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# Five dimensions of climate governance: a framework for empirical research based on polycentric and multi-level governance perspectives

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## Abstract

Governance of climate mitigation and adaptation has been discussed within polycentric and multi-level governance perspectives. Both perspectives on climate governance are intimately related but yet in some regards are distinctly different - as one perspective has evolved from empirical research within the United States and the other in the European Union. Within an increasingly global discourse on climate governance, there is a need in the literature to bring both discourses together. The findings are based on a systematic literature review of 42 climate governance papers published since 2000. This paper discusses how multi-level and polycentric climate governance perspectives converge and diverge along five dimensions. The five dimensions provide insights for applying a multi-level or polycentric governance perspective to empirical research.

**KEYWORDS**
analytical framework, climate governance, decision-making, multi-level governance, polycentric governance

## 1 | INTRODUCTION

Climate actions are implemented within governance arrangements at the national and sub-national levels across the globe. Within the climate governance literature, there is a lively debate about the importance of actions taken by local levels, in contrast to national and state levels (e.g., *Bundesland or* Province; Van der Heijden, 2018a; Jordan et al., 2018a; Bulkeley & Betsill, 2005, Betsill & Bulkeley, 2006; Ostrom, 2010a, Ostrom, 2010b; Setzer & Nachmany, 2018). Researchers that emphasize local actions tend to highlight the benefits of self-regulation, experimentation, leadership, mutual adjustment, and trust (Dorsch & Flachsland, 2017). Other researchers criticize the focus on the local level and emphasize the potential role of senior-level governments to regulate actions for subsequent levels (Dale et al., 2018; Peters & Pierre, 2016; Setzer & Nachmany, 2018; Van der Heijden, 2018a). Such questions over the dispersed decision-making authority at multiple scales for climate governance are fundamental concerns in multi-level (MLG) and polycentric climate governance (PCG); (Boswell et al., 2012; Wheeler, 2009; Betsill & Bulkeley, 2006; Jordan et al., 2018a; Ostrom, 2010a).

MLG and PCG perspectives are closely related and some researchers even consider MLG a type of PCG (Jordan, Huitema, Schoenefeld, et al., 2018a), while other researchers see both perspectives as distinctly separate (Homsy & Warner, 2015). Therefore, the purpose of this paper is to articulate the similarities and differences in both perspectives along five dimensions. The paper begins by discussing the historical genesis of the terms PCG and MLG within the United States and European Union. As the terminology evolved over

time, and as there is a global discourse on climate governance, it is critical to examine what the discourses share in common and how they diverge. The discussion will show how PCG and MLG perspectives have been applied to climate governance research and how authors make varying claims about governance arrangements wherein some interpret PCG and MLG narrowly while others interpret them in a wider context.

This paper finds that PCG and MLG oscillate along five dimensions: (1) the governance issue (interdependent policy problem), (2) the types of decision-makers, (3) the types of interactions among decision-makers, (4) the rules-in-use, and (5) the formal degree of dependency among decision-makers. Both PCG and MLG perspectives share several research interests along these five dimensions, yet the subsequent analysis shows that within the climate governance discourse PCG and MLG perspectives have been applied with different emphasis regarding the five dimensions. PCG perspectives on climate governance tend to emphasize the role of the local level and its capacity to self-regulate (Homsy & Warner, 2015). In contrast, there is a tendency in MLG perspectives to study governance arrangements with formally interdependent actors that work together across levels of government to manage their interdependencies (Benz et al., 2007).

Up until the present, the differences and similarities between MLG and PCG have not been clearly articulated in the literature and, in some instances, terms are used inconsistently. The authors of this article contend that it is crucial to reflect on the differences and similarities within a globalized discourse to inform empirical research. Clearly articulating these differences can shed a light on how to examine systematic variations in climate governance at the national, subnational and local level across the globe in cross-country comparative studies. Therefore, the last section of this paper offers an analytical framework for cross-country comparative analyses to examine the role of various levels for taking climate actions.

## 2 | BACKGROUND: HISTORICAL GENESIS OF PCG AND MLG PERSPECTIVES

A central feature of MLG and PCG perspectives is the dispersed decision-making authority among multiple actors whereby each actor can contribute, to some extent, to solving a common problem. One such problem, for instance, could be taking actions to mitigate or adapt to climate change (Newig & Fritsch, 2009, van der Heijden et al., 2019, Ostrom, 2010a, Gillar et al., 2017, Betsill & Bulkeley, 2006; Bolleyer & Börzel, 2010, p. 159). While this is widely recognized, there is a debate about the role of the various levels of government, including the local, national, and subnational levels. Van der Heijden (2018a, 2018b, 2019) draws attention to the "city as a savior" narrative which is particularly promoted within the urban climate governance discourse. While the urban climate governance discourse emphasizes successes at the local level (Van der Heijden, 2019), other researchers also question the likeliness of cities being the only implementers by drawing attention to the conditions under which cities set and implement climate policies (Hughes, 2016, p. 13, Setzer & Nachmany, 2018). These conditions are likely shaped by senior level governments' regulatory and financial decisions (Hughes, 2016, p. 9f). However, empirical studies find mixed evidence for the effectiveness of actions by sub-national governments. While some researchers find weak implementation of state climate policies at the local level (Boswell et al., 2012, p. 21; Wheeler, 2009), others find that state-level actions were crucial in shaping local success and efforts (Dale et al., 2018). An explanation for these differences in findings may reside within the five dimensions by which empirically observable climate governance arrangements can vary.

Questions over the role of different levels of government have been addressed from PCG and MLG perspectives. Overall both perspectives address one or more of the following five dimensions of climate governance (see Table 1): the existence of an interdependent policy problem (Dimension 1), the types of decision-makers (Dimension 2), the types of interactions among decision-makers (Dimension 3), the rules-in-use (Dimension 4), and lastly the degree of dependency among decision-makers (Dimension 5). After briefly presenting the historical genesis of both terms and methodology, the subsequent sections will explore each dimension in more depth and discuss the perspective of MLG and PCG on these different dimensions.

