qualitatively using MAXQDA software, which helps to structure and organize large quantities of data and construct coding schemes. Two independent researchers analyzed the same interview material separately and then compared the coding to ensure intercoder reliability.

Results: the diffusion of adaptation in the Rhein-Neckar Metropolitan Region

In this section, we present key empirical findings from our interview analyses and connect them to the three main diffusion mechanisms. The focus of our analysis is on the three policy diffusion mechanisms—learning, competition, and emulation—evident at the local and regional levels.

Learning: sustainable urban planning with regard to adaptation (and mitigation)

In terms of strategies for responding to the increased vulnerability of climate change, the interviewees' understanding of adaptation proved varied and unclear. While some

said, "We do both [adaptation and mitigation]" (e.g., INT 1; 25–26), others differentiated between the two strategies (e.g., INT 18; 22) but others were unable to differentiate between them at all (INT 17). One city councilor plainly stated that "adaptation is a term which is new to me," (INT 20) while one politician even (falsely) proclaimed that, "We do this [adaptation] in Africa, but not in Germany" (INT 21). These differences in knowledge existed between different cities and parties and, at times, within the same departments (e.g., INT 4) and political parties (e.g., INT 18; 19).

Planners were generally very knowledgeable about both adaptation and mitigation, emphasizing that they must "go hand in hand" (INT 14) in concrete planning situations and that the inclusion of both adaptation and mitigation should not be a simple box-ticking exercise in planning. The goal is to consider any effects of climate change in implementation planning and to prevent (mitigate) or respond (adapt) to them in the medium and long term by means of "climate-ecological urban redevelopment" (INT 19):

> A few square meters are now mitigation, the next square meters are adaptation or stormwater management or so, that's nonsensical, […] there has to be a [coherent] concept (INT 9).

Given the Rhein-Neckar Metropolitan Region's high population density, housing (in addition to ecological and mobility-related issues) is important in urban planning. This is why some cities do not want to legally mandate adaptation, particularly when new housing projects are created; learning processes have made it clear that these measures only provide benefits through owner voluntarism and proper maintenance. In this respect, there are sometimes different assessments between the administrative staff and politicians:

> We have been approached several times with the idea that we should specify green facades. So far, we have always rejected this […] it only works if the owner really cares about it and if he wants it. […] That means there are still some city council members who think we should stipulate that, but then we always explain to them why we don't do that. (INT 3)

With regard to the role of experts, many interviewees stated that they tend to reach out to external experts because of the lack of capacity and/or internal expertise within some of the cities. By involving external experts, conceptual knowledge is imparted with profound understanding, and a deep level of knowledge is achieved (de Jong and Ferguson-Hessler 1996). Smaller municipalities are usually not able to consult such external experts because of budget constraints. However, when they do, learning processes develop in which the administration profits from the external experts' knowledge transfer and politicians place greater trust in technical expertise and become more likely to adapt proposals and concepts (Wagner et al. 2019).

> As a rule, it's better to assign specialist offices […]. We are too small a city administration to employ our own climate experts. But also the objectivity is perceived differently […]. (INT 24)

In contrast, larger municipalities are equipped with greater financial resources and can hire specialized staff. Such experts not only become part of the staff but are also able to facilitate the development of conceptual knowledge within the municipality's existing staff. As one interviewee told us, the administration's own knowledge is also confirmed by Europe-wide certifications in order to represent the expertise externally and across all actor networks within the city.

> We have a climate action officer in the city. We have an energy manager in the city. We have now been certified twice by the European Energy Award, and I am willing to stand up and say that we have done it ourselves and can do it ourselves. (INT 26)

Without external reputation or certification, it is often challenging to be viewed as valid. In particular, politicians have too little trust in the expertise of their own administrative staff and would rather have this knowledge confirmed by external, independent experts. This hinders learning processes within the municipal networks and causes avoidable additional costs. In order to counteract this and to promote policy diffusion through learning, cities sometimes also join networks that specifically exchange information on different sectoral plans. Such networks mutually discuss best practices as well as failed project proposals, as was the case for Worms when it joined the Climate Alliance (INT 25).