Both MLG and PCG perspectives have been used to analyze the multi-scalar nature of climate governance arrangements. Initially, PCG was used more frequently within the United States while MLG was applied frequently to conduct researches within the European Union. To be more specific, the PCG perspective is rooted in the works of the Bloomington school, particularly the research of Elinor and

**TABLE 1** Dimensions of polycentric and multi-level governance

| Dimension | Explanation |
|---|---|
| The governance issue (interdependent policy problem) | A common goal or an interdependent policy problem that needs solving |
| Statutory responsibilities of decision-making centers | Multiple decision-making centers are part of the governance arrangement because they can contribute to solving a particular issue based on their statutory responsibilities |
| Types of interactions among decisions-makers | Decision makers may cooperate, compete, resolve conflicts, learn from each other, and mutually adjust their behavior and/or negotiate |
| Rules-in-use | The rules-in-use may either be self-regulated among decision-makers or constituted by legislative rules (state or federal laws) |
| Degree of dependencies in decision-making among decision-makers | The extent to which decisions by one decision-making center are formally independent or formally interdependent on decisions by another center |

Vincent Ostrom, regarding questions over collective actions and common pool resource problems (Homsy & Warner, 2015, p. 49; Sovacool, 2011, p. 3833; Hooghe & Marks, 2003, p. 237). The PCG perspective emerged out of a debate in the 1960s in the United States about the merits of government consolidation of services such as sewer, water and schools. Homsy and Warner (2015) summarize the debate as following "In opposition to the mid-twentieth-century calls for more metropolitan-wide regional governance structures, some political economists argued that many public goods are best provided at the local level […]." (p. 49). Within this context, much empirical research on PCG was done for public goods provision (e.g., water) in metropolitan areas in the United States to better understand the provision of services by multiple actors in metropolitan areas. From the empirical work, an early definition of PCG, frequently quoted in the climate governance literature, reads as following:

> "'Polycentric' connotes many centers of decision making that are formally independent of each other… To the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts, the various political jurisdictions in a metropolitan area may function in a coherent manner with consistent and predictable patterns of interacting behavior. To the extent that this is so, they may be said to function as a 'system' " (Ostrom et al., 1961, pp. 831–32 quoted in Jordan et al. (2018a), p. 11; see also Ostrom (2010a), Jordan et al. (2018b), Carlisle and Gruby (2019), Sovacool and van de Graaf (2018)).

The PCG perspective has been applied to climate governance by Elinor Ostrom (2010a). A frequently used premise of PCG perspectives is that local governments and other decision-makers would voluntarily adopt climate actions and self-regulate their relationships and interactions (for a lengthy discussion see Homsy & Warner, 2015, p. 49). PCG framework has been popularized within the EU most especially through the EU funded research project "Innovation in Climate Governance" (INOGOV; see Jordan et al., 2018 a,b).

Initially, within the European context, MLG perspectives tended to be more popular to analyze local actions in the context of national and sub-national actions concerning environmental and climate matters. The MLG perspective evolved within the context of the European Union to study the implementation of EU policies by its members. Broadly speaking, MLG perspectives are interested in how multiple actors manage their interdependencies to solve a shared issue (Benz 2007, Benz et al., 2007). As MLG perspectives originated with a governmental focus, some researchers argue that multi-level governance, in a narrower perspective, is similar to intergovernmental relations.[1] However, as the term was originally applied to climate governance, a shift in meaning occurred and widened the terminology into a broader context. This shift can partly be traced back to the work by Betsill and Bulkeley (2006) which applied an MLG framework by Hooghe and Marks (2001), Hooghe and Marks (2003) to the empirical study of transnational municipal networks working on climate change issues.

Applying the work by Hooghe and Marks meant that an understanding of MLG was applied to climate governance which drew on the works of the Bloomington School as well as on European scholarship on MLG. More specifically, Hooghe and Marks (2003) identified two types of MLG: Type I – MLG as usually characterized by a "durable systemwide architecture" while Type II – MLG is usually characterized by a more flexible design (p. 237f.). Type I is characterized by general purpose jurisdictions with bundled competencies (e.g., local government) that are nested within larger territorial scales (e.g., region, state or nation) (p. 236). In Type I, the wording "nesting" shares elements of Elinor Ostroms design principles as outlined in her "*Governing the commons*." Type II is characterized by task-specific jurisdictions that are organized around a particular policy problem (e.g., water and sewer district, transit district) and may even be overlapping (p. 237). The Type II model shares similarities to PCG perspectives in its interest on the provision of public services in metropolitan areas (Jordan et al., 2018a, p. 12).

Based on Hooghe and Marks work, Betsill and Bulkeley (2006) applied a Type II-MLG perspective to their analysis of climate governance in transnational municipal networks (p. 151). At the time of their writing, the discourse on global climate (environmental) governance emphasized the interactions of nations (p. 145). In search of a better explanation of the observed interactions in transnational municipal networks in contrast to command-and-control type settings, Betsill and Bulkeley highlighted the usefulness of the MLG framework (pp. 151ff). In their concluding remarks they describe MLG as "a polycentric arrangement of overlapping and interconnected spheres of authority" (Betsill & Bulkeley, 2006, p. 154). Their definition of MLG uses elements of PCG, thereby somewhat merging both perspectives under the terminology "multi-level governance."

Additionally, throughout the past decade, definitions have become somewhat muddled with researchers drawing on literature

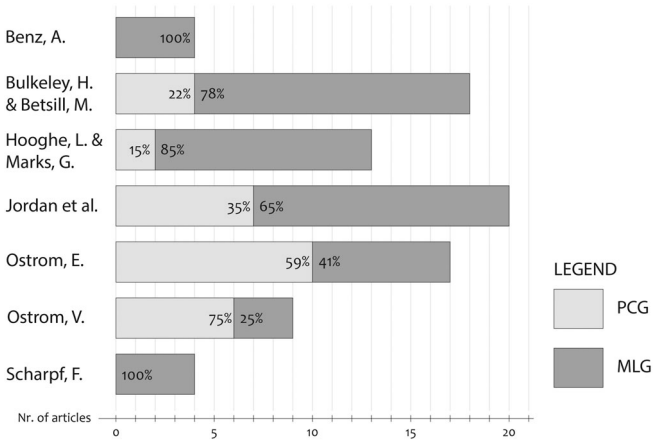


**FIGURE 1** Frequency of cited authors in examined PCG and MLG papers (Source: own illustration)

from both perspectives, as Figure 1 demonstrates (e.g., Jordan et al., 2015; Gillar et al., 2017; Gordon, 2013; Paavola, 2016). For this reason, one might wonder if PCG and MLG are the same concept, if they are related, or if they are different. As both concepts have evolved from historically unique situations of governance arrangements within the United States and Europe, the five dimensions advance an understanding on how both perspectives deal with similar issues (dimensions) but at times place different emphasis. Comparing how both concepts oscillate contributes to a clearer understanding for empirical research designs.

## 3 | METHOD: STANDARDIZED LITERATURE REVIEW

The objective of the paper is to critically analyze the use of the terms PCG and MLG in the field of climate governance in order to understand the multi-scalar climate governance. In a globalized discourse on climate governance, it becomes crucial to understand the nuances in terminology that are applied by using analytical perspectives such as PCG or MLG that historically stem from research traditions particular to the United States and European Union. While both concepts emerged in particular context, they have been applied to climate governance research from across the globe. Therefore, the authors systematically reviewed definitions of multi-level and PCG in peer-reviewed journal articles. The initial set of differences was identified through a qualitative analysis of 16 book and journal publications on climate governance. Subsequently, 32 peer-reviewed journal papers were included in a standardized literature review to verify observations from the qualitative analysis. Additionally, traditional writings in PCG and MLG literature have been consulted for context on the origin of both perspectives.

For the standardized literature review (see Kivimaa et al., 2015, p. 6), the EBSCO database was searched for the keyword combination "'climate governance' AND 'multi-level governance' OR 'polycentric governance'." Additional criteria were applied to the search results:

**STRUCTURE OF THE QUESTIONNAIRE**

SECTION 1 - Dimensions of Climate Governance

A. Source

B. Definition of PCG or MLG
2. Is climate governance described as polycentric or multi-level?
*3. Please insert the definition for PCG or MLG that the authors suggest

C. Dimensions
*4. Are the decision-makers described as being independent or interdependent?
*5. Do decision-makers have overlapping or nested authority?
*6. How do decision-makers interact?
*7. Which types of goals do decision-makers primarily pursue?
*8. How are the rules of the system determined?

SECTION 2 - Empirical context

D. Policy Sectors discussed
9. Sectors/issues within climate governance
10. Short description of the case study (include pages and quotes if appropriate)

E. Geographical Context
11a. Country/ies of case study
11b. If within EU, please specify the involved countries
12a. Is climate action described as multi-scalar (various levels of government involved)?
*12b. Which level(s) is/are emphasized for climate governance?

SECTION 3 - Additional information

F. Context
13. What academic department(s) are researchers affiliated with? (field of research)
14. Primary authors referenced
15. Are there any other observations that may be relevant? (Please describe)

*Questions with an asterisk contained the follow-up request „X. Please, insert quote for question above in the following format: Author Year, page"

**FIGURE 2** Structure of the survey (Source: own illustration)

The title, subtitle or key words needed to contain PCG or MLG to ensure that both were a central concept in the paper. The approach allowed the exclusion of articles which only briefly mentioned PCG or MLG. Furthermore, the review focused on papers from North America or from within the EU because the authors are most familiar with the governance discourses in those geographic regions. Lastly, the systematic literature review was limited to papers published after 2000 to stay within contemporary climate governance discourse. For the standardized literature review of the papers a survey format was created that allowed a systematic review of the components of the definitions and the empirical basis of the articles (see Figure 2).

## 4 | ANALYSIS: DIMENSIONS OF CLIMATE GOVERNANCE ARRANGEMENTS

### 4.1 | Dimension 1: governance issue – an interdependent policy problem

Interdependent policy problems (collective action problems) form the foundation of PCG and MLG perspectives. Both perspectives are interested in how governance arrangements engage to resolve an interdependent policy problem such as climate mitigation or adaptation. Frequently, interdependent policy problems can arise from the mismatch of the natural and regulatory scale of a problem (Newig & Fritsch, 2009, p. 209). The interdependent nature of a policy problem means that one actor cannot solve an issue by taking unilateral actions (Peters & Hoornbeek, 2007, p. 89; Ostrom, 2010a, p. 551). Furthermore, the actions by one actor may have positive and negative externalities for another set of actors (Hooghe & Marks, 2001, p. 12).Thus, from a PCG and MLG perspective, several actors would ideally engage with each other to solve an interdependent policy problem and to avoid socially perverse outcomes (Hooghe & Marks, 2001; Ostrom, 2010b).

Interdependent policy problems are frequently so complex that they require multiple decision-making centers to take coordinated actions in order to resolve an issue. Peters and Hoornbeek (2007) define interdependent policy problems as follows: "policy problems […] vary in the extent to which they are confined, or confinable, to a single policy domain. [… Some] policy problems […] require the involvement and coordination of a number of departments, agencies, and even levels of government" (p. 98). While both PCG and MLG discourses are interested in the governance of interdependent policy problems, both perspectives approach questions differently over how decision-making centers interact, regulate, and formally depend upon each other. The dimensions that are subsequently presented further explore these differences.

### 4.2 | Dimension 2: types of decision-making centers

A commonality in both PCG and MLG perspectives is that governance arrangements are characterized by their dispersed decision-making authority among multiple actors to resolve an issue. Both PCG and MLG perspectives are concerned with questions on appropriate scales of action and on how multiple actors can interrelate their decisions. Thereby, the focus is not on all actors but rather a subset of potential actors in a governance arrangement. This subset are decision-making centers[2] that have "spheres of authority" (Betsill & Bulkeley, 2006; Di Gregorio et al., 2019) such as for example jurisdiction over an issue (e.g., special-purpose jurisdiction, energy companies) or over a territory (e.g., general-purpose jurisdiction) (Dabrowski, 2018, p. 844; Hooghe & Marks, 2003).

This sphere of authority frequently originates in the statutory responsibilities of organizations that are granted by the constitution to various levels of government. Hence, empirically observable governance arrangements differ to the extent that actors have specific decision-making powers over elements of an interdependent policy problem. For instance, decision-making powers for land use and transportation actions are distributed differently across levels of government in the United States and the European Union (Henen 2020). PCG and MLG perspectives suggest a variety of approaches on how to cast the net to identify relevant decision-making centers in empirical settings.