In addition, mayors are typically assigned a special role in the diffusion mechanism. They can promote adaptation policies through (a) direct local action, (b) close relationships with intergovernmental networks, and (c) links to companies that operate and invest beyond the municipal level (Fraser et al. 2022). Thus, policy diffusion is facilitated through learning processes by individuals who can serve as role models and "teachers" for adaptation and mitigation through their actions, communications, and activities in urban and regional networks:

> Leadership from mayors is important for adaptation. For instance, the engagement of the lord mayor of Worms, as head of the municipal administration, has a strong influence on the cities' decisions and projects and leads to the adoption of adaptation in the city's building and finance committees. (INT 25)

Competition: limited cooperation between cities and the role of the association network

Various levels of cooperative behavior were displayed by local decision-makers between municipalities in the Rhein-Neckar Metropolitan Region. In theory, the concept of metropolitan regions in Germany is to establish a form of regional governance and to build a network between the individual municipalities so that different communities can cooperate with each other flexibly and voluntarily (Fricke 2017). In reality, however, interviewees brought up examples in which cities do not work together. For instance, the following was reported in the case of bicycle paths, which are not confined to the metropolitan region alone: "For example, in the metropolitan region, there are central axes where a bicycle path is being built from Heidelberg to Schifferstadt, and the state of Rhineland-Palatinate is not paying anything" (INT 25).

What is more, cities were influenced by cities and initiatives outside the metropolitan region. One interviewee stated that they looked at Constance, which developed a set of rules that was used as a blueprint for Mannheim (INT 18). Another interviewee explained that they were strongly influenced by the city of Essen because they initiated the Climate Alliance network that Worms later joined (INT 25).

Nevertheless, cities within the Rhein-Neckar Metropolitan Region continue to operate as separate entities and implement projects on a municipal basis. Thus, the respective policies, planning cultures, and learning processes with respect to adaptation—and especially the freedom of design of individual departments within the administration—influence the local implementation (INT 4).

The neighborhood association of the 18 municipalities in the Baden-Wuerttemberg part of the metropolitan region illustrates the advantages of cooperation. Particularly within the framework of the environmental impact assessment, which evaluates the direct and indirect effects of planning projects on the environment, compensation areas must be made available in the case of environmental interventions. These compensation areas can be seen as involved in either mitigation or adaptation: "We have proposed a total of six areas that you can then create, for example, as inter-municipal projects, which can be developed together, as compensation" (INT 12).

Another interviewee pointedly stated the following: "[Cooperation happens] when it is necessary, but there is still usually a bit of parochial thinking. […] Every city or every municipality has to spend money on compensation, and then you'd rather do it in your own municipality, if you can do it, then somewhere else" (INT 17). This quote shows that concrete planning decisions, including those about adaptation, tend to be made at the municipal level without much involvement from other cities. However, individual actors only coordinate with the regional authorities on green space management when they need to (INT 12).

Emulation: appropriateness of adaptation and issue competition

Local decision-makers' views on adaptation make clear that they broadly agree that climate change is an important topic. However, views about the appropriate course and scale of action, such as whether to prioritize adaptation or how urgent it is to make open and green spaces available as part of adaptation, differ between cities. On the one hand, local politicians, administrations, and representatives from regional associations reported that climate change is a highly important issue for municipalities and the region: "It has a high, high priority," one city councilor confirmed (INT 20). The impacts of climate change are already being felt in various ways, including heat waves, insufficient cooling at night, intense rain and flooding, and changing tree populations (INT 1–28). Feeling the effects of climate change makes inhabitants of the region feel vulnerable. One mayor summarized the situation as follows:

> The topic of climate change plays a very, very big role. This may be because we are directly located at the Upper Rhine Valley and […] have been able to observe for the last 30 years that we have increasingly hot and long summers and longer dry periods. (INT 24)

In a similar vein, the previous lord mayor of Speyer stressed that attaining climate objectives was one of the key issues he wanted to tackle when he took office in 2010. His predecessor had become involved in environmental and climate causes, which were also very important to him. Upon taking office, he implemented a different governance structure in his office, restructuring its divisions in an interdisciplinary manner so that they would be better equipped to tackle climate change from a holistic perspective. Having just lost re-election, he stated that he did not regret engaging with so many climate issues throughout his term (INT 28).