Overall, both perspectives point to the diversity of decision-making centers involved at multiple scales and in multiple sectors (Ostrom, 2010a, p. 553; Sovacool & Van de Graaf, 2018, p. 218). The multi-scalar and multi-sectoral nature of climate governance arrangements have been particularly emphasized within the MLG perspectives (Jänicke, 2017, p. 110f.). The approaches in the reviewed papers can be grouped into four categories: (1) some researchers applied a wider analytical perspective by including non-state actors (Marquardt, 2017, p. 167; Zeemering, 2012, p. 409; Newig & Fritsch, 2009, p. 199; Rhodes, 2007, p. 53; Jänicke, 2017, p. 110f.) However, many researchers apply a narrower analytical perspective by (2) focusing on governmental actors at different levels of government (Homsy & Warner, 2015, p. 53; Jänicke & Quitzow, 2017, p. 122; Schreurs, 2010, p. 88; Amundsen et al., 2010, p. 278). In this context, an MLG perspective refers to territorial units such as communities, counties, regions, states, and federal governments (Fröhlich & Knieling, 2013, pp. 15f). The core research interest is in how multiple levels of government interact to solve an interdependent policy problem. This analytical perspective is most closely related to the historical origins of MLG, but as the term has evolved the perspective is frequently referred to as the vertical dimension of MLG (Gordon, 2013, p. 298; Dabrowski, 2018, p. 839f).

The vertical dimension of MLG is complemented by a horizontal dimension which emphasizes (3) the multi-sectoral nature of climate governance, including the various policy sectors of government involved in governing climate actions (Bolleyer & Börzel, 2010, p. 158f; Dabrowski, 2018, p. 839f; Bulkeley & Betsill, 2005, p. 48; Jänicke, 2017, p. 110f). However, within the climate discourse the term horizontal MLG is also used in another sense, namely (4) the interactions among peers at the local level of government at a global scale; for instance the interactions of cities in transnational municipal networks (Betsill & Bulkeley, 2006; Landauer et al., 2018, p. 5; Dabrowski, 2018, p. 340).

Particularly this fourth perspective on the horizontal dimension of MLG is most similar to how PCG perspectives have been applied to climate governance. Originally, PCG was used to examine the provision of sectoral services in metropolitan regions where municipalities collaborate at the metropolitan level on, for instance, the provision of sewer, water, or transportation infrastructure. In that sense, the term "multi-level" is frequently referred to as multi-scalar. Multi-scalar in this sense means that decision-makers at one scale (e.g., local) engage other decision-makers at another scale (e.g., region or global) to solve a shared issue.

To summarize, PCG and MLG perspectives do share the fact that they include actors from multiple sectors and at multiple geographic scales (local, regional, state, national, supra-national, and international) as relevant for "solving" interdependent policy problems. This dimension of governance arrangements is challenging from an analytical perspective because there is a temptation to ask which "level/scale" is the most appropriate to govern an issue – this question is mirrored in the debate over the relevance of local, sub-national, and national actions for climate actions. The authors of this paper contend that by asking about an appropriate scale, the conversation becomes more about shifting powers from one level of government to the other. MLG and PCG perspectives offer the opportunity to understand how different scales and levels might be interdependent and interact based on the particular rules-in-use in an empirically observable governance arrangements. This draws attention to the following three governance dimensions.

### 4.3 | Dimension 3: types of interactions among decision-makers – between competition, coordination, conflict, and conflict resolution

Generally speaking, decision-makers can interact in many different ways to govern an issue (Rhodes, 2007; Gillar et al., 2017; Jänicke & Quitzow, 2017; Jänicke, 2017; Zeemering, 2012; Dabrowski, 2018; Gordon, 2013; Newig & Fritsch, 2009; see Figure 3).[3] While MLG perspectives accentuate cooperative forms of interactions to overcome conflict, the PCG perspectives actively include more forms of interaction between decision-makers (Jordan et al., 2018a,b; Dorsch & Flachsland, 2017; Thiel, 2017; Marquardt, 2017; Cole, 2015; Ostrom, 2010a; Carlisle & Gruby, 2019). In MLG perspectives, interactions are frequently described as cooperation (Dabrowski, 2018; Di Gregorio et al., 2019; Landauer et al., 2018; Newig & Fritsch, 2009), collaboration (Zeemering, 2012), and coordination (Bolleyer & Börzel, 2010; Marquardt, 2017; van der Heijden et al., 2019). Some researchers additionally highlight mutual learning and networking (Jänicke & Quitzow, 2017, p. 124; Gordon, 2013, p. 297; Figure 3). MLG perspectives are also concerned with the challenges and high costs of coordination which includes conflict resolution (Marquardt, 2017, p. 168; van der Heijden et al., 2019; Bolleyer & Börzel, 2010). In fact, Hooghe and Marks (2003) actually see Type I and Type II MLG as "alternative responses to fundamental problems of coordination" (p. 234). However, an underpinning assumption within MLG is that a group of decision-makers is actively governing an issue by cooperating.

From a PCG perspective, cooperation is only one of several options in a governance arrangement. From a PCG perspective an issue is still governed even without cooperation as there are decision-makers concerned with solving an issue – in fact actors may be competing with each other (Ostrom, 1990; Ostrom et al., 1961). Jordan et al. (2018a) describe PCG as a range of possible interactions, from very loose networks (weak forms of coordination) to formalized systems of coordination (p. 12). In that sense, some researchers may argue that MLG is a particular type of PCG in which actors actually do coordinate. PCG perspectives tend to accentuate conflict and competition as other possible types of interactions for the provision of public services. This is apparent when looking at Figure 3 and the "mix of interactions". Within the mix of interactions, competition and conflict resolution take on a smaller share in MLG perspectives than in PCG perspectives on climate governance. The MLG perspectives tend to emphasize more engaging forms of interactions such as collaboration, mutual learning, networking and negotiation.

The wider focus on interactions in PCG perspectives originates in the early definition of PCG by Ostrom et al. (1961) who speak about how decision-makers "take each other into account." The original definition reads as follows: "to the extent that [decision-makers] take

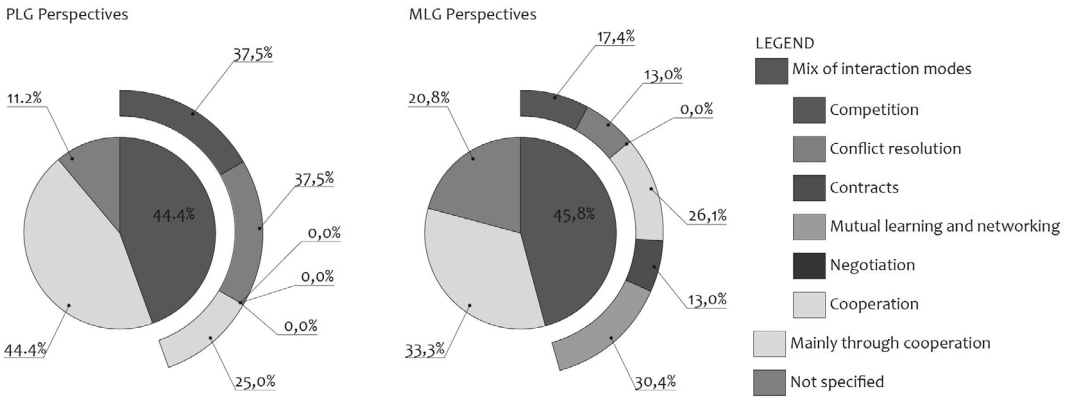


**FIGURE 3** Modes of interaction between decision-makers in PCG (left) and MLG perspectives (right) (Source: own illustration)

each other into account in competitive relationships, enter into various contractual and cooperative undertakings, or have recourse to central mechanisms to resolve conflicts, the various jurisdictions … may be said to function as a 'system'" (quoted in Jordan et al., 2018a, p. 11; in Ostrom (2010a) and (2010b) and in Carlisle and Gruby (2019)).

Within this context, getting decision-makers to cooperate, collaborate, or coordinate is generally described as a challenge from a PCG perspective (Ostrom, 2010a, p. 642; Sovacool & van de Graaf, 2018; Sovacool, 2011). This difference means that by choosing a PCG perspective, the governance of an issue can be discussed even if there are no formalized relationships between decision-making centers. In contrast, MLG perspectives tend to assume some sort of organized interactions. Thereby, MLG perspectives tend to differentiate between various types of coordination which may actually be marked by conflict among the decision-making centers. This means that historically a PCG perspective considered a wider range of potential governance arrangements which are defined by the issue and not by existing structures of cooperation. This initial difference in perspectives becomes more apparent as we turn to the fourth dimension: the rules-in-use.

### 4.4 | Dimension 4: rules-in-use – between self-regulation and legislative rules

The rules-in-use fundamentally shape the other four dimensions. To some extent, references to rules-in-use have been included in both the polycentric and multi-level climate governance discourses (Jordan et al., 2018a,b; Sovacool & Van de Graaf, 2018, p. 323; Marquardt, 2017; Landauer et al., 2018; Newig & Fritsch, 2009; van der Heijden et al., 2019). Overall, rules-in-use are frequently cited in the climate governance literature to provide clarity on governance arrangements; for instance they help explain purpose, roles and responsibilities, procedures on alignment of goals, acceptable and unacceptable actions, and information flows (Sovacool & Van de Graaf, 2018, p. 318; Amundsen et al., 2010, p. 278; Ostrom, 1990, loc. 1279f). These rules-in-use can partly be self-regulated among decision-makers and partly be "given" as legislative rules by a senior-level government.

Ostrom (1990) references both approaches, the one relying on the "rule of law" as "externally organized collective action" and the other relying on self-regulated rules as "self-organized collective action" (loc. 1293 and 1346). Rules-in-use are a primary analytical category within Ostrom's Institutional Analysis and Development (IAD) framework (McGinnis, 2011). Within the context of the climate governance discourse, the analyzed papers show that the PCG perspectives have been applied to study "self-regulated" settings, while the MLG perspectives have been more frequently used for settings with legislatively defined set of rules-in-use (Rhodes, 2007; Jänicke & Quitzow, 2017, p. 126f; Jänicke, 2017, p. 113f; Amundsen et al., 2010, p. 280; Jordan et al., 2012; Homsy & Warner, 2015).

The notion of self-regulation is particularly strong within the analyzed climate governance papers with a PCG perspective. Ostrom (2010a) argues that empirically we see climate actions at many scales without "an externally enforced set of rules" referring to rules at the global level (p. 555). She provides several examples of self-organization and self-regulation capacities at various levels of government. Factors frequently discussed that foster self-regulation in absence of legislative rules are trust, leadership, orchestration platforms, mutual learning, mutual monitoring, and networking (van der Ven et al., 2017, p. 2; Jordan et al., 2018a,b; Sovacool & Van de Graaf, 2018, p. 323; Ostrom, 2010a, Ostrom, 2010b). Nevertheless, Ostrom (1990) points to some downsides of self-regulation such as free riding, gaming the system, inadequate certification, inconsistent policies, and leakage (p. 554f.). Furthermore, she cautions that even in self-regulated settings there are deeper level rules that may be more challenging to uncover (loc. 1302; see also Ostrom, 2010b, p. 652ff. for more details). These deeper level rules may include constitutional rules on responsibility of governments but can also include national or sub-national laws on climate actions. Even specific laws governing sectors such as transportation, energy, or environment at the national and sub-national level may have implications for the implementation of climate actions. While rules-in-use (self-regulated and legislated) are a central feature of PCG perspectives, the analyzed PCG papers on climate governance tended to focus on self-regulation, hence not fully embracing the analytical width possible within PCG perspectives.

Conversely, the MLG papers tended to be more interested in legislative rules as one type of rules-in-use. Legislative rules are understood as rules that are defined in national and state-laws (Setzer & Nachmany, 2018, p. 51). Oftentimes, the discussion on legislative rules quickly relates to command-and-control type systems; however, many MLG authors do actually differentiate MLG from such systems (Newig & Fritsch, 2009, p. 199; Hooghe & Marks, 2003, p. 233; Betsill & Bulkeley, 2006; Cole, 2015, p. 114; Homsy & Warner, 2015, p. 53). In fact, legislative rules in MLG do not create one all-powerful actor that can override others' decisions (Jordan et al., 2018b, p. 363). Rather, national and state levels create "rules of the game" and set a framework for interactions between decision-making centers (Homsy & Warner, 2015, p. 53).