Such a view disagrees with the common mantra that politicians only care about re-election and shows that some elected politicians are willing to respond to climate change. In another example, one mayor was keen to discuss measures they had taken in consideration of climate impacts because "it is simply necessary to do them [adaptation and/or mitigation]. Plain and simple" (INT 25). In contrast, some interviewees argued that the long-term aspects of climate change did in fact diminish its importance in decision-making processes at the local level. For example, one member of the Christian Democratic Union (CDU)[4] argued that climate change is not nearly high enough on the political agenda due to the issue's long-term nature:

> Unfortunately, I agree. And we cannot simply destroy the planet without thinking where we will be able to live in

[4] The Christian Democratic Union (CDU) is conservative and economically liberal in orientation and is located in the center-right spectrum.

> 10, 20 years. […] I really don't understand why we [the CDU] leave this issue on the political sidelines. (INT 22)

City councilors reported that municipal politics usually have a 5- to 8-year cycle within which certain short- to mid-term interests and dependencies are prioritized (INT 19). Overall, willingness to build long-term policy approaches exists, but the serious prioritization of climate concerns remains rare. However, this has nothing to do with the topic of adaptation per se, but "that's [rather] a problem of democracy, that long-term problems are more difficult to tackle, but we won't be able to change that. Then it's all about conviction" (INT 27).

One issue that the interviews clearly revealed was that competing land-use concerns were far more important to municipalities than adaptation. For instance, politicians discussed the issue of mobility intensely. Many interviewees commented on the significance of mobility, and one even stated, "it's the mega topic, mobility, really" (INT 20). Good infrastructure is an absolute priority for many cities. Indeed, increasing traffic, road work, or ticket costs *are more pressing* than climate change: "Transportation is the main issue; it's the most important issue of municipal politics in Heidelberg" (INT 17). In addition, environmentally friendly and new forms of (micro-)mobility are also considered: "In terms of transport infrastructure, this will also happen above all via cycling expressways. This project is very, very positively received" (INT 19).

Another competing topic that surfaced during interviews was agriculture. Due to the region's rich soil (INT 25), available space is primarily used for small-scale farming rather than for renewable energy (INT 26). This led one mayor to conclude the following: "Supplying the general public with 'organic' and regionally cultivated food, which we all want, or renewable power generation—it's impossible to solve. For me, this conflict is impossible to solve" (INT 27).

The provision of housing was another core issue that surfaced throughout the interviews. Many portrayed the need for living space as far more important than adaptation (or mitigation) in urban areas. One mayor noted the following:

> The core conflict cannot be solved: They [real estate companies] want to build—that's it. And for them, what is in these [climate] concepts, is often an obstacle. A tremendous obstacle (INT 25).

Compromises include fitting rooftops with solar panels or greening measures. Indeed, many passive houses in cities in the Rhein-Neckar Metropolitan Region are already energy efficient. Interviewees also stated that passive houses had downsides as the default option, "because it usually also means more costs and investments" (INT 17)—money that mayors are not always willing to spend (INT 24, 25). In addition, bureaucrats are cautious about tender offers that specify the implementation of climate measures. A city councilor reported the following:

> For instance, if I write a tender offer and want to say that I only want investors who put a solar panel on rooftops—there is just too little cooperation and willingness from the local administration. They always say, "No, we cannot dictate that." (INT 19)

These quotes show that policymakers in densely populated areas such as the Rhein-Neckar Metropolitan Region deal with a multitude of concerns. Thus, adaptation (and mitigation) competes with other population pressure and economic-related issues and interests. So far, only a few politicians or planners see significant merit in viewing adaptation as an integral part of future plans and projects.

Discussion

In focusing on the Rhein-Neckar Metropolitan Region, we assumed that this regional entity would act as a boundary-spanning collective actor allowing the municipalities to coordinate adaptation planning. However, while the analysis revealed that the regional metropolitan association offers many possibilities for addressing climate issues within the region, we also found evidence of its compromised power and influence. We found that cooperation between individual municipalities and the regional association takes place at the level of information exchange (i.e., learning about adaptation) but not in the case of space-relevant questions concerning adaptation (INT 17). Rather than influencing each other, the cities looked outside the metropolitan region for networks such as the Climate Alliance (INT 25). Thus, the activities of the metropolitan region and the neighborhood association seem (so far) to be insufficient to influence "the domestic will-formation and decision-making processes" (Blatter et al. 2022: 813) of the different municipalities. This is consistent with the work of researchers such as Bulkeley and Kern (2005), who have long argued that insufficient guidance and financial resources are given to local authorities and that such authorities therefore have low incentives to collaborate with others, especially concerning adaptation (Austin et al. 2018). Table 1 summarizes these barriers.

One crucial finding in the context of emulation was that most bureaucrats and politicians were unwilling to devote more attention to adaptation. Rather, it seemed as if adaptation represented yet another concern that local policymakers had to consider, adding to the already growing number of responsibilities in metropolitan regions (León-Moreta 2019). This also prevented more systematic coordination, as evidenced by the fragmented cooperation between the local and regional levels and between municipalities. Nevertheless, the increasing frequency of record-breaking heat waves might compel policymakers to rethink their priorities and their integrative thinking in the future.

Local politicians across all interviewed parties did understand that climate change is important. However, both planners

Table 1 Policy diffusion processes regarding climate adaptation in the Rhein-Neckar Metropolitan Region

Diffusion mechanisms	Adaptation in the Rhein-Neckar Metropolitan Region	Barriers to the diffusion of adaptation
Learning	Learning in the sense of information transfer takes place in various forms within the Rhein-Neckar Metropolitan Region. The region organized a number of climate-focused events where issues relating to adaptation (and mitigation) are addressed in a concrete and location-independent manner Politicians and, in particular, urban planning actors can draw from environmental urban redevelopment experiences and apply them to adaptation	Learning processes are hindered by a lack of knowledge within the respective city administrations (in the case of small municipalities) or a lack of trust of other actors in the urban actor networks in the expertise of the city administration In addition, there is a lack of cooperation between epistemic communities. This is particularly surprising in large cities with a strong university reputation, as in the case of Heidelberg
Competition	The Heidelberg-Mannheim Neighborhood Association acts as a boundary-spanning actor, showing how individual policy-making processes in one polity have found positive resonance and have led to the cooperation of 18 regional municipalities, for example in relation to the preparation of a joint land use plan	On the regional level, the influence of metropolitan governance structures is largely limited to information and networking meetings From the perspective of relational space, cities must be seen both as independent networks and as part of large (in this case, regional) networks. This leads municipalities to have individualist perspectives and limited cooperative engagement, which hinders policy diffusion within the regions. For example, with regard to engagement within initiatives, cities looked outside their metropolitan region for partners, not necessarily within it
Emulation	Local policymakers broadly agreed that climate change is an important local issue. Seeking political re-election does not necessarily stand in the way of implementing climate-relevant measures—even if the positive effects may not be felt until the next election cycle	Policymakers' perceptions about the urgency and appropriateness of adaptation — especially in comparison with other local issues — was still limited

Own illustration

and politicians thought of adaptation as "add-ons"—that is, measures resulting from, for example, the designing of new building sites or the incorporation of greening space, but which play a subsidiary role in actual planning processes.

Interestingly, the electoral cycle did not necessarily influence long-term investment in climate change. However, most mayors' motivation was geared towards mollifying the impacts of climate change, which are already being felt. Such political commitment to adaptation could be characterized as fragmented, likely showing more "political rationalities […] [where] the focus is no longer on the environmentally desirable, but on the politically feasible" (Geden 2016: 792). Especially when considering emulation mechanisms, the socialization and embeddedness of questions in the fluid space plays an important role in assessing the appropriateness of different measures and actions (Gilardi and Wasserfallen 2016). Put differently, depending on how actors are socialized (i.e., spatially, socially, cognitively, institutionally, and in their local organizations), the assessment of appropriateness varies. In this sense, despite some visible political commitment and, at times, internal personal convictions, efforts were not strong enough to facilitate broader diffusion.