Underpinning the question on self-regulation and legislative rules is the dilemma of regulatory scale and natural scale of an environmental issue such as climate change (Newig & Fritsch, 2009, p. 209). As discussed in the introduction and background chapters, there is a debate on the roles of the local, sub-national and national levels. The challenge for climate governance is to conceptualize how agreements at a global scale can translate into actions at the national and sub-national levels of government. Therefore when comparing national and sub-national approaches across countries, one might observe efforts that are self-organized by locals at a regional scale in some instances, while in other countries we observe legislative rules set by the national and sub-national levels.

This has implications for research designs. To better understand the role of the rules-in-use for climate governance, there is a need for cross-country comparative research. For instance, Wheeler (2009)

and Dale et al. (2018) come to very different conclusions on the relevance of the sub-national level. Both address questions as to what extent the local level has implemented state policies on GHG reductions. While Wheeler (2009) concludes for the State of California that state legislation did not have an impact, Dale et al. (2018) indicate that the Provincial legislation in British Columbia was crucial for local actions. Studying the rules-in-use within the governance arrangements in more depth can surface legislative elements that can foster implementation while ensuring local autonomy (Heinen, 2020). As multiple researchers draw attention to the need to study the legislative rules in more depth (Setzer & Nachmany, 2018; Thiel, 2017; Van der Heijden, 2018a), we believe this indicates a blind spot in climate governance research.

### 4.5 | Dimension 5: formalized degree of dependencies in decision-making

A question relating to the rules-in-use includes the dimension of formalized interdependencies among decision-makers (Dimension 5). This last dimension addresses a question of empirical relevance: Ostrom et al. (1961) write that if "[polycentric governance arrangements] actually function independently, or instead constitute an interdependent system of relations, is an empirical question in particular cases" (pp. 831–32). At the time, they did not specify how interdependencies are set up. In reviewing the PCG and MLG climate governance papers for this study, it was notable that the PCG papers on climate governance tended to describe decision-makers as "formally independent" (Ostrom, 2010a; Dorsch & Flachsland, 2017, p. 48; Thiel, 2017, p. 57; Sovacool & Van de Graaf, 2018, p. 318; Cole, 2015; Di Gregorio et al., 2019, p. 65; Jordan et al., 2018a; Carlisle & Gruby, 2019) while the MLG papers described them as "formally interdependent." However, most of the papers, did not explained in more detail why the empirical cases were formally independent or interdependent. Some authors indicated that (1) the nature of the interdependent policy problem created interdependencies while (2) others referenced the rules-in-use.

More specifically, the term "interdependent" connotes varying meanings within and across papers. Some researchers refer to the interdependent nature of a policy problem (Dimension 1) when describing decision-makers as interdependent. In that sense, decision-makers are interdependent in resolving a problem. For instance, to prevent flooding, local actors depend on one another as downstream communities depend on upstream communities to not channel rivers. At the same time other researchers refer to the interdependencies among actors based on the rules-in-use (Dimension 5). For instance, based on a constitution certain issues might be the responsibility of several levels of government that are required to coordinate by law.

To be more specific, most MLG scholars describe decision-makers as interdependent or at least partly interdependent (Rhodes, 2007; Marquardt, 2017, p. 169; Amundsen et al., 2010, p. 287; Bulkeley & Betsill, 2005, p. 43; Zeemering, 2012, p. 412; Dabrowski, 2018, p. 839; Newig & Fritsch, 2009, p. 199). In fact, Benz et al. (2007) define governance as a theory of managing interdependencies among multi-level and multi-sector actors. This formal interdependency is illustrated by the following example: Within Germany, a member of the European Union, there is a functional separation of powers among governmental units in which the national and state level regulate and the local level implements (Heinen, 2020). Taking an action on in issue means that all three levels need to act to address the issue: The federal level needs to regulate and the local level needs to implement accordingly. This would be a nested governance arrangement with formal interdependency based on legislative constitutional rules governing the roles of each level of government. Frequently in MLG perspectives, the existence of an interdependent policy problem (Dimension 1) justifies the interdependencies based on legislative rules (Dimension 5) among decision-makers.

However, it is not always easy to determine if decision-makers are formally independent or interdependent. In fact, Dimension 5 is called "degree of dependency" because it seems likely that empirically there are many different extents by which decision-makers are formally interdependent. An example for a lighter formalized interdependencies is from the United States: in transportation planning, there is a federal requirement to coordinate among local governments to plan for transportation within metropolitan regions (US Code 23 Sec 134). The federally regulated metropolitan transportation planning process in the United States does create a formal interdependencies between formally independent units of government as local governments within the United States have far reaching regulatory powers delegated to them by the state governments. Nevertheless, the federal government requires them to coordinate on transportation planning.

The two examples underscore the empirical nature of the "degree of dependency." Understanding to what extent decision-makers are actually formally interdependent may help inform research designs. Another element to the degree of dependency are the "voluntarily" created interdependencies. A central research interest in PCG perspectives is that actors may voluntarily decide to interrelate their decisions to solve an interdependent policy problem (Ostrom, 1990, loc 1054ff.; Dorsch & Flachsland, 2017; Thiel, 2017; Ostrom, 2010a; Gillar et al., 2017; Cole, 2015; Rhodes, 2007, p. 53; Sovacool & Van de Graaf, 2018, p. 318; Thiel, 2017, p. 57). As decision-making centers self-organize and enter into agreements to interrelate their decisions, they might be thought of as interdependent. From the literature review, it seems that the PCG perspectives on climate governance focus stronger on self-organized interdependencies rather than legislated interdependencies. In the PCG papers, legislative rules were not analyzed in depth, but rather only mentioned in passing. In the analyzed PCG papers, decision-makers tended to be portrayed as independent by law (autonomous) but deciding to interrelate (self-organized interdependency) their decisions to solve an interdependent policy problem such as climate change. Nevertheless, taking into account the larger body of PCG literature (not just focusing on the more recent PCG literature), one can see that the work of Elinor Ostrom sets a foundation to think about rules-in-use (including rules-in-use that create interdependencies) more broadly.