Conclusion

What are the challenges and conflicts that arise among different actors in the context of adaptation? What factors foster—or hamper—adaptation policy diffusion mechanisms (i.e., learning, competition, and emulation)? This study set out to uncover adaptation diffusion processes at the subnational level in the Rhein-Neckar Metropolitan Region by investigating three core groups: local politicians, local bureaucrats, and the metropolitan association.

Overall, local actors displayed insufficient knowledge and/or different levels of understanding about climate change. We found remarkable differences in the politicians' understanding, and adaptation was especially poorly understood; with a few exceptions, this held true for actors in the administrative sphere. Moreover, our results showed that the context and even the personal insights and understanding of the issues determined the actual focus of the planning measures, thus influencing diffusion processes and inhibiting learning mechanisms.

The results of this study should be interpreted with caution, as the interviews only depict the views of those willing to give and share information. In the future, cities must rethink how best to accommodate emergent needs. Accordingly, this paper demonstrated the importance of studying policy diffusion from a multidisciplinary perspective and taking a closer look at local, political, and spatial factors. Even though circumstances in Germany differ from those in developing countries, this study may still offer insights into how adaptation diffuses—or not—in city networks and regions, especially in those that have limited space to accommodate adaptation. It may also deepen our understanding of the limits of policy diffusion mechanisms.

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References

Aberbach J, Rockman B (2002) Conducting and coding elite interviews. Polit Sci Polit 35:673–676. https://doi.org/10.1017/S1049096502001142

AG6 WG II (2022) Climate Change 2022: Impacts, adaptation and vulnerability. IPCC Sixth Assessment Report. Impacts Adaptation and Vulnerability. Cambridge University Press, Cambridge

Albrechts L, Healey P, Kunzmann K (2003) Strategic spatial planning and regional governance in Europe. J Am Plan Assoc 69:113–129. https://doi.org/10.1080/01944360308976301

Araos M, Berrang-Ford L, Ford JD, Austin SE, Biesbroek R et al (2016) Climate change adaptation planning in large cities: a systematic global assessment. Environ Sci Policy 66:375–382. https://doi.org/10.1016/j.envsci.2016.06.009

Austin SE, Ford JD, Berrang-Ford L, Biesbroek R, Tosun J et al (2018) Intergovernmental relations for public health adaptation to climate change in the federalist states of Canada and Germany. Glob Environ Chang 52:226–237. https://doi.org/10.1016/j.gloenvcha.2018.07.010

Biesbroek R, Swart J, van der Knaap G (2009) The mitigation-adaptation dichotomy and the role of spatial planning. Habitat Int 33:230–237. https://doi.org/10.1016/j.habitatint.2008.10.001

Blatter J, Portmann L, Rausis F (2022) Theorizing policy diffusion: from a patchy set of mechanisms to a paradigmatic typology. J Eur Publ Policy 29:805–825. https://doi.org/10.1080/13501763.2021.1892801

Blotevogel H-H (1996) Zentrale Orte: Zur Karriere und Krise eines Konzepts in Geographie und Raumplanung. Erdkunde 50:9–25. https://www.jstor.org/stable/25646756

Braun D, Gilardi F (2006) Taking 'Galton's Problem' seriously. Towards a theory of policy diffusion. J Theor Polit 18:298–322. https://doi.org/10.1177/0951629806064351

Bulkeley H, Kern K (2005) Local government and the governing of climate change in Germany and the UK. Urban Studies 43:2237–2259. https://doi.org/10.1080/00420980600936491

Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) (n.d.) Laufende Stadtbeobachtung – Raumabgrenzungen – Stadt und Gemeindetypen in Deutschland. URL: https://www.bbsr.bund.de/BBSR/DE/forschung/raumbeobachtung/Raumabgrenzungen/deutschland/gemeinden/StadtGemeindetyp/StadtGemeindetyp.html. Accessed 15 Apr 2022

Bundesinstitut für Bau-, Stadt- und Raumforschung (2021) Zentrale Orte in Deutschland. BBSR-Analysen KOMPAKT 11/2021, Bonn. URL: https://www.bbsr.bund.de/BBSR/DE/veroeffentlichungen/analysen-kompakt/2021/ak-11-2021-dl.pdf?__blob=publicationFile&v=4. Accessed 15 Apr 2022

de Jong T, Ferguson-Hessler MGM (1996) Types and qualities of knowledge. Educ Psychol 31:105–113. https://doi.org/10.1207/s15326985ep3102_2

Dobbin F, Simmons B, Garrett G (2007) The global diffusion of public policies: social construction, coercion, competition, or learning? Annu Rev Sociol 33:449–472. https://doi.org/10.1146/annurev.soc.33.090106.142507

Dunlop CA, Radaelli CM, Trein P (Eds.) (2018) Learning in public policy. Analysis, modes and outcomes. Palgrave Macmillan, Cham

Fraser T, Bancroft M, Small A, Cunningham L (2022) Leaders or networkers? The role of mayors in renewable energy transition. Environ Innov Societal Transit 42:301–316. https://doi.org/10.1016/j.eist.2022.01.003

Freeman R (2012) Reverb: policy making in wave form. Environ Plan A 44:13–20. https://doi.org/10.1068/a44177

Fricke C (2017) Metropolitan regions in a changing policy concept in a comparative perspective. Raumforschung und Raumordnung – Spat Res Plan 75:291–305. https://doi.org/10.1007/s13147-016-0450-3

Fricke C (2020) Metropolitan Policies of the European Union. In: European Dimension of Metropolitan Policies. Springer Geography. Springer, Cham. https://doi.org/10.1007/978-3-030-14614-6_7

Galland D, Harrison J (2020) Conceptualizing metropolitan regions: institutions, policies, spatial imaginaries and planning are influencing metropolitan development. In: Zimmermann K, Galland D, Harrison J (Eds) Metropolitan regions, planning and governance. Springer Nature, Cham, pp 1–24

Geden O (2016) The Paris Agreement and the inherent inconsistency of climate policymaking. Wiley Int Rev: Climate Change 7:790–797. https://doi.org/10.1002/wcc.427

Gilardi F (2010) Who learns from what in policy diffusion processes? Am J Polit Sci 54:650–666. https://doi.org/10.1111/j.1540-5907.2010.00452.x

Gilardi F, Wasserfallen F (2016) How socialization attenuates tax competition. Br J Polit Sci 46:45–65. https://doi.org/10.1017/S0007123414000246

Gilardi F, Wasserfallen F (2019) The politics of policy diffusion. Eur J Polit Res 58:1245–1256. https://doi.org/10.1111/1475-6765.12326

Givan RK, Roberts KM, Soule SA (eds) (2010) The diffusion of social movements: actors, mechanisms, and political effects. Cambridge University Press, Cambridge

Growe A (2018) Metropolregion. In: Handwörterbuch der Stadt-und Raumentwicklung. ARL-Akademie für Raumforschung und Landesplanung, Hannover, pp 1507–1515

Harrison J, Growe A (2014) When regions collide. In what sense a new 'Regional Problem'? Environ Plan A 46:2332–2352. https://doi.org/10.1068/a130341p

Jacobs A (2011) Governing for the long term: democracy and the politics of investment. Cambridge University Press, Cambridge

Jones M (2019) Phase space: geography, relational thinking, and beyond. Prog Hum Geogr 33:487–506. https://doi.org/10.1177/0309132508101599

Kammerer M, Namhata C (2018) What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion. Policy Sci 51:477–513

Kern K (2019) Cities as leaders in EU multilevel climate governance: embedded upscaling of local experiments in Europe. Environ Policies 28:125–145. https://doi.org/10.1080/09644016.2019.1521979

King JP (2022) Sixteen ways to adapt: a comparison of state-level climate change adaptation strategies in the federal states of Germany. Reg Environ Change 22: ahead of print. https://doi.org/10.1007/s10113-021-01870-3