Both PCG and MLG climate governance perspectives are interested in situations of solving interdependent policy problems such as collective action problems (Dimension 1). Depending on the assumptions of PCG perspectives on the degree of dependency, MLG can either be described as a type of PCG or as complementary to PCG. If PCG is interpreted in a wider sense as interested in interdependencies in general, MLG would draw attention to a particular type of interdependency – namely the interdependencies created by law in for instance nested governance arrangements. The only challenge may be that PCG has been applied to climate governance in a narrower sense to reference systems of formally independent decision-makers that choose to self-organize. Jordan, Huitema, Van Asselt, and Forster (2018b) write about polycentric governance patterns: "The emerging pattern is relatively fragmented, with multiple centers of authority, which are often functionally overlapping rather than nested." (Jordan et al., 2018b, p. 361). If PCG is understood in a narrower sense, then MLG would provide a complementary perspective on systems organized by law. To add to the trouble, MLG is sometimes also applied in a wider sense and has become increasingly interested in self-organized interdependencies. Given the oscillations in connotations and meanings, of the terms PCG and MLG, what are the implications for a global discourse on climate governance?

## 5 | DISCUSSION: IMPLICATIONS FOR COMPARATIVE ANALYSIS OF CLIMATE GOVERNANCE ARRANGEMENTS

Concerns over implementing climate adaptation and mitigation objectives have inspired a global climate governance discourse. The analysis above has shown that PCG and MLG perspectives on climate governance share relevant similarities in research interests despite having emerged from empirically different backgrounds. Both PCG and MLG perspectives share the view that interdependent policy problems (Dimension 1) are governed by multiple decision-making centers (Dimension 2). These decision-making centers interact in a variety of different ways (Dimension 3) which is bound/ framed by rules-in-use (Dimension 4). Decision-makers are constituted as independent or interdependent based on the rules-in-use (Dimension 5). Within these five dimensions, PCG and MLG perspectives on climate governance have tended to place different emphasis. Nevertheless, over the past two decades, the discourses on PCG and MLG have become increasingly entangled with authors frequently drawing on the intellectual foundations of both perspectives. As researchers apply PCG and MLG perspectives in narrower or wider senses, the differences between both concepts have become ambiguous.

The complexity and variety of empirically observable climate governance arrangements suggest that there is an indefinite number of combinations of attributes along the five dimensions. If applied in a narrower sense, multi-level governance perspectives might be more suitable for situations in which national or state governments adopted climate legislations that inform local climate actions. Within the narrower perspective, PCG might be a suitable framework for understanding self-regulated climate actions. However, both perspectives have been and can be applied within a wider sense drawing on the traditional works in both discourses.

The five dimensions framework of climate governance offers an opportunity to systematically identify the differences in empirically observable climate governance arrangements at the national and subnational level. The framework enables a structured cross-country comparison of climate governance by providing coherent analytical categories. Applying the analytical framework can help address questions in the climate literature about the relevance of legislative rules for climate actions. For an application of the framework to land use related climate actions in urban planning, Heinen (2020) offers an example.

The more normative climate governance debate has evolved towards calling for more regulatory freedom for cities but it may be worthwhile examining if cities (even small suburban communities) actually perform better in a self-regulated settings than in a setting with more legislative rules. From the metropolitan governance literature we know that "research indicates that independent action by local governments raises important challenges like capacity constraints of smaller cities, coordination across a metropolitan region, and the problem of service spillovers and negative externalities—all of which undermine regional equity" (Homsy & Warner, 2015, p. 52). Empirically, there is a wide variety of combinations along the five governance dimensions. Particularly for cross-country and comparative case study designs, reflecting on each case study along the five governance dimensions can provide insights to better understanding the conditions under which an empirically observable climate governance arrangements operate. Reflecting on the five dimensions could provide impetus for interesting research designs on the role of national and subnational actors and legal rules for the implementation capacities of cities.

## 6 | FRAMEWORK FOR ANALYSIS OF CLIMATE GOVERNANCE ARRANGEMENTS

Based on the previous analysis and discussion, this work suggests climate governance as an analytical framework in which there are no prior assumptions along the five dimensions. Rather than preemptively describing climate governance arrangements as polycentric or multi-level, the discussion here would like to suggest an analytical framework that allows authors to pre-consider several attributes of governance and to analyze the case studies along these dimensions. Derived from the MLG and PCG definitions, the authors suggest that climate governance arrangements are characterized by:

A. a particular interdependent policy problem that needs resolving (issue): As climate actions touch on multiple policy fields, case studies may focus on the implementation of for instance transportation or energy sector actions items in climate action plans,
B. multiple decision-making centers that can contribute to resolving an issue based on their realm of influence (statutory responsibilities),