Knill C, Tosun J (Eds.) (2015) Einführung in die Policy-Analyse. Verlag Barbara Budrich, Opladen & Toronto

Kramer C, Wagner M (2020) Enhancing urban sustainability indicators in a German city. Towards human-centered measurements for sustainable urban planning. World 1:104–123. https://doi.org/10.3390/world1020009

León-Moreta A (2019) Functional responsibilities of municipal government: metropolitan disparities and instruments of intergovernmental management. Urban Studies 56:2585–2607. https://doi.org/10.1177/00420980187946

Lesnikowski A, Biesbroek R, Ford JD, Berrang-Ford L (2021) Policy implementation styles and local governments: the case of climate change adaptation. Environ Polit 30:753–779. https://doi.org/10.1080/09644016.2020.1814045

Maggetti M, Gilardi F (2016) Problems (and solutions) in the measurement of policy diffusion mechanisms. J Publ Policy 36:87–107. https://doi.org/10.1017/S0143814X1400035X

Meijers E (2007) From central place to network model: theory and evidence of a paradigm change. Tijdschr Econ Soc Geogr 98:245–259. https://doi.org/10.1111/j.1467-9663.2007.00394.x

Ministers responsible for spatial planning (MKRO) (2016) Concepts and strategies for spatial development in Germany. Federal Ministry of Transport and Digital Infrastructure (BMVI), Berlin

Nachbarschaftsverband Heidelberg-Mannheim (n.d.). URL: http://www.nachbarschaftsverband.de. Accessed 10 December 2022

Pahl S, Sheppard S, Boomsma C, Groves C (2014) Perceptions of time in relation to climate change. Wiley Interdisc Rev: Climate Change 5:375–388. https://doi.org/10.1002/wcc.272

Peck J (2011) Geographies of policy: from transfer-diffusion to mobility-mutation. Prog Hum Geogr 35:773–797. https://doi.org/10.1177/0309132510394010

Pojani D (2020) Theoretical approaches to studying policy transfer. In: Planning for sustainable urban transport in Southeast Asia. The Urban Book Series. Springer, Cham, pp 9–16

Prince R (2012) Metaphors of policy mobility: fluid space of "creativity" policy. Geografiska Annaler Series b: Human Geography 94:317–331. https://doi.org/10.1111/geob.12001

Schoenefeld JJ, Schulze K, Bruch N (2022) The diffusion of climate change adaptation policy. WIREs Climate Change 13:e775. https://doi.org/10.1002/wcc.775

Schulze K (2021) Policy characteristics, electoral cycles, and the partisan politics of climate change. Global Environmental Politics 21:44–72. https://doi.org/10.1162/glep_a_00593

Shipan CR, Volden C (2008) The mechanisms of policy diffusion. Am J Polit Sci 52:840–857. https://doi.org/10.1111/j.1540-5907.2008.00346.x

Starke P (2013) Qualitative methods for the study of policy diffusion: challenges and available solutions. Policy Stud J 41:561–582. https://doi.org/10.1111/psj.12032

Tosun J, Koch MA (2022) Policy mixes for biodiversity: a diffusion analysis of state-level citizens' initiatives in Germany. J Environ Planning Policy Manage 24:513–525. https://doi.org/10.1080/1523908X.2021.1992265

Victor D (2011) Global warming gridlock: creating more effective strategies of protecting the planet. Cambridge University Press, Cambridge

Wagner M, Mager C, Schmidt N, Kiese N, Growe A (2019) Conflicts about urban green spaces in metropolitan areas under conditions of climate change: a multidisciplinary analysis of stakeholders' perceptions of planning processes. Urban Planning 3:15. https://doi.org/10.3390/urbansci3010015

Wolkenstein F, Senninger R, Bischof D (2020) Party policy diffusion in the European multilevel space: what it is, how it works, and why it matters. J Elections 30:339–357. https://doi.org/10.1080/17457289.2019.1666403

Yan S, Growe A (2022) Regional planning, land-use management, and governance in European metropolitan regions. The case of Metropolitan region Rhine-Neckar in Germany. Land 11:2088. https://doi.org/10.3390/land11112088