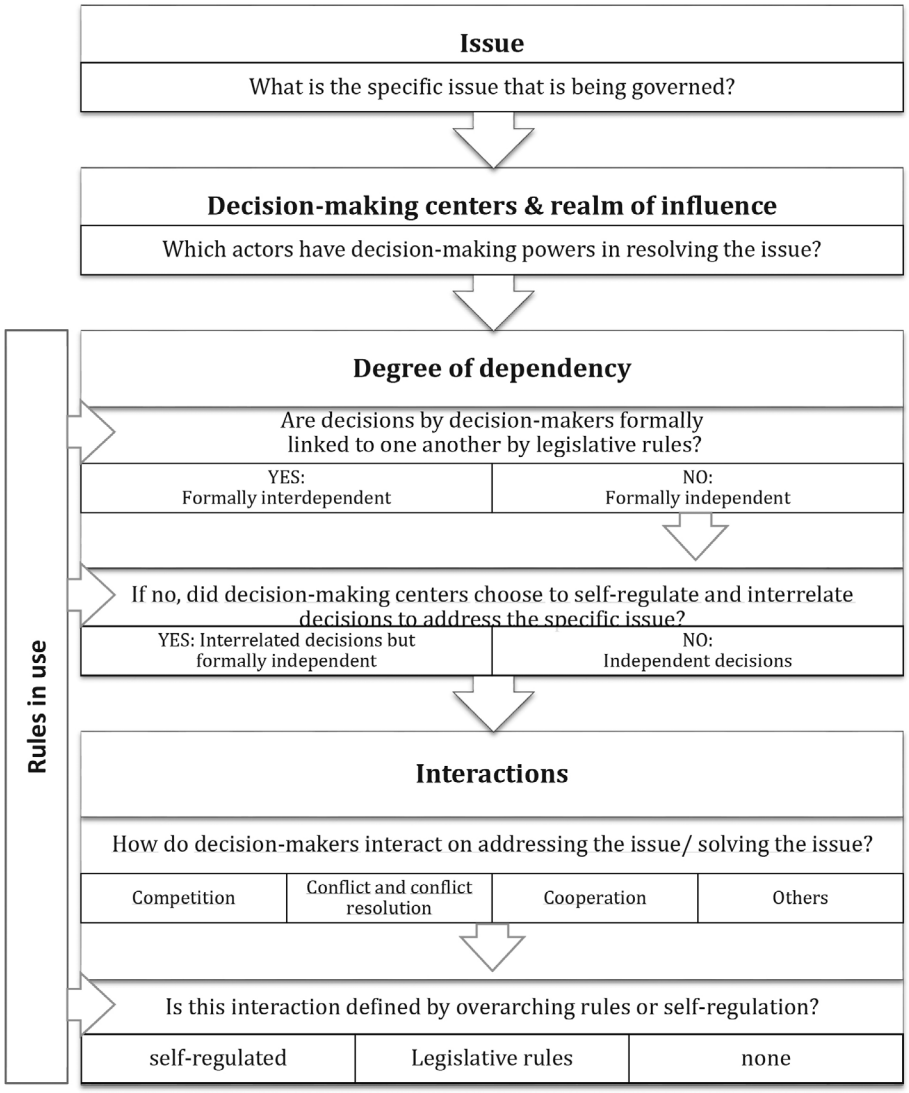


**FIGURE 4** Climate governance analytical framework (Source: own illustration)

C. decision-making centers that interact in a variety of ways, including coordination, competition, conflict and conflict resolution (types of interactions),
D. the rules-in-use structuring the other governance dimensions either through legislative legal rules or self-regulation among actors (rules-in-use),
E. a formalized degree of dependency among decision-making centers, which may be formally independent, formally interdependent, or choose to interrelate their decisions (degree of dependencies).

The analytical framework outlined in Figure 4 can be used as a guide early on in comparative cross-country case study research to classify the analyzed governance arrangements. Comparative research relies on clearly articulating similarities and differences in empirically observable governance arrangements in order to contextualize and explain findings. The framework could either inform a most-similar or most-different research design. Certainly, there are other characteristics of governance arrangements which have not been discussed in this paper that researchers may want to consider when sampling case studies. However, addressing the differences in empirically observable governance arrangements along these five dimensions may help to understand differences in implementation outcomes for climate actions.

## 7 | CONCLUSION

Researchers have applied PCG and MLG perspectives to better understand factors in climate governance arrangements. As climate governance researchers draw on the intellectual foundations of both perspectives, it has been increasingly difficult to clearly distinguish between both concepts despite their different origins. This paper contributes by highlighting five dimensions which indicate similar research interests between PCG and MLG perspectives. Despite the similar research interests, the discussion above shows that researchers have placed different emphasis within the five dimensions using either a PCG or MLG perspective. The most notable differences in the application of both perspectives include the types of

interactions (Dimension 3), the rules-in-use (Dimension 4), and the degree of dependency (Dimension 5). However, this application of perspectives has not been consistent, as some authors apply a narrower and others a wider understanding of PCG and MLG. Nevertheless, understanding the myriad emphases within each dimension can contribute to cross-country comparative research on governance arrangement for climate change policies.

For instance, within transnational municipal networks each municipality operates under different rules-in-use depending on national legal frameworks (constitution, climate laws, energy laws, transportation laws, planning laws, etc.). Within the context of transnational municipal networks, each city may depend, to varying degrees, on legislative rules set by national and subnational actions. One city may be part of a climate governance arrangement that is characterized by self-regulated climate actions at the local level. Another city may be part of a climate governance arrangement with legislative rules integrating climate efforts across levels of government and heavily funding local climate actions. Researchers observing either governance arrangement might come to different conclusions on the relevance of leadership, trust, mutual adjustment, learning, self-regulation, and other factors commonly discussed in the climate governance discourse. Therefore, this research underscores the need to better understand how the rules-in-use shape the configuration of climate governance arrangements.

From the analyzed papers, we observed that most papers did not intentionally address questions on the rules-in-use despite the relevance of the concept in the work of Elinor Ostrom. The climate governance discourses lean more towards understanding factors that foster self-regulated climate actions; such as trust, leadership, orchestration platforms, mutual learning, mutual monitoring, and networking (van der Ven et al., 2017, p. 2; Jordan et al., 2018 a,b; Sovacool & Van de Graaf, 2018, p. 323; Ostrom, 2010a, 2010b). This focus in climate governance research has contributed to a research gap on the relevance of rules-in-use (Dimension 4) for structuring responsibilities of different decision-makers (Dimension 2), for creating rules-in-use for interactions (Dimension 3), and for creating formal interdependencies (Dimension 5). The framework presented above is intended as encouragement to identify interesting combinations of cross-country comparative studies to further delve into the implications of the five governance dimensions for the implementation of climate actions.

To conclude, the analytical framework presented in this paper may advance the climate governance research if applied to cross-country comparative case studies on questions over conditions that foster the successful implementation of climate action. While it certainly would be tempting to offer a narrower definition of MLG and PCG as complementary perspectives, the authors would encourage future research to deliberately draw on both discourses. As both discourses are quiet entwined, deliberately drawing on both discourses would clarify connotations, assumptions, and variances along the five governance dimensions. By grounding empirical research in a coherent theoretical framework, the various empirical findings become increasingly comparable and more generalized conclusions about climate governance arrangements can be drawn that move beyond the emic perspective of researchers.

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## ENDNOTES

[1] Mayntz (2008) points out that the term governance (*politische Steuerung*) was initially used in a political context in the English speaking world whereas "new forms of governance" referred to governance arrangements including non-governmental actors (p. 45).

[2] For a discussion of the term decision-making centers see Peters & Pierre, 2016.

[3] Other authors also use the term relationships or self-organized relationships (Ostrom, 2010a; Sovacool & van de Graaf, 2018; Amundsen et al., 2010; Gordon, 2013).

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